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Research Article

Performance Evaluation Of Ensemble Learning Using Light GBM For Enhanced Heart Disease Detection And Prediction

V. Ramesh[1*], M. Swamy Das[2]

[1]Research Scholar, Department Of Computer Science and Engineering, UCEOU (A) Osmania University, Hyderabad, Telangana, India
Email:-rameshvoruganti36@gmail.com
[2]Professor, Department Of Computer Science and Engineering, Chaitanya Bharati Institute of Technology, Hyderabad, Telangana, India
Email:-msdas_cse@cbit.ac.in

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ARTICLE INFO

ABSTRACT

Diseases of the heart (CVD) include the primary source of rising death rates as well as major cause of fatality. Improving the predictability as well as accuracy of cardiac disease is the primary goal of constructing the suggested model. Experts who ignore patient complaints put the patient at danger of serious complications that might result in death or disability. Consequently, in order to find patterns and hidden information in the medical data related to heart disease, we require expert systems that act as analytical tools. Finding hidden underlying patterns in vast amounts of data is a cognitive process known as machine learning. This study uses ensemble learning approaches in an attempt to improve the preciseness of the risk of heart disease assessment. Additionally, this research project has included feature selection and hyper parameter tuning approaches, which have increased accuracy even further. Used the information on heart disease to assess its performance using several measures. Six machine learning classifiers, including SVM, LR, RF, DT, and Ensemble techniques, were applied to the final dataset for this purpose, both before and after the hyper parameter tuning of the classifiers. Additionally, by doing specific data pre-processing, dataset standardization, and hyper parameter tweaking, using the common heart disease dataset, we confirm their correctness. The K-fold cross-validation approach was use through the researchers. Lastly, the experimental findings showed that machine learning classifiers' accuracy of prediction increased with hyper parameter tweaking, and they produced noteworthy outcomes with data standardization, hyper parameter tuning, and Light GBM.

Keywords: Heart Disease, expert system, Light GBM and ensemble techniques

1. Introduction :

Cardiovascular disorders, including heart disease, are among the world's most deadly illnesses. The illness really arises from the heart's failure to pump enough blood to meet the needs of the body. Elevated blood pressure, obesity, smoking, alcohol misuse, sleep apnea, and elevated mental stress are the main risk factors for heart disease. As stated The World Health Organization estimates that heart disease accounts for around 24 percent of the deaths in India caused by non-communicable illnesses. Around the world, cardiovascular illnesses account for a third of all fatalities. Cardiovascular disease (CVD) is a leading cause of death globally, claiming the life of around 17 million people annually; Asia has the highest prevalence of CVD (WHO). And additionally Statistics from the World Health Organization (WHO) indicate that by 2030, heart failure and strokes would account for the majority of CVD-related deaths—more than 23.6 million deaths [13]. Numerous variables, such as stress, alcohol, smoking, poor food, sedentary lifestyle, and other linked health issues including high blood pressure, may contribute to CVD. On the other hand, once identified in their early stages, the majority of CVD-related illnesses are known to be fully treatable [14].It is very difficult to

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RESEARCH ARTICLE

An optimized meta-heuristic clustering-based routing scheme for secured wireless sensor networks

G Kiran Kumar, S K Prashanth, E Padmalatha, M Venkata Krishna Reddy, N Rama Devi, Laith Abualigah, Premkumar Chithaluru, Manoj Kumar

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Summary

Privacy and security present significant challenges in wireless sensor networks (WSNs). In order to enhance security, the sensor network is equipped with high throughput. While the importance of both source node (SN) and base station (BS) location privacy and security is acknowledged, recent research has predominantly focused on location privacy. Addressing this gap, the geometric zigzag bidirectional tree effectively tackles privacy and security threats at both the SN and BS locations. Future iterations of WSN are anticipated to integrate additional functionalities to meet diverse requirements in real-world applications. The absence of robust security constraints leads to an unpredictable sensor network setup. This article aims to reduce energy consumption (EC) while simultaneously enhancing network security and connectivity. To address security challenges in WSN, we propose an optimized meta-heuristic clustering-based privacy key-agreement routing technique. In the suggested system, a gateway-based network is constructed to devise a key arrangement protocol that promotes privacy during communication. The proposed routing strategy involves forming clusters of sensor nodes (S_n), facilitating the efficient selection of cluster heads (CHs) that prioritize nodes with the least modification. This effectively addresses the EC problem. A comprehensive performance evaluation is conducted, considering improvements in energy efficiency, packet delivery ratio (PDR), throughput, end-to-end delay (E^2 delay), and EC.

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Enhanced Beamforming Techniques in Intelligent Antenna Systems

Rupesh Kumar Mishra*[1], Pavan Mankal[2], Suhasini Vijayakumar[3], Padmavathi Vurubindi[4], N. Nagalakshmi[5]

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Abstract: This research paper presents the development and optimization of a Smart Antenna system for advanced communications using the Signum Data Least Mean Squares (LMS) beamformer with Signum Double application. The mathematical model begins with defining the problem statement and system architecture, followed by a detailed signal model considering received signals, noise, and interference sources. Exploiting the LMS algorithm, the mathematical model describes the iterative weight adjustment process of the antenna array to optimize signal reception. Furthermore, to enhance system performance, the Kaiser Bessel window is applied to reduce peak side lobes, thereby improving the overall antenna array response. The effectiveness of the proposed approach SSDLMS-KW is evaluated through simulations under various communication scenarios, considering metrics such as signal-to-interference-plus-noise ratio (SINR). Results demonstrate the efficacy of the Smart Antenna system in achieving superior communication performance, making it a promising solution for next-generation wireless communication networks.

Keywords: *Smart Antenna, Signum Data LMS Beamformer, Advanced Communications, Kaiser Bessel Window, Peak Side Lobe Reduction, Signal Processing, Wireless Communication, Antenna Array Optimization.*

1. Introduction

The demand for efficient and reliable communication systems has led to the development of advanced Smart Antenna technologies. These systems utilize sophisticated signal processing techniques to enhance signal reception, mitigate interference, and improve overall communication performance. In this context, the Signum Data Least Mean Squares (LMS) beamformer, augmented with Signum Double application, emerges as a promising solution for optimizing Smart Antenna systems. By leveraging adaptive algorithms, such as the LMS algorithm, Smart Antennas can dynamically adjust the weights of antenna arrays to adapt to changing communication environments. Additionally, the integration of the Kaiser Bessel window further enhances system performance by reducing peak side lobes and improving the antenna array's response characteristics. As seen in Fig. 1, a smart antenna system's transmission and reception components are conceptually comparable. This paper focuses on the development and optimization of a Smart Antenna system for advanced communications, employing the Signum Data LMS beamformer with Signum Double application.

[1]*Associate Professor, Department of CS&AI, SR University Warangal*
[2]*Department of E&CE, Guru Nanak Dev Engineering College, Bidar, Karnataka.*
[3]*Professor Bharati Vidyapeeth's Institute of Management and Information Technology*
[4]*Associate Professor Department of Computer Science and Engineering Chaitanya Bharathi Institute of Technology (CBIT(A)) Hyderabad, Telangana*
[5]*Assistant Professor, Department of Information Technology, Anurag University*
** Corresponding Author Email: rupeshmishra80@gmail.com*

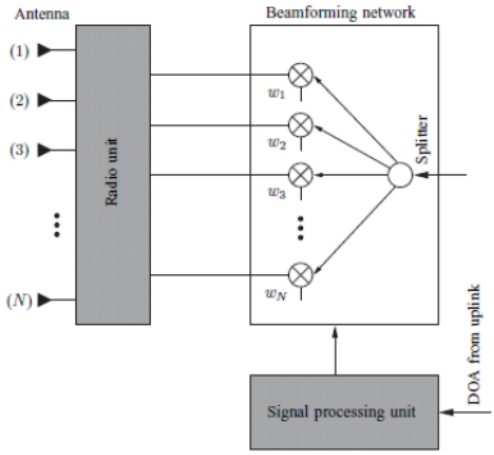

Fig 1: A smart antenna's transmission component.

We begin by outlining the system architecture and signal model, considering various factors such as received signals, noise sources, and interference sources. Subsequently, we describe the mathematical model governing the iterative weight adjustment process of the antenna array, facilitated by the LMS algorithm.

Furthermore, we discuss the application of the Kaiser Bessel window to mitigate side lobes, thereby enhancing system performance. Through simulations and analysis, we evaluate the effectiveness of the proposed approach in achieving superior communication performance, thereby demonstrating its potential for next-generation wireless communication networks.

Sunghyun Cho and Ji-Woong Choi's research, presented on downlink soft handover using multi-cell MIMO for 4G-LTE smartphones. Soft handover is a critical aspect of cellular communication systems, ensuring seamless

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RESEARCH ARTICLE

Intelligent Ultrasound Imaging for Enhanced Breast Cancer Diagnosis: Ensemble Transfer Learning Strategies

KUNCHAM SREENIVASA RAO[1], PANDURANGA VITAL TERLAPU[2], D. JAYARAM[3], (Member, IEEE), KALIDINDI KISHORE RAJU[4], G. KIRAN KUMAR[5], RAMBABU PEMULA[6], (Member, IEEE), M. VENU GOPALACHARI[3], (Member, IEEE), AND S. RAKESH[3], (Member, IEEE)

[1]Department of Computer Science and Engineering, Faculty of Science and Technology (IcfaiTech), The ICFAI Foundation for Higher Education, Hyderabad, Telangana 501203, India
[2]Department of Computer Science and Engineering, Aditya Institute of Technology and Management, Tekkali, Srikakulam, Andhra Pradesh 532201, India
[3]Department of Information Technology, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana 500075, India
[4]Department of Information Technology, SRKR Engineering College, Bhimavaram, Andhra Pradesh 534204, India
[5]Department of Computer Science and Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana 500075, India
[6]Department of Artificial Intelligence, Vidya Jyothi Institute of Technology, Hyderabad, Telangana 500075, India

Corresponding authors: Kuncham Sreenivasa Rao (ksrao@ifheindia.org) and Panduranga Vital Terlapu (vital2927@gmail.com)

ABSTRACT According to WHO statistics for 2018, there are 1.2 million cases and 700,000 deaths from breast cancer (BC) each year, making it the second-highest cause of mortality for women globally. In recent years, advances in artificial (AI) intelligence and machine (ML) learning have shown incredible potential in increasing the accuracy and efficiency of BC diagnosis. This research describes an intelligent BC image analysis system that leverages the capabilities of transfer learning (TLs) with ensemble stacking ML models. As part of this research, we created a model for analyzing ultrasound BC images using cutting-edge TL models such as Inception V3, VGG-19, and VGG-16. We have implemented stacking of ensemble ML models, including MLP (Multi-Layer Perceptron) with different architectures (10 10, 20 20, and 30 30) and Support Vector Machines (SVM) with RBF and Polynomial kernels. We analyzed the effectiveness of the proposed system in performance parameters (accuracy (CA), sensitivity, specificity, and AUC). Compared to the results with existing BC diagnostic systems, the proposed method (Inception V3 + Staking) is superior, with performance parameters 0.947 of AUC and 0.858 of CA values. The proposed BCUI analysis system consists of data collection, pre-processing, transfer learning, ensemble stacking of ML models, and performance evaluation, with comparative analysis demonstrating its superiority over existing methods.

INDEX TERMS Breast cancer, deep learning, machine learning, transfer learners, ultrasound images.

I. INTRODUCTION

Breast cancer (BC) is a frequent cancer that poses significant risks to women's lives globally. Correct diagnosis and early identification are critical in improving patient outcomes. According to the WHO's IARC, BC has overtaken lung cancer as the most prominent cancer form in terms of new cases recorded, with 2.26 million (11.7%) unique patients reported compared to 2.2 million (11.4%) instances of lung cancer. By the end of 2020, BC is expected to officially become the most prevalent cancer worldwide, highlighting the urgent need for increased awareness and comprehensive efforts to combat this disease [1], [2].

The continuous decrease in the cancer mortality rate since 1991, marking a 33% overall reduction and preventing approximately 3.8 million deaths, is attributed to declines in smoking, increased screening for breast, colorectal, and prostate cancers, and advancements in treatments such as adjuvant chemotherapies for colon and breast cancer (BC) [3]. The 2022-2024 BC Facts & Figures report shows a

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Heart Disease Prediction Using GridSearchCV and Random Forest

Shagufta Rasheed[1*], G Kiran Kumar[2], D Malathi Rani[3], MVV Prasad Kantipudi [4] and Anila M[5]

[1,2,5]Department of Computer Science and Engineering, Chaitanya Bharathi Institute of Technology, Gandipet, Hyderabad, Telangana State, India
[3]Department of Electronics and Communication Engineering, Marri Laxman Reddy Institute of Technology and Management, Dundigal, Hyderabad, Telangana State, India
[4]Symbiosis Institute of Technology, Symbiosis International (Deemed University), Pune 412115, Maharastra, India

Abstract

INTRODUCTION: This study explores machine learning algorithms (SVM, Adaboost, Logistic Regression, Naive Bayes, and Random Forest) for heart disease prediction, utilizing comprehensive cardiovascular and clinical data. Our research enables early detection, aiding timely interventions and preventive measures. Hyperparameter tuning via GridSearchCV enhances model accuracy, reducing heart disease's burdens. Methodology includes preprocessing, feature engineering, model training, and cross-validation. Results favor Random Forest for heart disease prediction, promising clinical applications. This work advances predictive healthcare analytics, highlighting machine learning's pivotal role. Our findings have implications for healthcare and policy, advocating efficient predictive models for early heart disease management. Advanced analytics can save lives, cut costs, and elevate care quality.
OBJECTIVES: Evaluate the models to enable early detection, timely interventions, and preventive measures.
METHODS: Utilize GridSearchCV for hyperparameter tuning to enhance model accuracy. Employ preprocessing, feature engineering, model training, and cross-validation methodologies. Evaluate the performance of SVM, Adaboost, Logistic Regression, Naive Bayes, and Random Forest algorithms.
RESULTS: The study reveals Random Forest as the favored algorithm for heart disease prediction, showing promise for clinical applications. Advanced analytics and hyperparameter tuning contribute to improved model accuracy, reducing the burden of heart disease.
CONCLUSION: The research underscores machine learning's pivotal role in predictive healthcare analytics, advocating efficient models for early heart disease management.

Keywords: AdaBoost Classifier (AB), Cross-Validation Methods, Data Preprocessing Techniques, Early Diagnosis Models, Healthcare Analytics, Logistic Regression (LR), Naïve Bayes Classifier (NB), Random Forest Algorithm (RF), Support Vector Machines (SVM)

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*Corresponding author. Email: shaguftarasheed21@gmail.com

1. Introduction

Cardiovascular diseases, including heart disease, keep on being a leading reason of morbidity and death worldwide. Heart disease, a leading global cause of death, is strongly linked to risk factors like smoking, high blood pressure, and cholesterol, affecting nearly half of the US population. Machine learning plays a pivotal role in predicting cardiovascular diseases based on personal indicators, with this paper presenting six models, including Xgboost, Adaboost, Random Forest, Decision Tree, Logistic Regression, and Naïve Bayes, achieving an impressive 91.57% accuracy using the logistic regression model [14]. In recent years, cardiovascular diseases have become a leading global cause of death, driven by lifestyle changes, dietary habits, and work culture. Early detection and continuous medical monitoring can mitigate this issue, but limited resources necessitate technological solutions.

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An LSTM based DNN Model for Neurological Disease Prediction Using Voice Characteristics

Anila M[1,*], G Kiran Kumar[2], D Malathi Rani[3], M V V Prasad Kantipudi[4] and D Jayaram[5]

[1,2]Department of Computer Science and Engineering, Chaitanya Bharathi Institute of Technology, Gandipet, Hyderabad, Telangana State, India

[3]Department of Electronics and Communications Engineering, Marri Laxman Reddy Institute of Technology and Management, Dundigal, Hyderabad, Telangana State, India

[4]Symbiosis Institute of Technology, Symbiosis International (Deemed University), Pune 412115, Maharashtra, India

[5]Department of Information Technology, Chaitanya Bharathi Institute of Technology (A), Gandipet, Hyderabad, Telangana State, India

Abstract

INTRODUCTION: A neurological condition known as Parkinson's disease (PD); it affected millions of individuals worldwide. An early diagnosis can help enhance the quality of life for those who are affected with this disease. This paper presents a novel Deep neural network model based on Long Short-Term Memory (LSTM) design for the identification of PD using voice features.

OBJECTIVES: This research work aims to Identify the presence of PD using voice features of individuals. To achieve this, a Deep neural Network with LSTM is to be designed. Objective of the work is to analyse the voice data and implement the model with good accuracy.

METHODS: The proposed model is a Deep Neural Network with LSTM.

RESULTS: The proposed method uses the features gleaned from voice signals for training phase of LSTM model which achieved an accuracy of 89.23%, precision value as 0.898, F1-score of 0.965, and recall value as 0.931and is observed as best when compared to existing models.

CONCLUSION: Deep Neural Networks are more powerful than ANNs ahd when associated with LSTM , the model outperformed the job of identifying PD using voice data.

Keywords: Voice features, Deep Neural Network, LSTM, Parkinson's Disease, Machine Learning (ML)

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*Corresponding author. Email: anilarao.m@gmail.com

1. Introduction

Worldwide, many people are afflicted by the neurological condition, called Parkinson's disease [1]. It is observed with biomarkers like with tremors, stiffness, and reduced motor skills that largely affects the central nervous system. Early detection of PD can enhance the patient's quality of life by enabling early intervention and treatment [2]. However, traditional methods for detecting Parkinson's disease are subjective and depend on the experience of the clinician. Therefore, there is a need for automated and objective methods that can accurately detect PD.

Many Machine Learning and Deep Learning models developed by various researchers are observed as automated methods that help detecting Parkinson's disease [3]. LSTM neural networks is observed with great potential for processing time-series data and have been used in different applications.

The proposed technique in this paper utilizes the features extracted from speech signals to train an LSTM model that accurately classifies the samples. The approach is of three

[1]Morarjee Kolla

[2]Phani Varma Gadiraju

[3]Dhruvraj Tondanoorthy

Form Check: Exercise Posture Correction Application

Abstract: - Weightlifting is a popular sport and a hobby of millions; however, the risk of injury is high, primarily when performed with incorrect form/posture due to voluntary or involuntary reasons. It results in a significant loss of strength and hinders progress. The gradual strain on tendons and ligaments causes wear and tear. This paper aims to develop a deep learning model that detects incorrect posture and provides insight into remedial steps that need to be taken to correct the same, thereby providing increased safety and efficiency. Our Form Check model detects a user's form, vector geometry of posture is evaluated and corrected. A graphical representation of the exercise is provided as feedback to the user. Object detection, pose estimation, and action recognition algorithms infer the human skeleton and recognize the exercise. The inconsistency in the exercise performed is determined and mapped to specific imperfections in the stance of users during the exercise through Graph Convolution Networks (GCN). Form Check is designed for exercises with a high potential risk of injuries like squats, lunges, and planks.

Keywords: Action Recognition, Form Check, Graph Convolution Networks, Pose Estimation.

I. INTRODUCTION

Form Check is an exercise posture correction model that can detect, recognize the activity and correct the exercise a user is performing. While we implemented Form Check for weightlifting exercises here, it can find use in gyms, sports, and yoga. Any user, from a trainee to a veteran, can use Form Check to make fine adjustments to their exercise posture. This helps reduce the risk of injury and increase efficiency.

Pose Estimation and Human Activity Recognition are two essential segments in Form Check. Human pose estimation localizes body key points to accurately recognize the postures of individuals given an image [1]. Activity recognition mimics the human ability to recognize another person's activities [2].

Form Check uses You Only Live Once (YOLO) [3] as a person tracker, VIBE [4] for pose estimation, and Graphical Convolution Network (GCN) [5] based models for exercise classification and correction. A graphical representation of performed and corrected exercises is displayed.

Weightlifting is the body's movement produced by muscular tissues contracting, resulting in the motion of limbs or torso. It generally involves using barbells, dumbbells, or just body weight. Weightlifting aims to improve strength, build muscle mass, reduce weight, and improve energy levels and persistence. The exercises involved can be beneficial to the health of individuals. However, it is a potential risk for injury and would be inefficient in attaining the required results when performed incorrectly. Newcomers to this field are especially prone to this risk. However, bad posture is something all levels of gym-goers occasionally fall prey to.

It is difficult to perfect the complicated series of actions involved in weightlifting exercises. Posture problems can manifest into muscular and joint conditions, putting a trainee at risk in areas such as the shoulder, neck, spine, and knees. Proper posture can reduce the strain on the human frame by preserving the integrity of tissues and the skeleton. A balanced musculoskeletal motion may be essential to prevent further damage and promote healing in weightlifting. Therefore, learning the correct posture is essential to any exercise, especially for people lifting heavy weights, which is quite common among gym-goers.

[1] [1]Associate Professor, Department of CSE, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India

morarjeek_cse@cbit.ac.in

[2,3]B. E. Student, Department of CSE, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India

ugs18034_cse.phani@cbit.org.in, ugs18028_cse.dhruvraj@cbit.org.in

[1]Morarjee Kolla

[2]Dr. K. Rajendra Prasad

[3]Dr. K Sreenivasulu

[4]Dr. Y. Rama Mohan

[5]Chatakunta Praveen Kumar

Secure Image Encryption Techniques with Fuzzy based Operation Modes for Trustworthy Accessing in Communication Devices

Abstract: - Digital networks present a number of interesting research problems, one of which is the secure image transfer through various channels of communication. In these circumstances, cryptography algorithms are commonly employed to securely encrypt and decode data at both the sending and receiving ends. To determine the most effective method of image encryption, a wide range of modern algorithms are analysed and compared. In this study, we describe several fuzzy modes of operation for image encryption. It guarantees the safety of digital image transfer. The work's goal is to provide the most trustworthy image encryption possible; This is achieved by integrating image encryption methods into a hybrid fuzzy based architecture. The proposed composite fuzzy-based encrypted systems (CFES) are recommended for use in order to ensure the security of data on various communications media. The composite fuzzy-based encrypted systems provide strong security while yet protecting users' privacy while viewing image content.

Keywords: Fuzzy Concept, Image Encryption, Fuzzy operation modes, Cryptography Methods, Image Privacy.

I. INTRODUCTION

Images, audio, and video data [1] can be transmitted securely with the help of cryptographic algorithms [2] and access control mechanisms [3]. It has become crucial for reliable apps or cloud services [4] to allow users to safely share and save their multimedia files in intelligent applications [5]. Healthcare image encryption [6], [7] is one of emerging applications that rely on image encryption. The development of secure scientific applications [8], space image map to defence [10], weather image and predictions [11], and software-defined image network analysis [12] all rely on the use of multimedia encryption. The corporate, governmental, and nonprofit sectors all have a need for image cryptography for various security-related applications. There have been several advancements in the field of image cryptography over the past decade, as evidenced by the proliferation of image encryption methods. Raster images store information in blocks of pixels all of the same size and shape [13]. In this way, images sent via insecure channels can be encrypted and decrypted quickly and easily using these pixels. Medical photographs, infrared photos, logos, etc. can all benefit from its image encryption capabilities. Currently, RC6 (Rivest Cypher 6) [15], [21] is the most used method for encrypting images, and it is used in a variety of fuzzy architecture modes[16], which are, cypher feedback (CFB), cypher block chaining (CBC), electronic codebook (ECB),output feedback (OFB). In addition to DES [23] and AES, the most widely employed encryption methods for protecting images are RSA [24] and the advanced encryption standard (AES) [17], [18], [19], [20], [22]. All across the world, private

[1] Associate Professor, Department of CSE, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India

morarjeek_cse@cbit.ac.in

[2]Professor, Department of CSE, Institute of Aeronautical Engineering, Dundigal, Hyderabad, Telangana, India

krprgm@gmail.com

[3]Professor of CSE, G. Pullaiah college of Engineering and Technology, Kurnool

sreenu.kutala@gmail.com

[4]Associate Professor in CSE Dept, G. Pulla Reddy Engineering College, Kurnool

yrm.ecs@gprec.ac.in

[5]Assistant Professor, Dept. of CSE, Institute of Aeronautical Engineering, Dundigal, Hyderabad, Telangana, India

c.praveenkumar@iare.ac.in

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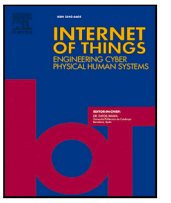

An intelligent FL-based vehicle route optimization protocol for green and sustainable IoT connected IoV

Pallati Narsimhulu [a], Premkumar Chithaluru [b], Fadi Al-Turjman [c,d], Vanitha Guda [e], Srujana Inturi [e], Thompson Stephan [f], Manoj Kumar [g,h,*]

[a] Department of Computer Engineering and Technology, Chaitanya Bharathi Institute of Technology, Hyderabad 500075, India
[b] Department of Information Technology, Mahatma Gandhi Institute of Technology, Telangana 500075, India
[c] Artificial Intelligence, Software, Information Systems Engineering Departments., AI and Robotics Institute, Near East University, Nicosia, Mersin10, Turkey
[d] Research Center for AI and IoT, Faculty of Engineering, University of Kyrenia, Kyrenia, Mersin10, Turkey
[e] Department of Computer Science and Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad 500075, India
[f] Department of Computer Science and Engineering, Graphic Era (Deemed to be University), Dehradun, Uttarakhand, 248002, India
[g] School of Computer Science, FEIS, University of Wollongong in Dubai, Dubai Knowledge Park, Dubai, United Arab Emirates
[h] MEU Research Unit, Middle East University, Amman, 11831, Jordan

ARTICLE INFO

Keywords:
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ABSTRACT

The intelligent Internet of Vehicles (IoV) provides superior results in effectively addressing complex transportation challenges. Predicting vehicle traffic, crashes, demand, location, communication, and travel safety are all critical issues in today's transportation systems. The proposed paper optimizes vehicle traffic by incorporating reroute recommendations, increasing the use of public transportation, and providing onboard vehicle drivers with intelligent health assistance using Federated Learning (FL). This research also focuses on resolving complex transportation issues such as a vehicle's current location, exact vehicle count information on each route, and onboard vehicle vacant seat information. Furthermore, vehicle communication contributes to the proposed system's efficiency by avoiding communication delays or information loss to registered users and the cloud server. An intelligent FL-based scheme for vehicle route optimization has been proposed as part of this research to prevent vehicle traffic in a real-time Internet of Things (IoT) connected IoV transportation system. The vehicle detection approach determines the number of vehicles traveling on each route to recommend the best route to registered users. The effective implementation of cluster-based vehicle communication and location estimation models enhances the efficiency of the proposed system.

1. Introduction

People nowadays spend a significant amount of time traveling between areas to meet their demands. Migration increases vehicle traffic, pollution, and demand [1]. According to the U.S. Energy Information Administration (EIA), the total global oil consumption in 2022 was 87.1 million barrels per day [2]. If current consumption rates persist, there will be only 51 years of oil left in the future, causing rapid depletion of nonrenewable energy sources [3]. Global vehicle carbon emissions from fossil fuels totaled 10.654 Gigatonnes (Gt) in 2017, according to the U.S. Environmental Protection Agency (EPA) [4], and daily vehicle carbon emissions were

* Corresponding author at: School of Computer Science, FEIS, University of Wollongong in Dubai, Dubai Knowledge Park, Dubai, United Arab Emirates.
E-mail addresses: narsimhulupallati@gmail.com (P. Narsimhulu), bharathkumar30@gmail.com (P. Chithaluru), fadi.alturjman@neu.edu.tr (F. Al-Turjman), drvanithaguda@gmail.com (V. Guda), sruint@gmail.com (S. Inturi), thompsoncse@gmail.com (T. Stephan), wss.manojkumar@gmail.com (M. Kumar).

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Fake product identification for small and medium firms (FPISMF) using blockchain technology

Sangeeta Gupta [a,*], Ramu Kuchipudi [b], Md Sohail [a], Karan Singh [a], J. Mahalakshmi [c], Ashok Sarabu [d]

[a] CSE Dept, Chaitanya Bharathi Institute of Technology, Hyderabad, India
[b] IT Dept, Chaitanya Bharathi Institute of Technology, Hyderabad, India
[c] Department of IT, MLR Institute of Technology, India
[d] Department of CSE, BVRIT Hyderabad College of Engineering for Women, Hyderabad, India

ARTICLE INFO

Keywords:
Code bits
Check digit
Cloud
Fake product
Hyperledger
QR-Code

ABSTRACT

Counterfeit products have become a significant problem for small and medium-sized businesses (SMBs), with the estimated value of counterfeit goods worldwide reaching trillions of dollars. However, SMBs often lack the resources and technical expertise to implement sophisticated anti-counterfeiting measures. Towards this end, the work proposes a blockchain-based solution named as Fake Product Identification for Small and Medium Firms (FPISMF) using Hyperledger and AES encryption to enable SMBs to identify fake products and protect their brand reputation. The details of the products and the details of customers are encrypted using AES encryption and recorded on the blockchain. The application communicates with the blockchain network to validate the product and retrieve the details of the product. Chaincode is executed in a containerized environment, which provides isolation and security for the code and data being processed. An algorithm is also proposed to substitute the missing QR-code bits and data that helps reduce customer wait time. Experiments are conducted on synthesized data sets and results showing the effectiveness of the proposed FPISMF framework and reconciliation technique. It is observed from the results that though the time taken to replace a blurry bit is greatly reduced as compared to manual replacement of the product, there is an increase in this time when associated with encryption while extraction of the corresponding code from cloud database thereby achieving a time complexity of O(n), where 'n' is the number of scanned products. In addition, the AES SMB time complexity is approximately recoded as O(n/2) and the Cloud access and retrieval time is O(n) as compared to O(2n) in the existing work. This shows a significant improvement in the ability to replace missing bits and perform a secure analysis respectively.

1. Introduction

Counterfeit code generators are ample in e-commerce industry to replace or substitute the expiry date on a product with an extended one, thereby risking the life of the customers. Hence, amongst a multitude of emerging technologies, blockchain serves as a suitable technology to deal with the fraudulent access-based product storage and detection. The initial manufacturing and expiry dates of the products are recorded in the chain and once the date is exceeded, an alert is sent to the firm owner to replace the expired products with the new once. If the replacement is not carried out within a stipulated time, then penalty will be imposed on the store owners in terms of the cryptocurrencies. This will add up as a reward to the customer and increase their stake in the store maintenance responsibilities [1]. In addition, the code associated with a particular product (either barcode or QR code or RFID) is encrypted and hashed before being stored in the blockchain such that only authenticated key based owners can gain access, thereby eliminating the scope for counterfeit code generation. The realistic implementation is lagging in many of the existing works as available in the literature. Hence, to provide a complete scenario about the proposed FPISMF framework, wide number of works to access product details using barcode/QR code and RFID are surveyed in the literature section to highlight the significance of integrating the aforementioned technologies with blockchain.

* Corresponding author.
E-mail addresses: ss4gupta13@gmail.com (S. Gupta), kramupro@gmail.com (R. Kuchipudi), mohammedsohail78490@gmail.com (M. Sohail), 3kcbit@gmail.com (K. Singh), mahalakshmi1203@gmail.com (J. Mahalakshmi), sarabu.ashok@gmail.com (A. Sarabu).

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REGULAR PAPER

Improved snake optimization-based task scheduling in cloud computing

Vijay Kumar Damera[1] · G. Vanitha[2] · B. Indira[3] · G. Sirisha[4] · Ramesh Vatambeti[5]

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Abstract
The recent focus on cloud computing is due to its evolving platform and features like multiplexing users on shared infrastructure and on-demand resource computation. Efficient use of computer resources is crucial in cloud computing. Effective task-scheduling methods are essential to optimize cloud system performance. Scheduling virtual machines in dynamic cloud environments, marked by uncertainty and constant change, is challenging. Despite many efforts to improve cloud task scheduling, it remains an unresolved issue. Various scheduling approaches have been proposed, but researchers continue to refine performance by incorporating diverse quality-of-service characteristics, enhancing overall cloud performance. This study introduces an innovative task-scheduling algorithm that improves upon existing methods, particularly in quality-of-service criteria like makespan and energy efficiency. The proposed technique enhances the Snake Optimization Algorithm (SO) by incorporating sine chaos mapping, a spiral search strategy, and dynamic adaptive weights. These enhancements increase the algorithm's ability to escape local optima and improve global search. Compared to other models, the proposed method shows improvements in cloud scheduling performance by 6%, 4.6%, and 3.27%. Additionally, the approach quickly converges to the optimal scheduling solution.

Keywords Task scheduling · Makespan · Cloud computing · Snake optimisation algorithm · Computing resources · Cloud providers

1 Introduction

Cloud computing has revolutionized the dynamic and virtualized distribution of computer resources and services over the Internet, offering capabilities that were previously unattainable [1]. Operating within the utility computing paradigm, users now pay for their computer resources like other essential services such as electric-

Extended author information available on the last page of the article

[1] Srujana Inturi *

[2] M. Swamy Das

Review of Automatic Computer Program Evaluation and Assessment Tools and Methods

JES Journal of Electrical Systems

Abstract: **-** Understanding the computer language is more important in today's world. All Computer Science students must have practical and proficient programming skills, which can be obtained through intensive exercise practices. Due to the regular rise in the number in a class, the evaluation of programming exercises imposes a heavy toll on the teacher or instructor, mainly if it must be performed manually. Manual grading for programming assignments might be time-consuming and error-inclined. Already available tools generate remarks with failing test instances. This research includes a thorough literature on the evolution of the recent (2004–2022) development of automatic programming assignment grading systems. From both a pedagogical and a technical viewpoint, the primary aspects supported by the tools and their diverse techniques were examined. In conclusion, several new systems are being built while also acknowledging the underlying causes of this situation. Building open-source systems and collaborating on their expansion is recommended as one solution. This paper concludes with suggestions for future research paths and possible enhancements to automatic code evaluation.

Keywords: Computer Science, Automated programming assessment, Grading tools, Education, Learning programming.

I. INTRODUCTION

Education in Computer Science is among the most popular academic fields worldwide. If you're passionate about computer hardware and software, you probably already know that earning a Bachelor's or Master's degree in CSE/IT can help you land a lucrative job. Most industries in the current digital era rely on data and software solutions. Everything is impacted by computer science and IT, including Scientific research, the advancement of healthcare, transportation, banking, communications, you name it. Now, even everyday items like refrigerators, microwaves, and door locks are wired to our Wi-Fi networks and personal assistants.

With a degree in Computer Science, you can gain the knowledge and abilities necessary to solve problems and create the next wave of devices or software that will enhance the lives of millions of people. Even people who do not work in the information and communication technologies field or do not aspire to work in that field should have some programming knowledge. Teaching a programming subject is more complicated than any theory subject because it involves a distinct procedure to assess and evaluate student-written code. In any educational system, assessment and evaluation is an essential component as it helps assess and evaluate the student's understanding, get feedback, and finally grade a student. The current manual system is time-consuming and tedious to evaluate the student's written code. However, teachers are free to assign grades however they see proper. On the other hand, there are exams when the questions and the answers could be slightly unclear and open-ended while still being accurate.

To reduce the teacher's time and maintain uniformity in the assessment and evaluation, several automatic tools have been built for the last few decades [1]. However, the pandemic has given rise to automatic grading tools at universities that offer traditional or distance learning [2,3]. Technological advances and communication systems have made education more accessible through Information and Communication Systems (ICT). The utilization of automatic grading tools has accelerated during the COVID-19 pandemic.

The benefits of Automatic Computer Program Evaluation are;

- It saves time and effort for the graders, cuts down on the number of issues presented to a student, and eliminates the need to restrict the number of applicants being evaluated based on the number of available graders.

[1] Department of Computer Science and Engineering, Chaitanya Bharathi Institute of Technology, Gandipet-75, Hyderabad, India. isrujana_cse@cbit.ac.in

[2] Department of Computer Science and Engineering, Chaitanya Bharathi Institute of Technology, Gandipet-75, Hyderabad, India. msdas_cse@cbit.ac.in

* Corresponding Author Email: isrujana_cse@cbit.ac.in

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Detection of Android Malware using Feature Selection with a Hybrid Genetic Algorithm and Simulated Annealing (SVM and DBN)

Dr. E. Padmalatha[1], M. Venkata Krishna Reddy[2], T. Suvarna Kumari[3], Kabeeruddin[4]
[1]Department of Computer Science and engineering
Chaitanya Bharathi Institue of Technology
Hyderabad,INDIA
Epadmalatha_cse@cbit.ac.in
[2]Department of Computer Science and engineering
Chaitanya Bharathi Institue of Technology
Hyderabad,INDIA
krishnareddy_cse@cbit.ac.in
[3]Department of Computer Science and engineering
Chaitanya Bharathi Institue of Technology
Hyderabad,INDIA
suvarnakumari_cse@cbit.ac.in
[4]Department of Computer Science and engineering
Chaitanya Bharathi Institue of Technology
Hyderabad,INDIA
kabeeruddin2297@gmail.com

Abstract: Because of the widespread use of the Android operating system and the simplicity with which applications can be created on the Android platform, anyone can easily create malware using pre-made tools. Due to the spread of malware among many helpful applications, Android users are experiencing issues. In this study, we showed how to use permissions gleaned from static analysis to identify Android malware. Utilising support vector machines and deep belief networks, we choose the pertinent features from the set of permissions based on this methodology. The suggested technique increases the effectiveness of Android malware detection.

Keywords: Support vector machine, Deep beliefNetwork.

I. INTRODUCTION

1. INTRODUCTION

The popularity of Android and the widespread use of smartphones have drawn the attention of those who can use malware to carry out their destructive intentions. It is very simple to enter the smartphone market because anyone can make the application accessible to the general public through a variety of markets. Android is widely used in society, as evidenced by the fact that 73% of smartphones today run the Android operating system [1]. Therefore, we need a reliable way to stop malware from spreading on Android smartphones. Machine learning can be used to detect malware by obtaining features from Android applications. The vectorization of features such as network addresses, permissions, and API calls. Each feature set has the potential to play a significant role in the detection of malware. Permissions are among the most significant and influential features. However, since attackers can request and obtain all necessary permissions during installation [2], they do not stop malware from being installed. It is possible to tell whether an application is malware by analysing and managing the permissions of Android applications because malware, like any other application, needs the permission of smartphone owners to carry out its destructive activities. The three categories of feature selection techniques are filter, wrapper, and embedded. In order to sort features and choose the features with the highest rankings, filtering techniques are used as preprocessing. The wrapper methods' criterion to choose features, one of the search algorithms' predictive performance is used to locate the pertinent subset. An example of an embedded method is choosing a variable during training without separating the data into training and test sets [3].

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ORIGINAL RESEARCH

Design and Implementation of Smart Manufacturing Systems Through AR for Data-Driven Digital Twin System

J. Ashok[1] · N. Anil Kumar[2] · David Winster Praveen Raj[3] · J. Ashok[3] · A. Vinay Bhushan[4] · Swathi Edem[5]

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Abstract
Modification of size, residual stress, and surface roughness have an enormous impact on a complex mechanical product's final machining quality. Machine quality can be ensured using Digital Twin (DT) technology by checking the real-time machining process. The virtual–real separation display method is the most modern DT System (DTS). It results in the ineffective transmission of the necessary restricting the use of the DTS by processing data on-site technicians to support field processing. Augmented Reality (AR) monitoring the manufacturing process approach to solve this problem is proposed based on the DT. First, the dynamic multi-view for AR is built using data from multiple sources. Second, real-time monitoring of complex product's intermediate processes incorporates AR to encourage communication between the users of the DT machining system. The outcome of the system can prevent errors that cannot be fixed. An application case for observing will be used to confirm the viability and the efficacy of the proposed method.

Keywords Digital twin · Machining technology · Monitoring application · Augmented reality · Effectiveness

Introduction

As Industry 4.0 takes off in the modern world, the conventional manufacturing industry is facing challenges globally because of the quick advancement and the development of digital technologies. While doing so, the idea of a "DT"—the introduction—is being used more and more in manufacturing [1]. An actual time simulation of a manufacturing system or component is called a DT. It can depict how a product performs, operates in an environment, and shaped, and resources' current states are updated based on ongoing data collection, and in comparison to its physical counterpart, DT is a growing industry as well. Convergence between information and physical space can be furthered with this efficient real-time interaction method [2]. The manufacturing environment has made extensive use of AR as one of the key technologies in Industry 4.0 [3]. With AR, users can see the real world while seeing virtual objects superimposed on it, instead of replacing it entirely. Additionally, it permits interaction between users and the outside world, where the virtual objects' information helps people carry out tasks in the real world [4].

Regarding the modeling of the ideal assembly, digital assembly technology has advanced in several ways recently, including analysis and simulation [1]. When used to simulate intricate product assembly, DT and AR technologies present new challenges and opportunities [5]. Researchers have tried to use AR in the industrial sector for life cycle operations like product design, planning, maintenance, and assembly by fusing virtual objects with a physical setting to create an environment for an augmented virtual fusion where product characteristics and behaviors can be examined [6]. Technology for assembling products using AR is, to some extent, a

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✉ J. Ashok
johnasmara984@gmail.com

1 Department of Electronic and Communication Engineering, V. S. B. Engineering College, Karur, Tamil Nadu, India

2 Department of Electronics and Communication Engineering, School of Engineering & Technology, Mohan Babu University, Tirupati, Andhra Pradesh, India

3 School of Business and Management, CHRIST (Deemed to be University), Bengaluru, Karnataka, India

4 Department of Business Analytics, Kirloskar Institute of Management, Harihar, Karnataka, India

5 Computer Science and Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, India

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Energy Efficient Mobile Adhoc Networks for LoRa for self-organizing network in Internet of Things

Vikram Narayandas (vikramnarayandas16@gmail.com)
Annamalai University Faculty of Engineering and Technology https://orcid.org/0000-0002-7750-013X
Archana Maruthavanan
Annamalai University Faculty of Engineering and Technology
Raman Dugyala
Chaitanya Bharathi Institute of Technology

Research Article

Keywords: EC-BATMAN, AODV, OLSR, LoRa, Manet, Mote

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ORIGINAL ARTICLE

Energy efficient better approach to mobile Ad hoc networking (BATMAN) using LoRa technology

Vikram Narayandas[1] · **Archana Maruthavanan**[1] · **Raman Dugyala**[2]

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Abstract The Internet of Things is now a subject of study that is expanding quickly. Massive volumes of data management and collection are addressed by web-connected sensors and devices. This sensor combination could be able to recognise and locate objects with more precision than a sensor working alone could. In any event, these dispersed sensors have to be able to operate in environments with little to no internet connectivity, which may greatly restrict their viability. These sensors might also be mounted on somewhat peculiar stages, further complicating connections and information flow. Using the energy-efficient B.A.T.M.A.N. (Better Approach to Mobile Ad Hoc Networking) steering convention modified for LoRa, known as EC-BATMAN, a low-power long-range RF convention, to route sensor data through various hubs to arrive at web passages and allow these devices to connect with the cloud that would otherwise be unable, is one potential solution. The aim of the research is to improve the ability to anticipate route quality. Several modifications to the algorithm will be examined, including the incorporation of energy efficiency and message signal solidarity. In comparison with existing systems due to the decrease in end-to-end delay, the proposed approach would help transfer a packet faster in a mobile network along with energy-efficiency. Hence, this framework seems to be a desirable, forgiving approach for such applications.

Keywords EC-BATMAN · AODV · OLSR · LoRa · MANET · Mote

1 Introduction

MANETs are being considered for use in military exercises, salvage operations, and time-based applications. The MANET test bed uses AODV, OLSR, and EC-BATMAN for remote multi-bounce organizations. When courses change often, BATMAN is superior to AODV because it cushions the packages. While AODV is a responsive convention, it delays organization (Failed 2010). Tolerable performance is unknown for wireless mesh networks. Given these companies' vast plans and boundary spaces, comprehensive execution reviews are impossible. BATMAN Advanced (BATMAN-Adv) conference in a realistic office setting, with the AODV conference as a control (Seither et al. 2011). B.A.T.M.A.N. progressed on an indoor mesh potato (MP) proving ground. MPs are small devices used for distant voice communications and data storage. BATMAN-Adv promotes ad hoc wireless groups. (Chissungo et al. 2011). Based on a deep understanding of a top-notch steering convention named BATMAN, we conducted a trial examination of its presentation using a delegate set of substantial measures using a Wireless Mesh Network (WMN) proving ground in our grounds. According to testing, BATMAN is a productive and reliable steering convention that meets media communication requirements in network organizations, according to testing. (Xu et al. 2011).

✉ Vikram Narayandas
vikramnarayandas16@gmail.com

Archana Maruthavanan
archana.aucse@gmail.com

Raman Dugyala
raman.vsd@gmail.com

[1] Department of Information Technology, Faculty of Engineering and Technology, Annamalai University, Chidambaram, Tamil Nadu 608002, India

[2] Computer Science and Engineering Department, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India

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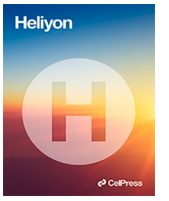

An improved energy-efficient cloud-optimized load-balancing for IoT frameworks

Nageswara Rao Moparthi [a], G. Balakrishna [b], Premkumar Chithaluru [c], Morarjee Kolla [d], Manoj Kumar [e,f,*]

[a] Department of Computer Science and Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, AP, 522302, India
[b] Department of Computer Science and Engineering, Anurag University, Telangana, India
[c] School of Computer Science and Artificial Intelligence, SR University, Warangal, Telangana, 506371, India
[d] Department of Computer Science and Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, 500075, India
[e] School of Computer Science, FEIS, University of Wollongong in Dubai, Dubai Knowledge Park, Dubai, United Arab Emirates
[f] MEU Research Unit, Middle East University, Amman, 11831, Jordan

ARTICLE INFO

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IoT
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Load balancer
Energy consumption
Response time

ABSTRACT

As wireless communication grows, so does the need for smart, simple, affordable solutions. The need prompted academics to develop appropriate network solutions ranging from wireless sensor networks (WSNs) to the Internet of Things (IoT). With the innovations of researchers, the necessity for enhancements in existing researchers has increased. Initially, network protocols were the focus of study and development. Regardless, IoT devices are already being employed in different industries and collecting massive amounts of data through complicated applications. This necessitates IoT load-balancing research. Several studies tried to address the communication overheads produced by significant IoT network traffic. These studies intended to control network loads by evenly spreading them across IoT nodes. Eventually, the practitioners decided to migrate the IoT node data and the apps processing it to the cloud. So, the difficulty is to design a cloud-based load balancer algorithm that meets the criteria of IoT network protocols. Defined as a unique method for controlling loads on cloud-integrated IoT networks. The suggested method analyses actual and virtual host machine needs in cloud computing environments. The purpose of the proposed model is to design a load balancer that improves network response time while reducing energy consumption. The proposed load balancer algorithm may be easily integrated with peer-existing IoT frameworks. Handling the load for cloud-based IoT architectures with the above-described methods. Significantly boosts response time for the IoT network by 60 %. The proposed scheme has less energy consumption (31 %), less execution time (24\%), decreased node shutdown time (45 %), and less infrastructure cost (48\%) in comparison to existing frameworks. Based on the simulation results, it is concluded that the proposed framework offers an improved solution for IoT-based cloud load-balancing issues.

* Corresponding author. School of Computer Science, FEIS, University of Wollongong in Dubai, Dubai Knowledge Park, Dubai, United Arab Emirates.

E-mail addresses: mnrphd@gmail.com (N.R. Moparthi), me2balu@gmail.com (G. Balakrishna), bharathkumar30@gmail.com (P. Chithaluru), morarjeek.cse@cbit.ac.in (M. Kolla), wss.manojkumar@gmail.com (M. Kumar).

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Secure cross-layer routing protocol with authentication key management scheme for manets

G.R. Rama Devi [a,*], M. Swamy Das [b], M.V. Ramana Murthy [c]

[a] Department of Computer Science and Engineering, Osmania University, Hyderabad, Telangana, India
[b] Department of Computer Science and Engineering, CBIT, Gandipet, Hyderabad, Telangana, India
[c] Department of Mathematics, Osmania University, Hyderabad, Telangana, India

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MANET
Secure routing
PSO
Relay node selection
ECC
Diffie-Hellman key
Energy consumption

ABSTRACT

MANET (Mobile ad-hoc networks) is typically a no-infrastructure multi-hop network where every node interacts with other network nodes either indirectly or directly via intermediate nodes. A lot of research is being undertaken to save the energy of mobile nodes at different levels. Power-relevant issues can have an effect on every layer of the stack, making the traditional layered approach ineffective. In this work, cross layered routing protocol based on PSO (Particle swarm optimization) with adapted contention window technique is proposed. To form consistent and energy efficient routing paths, PSO algorithm uses Traffic index, Average energy load, data success rate & trust value parameters that are computed from network layer. After establishing routing paths, network's contentions are measured MAC layers for communications and contention with measured contentions and average energy loads. The trust of nodes is computed using the following constraints: group trust-provided by neighbour nodes & quality trust-computed by node QoS. Dual authentications with EnDA (enhanced dual authentication) using key management strategies for enhanced data security and integrity. ECC (Elliptical curve cryptography) and Diffie-Hellman key exchanges with bilinear maps improve security of communications. The suggested protocol when measured in terms of energy usage and secure key agreements during network's transmissions, showed satisfactory performances.

1. Introduction

MANETs encompass sets of wireless nodes which are self-configurable and establish networks without pre-defined architectures [1]. The nodes are in motion and have randomized mobility. Every host in this network should be capable of functioning in the form of a router. Owing to differences in propagation route losses, shadowing effects, multipath fades, and interferences, host mobilities affect wireless connection signal qualities and routes relying on these connections are broken and links fail. Hence, due to their changing topologies, MANETs need reliable routing protocols that are adaptive.

In MANETs, the resources utilized are quite less i.e. the protocol utilized must not take up a massive amount of energy or are required to have less amount of computational or communication overheads [2]. There is a dynamic variation in the topology of the MANETs. Therefore, it is hard designing a protocol capable of achieving hard assurances regarding the security and energy that an application requires. Energy efficiency is a significant factor in MANETs, as nodes are relying on the less battery power supplied for their energy [3].

Dynamic topologies, real-time communications, resource depletions, bandwidth controls, and packet broadcast overheads are issues that ad hoc networks need to overcome [4]. Networks get complicated when routing protocols are created for addressing problems. Several routing protocols have been developed for MANETs, but they consume significant portions of nodes' battery power [5].

With MANETs, there is a difficult environment for having a secure communication among the nodes taking part. All nodes present within the signal reception range can acquire the packets and provide arbitrary responses. Routing attacks are aimed at interfering with the network's natural routing process and therefore, the protocol routing performance is degraded. The node mobility leads to a constantly varying network topology. All the nodes present in a signal reception range can acquire the packets and produce arbitrary responses. Hence, it is very easy for an intrusive node to plan and implement a routing attack against any node present in a MANET. Ad hoc networks are vulnerable to several attack types, including link assaults, which can vary from passive eaves

* Corresponding author.
E-mail addresses: ramadevigorree@gmail.com (G.R. Rama Devi), msdas@cbit.ac.in (M. Swamy Das), mv.rm50@gmail.com (M.V. Ramana Murthy).

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RESEARCH ARTICLE

WILEY

An opportunistic energy-efficient dynamic self-configuration clustering algorithm in WSN-based IoT networks

Sridevi Tumula[1] | **Y. Ramadevi**[2] | **E. Padmalatha**[1] | **G. Kiran Kumar**[1] | **M. Venu Gopalachari**[3] | **Laith Abualigah**[4,5,6,7,8,9] | **Premkumar Chithaluru**[1] | **Manoj Kumar**[10,11]

[1]Department of Computer Science and Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, India

[2]Department of AIML, Chaitanya Bharathi Institute of Technology, Hyderabad, India

[3]Department of Information Technology, Chaitanya Bharathi Institute of Technology, Hyderabad, India

[4]Computer Science Department, Al al-Bayt University, Mafraq, Jordan

[5]Department of Electrical and Computer Engineering, Lebanese American University, Byblos, Lebanon

[6]Hourani Center for Applied Scientific Research, Al-Ahliyya Amman University, Amman, Jordan

[7]Applied Science Research Center, Applied Science Private University, Amman, Jordan

[8]School of Computer Sciences, Universiti Sains Malaysia, Pulau Pinang, Malaysia

[9]School of Engineering and Technology, Sunway University Malaysia, Petaling Jaya, Malaysia

[10]School of Computer Science, FEIS, University of Wollongong in Dubai, Dubai, United Arab Emirates

[11]MEU Research Unit, Middle East University, Amman, Jordan

Correspondence
Manoj Kumar, School of Computer Science, FEIS, University of Wollongong in Dubai, Dubai Knowledge Park, Dubai, United Arab Emirates.
Email: wss.manojkumar@gmail.com

Summary

The demand for the Internet of Things (IoT) has significantly increased in the current scenario; specific sectors that require IoT include industrial automation, home control, health care applications, military and surveillance applications, habitat monitoring, and nanoscopic sensor applications. The use of optimal wireless sensor networks (WSNs) in transmission techniques has resulted in their involvement. A WSN is made up of thousands of randomly distributed sensor nodes that sense and transmit environmental data such as temperature, pressure, humidity, light, and sound. One of the most important requirements when using these sensor nodes is energy. As a result, it has become a major area of research in recent years; additionally, several design techniques and protocols have been presented in the last decade, particularly for IoT-based applications. As a result, the systemization of an energy-optimized WSN in dynamic functional conditions with automatic self-configuration of sensor nodes is a critical goal. This paper proposed an opportunistic energy-efficient dynamic self-configuration routing (OEDSR) algorithm for IoT-based applications. Initially, the optimal route to the base

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Research Article

An Energy-Efficient Learning Automata and Cluster-Based Routing Algorithm for Wireless Sensor Networks

Karthik Karmakonda[1*], M. Swamy Das[1], Guguloth Ravi[2]

[1]Department of Computer Science and Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India
[2]Department of Computer Science and Engineering, MRCET, Hyderabad, Telangana, India
Email: karthikk_cse@cbit.ac.in

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Abstract: Wireless sensor networks (WSNs), which may be used for a broad variety of applications, have recently emerged as a prominent data collection paradigm. The fundamental concerns in wireless sensor networks are the efficient use of energy and the reliable delivery of data, both of which are largely determined by the rate at which packets are dropped. When developing an energy-efficient routing protocol, one of the most important steps is selecting a node to act as a successor node in a routing path. The application of learning automata theory to guide the routing decisions made by the sensors in a WSN has recently been the subject of research in the field of WSNs, where it has been shown to have several advantages. In this paper, a learning automata-based PSO relay selection scheme for energy-efficient relay selection and reliable data delivery is proposed. The network is clustered using the LEACH protocol. The random number in the traditional LEACH protocol will be stabilized with the sensor node energy level for CH stability. Every sensor node in the network estimates the best possible routes to the sink node using the PSO algorithm. Instead of retransmissions, here we introduce learning automata for successor node selection during packet loss. The proposed learning automata calculate the next node's selection probability in a routing path using multi-objective parameters like communication cost, residual energy, distance from BS, buffer size, and previous selection probability. Performance evaluation clearly showed that the proposed approach decreases energy usage, transmission delays, and data transfers while extending network lifetime. According to the experimental results, the proposed scheme can improve energy efficiency by 21.68%, delay by 31%, PDR by 87%, routing overhead by 0.5%, and throughput by 18.76% as compared to existing techniques like O-LEACH (Optimized Low Energy Adaptive Clustering Hierarchy Protocol) and EEPC (enhanced energy proficient clustering).

Keywords: WSN, clustering, energy efficiency, PSO, learning automata, network lifetime, LEACH

MSC: 68T05,60A99,94A05,68Q80

1. Introduction

Because of their limited capabilities and resources, sensor nodes are extremely vulnerable to failure [1]. Energy is an essential component in sensor networks because the exhaustion of energy resources is one major cause of this failure.

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The use of IoT-based wearable devices to ensure secure lightweight payments in FinTech applications

Sriramulu Bojjagani [a,*], Nagarjuna Reddy Seelam [b], Neeraj Kumar Sharma [a], Ravi Uyyala [c], Sree Rama Chandra Murthy Akuri [b], Anup Kumar Maurya [d]

[a] Cyber Security Lab, Department of Computer Science and Engineering, School of Engineering and Applied Sciences (SEAS), SRM University-AP, Amaravati, 522503 India
[b] Department of Computer Science and Engineering, Lakireddy Bali Reddy College of Engineering, Mylavaram, JNTUK, Kakinada, A.P, India
[c] Department of CSE, Chaitanya Bharathi Institute of Technology (CBIT), Gandipet, Hyderabad 500075, India
[d] Goa Institute of Management, Goa, India

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ABSTRACT

Daily digital payments in Financial Technology (FinTech) are growing exponentially. A huge demand is for developing secure, lightweight cryptography protocols for wearable IoT-based devices. The devices hold the consumer information and transit functions in a secure environment to provide authentication and confidentiality using contactless Near-Field Communication (NFC) or Bluetooth technologies. On the other hand, Security breaches have been observed in various dimensions, especially in wearable payment technologies. In this paper, we developed a threat model in the proposed framework and how to mitigate these attacks. This study accepts the three-authentication factor, as biometrics is one of the user's most vital authentication mechanisms. The scheme uses an "Elliptic Curve Integrated Encryption Scheme (ECIES)", "Elliptic Curve Digital Signature Algorithm (ECDSA)" and "Advanced Encryption Standard (AES)" to encrypt the messages between the entities to ensure higher security. The security analysis of the proposed scheme is demonstrated through the Real-or-Random oracle model (RoR) and Scyther's widely accepted model-checking tools. Finally, we present a comparative summary based on security features, communication cost, and computation overhead of existing methods, specifying that the proposed framework is secure and efficient for all kinds of remote and proximity payments, such as mini, macro, and micro-payments, using wearable devices.

1. Introduction

Wearable payments are becoming an extension of digital payments. FinTech wearable applications refer to electronic devices embedded into items or accessories worn. They can do tasks just as a mobile or a computer can. It is a part of the emerging Internet of Things (IoT) trend, which helps optimize operations, increase productivity, boost revenue, and improve lives (Challa et al., 2017; Chen et al., 2019). Wearable technology can be categorized into two main categories: business and personal usage. Parts of physical objects are embedded with sensors and software for individual usage as activity trackers. For business-oriented purposes, wearable devices can be effectively used for transactions in global markets. The modes or channels of digital payments using smartphone applications are more. Nowadays, most people are interested in buying products through digital payments, especially wearable devices–the massive demand for wearable device payments in global payment markets. The enormous growth of payment market value for connected devices globally from 2015 to 2025 is shown in Fig. 1. It provides ten-year market forecasts of wearable transactions and transaction volume by region, device type, and technology from 2015 through 2025[1]. Wearable devices contribute toward banking and payments and provide better services than smartphone devices. Wearable devices have tremendous potential to provide better and more efficient services to end-users; for this reason, most banks are implementing wearable tech-

* Corresponding author.
E-mail address: sriramulubojjagani@gmail.com (S. Bojjagani).
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[1] https://www.statista.com/statistics/471264/iot-number-of-connected-devices-worldwide/.

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Blockchain-Based Federated Learning Technique for Privacy Preservation and Security of Smart Electronic Health Records

Manisha Guduri, *Senior Member, IEEE*, Chinmay Chakraborty, *Senior Member, IEEE*, Uma Maheswari V, *Senior Member, IEEE*, and Martin Margala, *Senior Member, IEEE*

***Abstract*—This study introduces a blockchain-based lightweight encryption strategy with federated learning to address the scalability and trust concerns of electronic health records (EHR). After implementing lightweight encryption, the EHR data is stored in a decentralized cloud system. The importance of protecting the privacy and security of distant patients' health records is explored. Now that stakeholders have a secure portal and cloud data is inaccessible, assaults on electronic healthcare records should decrease. The study guarantees full encryption throughout the whole conversation with federated learning. Deprived of the essential for a trusted third party, the system sets up active smart contracts at runtime between the sensor and the data user to facilitate the transfer of EHR data. To ensure that the data is private between the owner and user during the contract's execution, it employs a very effective proxy re-encryption mechanism with federated learning. To examine the performance of the proposed system, it has been built and deployed on an Ethereum-based testbed. It is observed that the PSNR and MSE of the proposed model are 39 (1.07×) and 229.6 (1.02×) respectively. The entropy of the image is assessed to be 7.8 for the proposed model. This is also compared with existing algorithms and proved to be a secured model.**

***Index Terms*—Federated learning, electronic health records, patient data, blockchain-based light weight encryption strategy, ethereum-based testbed.**

I. Introduction

MEDICAL facilities and healthcare providers have profited greatly from the Internet of Medical Things (IoMT). Concern about security and privacy concerns prevalent in the IoMT, nevertheless, present difficulties for firms using this innovation. The security, privacy, and accessibility of patient information are all at danger when several medical systems are used [1], [2]. Availability, data integrity, and privacy are all at risk if security is compromised. In addition, hackers can utilize medical records to locate prescriptions and commit fraud or identity by ordering medications online. Hackers may also use blackmail and extortion to coerce victims into disclosing medical information they would rather keep private. In addition, accessibility, privacy, and security of IoMT-enabled health tools like fitness trackers are major considerations [3], [4], [5]. Access management and authentication are also important aspects of security. To sum up, it's crucial to regulate who may access the IoMT network. After a user has been recognized and authenticated, it is critical to determine if they have the authorization to utilize the requested resources [6]. For access control to work, software entities must be able to ask for and grant permission to each other. However, it is difficult to implement reliable Internet access control for medical equipment.

Security and privacy in the IoMT face additional challenges from identity management and authentication. Authentication verifies the claimed identity of a person or group of people to establish trust in the identity management system. Since confidentiality, integrity, and availability might all be jeopardised without authentication in the IoT, it is essential. Availability is all jeopardised if an enemy can pose as a trusted entity and get access to entire data [7]. User authentication and identification is a major problem in the IoMT. Password/username combinations are widely used for identifying and authenticating users in computer systems. Shared keys, digital certificates, and biometric authentication are among more options. Security risks to the present Internet would rise because to the high rate of enormous size of IoMT systems. When it comes to IoMT's network and protocol security services, heterogeneity plays a huge role [8]. As well as protecting the data on IoT devices, security solutions must also allow for their authentication and authorization. Physical barriers to communication and technology are another source of security concerns. For the Internet of Things to function, even the tiniest devices must implement Internet Protocols. IoMT devices are limited in their capacity to process information at lightning speeds, hence this limits the potential of the technology [9]. The available resources, including storage space, processing power, and power, are limited. Different types of security are required to balance the opposing needs for low energy use and high performance. IoMT system efforts to ensure privacy and security are impacted by their limited resources and scale.

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Manisha Guduri and Martin Margala are with the School of Computing and Informatics, University of Louisiana at Lafayette, New Orleans, LA 70503 USA (e-mail: manisha.guduri@louisiana.edu; martin.margala@louisiana.edu).

Chinmay Chakraborty is with the School of Electronics and Communication Engineering, Birla Institute of Technology, Jharkhand 814142, India (e-mail: cchakrabarty@bitmesra.ac.in).

Uma Maheswari V is with the Computer Science and Engineering Department, Chaitanya Bharathi Institute of Technology, Hyderabad 500075, India (e-mail: umamaheswari@ieee.org).

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Research article

Machine learning job failure analysis and prediction model for the cloud environment

Harikrishna Bommala [a], Uma Maheswari V. [b], Rajanikanth Aluvalu [c,*], Swapna Mudrakola [d]

[a] Department of CSE, KG Reddy College of Engineering & Technology, Hyderabad 500075, India
[b] Department of CSE, Chaitanya Bharathi Institute of Technology, Hyderabad 500075, India
[c] Department of IT, Chaitanya Bharathi Institute of Technology, Hyderabad 500075, India
[d] Department of CSE, Matrusri College of Engineering, Hyderabad 500059, India

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ABSTRACT

Reliable and accessible cloud applications are essential for the future of ubiquitous computing, smart appliances, and electronic health. Owing to the vastness and diversity of the cloud, a most cloud services, both physical and logical services have failed. Using currently accessible traces, we assessed and characterized the behaviors of successful and unsuccessful activities. We devised and implemented a method to forecast which jobs will fail. The proposed method optimizes cloud applications more efficiently in terms of resource usage. Using Google Cluster, Mustang, and Trinity traces, which are publicly available, an in-depth evaluation of the proposed model was conducted. The traces were also fed into several different machine learning models to select the most reliable model. Our efficiency analysis proves that the model performs well in terms of accuracy, F1-score, and recall. Several factors, such as failure of forecasting work, design of scheduling algorithms, modification of priority criteria, and restriction of task resubmission, may increase cloud service dependability and availability.

1. Introduction

In cloud computing, tolerance enables uninterrupted service regardless of the failure of individual components. Cloud architectures are substantially more complicated than conventional distributed systems owing to their variety and scale. Therefore, new initiatives that guarantee high dependability and availability are required for the development of cutting-edge IoT-cloud applications, such as smart cities and e-Health. The reliability and dependency on cloud services are major issues for both cloud providers and their customers. The complexity of cloud formation is a major factor in the level of success [1–3]. Concerning dependability, the problems faced by cloud providers are not similar from those previously encountered. Problems include blackouts, computer breakdowns, botched deployments, faulty software, and simple human errors. Buyers of cloud services continue to worry about dependability and accessibility. Elastic Block Storage (EBS), an AWS service, had experienced an outage in the past. Because of this vulnerability, hundreds of applications and 24 h-hosted websites have been down [4]. When an error occurs, the application or website hosting it must be able to recover from the setback and continue functioning normally. Service providers in the cloud must keep their systems running smoothly and reliably for their customers so that they can enjoy good quality of service (QoS). The Capacity, Resource, and Service are the three different types of schedules. They are capable of similar tasks, and in certain contexts, more than one of them will be useful. Failure occurrences directly affect the dependability of the system with regard to schedule type. Despite the remarkable resilience of the public cloud, there were a few instances of failure in the first half of 2020, beginning at 9:30 am, when connections were down for more than six hours. Microsoft Azure is now experiencing [5] downtime, according to the company's status page. Fault-analysis techniques are required to identify the causes of peripheral and programming errors in a live cloud environment. Nevertheless, the major goal of the failure prophecy is to anticipate unsuccessful jobs. The key metrics and attributes of the cloud application are determined by developing a service for aborted analysis and forecasting. Exploring the typical alterations and behaviors of cloud applications is the primary focus of failure forecasting and scrutiny. In the event of a failure, substantial amounts of data storage and processing power are lost. The Google Traces feature [6] has been extensively studied [2–5,7], and its many qualities have been recognized [8,9]. There are some results from a few studies on the improvement

* Corresponding author.
E-mail address: Rajanikanth.aluvalu@ieee.org (R. Aluvalu).

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Enhancing and Empowering Network Security : Maximizing Anomaly Detection Efficiency through the Implementation of Advanced Neural Networks

[1]A. Prashanthi , [2]Dr. R. Ravinder Reddy

[1]Research Scholar

Department of CSE,

Osmania University,Hyderabad.

[2]Associate Professor, Dept. of CSE

Chaitanya Bharathi Institute of Technology, TS, India

Abstract:

In the dominion of cybersecurity, the prime tasks revolve around recognizing and moderating network breaches. This research paper impacts the widely recognized CICIDS2017 dataset to conduct a complete evaluation and comparison of numerous deep learning and machine learning representations designed for Anomaly-detection by the analysis of a diverse array of algorithms, spanning from traditional methodologies like logistic regression to more modern advances such as K-Nearest Neighbors (KNN) and state-of-the-art Swift-Net neural networks. The research also delves into the realism of employing dimensionality reduction and feature selection procedures, remarkably Principal Component Analysis (PCA) in addition with Gaussian Mixture Models (GMM). The implications of this consideration are substantial for the enhancement of network security with an emphasis of the efficiency of PCA and GMM in facilitating data visualization, enabling a deeper understanding of network behavior. Moreover, the paper highlights the potential of Swift-Net for real-time threat detection, signifying its relevance in the evolving cybersecurity environment. As the cybersecurity domain undergoes constant transformation, this research serves as a valuable reserve, paving the way for more effective Anomaly detection techniques and the employment of efficient network security solutions. These outcomes offer acute insights to reinforce network safety.

Keywords—*Anomaly-detection, Network security, Swift-Net Neural Network, CICIDS 2017 dataset, Comparative analysis, Machine learning, Deep learning, Classifier performance, Cyber security, Hyperparameter tuning, Network threats.*

Introduction

The demand of network security has become crucial in our highly interconnected society, as our reliance on digital infrastructure continues to expand. The extensive proliferation of digital data and the pervasive use of interconnected systems have rendered information technology infrastructures vulnerable to a wide range of cyber threats. Anomaly Detection Systems (ADS) have surfaced as essential tools in the discipline of cybersecurity, actively monitoring and protecting networks from malicious activity and unauthorizedaccess [1]. This paper is devoted to thoroughly investigating the always-changing field of ADS, with a main emphasis on recent progress and the complex obstacles they seek to overcome.

Clustering based EO with MRF technique for effective load balancing in cloud computing

Hanuman Reddy N., Amit Lathigara, Rajanikanth Aluvalu, Uma Maheswari V.

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Abstract

Purpose

Cloud computing (CC) refers to the usage of virtualization technology to share computing resources through the internet. Task scheduling (TS) is used to assign computational resources to requests that have a high volume of pending processing. CC relies on load balancing to ensure that resources like servers and virtual machines (VMs) running on real servers share the same amount of load. VMs are an important part of virtualization, where physical servers are transformed into VM and act as physical servers during the process. It is possible that a user's request or data transmission in a cloud data centre may be the reason for the VM to be under or overloaded with data.

Design/methodology/approach

VMs are an important part of virtualization, where physical servers are transformed into VM and act as physical servers during the process. It is possible that a user's request or data transmission in a cloud data centre may be the reason for the VM to be under or overloaded with data. With a large number of VM or jobs, this method has a long makespan and is very difficult. A new idea to cloud loads without decreasing implementation time or resource consumption is therefore encouraged. Equilibrium optimization is used to cluster the VM into underloaded and overloaded VMs initially in this research. Underloading VMs is used to improve load balance and resource utilization in the second stage. The hybrid algorithm of BAT and the artificial bee colony (ABC) helps with TS using a multi-objective-based system. The VM manager performs VM migration decisions to provide load balance among physical machines (PMs). When a PM is overburdened and another PM is underburdened, the decision to migrate VMs is made based on the appropriate conditions. Balanced load and reduced energy usage in PMs are achieved in the former case. Manta ray foraging (MRF) is used to migrate VMs, and its decisions are based on a variety of factors.

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EFFICIENT BUS ROUTE DETECTION USING YOLOV5 AND IOT

Morarjee Kolla[1*], B Komal Adithya Reddy[2], Mohammad Sohail[3]
[1]Associate Professor, Department of CSE, Chaitanya Bharathi Institute of Technology, Hyderabad, India
morarjeek_cse@cbit.ac.in
[2]B.E Student,Department of CSE, Chaitanya Bharathi Institute of Technology, Hyderabad, India
adithyareddy1705@gmail.com
[3]B.E Student,Department of CSE, Chaitanya Bharathi Institute of Technology, Hyderabad, India
sohail.mohammad1711@gmail.com

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ABSTRACT

Building on our prior research, currently under review for publication, which developed a robust system integrating YOLOv5 and PaddleOCR for efficient detection and recognition of bus routes, this chapter extends the system's capabilities with innovative enhancements. We introduce a user-friendly interface that allows users to upload images or videos using a camera module sensor based on IoT from which the system can extract relevant details, a feature not present in the initial version. This enhancement significantly improves accessibility and usability, enabling seamless interaction with the system in real-world environments. Additionally, we integrate a spell check algorithm based on the Levenshtein distance to refine the textual outputs obtained from PaddleOCR, effectively correcting recognition errors and ensuring higher accuracy in identifying route numbers and destination names.

Our enhanced system not only retains the high detection accuracy and efficiency of the original model but also significantly improves the overall user experience through better interaction and more reliable textual information. The results demonstrate that the incorporation of the UI and spell check algorithm markedly enhances the system's practical application, making public transportation navigation even more accessible and user-friendly. This chapter contributes to the advancement of intelligent transportation systems, highlighting the importance of user-centric design and error correction in real-world applications, and provides valuable insights for researchers and practitioners in the field.

Keywords: Bus Route Detection, Intelligent Transportation Systems, IoT, Levenshtein Distance, Optical Character Recognition, PaddleOCR, Spell Check Algorithm, User Interface, YOLOv5,

Introduction

Public bus transportation plays a crucial role in daily commuting, offering an affordable and extensive means of travel. However, many commuters face difficulties in accurately identifying bus routes, which can significantly impact their travel experience. This paper presents an advanced system that integrates YOLOv5 (You Only Look Once) and PaddleOCR (Optical Character Recognition) technologies to simplify bus route detection.

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Design of Ultra-Miniaturized Wearable Antenna for Bio-Telemetry Applications

Regalla Narendra Reddy[1, *], Nalam V. Koteswara Rao[2], Dasari Rama Krishna[1], and Jeet Ghosh[2]

Abstract—In this paper, an ultra-miniaturized, planar dual-band wearable antenna is proposed for bio-telemetry applications. The proposed antenna covers the 433 MHz and 915 MHz Industrial, Scientific, and Medical (ISM) bands with a compact volume of $0.000000384\lambda_0^3$. The antenna consists of a meander line on the top side of the substrate, while the backside is loaded with an inductive grid structure to achieve miniaturization. Moreover, the absence of vias in the design of the antenna offers a significant benefit in terms of simplifying the fabrication process. The design approach considers the integration of other components for device-level architecture. The antenna exhibits stable performance when being placed on different human body parts, such as the head and hand. The evaluated specific absorption rate (SAR) complies with the regulated human safety standard. Additionally, the link margin (LM) calculation shows that the antenna could establish a biotelemetry communication link at a distance of 20 meters.

1. INTRODUCTION

The emerging technology of wearable electronics is offering numerous healthcare applications such as endoscopy, neural recording, and glucose monitoring. A conventional wearable telemetry device is made up of one body control unit (BCU) and one or more body sensor units (BSUs) [1]. BCU can receive physiological signal data from BSUs and transmit it to a remote access point. To be able to maintain an effective communication link to the external unit, an efficient wearable antenna plays an important role in wearable devices. For maintaining the compactness and comfortability of the wearable devices, the antenna should be very small, low profile, and mechanically strong [2].

In the literature, several wearable antennas have been reported for wireless body area network (WBAN) applications at different Industrial, Scientific, and Medical (ISM) frequency bands, such as 0.433/0.915/2.45/5.85 GHz. In general, the footprint of the antenna is relatively small in the high-frequency region. For this reason, researchers are keen to design numerous wearable antennas at 2.45/5.85 GHz using a variety of geometries, including rectangular patches [3], circular patches [4], meander bowtie antennas [5], and co-planar waveguide (CPW)-fed monopoles [6]. A wearable antenna integrated with defected ground structure (DGS) and neutralization line (NL) has been presented in [7]. It should be mentioned that the high-frequency regions are prone to attenuation and propagation loss [8]. In this regard, the 433 MHz and 915 MHz frequency bands also have importance for the design of wearable antennas. The main design problem for low-frequency antennas is their size. In [9], an antenna unit with a volume of 1267.2 mm^3 is proposed for the communication in 400 MHz frequency band. Likewise, an alternate solution based on a meanderline monopole antenna is presented in [10]. It is observed that the antenna covers a large area of dimensions ($0.085\lambda_0 \times 0.075\lambda \times 0.002\lambda$) in wearable

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* Corresponding author: Regalla Narendra Reddy (narendra.r@uceou.edu).

[1] ECE Department, University College of Engineering, Osmania University, Hyderabad, Telengana, India. [2] ECE Department, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India.

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Research Article

Power Control and Optimization for Power Loss Reduction Using Deep Learning in Microgrid Systems

Puralasetty Ashok Babu, Javanna Latheef Mazher Iqbal, S. Siva Priyanka, Machana Jithender Reddy, Gaddam Sunil Kumar & Rajaram Ayyasamy

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Abstract

The effective management of microgrids, which incorporate DERs such as generators and batteries, is crucial for ensuring stability and efficiency in the power system. By evenly distributing the load across modules' capabilities, frequencies, and voltages, a network of micropower systems can be created, capable of transitioning between various states such as islanding, leaving, and reentering the grid. Synchronizing controllers play a vital role in regulating these transitional phases and maintaining system stability, and we propose a Deep Learning approach for power regulation and optimization. By monitoring voltages, phases, and frequencies on both sides of the

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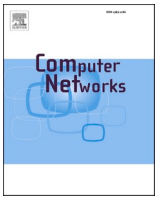

Optimized transmit antenna selection and self-attention based convolutional resource allocation model for massive MIMO technology

G.V. Pradeep Kumar [a,*], V.V. Satyanarayana Tallapragada [b], N. Alivelu Manga [c]

[a] Department of Electronics and Communication Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, India
[b] Department of Electronics and Communication Engineering, Mohan Babu University, (Erstwhile Sree Vidyanikethan Engineering College), Tirupati, 517102, India
[c] Solutions Engineer Sr. Grade-I, Synopsys Private Ltd. Hyderabad, India

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ABSTRACT

Massive multiple input and multiple output (MIMO) plays an important role in enhancing the transmission reliability and capacity of the transmitting channel. However, the resource allocation (RA) and transmit antenna selection (TAS) scheme are essential for massive MIMO systems to reduce implementation costs and complex operations. Because the presence of a large antenna consumes enormous resources that must be reduced in order to develop a user-friendly model. Hence, this article introduces a novel TAS and RA scheme in a massive MIMO system that can enhance communication performance efficiently. In this study, an improved sheep flock optimization algorithm (ISFOA) is first emphasized to select the efficient antenna, thus effectively minimizing the cost and the design complexity. Then, a novel deep learning (DL) based self-attention aided deep convolutional neural network (SA-DCNN) model for the stable allocation of resources to all available users is proposed. Thus, the user equipment (UE) can develop a better quality path and reduce the power consumption of the entire system. In the experimental scenario, the performance of the proposed model is compared with an existing technique based on sum rate, spectral efficiency (SE) and energy efficiency (EE) by varying base station (BS) antennas, varying user, signal to noise ratio (SNR), and sub-carriers along with the computational performance. Particularly, when the SNR=10 dB, the proposed model obtains the SE of about 50 bits/s Hz compared to the existing techniques.

1. Introduction

In recent years, wireless communication (WC) has played a vital role in developing advanced applications for better communication [1]. Massive multiple input multiple output is considered as an extension of mMIMO and its primary objective is to improve the transmission reliability among the channels [2]. The massive MIMO is the key system in the fifth generation (5 G) as it increases energy efficiency and spectral efficiency [3]. The millimeter wave (mm) with a massive MIMO system can produce a frequency ranging from 30 GHz to 300 GHz [4]. The massive MIMO with mm-wave maximizes energy efficiency with high channel gain, especially in recent WC applications. Compared to traditional antenna systems, mm-wave MIMO improves EE based on 3rd order magnitude [5]. However, in massive MIMO systems, many RF chains are required, rapidly increasing design complexity and system cost. For the design of energy-efficient Massive MIMO systems, an improved TAS (Transmit Antenna Selection) system is imperative to minimize system implementation and hardware costs [6].

Some of the traditional techniques like branching algorithms [7], bounding search [8] and traditional global optimizers [9] have been used to select the effective antenna in the MIMO system. However, the traditional TAS approach reduces spectrum power and increases

Abbreviation: WC, wireless communication; M-MIMO, massive-multiple input multiple output; SA-DCNN, Self-attention aided deep convolutional neural network; RA, resource allocation; TAS, transmit antenna selection; H-CRAN, heterogeneous based cloud and radio access networks; DL, deep learning; SE, spectral efficiency; EE, energy efficiency; UE, user equipment; BS, base station; SNR, signal to noise ratio; ISFOA, Improved sheep flock optimization algorithm; CSI, channel state information; RL, reinforcement learning; MDP, Markov's decision process; ZF, zero forcing; MMSE, minimum mean square error; QoS, quality of service; WPT, wireless power transfer; GSA, gravitational search algorithm; ML, machine learning; IUI, Inter-user interference; GA, genetic algorithm; PSO, particle swarm optimization.

* Corresponding author.
E-mail address: pradeepgv16@gmail.com (G.V.P. Kumar).

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RESEARCH ARTICLE

E-shaped patch with reactive impedance surface for high gain and broadband circularly polarized antenna

Guthi Srinivas, Srikar D

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Summary

A low-profile circularly polarized (CP) antenna with high gain and broad bandwidth is aimed at 5-GHz Wi-Fi applications using a symmetrical E-shaped patch. Initially, the radiating element is modeled as a symmetrical E-shape. An array of 4 × 4 rectangular patches are arranged periodically to make up a reactive impedance surface (RIS) structure. Furthermore, the RIS structure is deployed in the middle of a symmetrical E-shaped radiating patch and a perfect electric conductor (PEC) ground plane. As a result, the broadband CP is achieved with high gain. The above-mentioned combinations have achieved a −10-dB reflection coefficient bandwidth of 21.4% (4.92–6.1 GHz) and a 3-dB axial ratio (AR) bandwidth of 15.5% (5.25–6.1 GHz), and the antenna has attained a gain of 7.45–7.53 dBic.

Open Research

DATA AVAILABILITY STATEMENT

All the data included in the manuscript.

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Original Article

On companding techniques for PAPR reduction in DCT SC-FDMA system in the presence of CFOs

Naim Ben Ali [a,b], Shri Ramtej Kondamuri [c,*], Venkata Sainath Gupta Thadikemalla [c], Srikar D [d], Pavel Trojovský [e], Vijaya Durga Chintala [f]

[a] Department of Industrial Engineering, College of Engineering, University of Ha'il, 2440 Ha'il City, Saudi Arabia
[b] University of Tunis El Manar, National Engineering School of Tunis, Photovoltaic and Semiconductor Materials Laboratory, 1002 Tunis, Tunisia
[c] Department of Electronics and Communication Engineering, Velagapudi Ramakrishna Siddhartha Engineering College, Vijayawada, Andhra Pradesh, India
[d] Department of Electronics and Communication Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India
[e] Department of Mathematics, Faculty of Science, University of Hradec Králové, 50003 Hradec Králové, Czech Republic
[f] Department of Electronics and Communication Engineering, Vasavi College of Engineering, Hyderabad, Telangana, India

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ABSTRACT

In the single carrier frequency division multiple access (SC-FDMA) system, the use of discrete cosine transform (DCT) instead of discrete Fourier transform (DFT) has shown improved bit error rate (BER) performance. Nevertheless, peak-to-average power ratio (PAPR) in the DCT-based SC-FDMA system is higher than that in the DFT-based system. This paper investigates the performance of various companding schemes to reduce PAPR in DCT-based SC-FDMA systems by considering carrier frequency offsets (CFOs). Simulation results, considering parameters like BER, PAPR, and power spectral density (PSD), are provided to find the best companding technique. Furthermore, the results have been validated in a real-time indoor channel using a wireless open-access research platform (WARP) hardware.

1. Introduction

Cellular systems provide wireless communication services through multiple base stations covering a specific geographical area. In these systems, downlink transmissions are one-to-many, where a base station simultaneously transmits signals to multiple user devices within its coverage area. This necessitates high transmission power capability at the base station to accommodate the shared transmission power among multiple users [1]. In contrast, uplink transmissions are many-to-one, where a single user device has its entire transmission power available for transmitting signals to the base station. Designing an efficient multiple access and multiplexing scheme for uplink transmissions is more challenging compared to the downlink due to the many-to-one nature of the uplink communications. Additionally, low signal peakiness is a crucial requirement for uplink transmissions as user devices have limited transmission power available.

One commonly used multiple access system is orthogonal frequency division multiple access (OFDMA), which is employed in standards such as IEEE 802.11 and IEEE 802.16 and long term evolution (LTE) downlink communications [2,3]. However, OFDMA suffers from a peak-to-average power ratio (PAPR) problem, which makes single-carrier transmissions more favorable. So, in LTE standard for uplink communications, single carrier frequency division multiple access (SC-FDMA) has replaced OFDMA systems due to its lower PAPR values [4]. SC-FDMA, which is a discrete Fourier transform (DFT) spread OFDMA, spreads all modulation symbols to all allocated sub-carriers before the OFDMA modulation, resulting in reduced PAPR [5]. In [6], authors suggested the use of different sinusoidal transforms in place of DFT for OFDM systems. This prompted the development of a new SC-FDMA system that used discrete cosine transform (DCT) in place of DFT [7]. Due to the energy compaction property of DCT, a significant amount of signal energy is packed into its first few samples. This reduces the intersymbol interference as the relative amplitudes will be smaller at high-frequency indices, thereby improving the performance of bit error rate (BER) when compared to DFT-based systems. Moreover, DCT can be computed by using only real arithmetic operations whereas DFT needs complex arithmetic operations. Although DCT-based system surpasses DFT-based system in BER performance [1], its PAPR is higher than that

* Corresponding author.
E-mail addresses: na.benali@uoh.edu.sa, naimgi2@yahoo.fr (N.B. Ali), shriramtej@gmail.com (S.R. Kondamuri), sainathgupta@vrsiddhartha.ac.in (V.S.G. Thadikemalla), srikard86@gmail.com (S. D), pavel.trojovsky@uhk.cz (P. Trojovský), vijayadurga20@gmail.com (V.D. Chintala).

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Implementation of TCAM Controller Enabled CDMA Network on Chip Router for High-Speed 5G Communications

Original Research Published: 27 September 2023

Volume 4, article number 740, (2023) Cite this article

G. Renuka, P. Anuradha, Poli Lokeshwara Reddy, V. Gurumurthy & K. Rajkumar

Abstract

The 5G communications needs a high-speed data rate to satisfy the real-world communication applications. Further, the network on chip (NoC) plays the major role in real-time applications, which includes data communications, multi-processors and multi-controllers. However, existing NoC systems resulted in lower data rate with higher hardware resource utilization. Therefore, this article is focused on implementation of code division multiple access-NoC (CDMA-NoC router) using ternary content addressable memory (TCAM) buffer, Round Robin Arbiter (RRA) and XY-routing algorithm. Here, TCAM used to store the data generated across input and output ports. Further, TCAM also controls the read–write operations based on route requests. Then, RRA is used to allocate the priorities to the routes based on the traffic presented in the route. Finally, XY-routing

A deep learning framework optimised by Harris Hawks algorithm for intelligent ECG classification in WSN-IoT environment

Article type: Research Article

Authors: Anuradha, P. (https://content.iospress.com:443/search?q=author%3A%28%22Anuradha, P.%22%29)[a,*] | Navitha, Ch. (https://content.iospress.com:443/search?q=author%3A%28%22Navitha, Ch.%22%29)[a] | Renuka, G. (https://content.iospress.com:443/search?q=author%3A%28%22Renuka, G.%22%29)[b] | Jithender Reddy, M. (https://content.iospress.com:443/search?q=author%3A%28%22Jithender Reddy, M.%22%29)[c] | Rajkumar, K. (https://content.iospress.com:443/search?q=author%3A%28%22Rajkumar, K.%22%29)[d]

Affiliations: [a] Department of ECE, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India | [b] Department of ECE, Anurag University, Hyderabad, Telangana, India | [c] Department of CSE, Vasavi College of Engineering, Hyderabad, Telangana, India | [d] Department of ECE, SR University, Warangal, Telangana, India

Correspondence: [*] Corresponding author. P. Anuradha, Department of ECE, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India. E-mail: anu.rnitw99@gmail.com (mailto:anu.rnitw99@gmail.com).

Abstract: Nowadays, WSN-IoT may be used to remotely and in real-time monitor patients' vital signs, enabling medical practitioners to follow their status and deliver prompt treatments. This equipment can evaluate the gathered data on-site thanks to the integration of edge computing, enabling quicker diagnostic and medical options with the need for massive data transmission to a centralized server. Making the most of the resources accessible without sacrificing monitoring efficiency is critical due to the constrained lifespan and resource availability that these intelligent devices still encounter. To make the most of the assets at hand and achieve excellent categorization performance, intelligence must be applied through a learning model. Making the most of the resources that are available without sacrificing performance monitoring is essential given the restricted lifespan and resource availability that these intelligent devices still suffer. A learning model must incorporate intelligence in order to maximize the utilization of resources while maintaining excellent classification performance. In this study, a unique Harris Hawks Optimized Long Short-Term Memory (HHO-LSTM) that categorizes Electrocardiogram (ECG) data without compromising optimum utilization of resources is proposed for Edge enabled WSN devices. We will train the model to correctly categorize various kinds of ECG readings by employing cutting-edge techniques and neural networks. Significant testing is carried out on fifty individuals utilizing real-time test chips with integrated controllers coupled to ECG sensors and NVIDIA Jetson Nano Boards as edge computing devices. To show the benefits of the suggested model, performance comparisons with various deep-learning techniques for peripheral equipment are conducted. Experiments show that in terms of classification results (98% accuracy) and processing expenses, the suggested model, which is based on Edge-enabled WSN devices, beat existing state-of-the-art learning algorithms. The ability of this technology to help medical personnel diagnose a range of heart issues would eventually enhance customer management.

Keywords: WSN, IoT, edge computing, Harris Hawks Optimization, gated recurrent neural networks, electrocardiograms

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IoT based enabling home automation system for individuals with diverse disabilities

P. Anuradha [a,*], K. Vasanth [a], G. Renuka [b], A. Rajeshwar Rao [c]

[a] Department of ECE, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India
[b] Department of ECE, Anurag University, Hyderabad, Telangana, India
[c] Department of ECE, School of Engineering, SR University, Warangal, Telangana, India

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ABSTRACT

This paper addresses the challenges faced by individuals with impairments, focusing on their specific needs. Moreover, the insights from this study can be applied to individuals who have encountered accidents or various similar circumstances. The primary objective of this endeavor is to mitigate their discomfort. The project demonstrates the creation of an affordable machine control system utilizing IoT technology. This system incorporates functionalities such as speech control and hand gestures, making it beneficial for people with impairments. The Internet of Things (IoT) pertains to the interconnectedness of electronic devices, software, sensors, actuators, and network connectivity among machines, vehicles, structures, and other entities. This connectivity enables the gathering and sharing of data.

The application of IoT technology in this undertaking facilitates wireless control of devices via internet connectivity. The project employs a Node MCU development board as the central computing module. Furthermore, the project envisions an interface that empowers users through voice commands and hand gestures, accessible through a dedicated app. The MIT Software Inventor employs an online speech-to-text infrastructure to enable speech control. The system listens for the user's vocal commands and recognizes hand angular positions. Upon detecting specific predefined phrases, corresponding actions are triggered to activate or deactivate the machines. The innovative aspect of this concept lies in its ability to empower differently-abled individuals to effortlessly control machines through voice commands and hand gestures. The proposed system extends its applications to the industrial sector, streamlining machinery management and enhancing personnel control. This app-based interface can be accessed from any global location, further enhancing its accessibility and usability.

Introduction

Designing an affordable IoT based system for machine control with voice and hand Gesture recognition. This study endeavors to create an economical machine control system harnessing IoT (Internet of Things) technology, integrating voice commands and hand movement detection to facilitate device activation and deactivation. The proposed system offers versatility in its application, extending its usability across various scenarios. IoT represents the interconnectivity of products encompassing electronics, software, sensors, actuators, and network connectivity to gather and exchange data. In this project, IoT technology takes center stage to enable wireless equipment control through internet connectivity. This innovation serves a dual purpose: aiding individuals with visual impairments and offering a solution for emergency situations, such as car accidents, where voice recognition can assist those incapable of conventional communication. The project employs IoT to remotely manage devices via the internet, employing a Node MCU development board as the core computational unit. Furthermore, the concept strives to empower users through a dedicated mobile app, granting them control through vocal commands and hand gestures. The system adeptly captures and responds to hand gestures as they are performed. The integration of speech control and hand gestures simplifies machine operation for individuals with physical disabilities, enhancing their accessibility and independence. This initiative carries significance for industrial contexts, streamlining machinery management through app-based control. Notably, the app's utility extends globally, allowing operation from any corner of the world.

* Corresponding author.
E-mail address: anuradhap_ece@cbit.ac.in (P. Anuradha).

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ORIGINAL PAPER

Doppler collision analysis and mitigation using hybrid approach for NavIC system

P. Sathish[1] · D. Krishna Reddy[1] · V. Lokendra Kumar[1] · A. D. Sarma[2]

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Abstract
Doppler collision has a very important issue in satellite-based navigation systems. Navigation with the Indian Constellation (NavIC) comprises seven operational satellites, among which three are geo-stationary (GEO) satellites, and the rest are geosynchronous satellites. Due to the 'small line of sight velocities' of GEO satellites, estimated ranges suffer from the unique challenge of Doppler collision (DC). In this study, we present an analysis of DC events in both static and dynamic conditions, particularly in aerospace applications. We utilize experimental data acquired from the Indian Regional Navigation Satellite System (IRNSS)-GPS-Satellite Based Augmentation System (SBAS) (IGS) receiver located at a low altitude station to develop algorithms for the prediction, avoidance, and mitigation of DC events. The prediction of DC is based on the moving average method. We have devised an efficient algorithm to avoid the occurrence of DC, considering all possible combinations of IRNSS GEO satellites. Additionally, we perform the mitigation of DC using a proposed hybrid approach that involves both the space segment and user segment. The approach is based on repositioning the IRNSS 1C satellite and varying the loop bandwidth of the Delay Locked Loop (DLL). With the implementation of this proposed hybrid approach, the time duration of DC is reduced by 59.16% in static conditions and 16% in dynamic conditions.

Keywords Doppler collision · NavIC · GEO satellites · IGS receiver

1 Introduction

The radio navigation, which makes use of electromagnetic waves in position fixing, has accuracy far superior to earlier navigational methods such as celestial navigation and dead reckoning [1]. In addition to Global Navigation Satellite Systems (GNSS) such as GPS, GLONASS, Galileo, and BeiDou, recently, regional navigational systems like NavIC (the operational name of the IRNSS system) and Quasi Zenith Satellite System (QZSS) have become operational. The NavIC system is designed and developed by the Indian Space Research Organization (ISRO), India [2, 3]. It provides Position, Navigation, and Timing services over the Indian landmass and the surrounding region, extending 1500 km around it. The first phase of the NavIC constellation consists of seven satellites, among them, four are geosynchronous (GSO) and three are GEO satellites, operating at L5 (1176.45 MHz) and S1 (2492.028 MHz) band frequencies [4, 5]. The position coordinates and their status of IRNSS satellites are presented in Table 1. The first phase of the IRNSS satellites became operational in July 2016 onwards. The second phase of NavIC includes four geosynchronous (GSO) satellites in addition to the seven IRNSS satellites [6].

In addition to several other limitations, Doppler Collision (DC) presents a unique challenge to NavIC, BeiDou Phase - II, and the Wide Area Augmentation System (WAAS), which use GEO satellites in ranging [7]. The sky plot (Fig. 1) describes the 'figure of Eight' orbital path of IRNSS four geosynchronous satellites. Satellites 1A and 1B are placed in one orbit, while 1D and 1E are in another orbit. The orbital path of geostationary satellites 1C, 1E, and 1G with $\pm$ 5° inclination angle can also be seen in Fig. 1. DC can significantly influence the navigation solution for aerospace applications but to a lesser extent influence standalone applications [8]. It occurs when the relative Doppler shift between two satellites is less than the receiver code tracking loop

✉ P. Sathish
psathish_ece@cbit.ac.in

[1] Chaitanya Bharathi Institute of Technology (Department of ECE), Hyderabad, Telangana, India

[2] Chaitanya Bharathi Institute of Technology, (R&E Hub), Hyderabad, Telangana, India

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Symbol interferometry and companding transform for PAPR reduction of OTFS signal

Aare Gopal[1] | **Desireddy Krishna Reddy**[2] | **Srinivasarao Chintagunta**[3]

[1]Department of Electronics and Communication Engineering, Osmania University, Hyderabad, Telangana, India

[2]Department of Electronics and Communication Engineering, CBIT, Hyderabad, Telangana, India

[3]Department of Electronics and Communication Engineering, National Institute of Technology Calicut, Kozhikode, Kerala, India

Correspondence
Aare Gopal, Department of Electronics and Communication Engineering, Osmania University, Hyderabad, Telangana, India.
Email: aaregopal@gmail.com

Abstract

This paper presents methods for reducing the peak-to-average power ratio (PAPR) of the orthogonal time frequency space (OTFS) signal. These methods mainly consist of two operations: symbol interferometry (SI) and either μ-law or A-law companding. SI spreads the data of one OTFS symbol onto all symbols and is implemented using a simple inverse fast Fourier transform operation on each OTFS symbol. During the second operation, the PAPR of the OTFS signal is significantly reduced. For our performance analysis, the complementary cumulative distribution function, probability density function, and bit error rate are illustrated through simulations performed in MATLAB. The performance is also analyzed using a solid-state power amplifier at the transmitter and compared with OTFS, μ-law-based OTFS, and SI OTFS systems. The results indicate that the proposed OTFS system achieves a low PAPR.

KEYWORDS

A-law companding, OTFS, PAPR, symbol interferometry, μ-law companding

1 | INTRODUCTION

Future-generation wireless networks are expected to support reliable communication in high-mobility scenarios (e.g., high-speed railway, drone, and vehicle-to-vehicle communications). The existing fourth- and fifth-generation communication technologies are based on orthogonal frequency-division multiplexing (OFDM) and offer considerable spectral efficiency for time-invariant channels. However, OFDM is not robust to time-varying channels, particularly in high-Doppler spreads. The new two-dimensional (2D) orthogonal time–frequency space (OTFS) modulation technology enables proper operations through time-varying channels [1, 2]. As such, the data points are multiplexed in the delay and Doppler domains rather than in the general time and frequency domains. The main process behind an OTFS system considers a time-varying wireless channel as a delay-Doppler (DD) type. In a DD channel, the time-varying wireless channel is treated as a time-invariant channel, which leads to improved performance over OFDM modulations.

Similar to OFDM [3–6], OTFS modulation exhibits a high peak-to-average power ratio (PAPR), whose mitigation has already been addressed [7–12]. The authors in [2] presented an analytical upper bound for the PAPR, considering that the size of one OTFS frame is $N_\tau \times N_v$, N_τ and N_v are the numbers of grids along the delay and Doppler dimensions, respectively. According to this upper bound [2], the PAPR of the OTFS modulation does not increase with the number of subcarriers (delay grids), as is the case with OFDM. However, the PAPR increases with the number of symbols (Doppler grids). This characteristic was verified using a complementary cumulative distribution function (CCDF) metric for the PAPR

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ORIGINAL PAPER

ML-based LOS/NLOS/multipath signal classifiers for GNSS in simulated multipath environment

S. R. S. Jyothsna Koiloth[1] · Dattatreya Sarma Achanta[1] · Padma Raju Koppireddi[2]

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Abstract
The position accuracy of GNSS is limited by several errors including multipath error. The multipath error is well known as one of the dominant error sources in most of the high-precision GNSS applications, as its fast-changing and site-dependent nature make it challenging to model and mitigate. The Non-Line-of-Sight (NLOS) signals in combination with the original Line-of-Sight (LOS) signal lead to multipath (MP), which results in erroneous range estimation. To mitigate the effect of multipath, detecting the presence of NLOS/multipath signals plays a vital role. In this paper, GPS and IRNSS signals are considered in simulated multipath environment and in open-sky conditions. A machine learning (ML) approach for classification of LOS/NLOS/multipath is presented in both the environments. In this paper, two classifiers are proposed. The proposed classifiers are trained with signal strength, elevation angle, Doppler shift, delta pseudorange, and pseudorange residuals as attributes. The accuracies of these models are computed and compared and it is found that, among all the algorithms, K-Nearest Neighbors, Decision Tree, and its ensemble functions have demonstrated superior performance. Experimental results are presented using GPS L1, IRNSS L5, and S1 data. A comparative analysis on both the classifiers is also presented. Further, to substantiate these results, another experiment is conducted in a complex real-time dynamic multipath environment and the obtained results are also presented.

Keywords GPS · IRNSS · Machine learning · Data classification

1 Introduction

Global Positioning System (GPS) is a well-established satellite-based navigation system with global coverage, whereas Indian Regional Navigation Satellite System (IRNSS) is the emerging satellite-based autonomous navigation system developed by Indian Space Research Organization (ISRO), India to cater navigational and precise time needs over the Indian region and its surrounding. GPS constellation consists of 24 satellites in Medium Earth Orbit (MEO) at an altitude of 20,200 Kms, whereas IRNSS Constellation consists of 7 satellites at an altitude of 36,000 Kms above the earth's surface in geo synchronous orbit (GSO)/geostationary orbit (GEO). Out of these seven satellites, three are located in geostationary orbit (GEO) at 32.5° East, 83° East, and 131.5° East longitude. The remaining four satellites are in inclined geosynchronous orbit (GSO) [1, 2]. IRNSS system operates on both L band (1164.45–1188.45 MHz) and S band (2483.5–2500 MHz) frequencies in contrast to GPS that operates only on L band [3, 4]. The performance of both of these systems is limited by several errors like tropospheric error, ionospheric error etc., including one of the predominant errors, i.e., "multipath" [5].

Multipath is a dominant error source that affects GNSS positioning, because the transmitted radio waves arrive in multiple paths to a receiver in the presence of various obstacles [6, 7]. A considerable research was carried out to mitigate the multipath error from multipath-affected GNSS signals. Yedukondalu et al. has estimated and mitigated the multipath error using GPS signals [8]. However, to eliminate the multipath effect, the reflected signals, i.e., NLOS/multipath signals, are to be isolated from the direct (LOS) signal. Hence, the classification of LOS/NLOS/multipath plays a significant role. In the previous studies, Marais et al. (2005)

✉ Dattatreya Sarma Achanta
ad_sarma@yahoo.com

[1] Department of ECE, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India

[2] Department of ECE, Adikavi Nannaya University, Rajamahendravaram, Andhra Pradesh, India

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A NOVEL APPROACH TO GENERATE TRIGONOMETRIC FUNCTIONS USING HIGH PERFORMANCE FPGA

B. Khaleelu Rehman[1], Prasanthi Kumari N.[2], Raman Kumar[3], Vetriveeran Rajamani[4] and Mudasar Basha[5]
[1]Department of Electrical and Computer Engineering, Chaitanya Bharathi Institute of Technology (A), Hyderabad, India
[2]School of Computer Sciences, UPES, Dehradun, India
[3]Department of Electrical and Computer Engineering, Nalla Malla Reddy Engineering College, Hyderabad, India
[4]School of Electronics Engineering (SENSE), Vellore Institute of Technology, Vellore, India
[5]Department of Electrical and Computer Engineering, B V Raju Institute of Technology, Narsapur, Telangana, India
E-Mail: khaleelurehmanb_ece@cbit.ac.in

ABSTRACT

This paper describes the novel approach to generate the trigonometric function sine wave with different amplitudes and different frequencies. The proposed design is synthesized using Xilinx ISE 14.7 using Verilog HDL programming language and simulated using the modelsim simulator. The sine wave generation is targeted on the high performance Zynq 7-series Zedoard FPGA (7020) which has a capability of programming language (PL) and processing system (PS). Generation of sine wave is carried out using Xilinx IP Core (DDS) approach with simulation, and synthesis. Zed board works on 28nm technology. Hardware device utilization summary of the design is analyzed along with the timing values. The power report of the design is extracted using the X power analyzer. Power analysis is compared with Micro wind software and X-power analyzer.

Keywords: Xilinx ISE, FPGA, zedboard, modelsim.

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1. INTRODUCTION

Modern Electronic equipment such as function generators uses Sine wave generation for calibration, reference, and other purposes. FPGAs are more popular nowadays because of their less delay, less area, and low power consumption. The most important trigonometric functions like sine and cosine waves in digital circuits can be generated, simulated, and synthesized by using different techniques like Direct Digital Synthesizer(DDS) core, CORDIC(Coordinate Rotation and Digital Computer) based algorithm, Double integration, LUT based approach. This article proposes a novel and simple approach to generate the sine wave with the amplitude and frequency. The sine wave can easily be transferable to any targeted chip.

1.1 Sine Look Up Table Generation

The method of generating the samples of sine waves with certain amplitude and frequency can be done by using MATLAB or Python script. The amplitude of samples is converted into binary data and stored in the ROM memory of FPGA. Here this article proposes the generation of sine wave values using online generating sine wave values using the website [1]. This online tool provides one complete cycle with fixed frequency and amplitude levels. For example, one can select the number of points as shown in Table-1. Here in this example, 32 points are taken and similarly, the maximum amplitude is set as 255 the number of samples per row is selected as 8 and the generated samples are taken in decimal format. The hexadecimal format samples can also be generated. The 8 bit binary data is taken as an output. The maximum value for an 8 bit data is 255(2^8-1). All the values in the table can be generated according to the design and according to the frequency and amplitude requirement of the design engineer

Table-1. Sine look up table generator input.

Sine Look Up Table Generator Input	
Number of points	32
Max Amplitude	255
Numbers Per Row	8
○Hex	◉ Decimal

```
{128,152,176,198,218,234,245,253,
255,253,245,234,218,198,176,152,
128,103,79,57,37,21,10,2,
0,2,10,21,37,57,79,103}
```

2. LITERATURE REVIEW

Many researchers proposed trigonometric functions like sine waves, and cosine waves using the hardware description language (HDL). Upadhyaya *et al* [2] proposed a Direct Digital Synthesizer core approach to generate a sine sample using a Spartan 3 FPGA device. The hardware device utilization is discussed and the power analysis is carried out. Bohrn *et al* [3] proposed ASIC Sine wave using Spartan 3 FPGA device and the hardware utilization summary is summarized and the different algorithms are compared. Liu *et al* [4] proposed the AM modulated wave form using a DDS core with the help of a NIOS-II softcore processor and the Quartus II FPGA device. The theoretical frequency and the measured frequency from the oscilloscope are compared. Al-Safi *et*

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A novel intelligent deep optimized framework for heart disease prediction and classification using ECG signals

P. Satyanarayana Goud[1] · **Panyam Narahari Sastry**[2] · **P. Chandra Sekhar**[3]

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Abstract
The advancement in medical diagnosis approaches increases the demand for effective disease prediction and classification system. Although, various machine learning (ML) based disease classification techniques were developed, they face severe issues. Hence, a novel optimized framework named as Wolf based Generative Adversarial System (WbGAS) system was designed to predict and specify the heart disease using Electrocardiogram (ECG) database. The collected dataset contains three classes namely Normal Sinus Rhythm (NSR), Arrhythmia (ARR), and Congestive Heart Failure (CHF). The dataset is initialized and trained using the proposed (WbGAS) approach to predict the normal and abnormal signals present in dataset. In addition, the integration of wolf fitness function in the presented approach provides finest prediction rate. Moreover, the type of heart disease is specified based on the trained features. Also, a case study was presented with three different cases to explain the functioning of designed (WbGAS) approach. The designed model is implemented in MATLAB software and then, the performance of the system is determined as specificity, recall, accuracy, and precision value. At the end, to verify the results of the developed technique a comparative assessment was performed by comparing the outcomes of presented approach with existing ML based approaches.

Keywords Heart disease classification · Grey wolf algorithm · Generative adversarial network · Arrhythmia · Heart failure

✉ P. Satyanarayana Goud
satyanarayanagoudp@gmail.com

Panyam Narahari Sastry
naraharisastry_ece@cbit.ac.in

P. Chandra Sekhar
sekharpaidimarry@gmail.com

[1] Department of Electronics and Communication Engineering, G. Narayanamma Institute of Technology and Science (for Women), Hyderabad, Telangana 500104, India

[2] Department of Electronics and Communication Engineering, Chaitanya Bharathi Institute of Technology (CBIT), Hyderabad, Telangana 500075, India

[3] Department of Electronics and Communication Engineering, Osmania University, Hyderabad, Telangana 500007, India

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Optimized transmit antenna selection and self-attention based convolutional resource allocation model for massive MIMO technology

G.V. Pradeep Kumar [a,*], V.V. Satyanarayana Tallapragada [b], N. Alivelu Manga [c]

[a] Department of Electronics and Communication Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, India
[b] Department of Electronics and Communication Engineering, Mohan Babu University, (Erstwhile Sree Vidyanikethan Engineering College), Tirupati, 517102, India
[c] Solutions Engineer Sr. Grade-I, Synopsys Private Ltd. Hyderabad, India

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Massive multiple input multiple output system
Improved sheep flock optimization
Deep convolutional neural network
Resource allocation
Transmit antenna selection

ABSTRACT

Massive multiple input and multiple output (MIMO) plays an important role in enhancing the transmission reliability and capacity of the transmitting channel. However, the resource allocation (RA) and transmit antenna selection (TAS) scheme are essential for massive MIMO systems to reduce implementation costs and complex operations. Because the presence of a large antenna consumes enormous resources that must be reduced in order to develop a user-friendly model. Hence, this article introduces a novel TAS and RA scheme in a massive MIMO system that can enhance communication performance efficiently. In this study, an improved sheep flock optimization algorithm (ISFOA) is first emphasized to select the efficient antenna, thus effectively minimizing the cost and the design complexity. Then, a novel deep learning (DL) based self-attention aided deep convolutional neural network (SA-DCNN) model for the stable allocation of resources to all available users is proposed. Thus, the user equipment (UE) can develop a better quality path and reduce the power consumption of the entire system. In the experimental scenario, the performance of the proposed model is compared with an existing technique based on sum rate, spectral efficiency (SE) and energy efficiency (EE) by varying base station (BS) antennas, varying user, signal to noise ratio (SNR), and sub-carriers along with the computational performance. Particularly, when the SNR=10 dB, the proposed model obtains the SE of about 50 bits/s Hz compared to the existing techniques.

1. Introduction

In recent years, wireless communication (WC) has played a vital role in developing advanced applications for better communication [1]. Massive multiple input multiple output is considered as an extension of mMIMO and its primary objective is to improve the transmission reliability among the channels [2]. The massive MIMO is the key system in the fifth generation (5 G) as it increases energy efficiency and spectral efficiency [3]. The millimeter wave (mm) with a massive MIMO system can produce a frequency ranging from 30 GHz to 300 GHz [4]. The massive MIMO with mm-wave maximizes energy efficiency with high channel gain, especially in recent WC applications. Compared to traditional antenna systems, mm-wave MIMO improves EE based on 3rd order magnitude [5]. However, in massive MIMO systems, many RF chains are required, rapidly increasing design complexity and system cost. For the design of energy-efficient Massive MIMO systems, an improved TAS (Transmit Antenna Selection) system is imperative to minimize system implementation and hardware costs [6].

Some of the traditional techniques like branching algorithms [7], bounding search [8] and traditional global optimizers [9] have been used to select the effective antenna in the MIMO system. However, the traditional TAS approach reduces spectrum power and increases

Abbreviation: WC, wireless communication; M-MIMO, massive-multiple input multiple output; SA-DCNN, Self-attention aided deep convolutional neural network; RA, resource allocation; TAS, transmit antenna selection; H-CRAN, heterogeneous based cloud and radio access networks; DL, deep learning; SE, spectral efficiency; EE, energy efficiency; UE, user equipment; BS, base station; SNR, signal to noise ratio; ISFOA, Improved sheep flock optimization algorithm; CSI, channel state information; RL, reinforcement learning; MDP, Markov's decision process; ZF, zero forcing; MMSE, minimum mean square error; QoS, quality of service; WPT, wireless power transfer; GSA, gravitational search algorithm; ML, machine learning; IUI, Inter-user interference; GA, genetic algorithm; PSO, particle swarm optimization.

* Corresponding author.
E-mail address: pradeepgv16@gmail.com (G.V.P. Kumar).

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EEG-BCI-based motor imagery classification using double attention convolutional network

V. Sireesha[a], V. V. Satyanarayana Tallapragada[b], M. Naresh[c] and G. V. Pradeep Kumar[d]

[a]Department of Computer Science and Engineering, School of Technology, GITAM University, Hyderabad, India; [b]Department of ECE, Mohan Babu University, Tirupati, Andhra Pradesh, India; [c]Department of ECE, Matrusri Engineering College, Saidabad, Hyderabad, India; [d]Department of ECE, Chaitanya Bharathi Institute of Technology, Hyderabad, India

ABSTRACT

This article aims to improve and diversify signal processing techniques to execute a brain-computer interface (BCI) based on neurological phenomena observed when performing motor tasks using motor imagery (MI). The noise present in the original data, such as intermodulation noise, crosstalk, and other unwanted noise, is removed by Modify Least Mean Square (M-LMS) in the pre-processing stage. Traditional LMSs were unable to extract all the noise from the images. After pre-processing, the required features, such as statistical features, entropy features, etc., were extracted using Common Spatial Pattern (CSP) and Pearson's Correlation Coefficient (PCC) instead of the traditional single feature extraction model. The arithmetic optimization algorithm cannot select the features accurately and fails to reduce the feature dimensionality of the data. Thus, an Extended Arithmetic operation optimization (ExAo) algorithm is used to select the most significant attributes from the extracted features. The proposed model uses Double Attention Convolutional Neural Networks (DAttnConvNet) to classify the types of EEG signals based on optimal feature selection. Here, the attention mechanism is used to select and optimize the features to improve the classification accuracy and efficiency of the model. In EEG motor imagery datasets, the proposed model has been analyzed under class, which obtained an accuracy of 99.98% in class Baseline (B), 99.82% in class Imagined movement of a right fist (R) and 99.61% in class Imagined movement of both fists (RL). In the EEG dataset, the proposed model can obtain a high accuracy of 97.94% compared to EEG datasets of other models.

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KEYWORDS
Motor imagery; EEG signal; modified least mean square; common spatial pattern; pearson correlation coefficient; arithmetic operation optimization; double attention; convolutional net

1. Introduction

The brain is one of the important organs in the human body, and it can control emotions, thoughts, and memories, etc. There are several neurons present in the body, and these neurons cause electrical waves with every action of the human body. These waves are called Electroencephalography (EEG). In the human scalp, electrical activities are measured by these EEG signals. Brain-Computer Interface (BCI) analyses signals from the brain and translates them into commands. Due to BCI's non-invasive, low cost and high time resolution, BCI is generally used to record EEG signals in systems (Padfield et al. 2019). Motor Imagery (MI) is the most important concept in the BCI system. Different techniques, such as Auto Regression and linear regression, are used to classify the types of MI. Features required for MI recognition are extracted by various methods, such as Fast Furrier Transform (FFT) and Common Spatial Pattern (CSP) (Chen et al. 2014).

Certain people perform MI tasks, and energy decreases in the ipsilateral place and increases in the contralateral place. Thus, several kinds of signals are attained and converted into commands. (Zhang et al. 2017). In the early days, various researchers analyzed and implemented MI-based BCI systems. Based on the analyses, multiple limitations are observed, such as being time-consuming, less accurate and providing very low performances. Due to the limitations presented in the existing model, an efficient system cannot be achieved by using single classifiers. Various learning algorithms, such as deep learning (DL), Machine Learning (ML), Transfer Learning, and Motor Learning, are introduced to overcome these limitations. Different types of classifiers related to the DL technique, pre-processing, and feature extraction stage are used to decode EEG signals and MI

CONTACT V. V. Satyanarayana Tallapragada satya.tvv@gmail.com

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RESEARCH ARTICLE

WILEY

Joint optimal beam forming and resource allocation in intelligent reflecting surface aided wireless power transfer rate splitting multiple access system

M. Naresh[1] | G. V. Pradeep Kumar[2] | V. Sireesha[3] | V. V. Satyanarayana Tallapragada[4]

[1]Department of ECE, Matrusri Engineering College, Saidabad Hyderabad, Telangana, India

[2]Department of ECE, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India

[3]Department of Computer Science and Engineering, School of Technology, GITAM University, Hyderabad, Telangana, India

[4]Department of ECE, School of Engineering, Mohan Babu University (Erstwhile Sree Vidyanikethan Engineering College), Tirupati, Andhra Pradesh, India

Correspondence
V. V. Satyanarayana Tallapragada, Department of ECE, School of Engineering, Mohan Babu University (Erstwhile Sree Vidyanikethan Engineering College), Tirupati, Andhra Pradesh 517102, India.
Email: satya.tvv@gmail.com

Summary

The intelligent reflecting surface (IRS) has recently become the most promising technology to achieve maximum beam-forming gain with a simultaneous wireless information and power transfer (SWIPT) system. Many existing studies perform a single IRS deployment or utilize space division multiple access (SDMA) and non-orthogonal multiple access (NOMA) schemes. However, the existing schemes face high time complexity and block signal transmission for larger indoor communications. Hence, this article introduces a dual IRS-aided multiuser SWIPT system by implementing rate-splitting multiple access (RSMA) systems. To enhance the minimum achievable rate and ensure the minimum harvesting energy (HE), this study proposes a joint successive convex approximation with an integrated optimization algorithm (SCA-IOA). The proposed algorithm jointly optimizes the reflecting beam forming and power splitting (PS) coefficient of all the users effectively. The simulation results demonstrate the effectiveness of the proposed techniques and produce an outstanding performance for deploying dual IRS and implementing RSMA compared to traditional SDMA and NOMA systems.

KEYWORDS

beam forming design, intelligent reflecting surface, min-max rates, rate splitting multiple access, resource allocation, signal-to-interference noise ratio, simultaneous wireless information and power transfer

1 | INTRODUCTION

The distribution of larger internet of things (IoT) devices has recently led to many design complexities over wireless networks.[1] The number of users accessing the networks, especially in heterogeneous devices, faces high power consumption, self-interference, interference, and so forth. To overcome this issue, SWIPT is introduced in the IoT system to enhance communication performance.[2–4] In the SWIPT systems, two receivers, namely power splitting (PS) and time switching (TS), are utilized. The PS is more flexible in correspondence with rate achievement and harvesting energy than the TS.[5] However, the TS is highly efficient with a binary PS coefficient. In wireless links (WL), the SWIPT system is highly reliable but exhibits high path loss for larger propagation that reduces the efficiency of wireless power transfer (WPT).[6,7] However, the WPT is the bottleneck for the SWIPT system; hence it cannot be avoided.

The efficient reconfigurable surface device, intelligent reflecting surface (IRS), is introduced to work flexibly throughout the wireless channels to maximize WL quality. The IRS system works dynamically in the wireless channels to maximize transmission reliability and channel gain.[8,9] The IRS system controls the phase and amplitudes using reflecting unreceptive elements. Several studies have been reported for IRS with SWIPT systems that prove high data rates, better energy efficiency (EE), and energy harvesting compared to other systems.[10] The heterogeneity devices require enhanced multiple access schemes to reduce the challenges over complex IoT networks.[11] Nowadays, rate-splitting multiple access (RSMA) has

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Blind forgery detection using enhanced mask-region convolutional neural network

V. V. Satyanarayana Tallapragada[1] · D. Venkat Reddy[2] · G. V. Pradeep Kumar[3]

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Abstract
This work proposes a DL model for locating and classifying the forgery images. The proposed work has stages like pre-processing, feature extraction, segmentation, localization, and forgery detection. The input RGB images are converted into an YCbCr colour model in the pre-processing stage. Due to the size of the blocks, the processing time may be increased. Hence, the input images are split into overlapping blocks to reduce the time complexity. Here, a series of residual blocks are utilized for feature extraction, segmentation, and localization. Hybrid DL model Enhanced Mask-RCNN carries out this process. The Enhanced Mask-RCNN integrates the residual network with Mask-RCNN (Mask-region convolutional neural network). In this hybrid network, the residual network is used to extract the features, and the Mask-RCNN is used to segment, locate, and detect the tampered region. Further, the neural network weights are optimized by sandpiper optimization (SO) to enhance the recognition accuracy. The performance of a proposed forgery detection model is compared with three benchmark datasets and attained better accuracy of 0.991, 0.997, and 0.997 on the GRIP, Coverage, and CASIA-V1 datasets, respectively.

Keywords Blind forgery detection · Deep learning · Manipulated features · Enhanced mask-RCNN · Tampered region · Overlapping blocks · Optimization

1 Introduction

The emergence of the Internet with social networks and other fields has created digital images as the essential information need. These images are used as evidence for legal purposes and in medical and sports fields. Further, digital imaging ensures various feasibilities

✉ V. V. Satyanarayana Tallapragada
satya.tvv@gmail.com

[1] School of Engineering, Department of ECE, Mohan Babu University, Tirupati, Andhra Pradesh 517102, India

[2] Department of ECE, Mahatma Gandhi Institute of Technology, Gandipet, Hyderabad 500075, India

[3] Department of ECE, Chaitanya Bharathi Institute of Technology, Gandipet, Hyderabad 500075, India

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Integrity monitoring of NavIC by parsing broadcast ephemeris

Devalapally, Sony[a] ; Desireddy, Krishna Reddy[a]; Perumalla, Naveen Kumar[b]
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[a] Chaitanya Bharathi Institute of Technology, Gandipet,Telangana, Hyderabad, 500075, India
[b] University College of Engineering, Osmania University, Telangana, Hyderabad, 500007, India

Abstract

Global navigation satellite systems (GNSS) are used to provide position estimation to the users. These navigation systems must meet the required navigation parameters (RNP) parameters. Among them integrity being the important parameter, defined as a navigation system's honesty of the information provided to the user by satellites.

The extremity of error due to clocks, ephemeris etc., broadcasted in navigation message of NavIC will result in inaccurate information provided by the satellites that tamper the Navigation with Indian constellation (NavIC) system integrity. The information provided by the satellites may be faulty due to various error sources and cannot be used for applications which require very high accuracy. Integrity of the information provided by satellites plays a vital role and the system needs to be notified accordingly. The traditional methods receiver autonomous integrity monitoring (RAIM) algorithms require both navigation and observation data for implementation and involves several computations, hence in this paper an efficient approach considering only navigation message is proposed to monitor the integrity of NavIC. The NavIC Navigation data of 28 days data corresponding to 4 months is collected from IGS website. The integrity check is performed considering the satellite's User Range Accuracy Upper Bound (URA UB), fit interval and health parameters from navigation message. It is observed from the results that there are specific instances of integrity failure of NavIC system. However, it is also noticed that 99.5% of times the integrity provided by NavIC is within specified limits that guarantee the NavIC utility for critical applications. © 2023 Walter de Gruyter GmbH, Berlin/Boston.

Author keywords

Indian regional navigational satellite system; integrity; receiver autonomous integrity monitoring (RAIM); user range accuracy (URA)

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Devalapally, S.; Chaitanya Bharathi Institute of Technology, Gandipet,Telangana, Hyderabad, India; email:sonyd_ece@cbit.ac.in

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Research article

A novel energy efficient 4-bit vedic multiplier using modified GDI approach at 32 nm technology

K. Nishanth Rao [a], D. Sudha [b], Osamah Ibrahim Khalaf [c], Ghaida Muttasher Abdulsaheb [d], Aruru Sai Kumar [e,*], S. Siva Priyanka [f], Khmaies Ouahada [g], Habib Hamam [g,h,i,j]

[a] Department of ECE, MLR Institute of Technology, Hyderabad, India
[b] Department of ECE, CMR College of Engineering and Technology, Telangana, India
[c] Department of Solar, Al-Nahrain Research Center for Renewable Energy, Al-Nahrain University, Jadriya, Baghdad, Iraq
[d] Department of Computer Engineering, University of Technology, Baghdad 10066, Iraq
[e] Department of ECE, VNR Vignana Jyothi Institute of Engineering and Technology, Telangana, India
[f] Department of ECE, Chaitanya Bharathi Institute of Technology, Telangana, India
[g] School of Electrical Engineering, University of Johannesburg, Johannesburg 2006, South Africa
[h] Faculty of Engineering, Université de Moncton, Moncton, NB, E1A3E9, Canada
[i] Hodmas University College, Taleh Area, Mogadishu, Somalia
[j] Bridges for Academic Excellence, Tunis, Tunisia

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ABSTRACT

Multipliers are essential components within digital signal processing, arithmetic operations, and various computational tasks, making their design and optimization crucial for improving the efficiency and performance of integrated circuits. Among multiplier architectures, Vedic multipliers stand out due to their inherent efficiency and speed, derived from ancient Indian mathematical principles. This study presents a comprehensive analysis and comparison of 4-bit Vedic multiplier designs utilizing Gate Diffusion Input (GDI), Complementary Metal-Oxide-Semiconductor (CMOS), and Transmission Gate (TG) technologies, utilizing different adder architectures such as Ripple Carry Adder (RCA), and Carry Lookahead Adder (CLA), Carry Skip Adder (CSA). The objective is to explore the performance, area, and power consumption characteristics of these multipliers across different technologies and adder implementations. Each multiplier architecture is meticulously designed and optimized to leverage the unique features of the respective technology while adhering to the principles of Vedic mathematics. The designs are evaluated based on parameters such as transistor count, delay, power dissipation, and area. The results demonstrate the effectiveness of GDI technology in terms of in tems of delay, area, power and PDP when compared with other technologies. The 4-bit Vedic multiplier has been designed using 32 nm technology within Tanner EDA software tools.

* Corresponding author.
E-mail address: asaikumar.nitw@gmail.com (A.S. Kumar).

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IDENTIFICATION OF INTRA PULSE MODULATION SIGNAL IN THE PRESENCE OF NOISE

Neeraja Bandi[1], N. V. Koteswara Rao[1] and B. Rajendra Naik[2]
[1]Department of Electronics and Communications Engineering, Chaitanya Bharathi Institute of Technology, India
[2]Department of Electronics and Communications Engineering, Osmania University, India
E-Mail: bneeraja_ece@cbit.ac.in

ABSTRACT

In Electronic Warfare systems, Low Probability of Intercept (LPI) radar signals are used for identifying the targets in the selected region of operation. LPI radars are designed to minimize the chances of being intercepted or detected by passive radar receivers. Advanced signal processing techniques become an essential requirement when these signals are used for the detection and separation of multiple targets in a noisy environment. In this work, a noisy Stepped Frequency Modulated (SFM) waveform is detected by using high resolution spectrum estimation techniques. To improve the detection capability of the noisy SFM, two level filtering is used as pre-processing step. The filtered SFM signal is analysed using Root MUSIC and Eigenvector algorithms and the multiple target frequencies are estimated. The proposed method is successful in detecting the parameters of the SFM signal in the low Signal Noise Ratio conditions up to -9dB with an accuracy of 99%.

Keywords: stepped frequency FM, root MUSIC algorithm, eigenvector method, denoising filters, electronic warfare.

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1. INTRODUCTION

Radar is a vital and versatile tool for many applications because it can operate in all weather conditions. Radar images captured by satellites have a wide range of applications, such as visualizing the surface of the Earth from orbit, studying asteroids, and exploring the surfaces of other planets. It can also be used for assisting with navigation in the air and on the water, assisting in the detection of military forces, enhancing traffic safety, and providing scientific data [1]-[3]. Radar is a tool used by military forces to target different kinds of weapons as well as track the movement of troops, missiles, and aircraft in the Electronic Warfare field.

Electronic warfare (EW) system uses electromagnetic energy to detect, exploit, or prevent hostile use of the electromagnetic spectrum. The primary two problem that EW receivers encounter is determining a theoretical bound for a receiver that can process two simultaneous signals. The second problem is to find the dynamic range and frequency resolution of the radar signals. This problem should be answered with real time signal processing in mind This problem should be addressed with real-time signal processing techniques. Because of the increase in signal processing speed, digital receivers are employed in EW systems to detect the targets [4]-[7]. Most of the users of radar systems are employing LPI radar signals as tactical requirements for Electronic Warfare applications [8]-[10]. A.B.Glenn in 1984 proved that the most significant improvement in LPI performance may be obtained by operating at extremely high frequency ranges. The basic purpose of an LPI capability for a communication system is to prevent the enemy from locating our communication systems, which will reduce the effect of electronic attacks and physical attacks [11]. R.K.Niranjan and B.Rajendra Naik proposed Digital IQ Method for detecting complex pulsed radar signals. The modulation techniques used in pulsed radar are Inter-Pulse Modulation and Intra-Pulse Modulation. For intrapulse analysis, it measures immediate parameters including phase, frequency, and amplitude, while for interpulse analysis, it measures pulse width and pulse repetition interval. With the suggested approach, different radar signal waveforms can be handled [12]. Since the range resolution is inversely proportional to the signal bandwidth, therefore the modulation improves range resolution without narrowing pulse width. In Inter-Pulse Modulation, modulation is applied from pulse to pulse. It is classified into two types Frequency modulated signal (Stepped FM) and Phase Modulated signal [13]-[18].

In stepped FM, the frequency is varied in the form of steps which is constant with Δf. It can achieve a large bandwidth for high range resolution by repeatedly changing carrier frequency over pulses. Wide bandwidth signals are required in high resolution radars to achieve a narrow main lobe width [19]. The generation of such wide bandwidth signals raises the system's cost and complexity. To overcome these constraints, the wide bandwidth signal is divided into a group of narrowband signals that are transmitted and received separately. The effect of a wide bandwidth signal is obtained by coherently merging narrow band signals. Such narrow band signals are called Stepped FM waveforms frequency jumped train or synthetic wide band waveforms [20]-[21]. The majority of digital receiver systems employ the FFT to determine the radar signal spectra. This method of spectral analysis is highly effective and yields acceptable outcomes for a wide range of signal processing applications [22]. Apart from these advantages, it has several performance limitations. The most prominent limitation is that, if there are multiple signals with frequencies that are very close in range, the FFT operation gives a spurious response that, one flat peak containing the response of multiple signals. Many

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SALINE FLUID FLOW SUPERVISION IN INTENSIVE CARE UNIT USING PRECISION ALGORITHM

[1]K.VIDYA SAGAR, [2]SURYA PRASADA RAO BORRA, [3]A. GEETHA DEVI, [4]M. RAJ KUMAR NAIK, [5]LAKSHMI RAMANI BURRA, [6]VEERA VASANTHA RAO BATTULA, [7]TATA BALAJI

[1]Department of EIE, VNR Vignana Jyothi Institute of Engineering and Technology, Hyderabad.
[2,3,7]Department of ECE, PVP Siddhartha Institute of Technology, Vijayawada, India
[4]Department of ECE, Chaitanya Bharathi Institute of Technology, Gandipet, Telangana, India
[5]Department of CSE, Koneru Lakshmaiah Education Foundation, Vaddeswaram AP, India
[6]Department of ECE, RVR&JC College of Engineering, Guntur, AP, India

Corresponding Author: suryaborra1679@gmail.com

ABSTRACT

Saline fluid infusion in intra vein supervision is imperative to correct significant abnormalities. The fluid infusion rate influence on the physiological parameters like systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), pulse rate (PR) and respiration rate (RR). The temperature (T) will change with rapid infusion of saline fluid. Saline fluid level monitoring is also significant. Monitoring these parameters continuously using Atmega 328 controller and energizing the alarm system and sending alert signals to the registers persons to curtail further disorders. With preset volumetric flow rate of the fluid patient is observed for 30 minutes with dextrose solution. Heart rate and cardiac stroke volume (CSV) and cardiac stroke volume index (CSVI) values change with increasing fluid infusion rate. Ther saline fluid infusion rate is controlled based on the changes of HR level, CSV, CSVI, SBP, and DBP variations, body temperature and RR values. The experimental finding shows blood pressure variation (BPV) change of 11.56%. systolic blood pressure (SBP) is increased 8% and diastolic blood pressure is decreased 3.25%. The heart rate change is 1.25 BPM. After 30 minutes of observation the heart rate change is 12%. This is significant.

Keywords: *Saline Fluid Monitoring, Systolic Blood Pressure, Diastolic Blood Pressure, Heart Rate, Pulse Rate, Cardiac Output, Cardiac Stroke Volume.*

1. INTRODUCTION

Infusing fluid into intracellular vessels is imperative to balance the electrolytes, to correct acid-based abnormalities and some specific disorders. The inadequate infusion of saline fluid and rapid infusion leads to disorders in human body. Infusion of saline is influencing on HR and of the atrial valve pressures. The CSV and CSVI is considered. Infusion of saline increases the CSVI value. Diastolic pressure levels are increased, and systolic pressure levels decreased significantly. The heart rate is continuously monitored during infusion of saline. Significant changes of diastolic and systolic pressure volume levels influencing on the heart rate.

Most of the relevant papers focused on mechanical system development and its kinematics. Some research papers considered heart rate and blud pressure parameters impact with saline fluid infusion.

But the proposed article/ paper meticulously regulating the fluid flowrate and addressing insight analysis of the physiology. The clinical investigations or findings are corelated with the physician recommendations.

The difference of diastolic and systolic volume levels represents the stroke volume. The heart rate is much influenced with stroke volume. With increase in stroke volume, the heart rate is significantly increased. The cardiac output is estimated with the multiplication of stroke volume and heart rate. Changes in heart rate is influencing on the changes of cardiac output.

Literature review screening is done to develop a reliable model. Relevant work discussion is not included in the paper owing to more results and discussion. Research work is presented to impart good significant study.

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Investigation of Beam Forming Algorithms Using Smart Antenna for Modern Wireless Communication

Narayanadas Mallaiah[1], N. V. Koteswara Rao *[2], D. Ramakrishna[3]

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Abstract: In Recent wireless communications especially for mobile phones the effectiveness of the system depends on how well the signal is received, with signals coming from several service providers and radio users, the wireless channels grow crowded. Enhancing a signal's quality is important under these fictitious circumstances Additionally, the current generation of services, like 5G, will use a higher frequency range and require a broader bandwidth and more channel capacity for high-speed data transfers.

One of the technologies that can improves the wireless communication system is smart antenna with respect to enhancing quality, coverage, and capacity of networks while increasing efficiency.

The biggest issue in a noisy setting is getting the most signal reception in the desired direction. Therefore, Adaptive algorithms contributes a key factor in obtaining the optimum signal quality with improving efficiency.

In this paper we considered uniform linear array with 15 elements and performance can be investigated using adaptive beam forming algorithms Recursive Least Square (RLS), Least Mean Square (LMS) The results of simulations are carried out by using MATLABR2023A.

Our focus is to improves the system efficiency with high gain towards the desired direction without any side lobes. This can be obtained by using the N-LMS algorithm

Keywords: *Adaptive beamforming, smartantenna,RLS LMS, NLMS*

1. Introduction

A system of elevated conductors known as an antenna, which connects or aligns the transmitter or receiver with empty space. In order to transmit or receive radio waves, antennas act as interfaces between photons in space and electrons on conductors. An antenna array is a collection of related antennas those are all pointed in the same general direction. The two types of antenna array systems are as follows: They are a non-uniform linear array where the current excitation coefficients vary and a uniform linear array where each element is given an equal amount of current with the phase shift along the line is uniform.

A smart antenna system integrates digital signal processing methods with array antenna components. A technique for manipulating signals can created on an array antenna's elements is known as array signal processing. Mobile communication services are increasingly requiring smart antennas in a noisy environment so that they can achieve the spatial dimensions of a wireless channel [1].

The Direction of arrival (DOA) and beamforming techniques are generally developed at signal processing technology. All incoming signals have their direction of arrival determined by the DOA algorithm. The system settings are then updated using the adaptive beam forming technique. In order to reduce the phase shift in the received signal, the main beam is aimed in the direction of the intended signal, while nulls are aimed in the direction of interference [2], with the weights of the elements affecting both phase shift and amplitude attenuation. In an adaptive smart antenna system, a maximum-intensity beam can be formed in any desirable direction while a Smart antenna produces a beam based on the estimated DOA.

This paper organized into following sections: Section II Shows the description about antenna arrays, Smart antenna system was described in section III. Beam forming algorithms Recursive Least Square, Least Mean Square and Normalized -LMS techniques in section IV. The Section V presents the simulations findings. In section VI, Concluding Remarks are made.

2. Linear Arrays

The spatial locations of antenna elements in various forms called antenna array geometry, we consider the linear array in our case with 15elements for simplicity and ease of operation and implementation [3][4] and it is shown in fig1

[1]*Ph.D. Research Scholar ,Department. of ECE Osmania University, Hyderabad, India narayanadas.mallaiah@gmail.com*
[*2]*Professor & Director of IQAC, ECE Dept CBIT, Hyd, India nvkoteswararao@gmail.com*
[3]*Professor &Head, Dept. of ECE Osmania University, Hyd, India dasariramakrishna@osmania.ac.in*

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Original Article

Slime Mould-Based Collaborative Deep Boltzmann Machine for Intrusion Detection Model in Mobile Ad Hoc Network

G. Parameshwar[1,4], N.V. Koteswara Rao[2], L. Nirmala Devi[3]

[1,3]*Department of Electronics and Communications Engineering, University College of Engineering, Osmania University, Hyderabad, India.*
[2]*Department of Electronics and Communications Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, India.*
[4]*Department of Electronics and Communications Engineering, Vidya Jyothi Institute of Technology, Hyderabad, India.*

[1]*Corresponding Author : paramesh.gujjula@gmail.com*

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Abstract - *Mobile Ad Hoc Network (MANET) is a dynamic wireless network developed by using wireless nodes without using any infrastructures. The significant features of MANET are low-cost infrastructure, self-organization, mobility and rapid deployment, which offer the opportunity to deploy it in various applications such as disaster relief, environmental monitoring and military communications. Based on the previous studies, improved Quality of Service (QoS) metrics with security problems during data communication are challenging with the increased wireless technology. By addressing these issues, here proposed a novel secured intrusion detection model in MANET. The cluster formation is effectuated with the Modified K-Harmonics Mean Clustering (MKHMC), and the cluster heads are selected with the proposed Chaotic Multi-verse Krill Herd Optimization (CMKHO) algorithm, which helps to provide energy efficiency, reduction in delay, and increased throughput. Meanwhile, this proposed blockchain-secured Slime Mould-based Collaborative Deep Boltzmann Machine (SM-CDBM) includes three stages, (i) learning the unimodal DBM models to identify the intrusion, (ii) learning the shared layer parameters utilizing a Collaborative Restricted Boltzmann Machine (CRBM), and (iii) fine-tuning the CDBM using the Slime Mould Optimization (SMO) algorithm. Simulations are effectuated in the NS2 tool and accomplish improved malicious node detection, end-to-end delay, energy efficiency, and overhead compared to other state-of-the-art approaches.*

Keywords - *MANET, Modified K-Harmonics Mean Clustering, Chaotic Multi-verse Krill Herd Optimization, Collaborative DBM, Slime Mould Optimization algorithm.*

1. Introduction

Mobile Ad-Hoc Networks (MANETs) [1] can be developed in a conscience method with none from before the supply chain and operations supervision, unlike standard cellular connections like Wi-Fi connectivity and data networks. These connections are less expensive and are suitable for scenarios like earthquakes, catastrophes, flash points, relief efforts, etc., because they don't depend on any from before the infrastructure.

Sensor networks, automotive wireless communications, robot communications, autonomous aerial vehicles [2], underwater networks, Internet of Things (IoT) [3], and other non-emergency applications are examples. As a result of the nodes' potential for continuous motion, the network architecture is dynamic and highly unstable. Especially compared to comparable bulk counterparts, communication networks have a shorter lifespan. Several abilities and frequency restrictions apply to the bandwidth links. Both unidirectional and bidirectional links are possible. These networks have lower efficiency since interference, withering, vibration, and orthogonal frequency division multiplexing [4]. The benefit of using a Mobile Ad Hoc Network is an internet connection without a wireless router. As a result, maintaining an ad hoc network may be less expensive than maintaining a standard network.

Shams et al. [5] have described a Support Vector Machine- Intrusion Detection System (SVM-IDS) to examine internet usage to find and eliminate rogue connections to boost performance. It is highly effective in identifying network attacks and eradicating faulty activities from the system. Hence, it poses a severe risk to impose operators and broadband connections. Islabudeen et al. [6] have presented a Smart Approach for Intrusion Detection and Prevention System (SA-IDPS) to use computational techniques to reduce

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IMPLEMENTING RESNET-50 TRANSFER LEARNING MODEL FOR DIAGNOSING OCT IMAGES FOR DETECTING AND CLASSIFYING DME ABNORMALITIES

[1] A. GEETHA DEVI, [2] SURYA PRASADA RAO BORRA,[3]D. HARI KRISHNA, [4]M. RAJ KUMAR NAIK, [5]K. VIDYA SAGAR, [6]LAKSHMI RAMANI BURRA

[1,2] Associate Professor, Department of ECE, PVP Siddhartha Institute of Technology, Vijayawada, India
[3]Associate Professor, Department of ECE, B V Raju Institute of Technology, Narasapur, Telangana
[4]Assistant Professor, Department of ECE, Chaitanya Bharathi Institute of Technology, Gandipet, Telangana
[5]Department of EIE, VNR Vignana Jyothi Institute of Engineering and Technology, Hyderabad.
[6]Department of CSE, Koneru Lakshmaiah Education Foundation, Vaddeswaram AP, India

Email: geetha.agd@gmail.com, suryaborra1679@gmail.com, harikrishna.dodde@bvrit.ac.in, raj.meghavath@gmail.com, vidyasagar_k@vnrvjiet.ac.in, ramanimythili@gmail.com

ABSTRACT

One of the major diseases that affect human eyes due to complications of diabetes is Diabetic Retinopathy (DR). A particular type of DR affecting the retina's central portion, called the macula, creates a vision problem. It is called Diabetic Macular Edema (DME). The blood vessels in the eye get damaged, and leaking fluid on the macula causes tissue thickening and swelling. The image may be occluded for various external and environmental reasons, which can degrade the image quality and provide a wrong diagnosis. The early diagnosis of DME is essential to avoid vision loss, and OCT images are used for prescreening because OCT is one of the non-invasive imaging modalities that can provide high-resolution retina images speedily. Several earlier research works have focused on analyzing various DR images using image processing methods, providing less prediction accuracy. This work aims to create an automatic transfer learning model for classifying DME using OCT images. ResNet-50 is created by training with 80% of the training OCT images, evaluated and validated by random, and 20% of the testing images. The reason for using the **ResNet-50** model is that it is a pre-trained model using ImageNet data. The proposed ResNet is experimented with a benchmark dataset with Python for testing and validating its output. The output is compared with the other earlier methods to evaluate the performance. The comparison shows that the proposed ResNet-50 model outperforms others by obtaining 97.56% accuracy.

Keywords: *Diabetic Macula Edema, OCT Images, Transfer Learning Models, ResNet-50, Diabetic Retinopathy, Medical Image Processing.*

1. INTRODUCTION

One of the complications of diabetes that affects the eyes is Diabetic Retinopathy (DR). It occurs when high blood sugar levels damage the blood vessels in the retina, the part of the eye that senses light and sends signals to the brain. Over time, these damaged blood vessels can leak blood and other fluids, causing swelling and clouding of the retina. It can lead to blurred vision, floaters, and even complete vision loss. DR is a severe condition that can develop without symptoms, so people with diabetes need regular eye exams to detect the symptoms of early diseases. Tight control of blood sugar, blood pressure, and cholesterol levels can help to reduce the risk of developing DR. Diabetic macular edema (DME) is a specific type of DR that affects the macula, the central part of the retina responsible for sharp, detailed vision. Age factors of DR affect the macula immediately in the retina.DME can be a severe complication of diabetes that can lead to permanent vision loss if left untreated. In DME, the blood vessels in the retina become damaged and leak fluid into the macula, causing swelling

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An enhanced skin lesion detection and classification model using hybrid convolution-based ensemble learning model

Nagadevi D.[a] ; Suman K.[a]; Lakshmi, P Sampurna[b]

Save all to author list

[a] Department of Electronics and Communication Engineering, Chaitanya Bharathi Institute of Technology, Telangana, Hyderabad, 500075, India

[b] Department of Electronics and Instrumentation Engineering, Vallurupalli Nageswara Rao Vignana Jyothi Institute of Engineering & amp; Technology (VNRVJIET), Telangana, Hyderabad, 500090, India

Abstract

Background: One of the major health concerns that affect the well-being of people around the world is called as the skin cancer. Among diverse kinds of skin cancer, melanoma is regarded as the most harmful disease along with a higher rate of mortality. Earlier detection as well as the screening process is considered the more complex job for dermatologists due to the enormous variations in morphological attributes of skin cancer. Therefore, there is a requirement for the most reliable and efficient diagnosis system, which has aided dermatologists in adequate decision-making and diagnosis. Aim: An advanced deep learning technique-based skin lesions classification and detection model for early detection and efficient classification of skin lesions is proposed. Methods: The dermoscopic images are collected from online sources in the earlier stage. Then, the collected images are segmented with the help of dilated Mask-Regions with Convolutional Neural Networks (RCNN) with an attention mechanism for segmenting the abnormal regions. After that, the segmented images are classified using adaptive hybrid convolution-based ensemble learning (AHC-EL), which is used along with techniques like residual attention network (RAN), MobileNet, and Inception. Here, parameters optimization takes place using a hybrid optimization algorithm namely, fitness-aided battle royale and red deer algorithm (FBR-RDA) for enhancing the classification performance. Finally, the classified outputs of skin lesion classification are obtained based on high ranking between the ensemble learning techniques. Conclusion: Experimental analysis is carried out between proposed and conventional approaches to verify the efficacy of the recommended method. © The Author(s), under exclusive licence to The Brazilian Society of Biomedical Engineering 2024.

Author keywords

Dermoscopic images; Dilated Mask RCNN with attention mechanism; Fitness-aided battle royale and red deer algorithm; Inception; MobileNet; Residual attention network; Skin lesion segmentation and classification

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Nagadevi, D.; Department of Electronics and Communication Engineering, Chaitanya Bharathi Institute of Technology, Telangana, Hyderabad, India; email:dnagadevi_ece@cbit.ac.in

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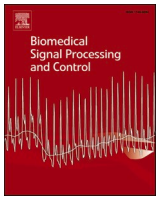

Brain tumor classification utilizing Triple Memristor Hopfield Neural Network optimized with Northern Goshawk Optimization for MRI image

Satyavati Jaga [a], K. Rama Devi [b]

[a] Department of Electronics and Communication Engineering, Chaitanya Bharati Institute of Technology (A), Hyderabad, India
[b] Department of Electronics and Communication Engineering, JNTU College of Engineering, Kakinada 533003, Andhra Pradesh, India

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ABSTRACT

Brain tumor classification plays a significant role in exact detection of abnormal brain tissues and facilitates the clinical diagnosis of patients. The computer vision researchers have created numerous algorithms, but they still suffer from low accuracy. Therefore, a Brain Tumor Classification utilizing Triple Memristor Hopfield Neural Network optimized with Northern Goshawk Optimization is proposed in this paper for MRI Image (BTC-TMHNN-NGOA). Here, the input imageries are pre-processed to increase the images quality using Median Modified Weiner Filtering (MMWF) method. The pre-processed image is supplied to Synchro Extracting Chirplet Transform (SECT) to extract the features of anti-noise interference capability and image resolution. Then the Triple Memristor Hopfield Neural Network (TMHNN) for classifying Tumor and Non-Tumor Image. Afterward, Northern Goshawk Optimization Algorithm (NGOA) is used to optimize the weight parameters of TMHNN classifier for precise classification. The proposed BTC-TMHNN-NGOA technique is activated in MATLAB under metrics, like precision, accuracy, sensitivity, specificity, ROC, F1-score, computational time and computation cost. The proposed method attains 13.88%, 8.75%, and 8.46% higher accuracy for tumor; 9.47%, 14.51% and 10.23% higher accuracy for Non-Tumor on MRI brain image dataset compared with existing methods like Automated Brain Tumor Categorization utilizing Optimized Hybrid Neural Network (EABTC-OHNN), Convolutional Neural Network for MRI-Based Brain Tumor Categorization (CNN-MRI-BTC), Enhancing Convolutional Neural Network using Hybridized Elephant Herding Optimization approach for MRI Categorization Glioma Brain Tumor Grade (OCNN-HEHOA-MRIC-GBTG). The comparative results exemplify the effectiveness of the proposed method and underscore its advantages in automating brain tumor classification.

1. Introduction

Brain is the most complex organ in the human body; it is made up of billions of cells [1]. The brain tumour arises from an abnormal collection of cells around or inside the brain due to uncontrolled cell growth [2]. These cells have ability to destroy healthy tissue, also obstruct proper brain function [3]. The tumour is separated as benign and malignant [4]. Benign is considered less aggressive because they are not malignant and not spread to other body parts [5]. Usually, they begin at the brain then progressively grow. Malignant is considered as cancer that develops rapidly [6]. They could result from the primary malignant tumour that starts in the brain, but the secondary tumour that spreads to the brain from another part of the body [7]. A number of techniques have been suggested so far to classify the tumors of brain [8]. Benign is also known as primary tumour and Malignant is also known as secondary tumour. Tumour begins in the brain is known as primary tumour [9]. Secondary tumours originate from cancer in another part of the body and progress to the brain [10]. Early, accurate grading with categorization of brain tumors are essential to diagnose cancer, develop a treatment plan, and evaluate the medicine efficacy [11]. Even though advances in medicinal technology, the histological analysis of specimen is principally utilized to identify brain tumors [12–15]. A final diagnosis is usually reached after pathological testing [16]. The disadvantages of these diagnostic techniques are invasive, time-consume, and leads to collection errors [17]. Numerous tests, such as MRI, CT scan, biopsies can identify the brain tumours. Among these, MRI has more effective for tumor classification [18–20]. MRI provides additional benefits, such as lessening time, chemical shift that help accurate depiction of the brain tissue [21–24]. Improving the diagnostic skills of doctors to reduce the time required for accurate analysis is possible with the help of fully automated identification [25].

Nowadays, there is a significant emphasis on employing machine

E-mail address: profsatyavatijaga@gmail.com (S. Jaga).

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learning approaches and optimization strategies for classifying brain tumors. However, the existing approaches face challenges related to substantial computational costs and limited precision [26–32]. The proposed method utilizes TMHNN classifier basis feature map creation.

The aim of the BTC-TMHNN-NGOA technique is "to categorize an MRI tumor picture automatically". The TMHNN weight parameters are ideally chosen to optimise the NGOA and increase the classification accurateness. After the process of classification, the effectiveness of the BTC-TMHNN-NGOA method is evaluated.

The primary contributions of this paper are summarized below:

- Brain Tumor organization utilizing Triple-Memristor Hopfield Neural Network enhanced through Northern Goshawk Optimization Algorithm proposed classifying normal and tumor image of the MRI Images (BTC-TMHNN-NGOA)
- The data is amassed from Brain Tumor dataset [33,34]. Then the data is fed to pre-processed stage.
- During pre-processing, the noise is removed as well as improves the picture quality under Median Modified Weiner Filtering (MMWF) [35].
- The pre-processing image is given to the feature extraction with the help of Synchro Extracting Chirp let Transform (SECT) [36] to extract the features of anti-noise interference capability and image resolution.
- After that, the extracted features are given to Triple Memristor Hopfield Neural Network (TMHNN) [37] for classifying the tumor and non-tumor of MRI Image effectively.
- Northern Goshawk Optimization Algorithm (NGOA) [38] is considered to enhance the weight parameters of TMHNN classifier, which precisely classifies the Normal and Tumor image of the MRI image.
- The metrics, like accuracy, precision, sensitivity, F1-score, specificity, ROC, computational time is analyzed to verify the proficiency of the proposed method.
- The obtained outcomes of BTC-TMHNN-NGOA method are compared with existing EABTC-OHNN [26], CNN-MRI-BTC [27], and OCNN-HEHOA-MRIC-GBTG [28] models.

Continuing paper is designed as: unit 2 analyses the recent studies, unit 3 designates the proposed method, unit 4 proves the results, unit 5 presents the conclusion.

2. Literature survey

Some of the recent works presented in the literature related to deep learning based BTC are reviewed here,

Shanthi et al., [26] have presented proficient automatic brain tumor categorization using enhanced hybrid neural network. The input image data was taken from MRI dataset. Images were pre-processed for removing noise, also enhance the input image. The MRI image was classified with OHDNN. OHDNN was the consolidation of Convolution Neural Network-Long Short Term Memory. Adaptive Rider Optimization Algorithm (AROA) was used to improve the performance of the OHDNN. It reached higher accuracy, but maximal computation period.

Soewu et al., [27] have introduced convolutional neural network MRI-based brain tumor categorization. The data was taken from MRI image dataset under Kaggle. Input picture was pre-processing. Then the image dimensionality was reduced through Convolutional Auto encoder. By using convolutional neural network, MRI image was classified as cancer and non-cancer. It reached high precision, but high computation time.

Bezdan et al., [28] have presented Optimizing CNN depending on Hybridized Elephant Herding Optimization approach for MRI categorization Glioma Brain Tumor Grade**.** Input image were gleaned from MRI image dataset. Input image was pre-processed by pre-processing filter to improve the image resolution. The pre-processed image was classified with Convolutional Neural Network. It attained low computation time, but low sensitivity.

Kumar and Mankame, [29] have presented optimized driven deep convolutional neural network for braintumor categorization. Input images were gleaned from MRI image dataset. Input image was pre-processed by pre-processing filter for improve the image resolution. The pre-processed image was given to feature extraction phase. In feature extraction phase, some of the arithmetical features, such as mean, variance, and skewness can be performed. It reached high sensitivity, but low F-Score.

Ghassemi et al., [30] have introduced deep neural network along generative adversarial networks (DNN-GAN) pre-trained for BTC. Input image was gathered from MRI dataset. Image was pre-processed through pre-processing filter for image normalization. The pre-processed image was supplied to the feature extraction for extracting the robust structures, learn structures MRI convolutional layers. Features of MRI can be classified utilizing DNN-GAN. Then the classified image was optimized with Adaptive Algorithm. It attained high F-score, but low accuracy.

Siddique et al., [31] have suggested deep convolutional neural network based for the classification of brain tumour. The input data was gathered via MRI dataset. The dataset contains 253 brain images. The imagery was pre-processed by pre-processing filter for noise reduction and image normalization. Normalized image was supplied to the feature extraction phase VGG-16. Then the extracting image was classified with DCNN. It achieved high sensitivity, but low specificity.

Kibriya et al., [32] have presented multiple class BTC utilizing convolutional neural network with support vector machine. The input image was amassed from Fig share dataset. Then the input image was pre-processed by min–max normalization technique for normalizing the image. The normalized image was classified with convolutional neural network. It reached high F1-score, but low specificity.

3. Proposed methodology

Brain Tumor classification under Triple Memristor Hopfield Neural Network enhanced through Northern Goshawk Optimization Algorithm (BTC-TMHNN-NGOA) is discussed in this segment. The block diagram of

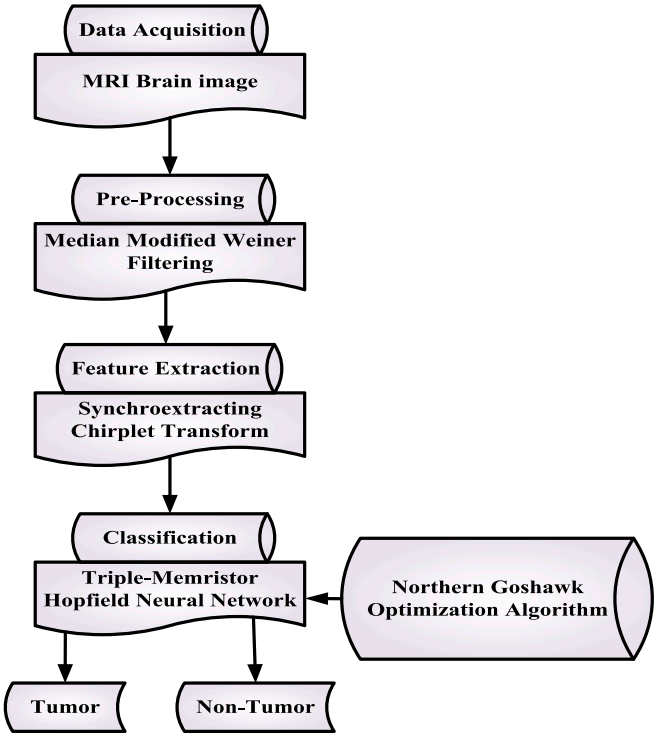

Fig. 1. Block diagram of proposed BTC-TMHNN-NGOA Technique.

the BTC-TMHNN-NGOA is represented in Fig. 1. It covers four stages: pre-processing, data acquisition, feature extraction, brain tumor categorization. The comprehensive illustration of all stages are specified beneath,

3.1. Data acquisition

The image is taken from kaggle MRI Brain image Dataset to classify the Brain Tumor. The image was sorted in a file and loaded into MATLAB software. This dataset has totally 3762 MRI brain tumor images, in which 1000 Tumor images and 2762 non tumor images. The dimension of the image was 512x512 pixels. Image column delimits the name of image, whereas Class column delimits either the imagery has tumor or not (1 = tumor, 0 = non-tumor). Sample MRI images of kaggle Brain Tumor dataset is depicted in Fig. 2.

3.2. Pre-processing using Median Modified Weiner Filtering (MMWF)

In this step, Median Modified Weiner Filtering [28] accomplishes data pre-processing for reducing noise and improving the image quality. Initially, Median Modified Weiner Filtering is employed for degraded noise image exhibited in equation (1),

$$r(a,b) = e(a,b) * v(a,b) + m(a,b) \tag{1}$$

where $e(a,b)$ denotes acquired image, $v(a,b)$ denotes squalor function, $m(a,b)$ signifies Gaussian noise, $*$ is the convolution. The Final unknown noise characteristics image can be calculated by equation (2),

$$s(a,b) = R[r(a,b)] \tag{2}$$

here $r(a,b)$ signifies output degraded image $s(a,b)$ denotes final output degraded image with submission technique R. Noise reduction image of the Weiner filter can be calculated in following equation (3)

$$\alpha = \frac{1}{SR}\sum_{s,r\in\eta} x(s,r) \tag{3}$$

where α is the mean of the image and (s,r) is the mask matrix of the $s \times r$ set for spatial reduction filter. Variance of the image can be calculated by equation (4),

$$\beta^2 = \frac{1}{SR}\sum_{s,r\in\eta} x^2(s,r) - \alpha^2 \tag{4}$$

where β^2 denotes variance of Gaussian noise in image set of $s \times r$ matrix and η denotes locality area in mask. Then the new pixel value of the image can be calculated in following equation (5)

$$y_w(s,r) = \alpha + \frac{\beta^2 - v^2}{\beta^2}.(x(s,r) - \alpha) \tag{5}$$

here v^2 denotes noise variance of mask matrix of Weiner Filter and $y_w(s, r)$ is the median pixel value of the image. Then the average pixel value of the image is scaled by equation (6)

$$y_{mmwf}(s,r) = \widetilde{\alpha} + \frac{\beta^2 - v^2}{\beta^2}.(x(s,r) - \widetilde{\alpha}) \tag{6}$$

where $\widetilde{\alpha}$ is the average mean of the image and y_{mmwf} is the final improved image with Median Modified Weiner Filter. Finally, the noise reduction and quality of the image is improved was done by Median Modified Weiner Filtering. Then the pre-processed image preserved feature extraction phase.

3.3. Feature extraction utilizing Synchro Extracting Chirplet Transform (SECT)

The substantial features present under pre-processing are clarified with the help of Synchro Extracting Chirplet Transform [29]. From pre-processing output, its substantial features, such as anti-noise interference capability, image resolution can be extracted with the help of SECT. The foremost intention of SECT is to excerpt discriminative features for attaining accurate brain tumor classification. The improved anti-noise interference is computed by equation (7),

$$a(t) = X(t)^{i\delta(t)} \tag{7}$$

let $X(t)$ denotes instantaneous amplitude, $\delta(t)$ denotes prompt phase,$a(t)$ denotes signal of reconstruction image. The phase of original image is exhibited in equation (8),

$$\varphi(\alpha + t) \approx \varphi(t) + \varphi'(t)\alpha + \frac{1}{2}\varphi''(t)\alpha^2 \tag{8}$$

Consider $\varphi'(t)$ denotes first derivative of the image time-varying behaviour, $\varphi(t)$ denotes phase of image and $\varphi''(t)$ denotes second derivative of the image time-varying behavior. The amplitude of the image is computed by equation (9),

$$X(\alpha + t) \approx \sum_{n=0}^{N} \frac{X^{(n)}(t)}{n!}\alpha^{(n)} \tag{9}$$

where $X^{(n)}$ implies n^{th} order derivative of the $X(t)$, N implies positive integer. The concise chirplet transform is scaled by equation (10),

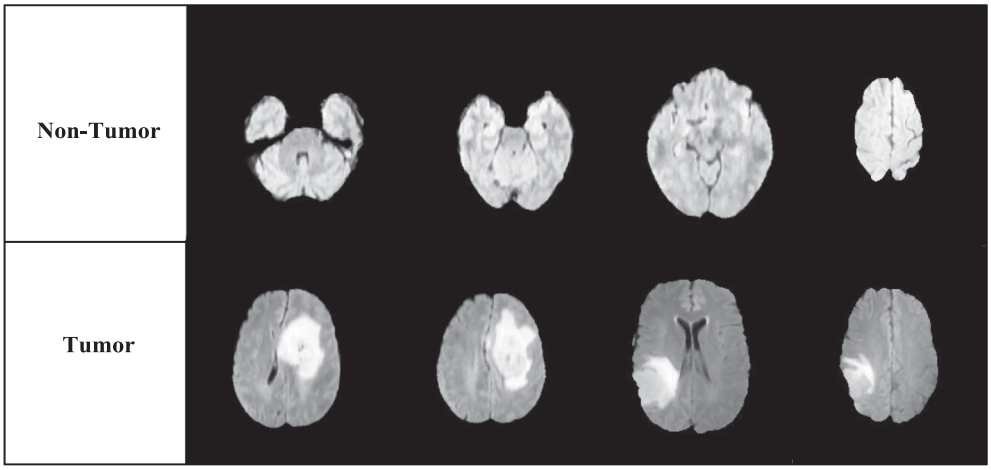

Fig. 2. Sample mri images of kaggle Brain Tumor dataset.

$$CT_s^r(t,\delta,\beta) = \int_{-\infty}^{+\infty} a(\tau)\,.\,r(\tau-t)\,.\,e^{-\frac{i\beta(\tau-t)^2}{2}} e^{-i\omega(\tau-t)} d\tau \tag{10}$$

where β is the crucial parameter chip rate. Then the Chirplet rate is estimated using equation (11),

$$CT_s^r(t,\delta,\beta) = e^{i\varphi(t)} \sum_{n=0}^{N} \frac{1}{n!} X^n(t) \int_{-\infty}^{+\infty} \tau^n r(\tau) e^{-\frac{i\ (\varphi^{''}(t)-\beta)\tau^2}{}} e^{-i\ (\omega-\varphi^{'}(t))^{\tau}} d\tau \tag{11}$$

where τ^n is the density of the image. The simpler form of Chirplet Rate is determined by equation (12),

$$CT_s^r(t,\delta) = e^{i\varphi(t)} \sum_{n=0}^{N} \frac{i^n}{n!} X^n(t) r^{(n)}(\delta-\varphi^{'}(t)) \tag{12}$$

let i^n denotes projection of the image. The image resolution is determined by equation (13),

$$\Im\left\{ \frac{\frac{\partial}{\partial t} CT_s^r(t,\delta)}{CT_s^r(t,\delta)} + \varphi^{''}(t) \frac{\frac{\partial}{\partial \delta} CT_s^r(t,\delta)}{CT_s^r(t,\delta)} \right\} = \delta \tag{13}$$

where $\Im$ is the linear coefficient of the pixel image. The synchro extracting chirp let operator is expressed in equation (14),

$$\rho(\delta-\delta_1(t,\delta)) = \left\{ \begin{matrix} 1, & \delta=\delta_1(t,\delta) \\ 0, & otherwise \end{matrix} \right\} \tag{14}$$

where ρ is the improved resolution of the image. Then the pixel representation can be calculated by equation (15),

$$\delta_1(t,\delta) = \Im\left\{ \frac{\frac{\partial}{\partial t} CT_s^r(t,\delta)}{CT_s^r(t,\delta)} + \varphi^{''}(t) \frac{\frac{\partial}{\partial \delta} CT_s^r(t,\delta)}{CT_s^r(t,\delta)} \right\} \tag{15}$$

here δ_1 denotes accurate representation of the pixel image. The final output of Chirplet Transform is articulated in equation (16),

$$SECT(t,\delta) = CT_s^r(t,\delta)\rho(\delta-\delta_1(t,\delta)) \tag{16}$$

The extracted features are given to Triple Memristor Hopfield Neural Network classifier. A comparison among the proposed and existing methods is given in Table1.

Table 1 demonstrates that the proposed methodology shows superior performance compared to others due to its optimized Triple Memristor Hopfield Neural Network (TMHNN) leveraging the Northern Goshawk Optimization Algorithm (NGOA), leading to higher accuracy and reduced computation time. The integration of advanced algorithms enables efficient brain tumor classification, making it a standout choice among the presented methods.

3.4. Classification using Triple Memristor Hopfield Neural Network

The input MRI image is given to TMHNN for categorizing MRI brain image as tumor or non-tumor. Classification of brain tumors using TMHNN [30] accurately classifies MRI images into tumor and non-tumor. Memristors established great promise creating Memristive neural network through complex dynamics. TMHNN perform two functions: (i) multi-structure chaotic attractors, (ii) spatial initial-offset simultaneous behaviours. Hopfield Neural Network is studied since the network organization and convoluted chaotic dynamics.

The active Memristor of the structured image is exhibited in equation (17)

$$\left\{ \begin{matrix} j = X(\beta)\,u = a\beta u \\ d\varphi/\,dt = cu - dg(\beta) \end{matrix} \right. \tag{17}$$

let $d\varphi$ as the position of the spatial Memristor. Then the chaotic attractors can be calculated by equation (18),

$$g_1(\beta) = \left\{ \begin{matrix} \beta, N=0 \\ \beta - \sum_{i=1}^{N} (\text{tang}) q\,(\beta + (2i-1))) + \text{tang}\,(q\,(\beta-(2i-1)))) \\ N = 1,2,3,.... \end{matrix} \right. \tag{18}$$

here $\sum_{i=1}^{N}(\text{tang})$ is the exponential function of the weighted image. Then the multi-structure chaotic of the image characters is calculated by using equation (19),

$$g_2(\beta) = \left\{ \begin{matrix} \beta - \text{tang}\,(q\beta),\ M=0 \\ \beta - \text{tang}\,(q\beta) - \sum_{j=1}^{M} (\text{tang}(q(\beta+2j)))) + \text{tang}(q(\beta-2j)) \\ M = 1,2,3,..... \end{matrix} \right. \tag{19}$$

here $\beta - 2j$ is the fixed coefficient of the memristor,N, M denotes regulator parameters. The fundamental properties of the image is shown in

Table 1
Comparison between the proposed and existing related works.

Authors	Methodology	Contributions	Advantages	Limitations	Hardware Configuration
Shanthi et al., [26]	OHDNN with AROA	Efficient Automatic Brain Tumor Classification	High accuracy, OHDNN combines CNN-LSTM	High computation time	PC contains 4 GB RAM along Intel core i7, AMD Radeon RX 5700 XT,
Soewu et al., [27]	CNN with Convolutional Autoencoder	CNN-Based MRI-Founded Brain Tumor Classification	High precision	High computation time	AMD Ryzen9, NVIDIA Quadro RTX 5000, 64 GB
Bazedan et al., [28]	CNN with Hybridized Elephant Herding Optimization Algorithm	Glioma Brain Tumor Grade Classification	Low computation time	Low sensitivity	Intel Xeon Gold,NVIDIA Tesla V100, 8 GB
Kumar and Mankame, [29]	DNN with Dolphin-SCA Optimization Process	Optimized Deep Convolutional Neural Network Brain Tumor Detection	High sensitivity	High computation time, Low F-Score	Intel Core i9,NVIDIA RTX 3090 Ti, 32 GB
Ghasemi et al., [30]	DNN-GAN with Adaptive Algorithm	MR Images-Based Brain Tumor Organization	High F-Score	Low accuracy	AMD Ryzen 7, NVIDIA GeForce GTX 1080 Ti, 32 GB
Siddique et al., [31]	DCNN with VGG-16	Deep Convolutional Neural Networks Model for Brain Tumor Detection	High Sensitivity	Low specificity	Intel Core i7, AMD Radeon RX 5700 XT, 16 GB
Kibriya et al., [32]	CNN with Support Vector Machine	Multiclass Brain Tumor Classification	High F1-Score	Low Specificity	Intel Core i7, NVIDIA Quadro P5000, 32 GB
BTC-TMHNN-NGOA (proposed)	TMHNN with NGOA Algorithm	Brain Tumor Classification using optimized Triple Memristor Hopfield Neural Network	High accuracy, low computation time	–	PC along Intel Core i7, NVIDIA Tesla V100, 64 GB RAM

equation (20),

$$d\beta/dt = -dg(\beta) \tag{20}$$

where $d\beta$ is the space initial-offset behavior of the image. Then the final chaotic Hopfield neural network is exhibited in equation (21),

$$C_i y_i = -\frac{y_i}{R_i} + \sum_{j=1}^{n} x_{ij} \tan g\left(y_j\right) + I_i \tag{21}$$

where C_i, y_i, R_i denotes membrane capacitance, membrane resistance, membrane resistance i^{th} neuron, tang denotes neuron activation action I_i denotes external input current.

Finally, Triple Memristor Hopfield Neural Network classifies the MRI image as tumor and non-tumor, where space multi-configuration attractors, space initial-offset behavior can be done. Northern Goshawk Optimization Algorithm approach is taken due to the convenience, pertinence, comprehensive belvedere.

Northern Goshawk Optimization Algorithm is exploited for enhancing ideal parameters of TMHNN classifier. NGOA is applied to tune the weight with bias parameters of TMHNN. Some methods used restriction formation. Investigation share familiar weakness regarding reiteration time, no subterfuge-collected acquainted exploration. To solve these problems, NGOA is used.

In this work, NGOA is selected, since it has own development, takes slow repetition time than other tuning models, viz grid investigation, manual investigation, random investigation also finding optimal weight parameter of generator. This is a meta-heuristic approach incited by Northern Goshawk foraging with navigation behaviours. The stepwise process of NGOA are specified below,

3.5. Northern Goshawk Optimization Algorithm (NGOA)

This segment discusses about the NGOA [31]. Northern goshawk medium-sized hunter of Accipitridae family first defined under present scientific name, Accipitridae. The Accipiter genus includes the northern goshawk, hunts small and large birds, and tiny critters like mice, rabbits, squirrels, also large animals like foxes, raccoons. The northern goshawk hunting strategy is divided into two phases: first, it moves quickly upon seeing its prey, then it engages in a brief tail-chase manoeuvre to pursue it.

Step 1: Initialization

Initially the populace members are initialized at the exploration space at random. In NGOA algorithm, the population matrix is shown in equation (22),

$$Y = \begin{bmatrix} Y_1 \\ \vdots \\ Y_i \\ \vdots \\ Y_M \end{bmatrix}_{M\times u} = \begin{bmatrix} y_{1,1} & \cdots & y_{1,j} & \cdots & y_{1,u} \\ \vdots & \ddots & \vdots & \cdots & \vdots \\ y_{i,1} & \cdots & y_{i,j} & \cdots & y_{i,u} \\ \vdots & \cdots & \vdots & \ddots & \vdots \\ y_{M,1} & \cdots & y_{M,j} & \cdots & y_{M,u} \end{bmatrix}_{M\times u} \tag{22}$$

Let M denotes number of population member,Y specifies population algorithm northern goshawks, $y_{i,j}$ denotes j^{th} variable specified i^{th} proposed result, u denotes problem variables.

Step 2: Random Generation

First phase of hunting, northern goshawk discoveries target random, attack quickly. Since random collection of prey in exploration space, phase boosts NGOA's investigation power.

Step 3: Fitness function

The solution is generated randomly through the initialization. The evaluation of the fitness function uses the results of weight parameter optimization β. It is shown in equation (23),

$$fitness\,function = Optimizing[\beta] \tag{23}$$

Step 4: Exploitation phase

Phase initiates global exploration of search space to determine the best region. Northern goshawk behavior through stage, includes prey selection, attack. The phase notions are quantitatively modelled using equation (24),

$$Y_i = \begin{cases} Y_i^{New,B2}, E_i^{New,B2} < E_i, \\ Y_i \quad\quad , E_i^{New,B2} \geq E_i, \end{cases} \tag{24}$$

where $Y_i^{New,B2}$ denotes new status for *ith* proposed result, $E_i^{New,B2}$ denotes objective function value of NGOA.

Step 5: Exploration phase

NGOA's searching capacity is enhanced by randomly selected prey in exploration space throughout phase. This stage results in a study of the search space for the best site of searching. Conceptions expressed in phase exactly modelled utilizing equation (25),

$$y_{i,j}^{New,B1} = \begin{cases} y_{i,j} + v(b_{i,j} - J y_{i,j}), E_{Bi} < E_i, \\ y_{i,j} + v(y_{i,j} - b_{i,j}), E_{Bi} \geq E_i, \end{cases} \tag{25}$$

Let J denotes random numbers to generate random NGOA, v denotes the random number interval, and b_i shows the position of *ith* NGOA.

Step 6: Termination

Weight parameter values β from Triple Memristor Hopfield Neural Network is optimized with the help of NGOA, will repeat the functions until the position information $v_i(r+1) = v_i(r)$ is met. Finally, BTC-TMHNN-NGOA identifies the data transmission. Fig. 3 represents the flow chart of NGOA.

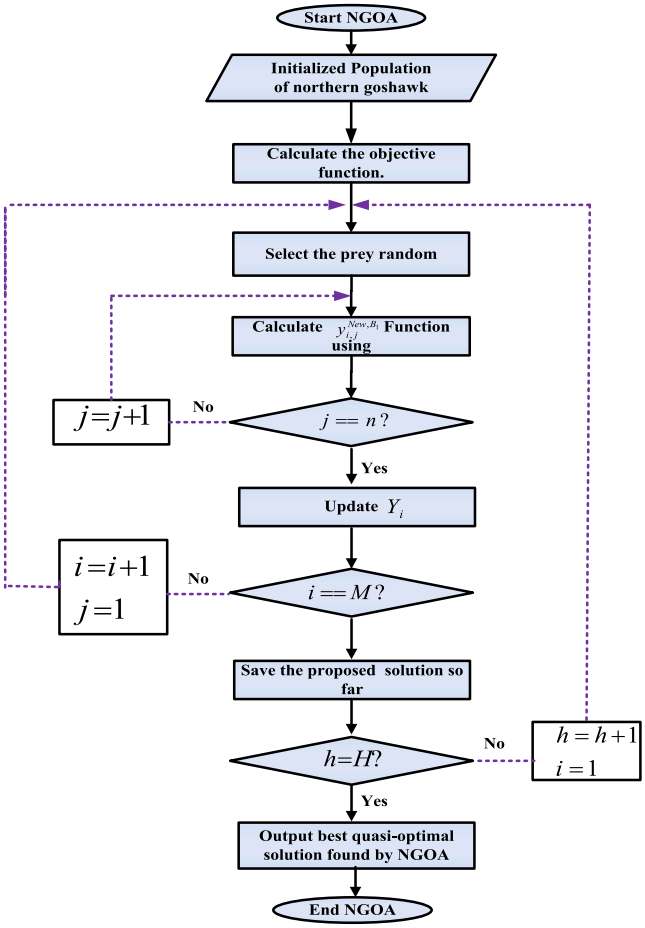

Fig. 3. Flowchart of NGOA for enhancing TMHNN parameter.

4. Result and discussion

The experimental outcomes of the BTC-TMHNN-NGOA method are analyzed in this section. The proposed technique is activated in MATLAB using PC along Intel Core i7, NVIDIA Tesla V100 with 2.50 GHz CPU, 64 GB RAM, Windows 7. The performance is evaluated under the mentioned metrics. The attained outcomes of the proposed technique are compared with existing EABTC-OHNN [26], CNN-MRI-BTC [27], OCNN-HEHOA-MRIC-GBTG [28] models. The simulation parameter of the BTC-TMHNN-NGOA method is shown in Table2.

4.1. Performance measures

The following metrices confirm the effectiveness of the BTC-TMHNN-NGOA approach.

4.1.1. Accuracy

It determines the identification rate that is properly categorized. It is measured by eqn (26),

$$Accuracy = \frac{(TP + TN)}{(TP + FP + TN + FN)} \tag{26}$$

4.1.2. Precision

The maximum positive labels are anticipated through eqn (27),

$$Precision = \frac{TP_{\alpha}}{(TP_{\alpha} + FP\lambda)} \tag{27}$$

4.1.3. Sensitivity

It defines the ratio of positives using eqn (28),

$$Sensitivity = \frac{TP}{(TP + FN)} \tag{28}$$

4.1.4. F1-score

It depends on the precision or recall value using eqn (29),

$$F1Score = \frac{TP}{\left(TP + \frac{1}{2}[FP + FN]\right)} \tag{29}$$

4.1.5. Specificity

This is the ratio of negatives determined by eqn (30),

$$Specificity = \frac{TN}{(FP + TN)} \tag{30}$$

4.1.6. RoC

The range of area within the RoC curve is 0.5 to 1. It is measured through eqn (31),

$$RoC = 0.5 \times \left(\frac{TP}{TP + FN} + \frac{TN}{TN + FP}\right) \tag{31}$$

Table 2
Simulation parameter.

Parameter	Value
Count of neurons	1000
Learning rate	0.01–0.1
Population size	50
Number of iterations	200
Activation function	Sigmoid, linear
Halting criteria	0 to 1
Number of epochs	20,40,50,60,80,100
Number of classes	2

4.2. Performance analysis

Fig. 4-11 depicts the experimental results of BTC-TMHNN-NGOA. In these Figures, the proposed BTC-TMHNN-NGOA technique is analyzed with existing EABTC-OHNN [21], CNN-MRI-BTC [22] and OCNN-HEHOA-MRIC-GBTG [23] models. Fig. 4 shows analysis of accuracy. The proposed method employing TMHNN with NGOA attains higher accuracy due to its innovative combination of advanced neural network architecture and optimization technique. TMHNN enhances the model's capacity to capture intricate patterns in MRI images. Simultaneously, the NGOA optimizes the network parameters, leading to superior performance in accurately distinguishing between different tumor classes. Proposed BTC-TMHNN-NGOA method attains 7.42 %, 12.81 %, 8.45 % and 16.18 % higher Accuracy for Tumor analysis; 11.98 %, 10.19 %, 15.12 %, 14.4 % greater accuracy Non-Tumor equated existing methods such as EABTC-OHNN, CNN-MRI-BTC and OCNN-HEHOA-MRIC-GBTG respectively.

Fig. 5 shows precision analysis. The proposed BTC method excels in precision by incorporating a comprehensive image processing pipeline. Pre-processing using MMWF Filtering method effectively enhances image quality by reducing unwanted noise. The integration of Triple Memristor Hopfield Neural Network as a classifier, followed by optimization through NGOA, synergistically refines precision, ensuring accurate classification of tumor or non-tumor MRI images. Proposed BTC-TMHNN-NGOA technique reaches 9.42 %, 12.81 %, 10.45 % and 15.18 % higher precision for Tumor analysis; 10.98 %, 5.19 %, 15.12 % and 16.42 % greater precision Non-Tumor equated with existing methods such as EABTC-OHNN, CNN-MRI-BTC and OCNN-HEHOA-MRIC-GBTG respectively.

Fig. 6 shows sensitivity. The proposed method achieves higher sensitivity through a robust framework. TMHNN excels in capturing intricate patterns in MRI images, enhancing its sensitivity to tumor features. NGOA fine-tunes the TMHNN's weight parameters, ensuring heightened sensitivity in detecting subtle abnormalities. This results in a classification model that effectively identifies potential tumors with increased sensitivity, showcasing the method's efficacy in brain tumor diagnosis. Proposed BTC-TMHNN-NGOA technique reaches 9.42 %, 14.81 %, 9.85 % and 17.18 % higher Sensitivity for Tumor analysis; 10.88 %, 11.19 %, 14.62 % and 15.92 % greater Sensitivity Non-Tumor equated existing methods likes EABTC-OHNN, CNN-MRI-BTC and OCNN-HEHOA-MRIC-GBTG respectively.

Fig. 7 depicts F1-Score estimation. The proposed method attains a higher F1 score, indicative of its balanced precision and recall performance. The Triple Memristor Hopfield Neural Network contributes to a more precise classification. The Northern Goshawk Optimization Algorithm optimizes the TMHNN's weight parameters, striking a balance amongst minimizing false positives and false negatives. This meticulous optimization process results in an enhanced F1 score, reflecting the proposed method's robust ability to achieve both high precision and recall in brain tumor classification. Proposed BTC-TMHNN-NGOA

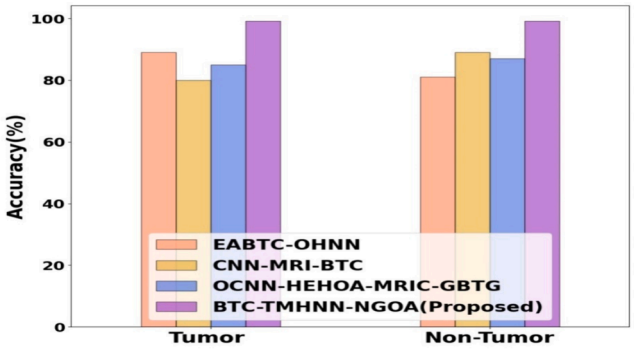

Fig. 4. Analysis of brain tumor Classification accuracy of different approaches.

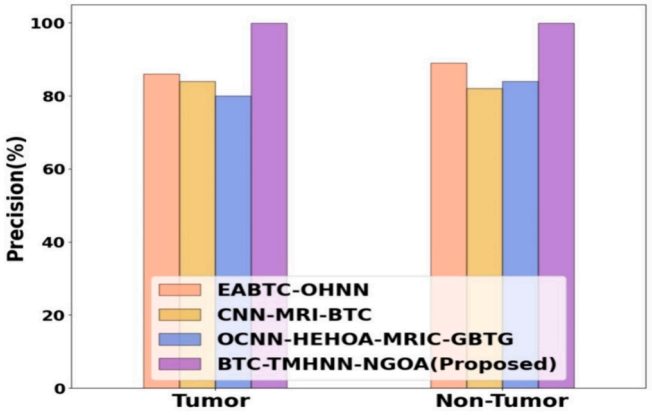

Fig. 5. Analysis of brain tumor Classification Precision of different approaches.

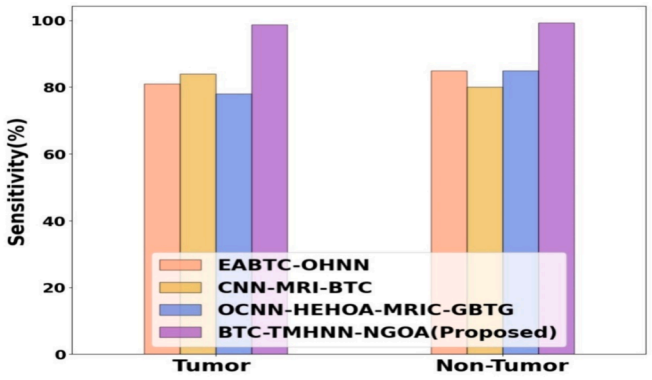

Fig. 6. Analysis of sensitivity of different approaches.

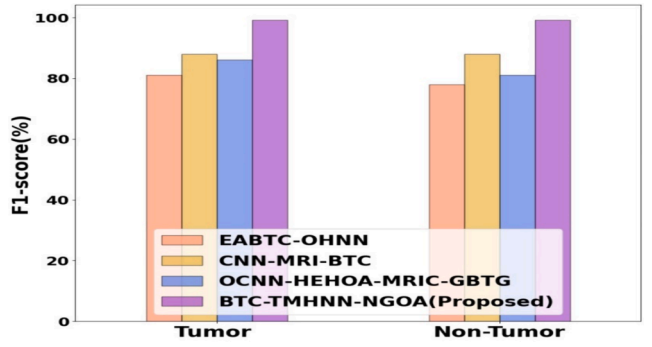

Fig. 7. Analysis of brain tumor Classification F1-Score of different approaches.

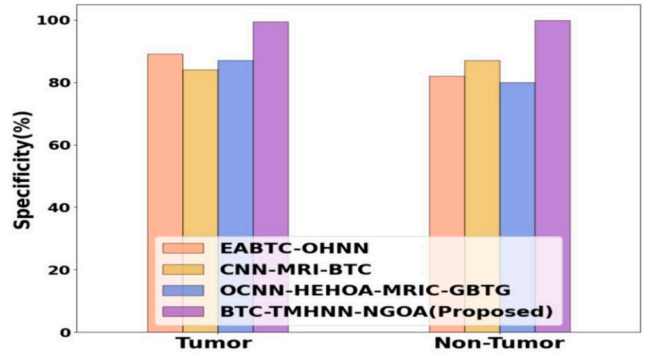

Fig. 8. Analysis of specificity.

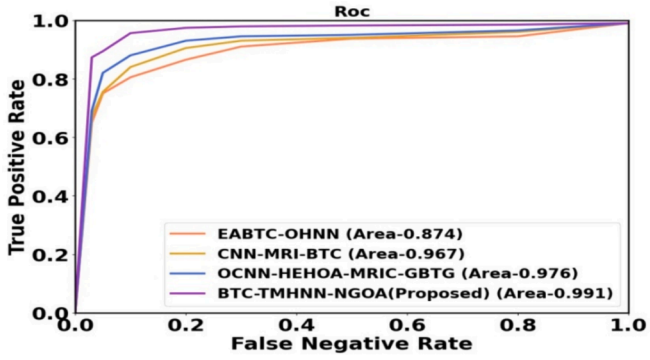

Fig. 9. RoC Analysis of different brain tumor Classification approaches.

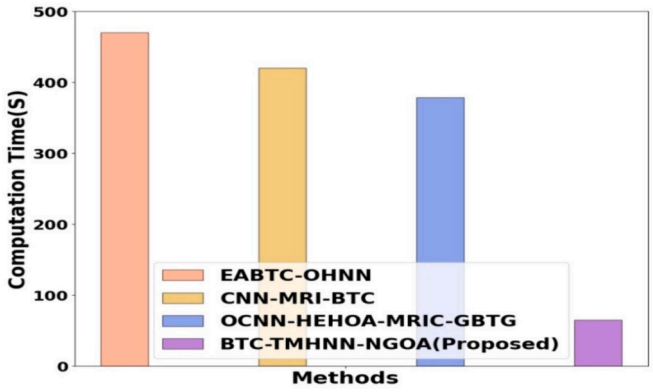

Fig. 10. Overall Computation Time Analysis of different brain tumor Classification approaches.

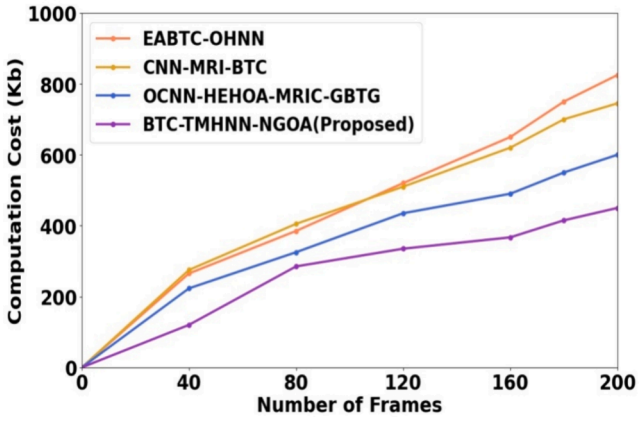

Fig. 11. Computation cost Analysis.

method attains 7.42 %, 16.81 %, 10.45 % and 17.18 % higher F1-Score for Tumor analysis; 11.98 %, 9.80 %, 14.92 % and 15.82 % greater F1-Score for Non-Tumor equated through existing techniques likes EABTC-OHNN, CNN-MRI-BTC and OCNN-HEHOA-MRIC-GBTG correspondingly.

Fig. 8 displays specificity estimation. The proposed brain tumor categorization uses TMHNN for accurate identification of non-tumor regions, thereby boosting specificity. Optimization with NGOA fine-tunes the TMHNN's parameters, emphasizing its ability to minimize false positives and enhance discrimination against non-tumor elements. This meticulous optimization contributes to the method's higher specificity, making it proficient in accurately differentiate tumor and non-tumor regions. Here, the BTC-TMHNN-NGOA method attains 8.42 %,

13.81 %, 9.45 % and 16.18 % higher Specificity for Tumor analysis; 10.98 %, 9.19 %, 14.12 % and 15.42 % better Specificity for Non-Tumor analyzed with existing EABTC-OHNN, CNN-MRI-BTC and OCNN-HEHOA-MRIC-GBTG models.

Fig. 9 shows RoC analysis. The TMHNN's ability to capture intricate patterns in MRI images, coupled with the precise optimization achieved through NGOA, results in a classifier with an improved trade-off among true positive rate (sensitivity) and false positive rate. This elevated ROC curve highlights the proposed method's enhanced discriminatory power, showcasing its effectiveness in distinguishing between tumor and non-tumor instances with higher accuracy. Here, BTC-TMHNN-NGOA method attains 6.282 %, 5.365 %, 2.451 % and 3.915 % higher RoC analyzed to the existing EABTC-OHNN, CNN-MRI-BTC and OCNN-HEHOA-MRIC-GBTG models respectively.

Fig. 10 portrays computation Time analysis. The BTC-TMHNN-NGOA technique lowers computation time by capitalizing on TMHNN's efficient associative memory and Northern Goshawk Optimization Algorithm's ability to fine-tune parameters, optimizing the brain tumor classification process. The integrated approach enhances the network's learning and decision-making efficiency, resulting in faster and more precise MRI image classification. So the proposed method reaches 52.136 %, 59.04 %, 44.51 % and 35.81 % lesser computation Time evaluated to the existing EABTC-OHNN, CNN-MRI-BTC and OCNN-HEHOA-MRIC-GBTG models respectively.

Fig. 11 shows analysis of computation cost. The BTC-TMHNN-NGOA technique reaches lower Computation cost due to the optimized nature of its TMHNN combined with NGOA. This synergy allows for efficient brain tumor classification without incurring excessive computational expenses. The algorithm's inherent optimization strategies and synergistic integration contribute to streamlined computations, minimizing the overall resource utilization and associated costs. Thus the proposed method attains average computation cost of 300 Kb. This demonstrates the cost-effectiveness and efficiency of the proposed method.

5. Discussion

Brain Tumor Classification for MRI image is discussed. Brain Tumor organization using Triple Memristor Hopfield Neural Network enhanced through Northern Goshawk Optimization Process MRI Images (BTC-TMHNN-NGOA) is proposed. The stepwise procedure of the proposed methodology is outlined in a coherent manner, starting from image preprocessing involving the use of Median Modified Weiner Filtering (MMWF) improve input image quality, decrease the noise. Subsequently, the feature extraction process is described, wherein the Synchro Extracting Wavelet Transform (SEWT) method is employed the Substantial features such as anti-noise interference capability, image resolution can be extracted with the help of Synchro Extracting Chirplet Transform. TMHNN categorize as tumor and non-tumor of MRI image with the help of Hopfield Neural Network layer. Additionally, the integration of NGOA to fine-tune weight parameters of TMHNN shows a strategic approach to further enhance model's performance. The proposed technique is examined under the mentioned metrics. The obtained result shows that the BTC-TMHNN-NGOA method gives best classification performance with 98.04 % accuracy when compared to the existing EABTC-OHNN, CNN-MRI-BTC, and OCNN-HEHOA-MRIC-GBTG models.

5.1. Statistical analysis

The statistical validation of the BTC methods presents in Table 3. The proposed BTC-TMHNN-NGOA method achieves the highest accuracy of 98 %, with a negligible standard deviation of 2 %. This outstanding result is reflected in the narrow confidence interval [97.99 %, 98.01 %], demonstrating not only superior performance but also exceptional consistency and confidence in the classification outcomes.

The significant margin between the proposed method and existing approaches, along with the minimal standard deviation and tight confidence interval, underscores the robustness and reliability of the BTC-TMHNN-NGOA method. These findings position the proposed approach as highly promising for advancing the field of brain tumor classification, outperforming current state-of-the-art methods in both accuracy and consistency.

Table 3
Statistical validation of brain tumor classification methods.

Methods	Mean accuracy	Standard deviation	Confidence interval
EABTC-OHNN	85 %	15 %	[82 %, 88 %]
CNN-MRI-BTC	80 %	20 %	[77 %, 83 %]
OCNN-HEHOA-MRIC-GBTG	82 %	18 %	[79.5 %, 84.5 %]
BTC-TMHNN-NGOA (Proposed)	98 %	2 %	[97.99 %, 98.01 %]

6. Conclusion

In this manuscript, BTC-TMHNN-NGOA is successfully implemented for classifying the tumor and non-tumor region of the MRI image. Here, Synchro Extracting Wavelet Transform is presented for extracting more discriminative features and TMHNN is used for classification of brain tumors using kaggle MRI Brain image Dataset. The BTC-TMHNN-NGOA approach enhances the brain tumor detection accurately and rapid identification times by extracting the features. The proposed BTC-TMHNN-NGOA technique is activated in MATLAB. The BTC-TMHNN-NGOA attains 9.42 %, 12.81 %, 10.45 %, 15.18 % higher accuracy, 11.98 %, 9.80 %, 14.92 % and 15.82 % higher F1-score when compared with existing EABTC-OHNN, CNN-MRI-BTC and OCNN-HEHOA-MRIC-GBTG models. Future research will focus on creating classification methods that use hybrid deep learning techniques to account for genetic and molecular profiles recognize tumor types and offer insights into personalized treatment options based on tumor aspects, patient demographics, and treatment history.

CRediT authorship contribution statement

Satyavati Jaga: Writing – original draft. **K. Rama Devi:** Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

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Decoder based VLSI Architectures for Nonlinear filter in Image applications

Kishorebabu, Vasanth[a] ; Sangala, Pradeep Kumar Reddy[b] ; Subramanyam, Nagaraj[c] ; Kaveripakam, Thyagarajan[c]

Save all to author list

[a] Chaitanya Bharathi Institute of Technology, Hyderabad, 500075, India

[b] Vidya Jyothi Institute of Technology, Hyderabad, 500075, India

[c] Sri Venkateswara College of Engineering and Technology, Chittoor, 517217, India

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Abstract

The Paper introduces the Decoder based Architectures for data comparators mainly used in Nonlinear filters in Imaging applications. Two Decoder based Architectures for a data Comparators is enumerated in this paper. The former checks for the magnitude and selects a higher or lower value based on decoder output and the latter has a carry generation circuit implemented using Decoder based full subtractor that triggers a set of multiplexers that selects Maximum and Minimum values. The proposed Algorithm was mapped for XCV2000e-7bg560 and various Data comparators were implemented using VHDL language. It was found that the modified Decoder based Architecture offers a combinational delay of 17.90ns with power consumption of 7mw. The Proposed Architecture also performed well when compared with decoder based comparators with Area, speed and Power.

Author keywords

Carry Generation Circuit; Data Comparators; Decoder based Full Subtractor; Low Power Consumption

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Kishorebabu, V.; Chaitanya Bharathi Institute of Technology, Hyderabad, India; email:vasanthecek@gmail.com

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RESEARCH ARTICLE

Semantic segmentation of urban environments: Leveraging U-Net deep learning model for cityscape image analysis

T. S. Arulananth[1], P. G. Kuppusamy[2], Ramesh Kumar Ayyasamy[3]*, Saadat M. Alhashmi[4]*, M. Mahalakshmi[5], K. Vasanth[6], P. Chinnasamy[7]

1 Department of Electronics and Communication Engineering, MLR Institute of Technology, Hyderabad, India, **2** Department of Electronics and Communication Engineering, Siddharth Institute of Engineering & Technology, Puttur, Andhrapradesh, India, **3** Faculty of Information and Communication Technology, Universiti Tunku Abdul Rahman, Kampar, Perak, Malaysia, **4** College of Computing and Informatics, University of Sharjah, Sharjah, UAE, **5** Department of Networking and Communications, SRM Institute of Science & Technology, College of Engineering and Technology, Kattankulathur, Tamil Nadu, India, **6** Department of Electronics and Communication Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India, **7** Department of Computer Science and Engineering, MLR Institute of Technology, Hyderabad, Telangana, India

* rameshkumar@utar.edu.my (RKA); salhashmi@sharjah.ac.ae (SMA)

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Abstract

Semantic segmentation of cityscapes via deep learning is an essential and game-changing research topic that offers a more nuanced comprehension of urban landscapes. Deep learning techniques tackle urban complexity and diversity, which unlocks a broad range of applications. These include urban planning, transportation management, autonomous driving, and smart city efforts. Through rich context and insights, semantic segmentation helps decision-makers and stakeholders make educated decisions for sustainable and effective urban development. This study investigates an in-depth exploration of cityscape image segmentation using the U-Net deep learning model. The proposed U-Net architecture comprises an encoder and decoder structure. The encoder uses convolutional layers and down sampling to extract hierarchical information from input images. Each down sample step reduces spatial dimensions, and increases feature depth, aiding context acquisition. Batch normalization and dropout layers stabilize models and prevent overfitting during encoding. The decoder reconstructs higher-resolution feature maps using "UpSampling2D" layers. Through extensive experimentation and evaluation of the Cityscapes dataset, this study demonstrates the effectiveness of the U-Net model in achieving state-of-the-art results in image segmentation. The results clearly shown that, the proposed model has high accuracy, mean IOU and mean DICE compared to existing models.

1. Introduction

Semantic segmentation of urban landscapes using deep learning has emerged as a central research subject in recent years [1], because of its transformational potential in comprehending

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Cooperative optimization techniques in distributed MAC protocols – a survey

Subramanyam, Radha[a] ; Jancy, Y. Adline[b] ; Nagabushanam, P.[c]

Save all to author list

[a] Department of ECE, Chaitanya Bharathi Institute of Technology, Hyderabad, India

[b] Department of ECE, Sri Ramakrishna Engineering College, Coimbatore, India

[c] Department of EEE, VNR Vignana Jyothi Institute of Engineering and Technology, Hyderabad, India

Abstract

Purpose: Cross-layer approach in media access control (MAC) layer will address interference and jamming problems. Hybrid distributed MAC can be used for simultaneous voice, data transmissions in wireless sensor network (WSN) and Internet of Things (IoT) applications. Choosing the correct objective function in Nash equilibrium for game theory will address fairness index and resource allocation to the nodes. Game theory optimization for distributed may increase the network performance. The purpose of this study is to survey the various operations that can be carried out using distributive and adaptive MAC protocol. Hill climbing distributed MAC does not need a central coordination system and location-based transmission with neighbor awareness reduces transmission power. Design/methodology/approach: Distributed MAC in wireless networks is used to address the challenges like network lifetime, reduced energy consumption and for improving delay performance. In this paper, a survey is made on various cooperative communications in MAC protocols, optimization techniques used to improve MAC performance in various applications and mathematical approaches involved in game theory optimization for MAC protocol. Findings: Spatial reuse of channel improved by 3%–29%, and multichannel improves throughput by 8% using distributed MAC protocol. Nash equilibrium is found to perform well, which focuses on energy utility in the network by individual players. Fuzzy logic improves channel selection by 17% and secondary users' involvement by 8%. Cross-layer approach in MAC layer will address interference and jamming problems. Hybrid distributed MAC can be used for simultaneous voice, data transmissions in WSN and IoT applications. Cross-layer and cooperative communication give energy savings of 27% and reduces hop distance by 4.7%. Choosing the correct objective function in Nash equilibrium for game theory will address fairness index and resource allocation to the nodes. Research limitations/implications: Other optimization techniques can be applied for WSN to analyze the performance. Practical implications: Game theory optimization for distributed may increase the network performance. Optimal cuckoo search improves throughput by 90% and reduces delay by 91%. Stochastic approaches detect 80% attacks even in 90% malicious nodes. Social implications: Channel allocations in centralized or static manner must be based on traffic demands whether dynamic traffic or fluctuated traffic. Usage of multimedia devices also increased which in turn increased the demand for high throughput. Cochannel interference keep on changing or mitigations occur which can be handled by proper resource allocations. Network survival is by efficient usage of valid patis in the network by avoiding transmission failures and time slots' effective usage. Originality/value: Literature survey is carried out to find the methods which give better performance. © 2023, Emerald Publishing Limited.

Author keywords

Base stations; Congestion; Cooperative communication; Distributed MAC; Energy; Game theory optimization; Nash equilibrium; Optimization; Traffic

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Nagabushanam, P.; Department of EEE, VNR Vignana Jyothi Institute of Engineering and Technology, Hyderabad, India;
email:nagabushanamphd14@gmail.com

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Optimal relay nodes placement with game theory optimization for Wireless Sensor Networks

Radha, Subramanyam[a] ; Bala, G. Josemin[b] ; Rajkumar, Nalluri Prophess[c] ; Indumathi G.[d] ; Nagabushanam, Perattur[e]

Save all to author list

[a] ECE Department, Chaitanya Bharathi Institute of Technology, Hyderabad, India
[b] ECE Department, Karunya Institute of Technology and Sciences, CBE, India
[c] ECE Department, Chalapathi Institute of Engineering & Technology, AP, Guntur, India
[d] ECE Department, Mepco Schlenk Engineering College, Sivakasi, India

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Abstract

Wireless Sensor Networks (WSN) play a major role in the wide variety of applications like underground pipeline and leaks monitoring, temperature distribution monitoring in industrial cyber systems, military, forest life monitoring, and environmental and geographical monitoring. Sensors are widely used in these different applications. The number of sensors and the application concerned mainly decides the energy consumption, network lifetime. In this process relay nodes may help the sensors as backbone to connect with sink node or base stations. In this paper, we introduce a new approach for relay node selection in WSN to minimize the energy consumption of the network. It uses channel aware relay selection technique using game theory optimization and act as a virtual backbone in connecting to the base station. However, the relay nodes are varied to check the optimal number of relays required for the small, medium and large number of nodes deployed in the network. Simulations are carried out using Network Simulator NS-2.35 and network is analyzed in wide variety of scenarios. Results show that the proposed relay node selection algorithm reduces energy consumption, improves lifetime, throughput of the network.

Author keywords

channel aware transmission; energy consumption; game theory; relay nodes; virtual backbone; WSN

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Nagabushanam, P.; EEE Department, VNR Vignana Jyothi Institute of Engineering and Technology, Hyd, India; email:nagabushanamphd14@gmail.com

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Design and investigation on two port circularly polarized graphene-silicon based MIMO antenna with high isolation for THz wireless applications

Reddy, M. Ramana[a]; Charyulu, M. Lakshmi Narasimha[a]; Kushwah, Vivek Singh[a] ✉ ; Sastry, P. Narahari[a]; Kumar, Rohit[b]

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[a] Department of Electronics & amp; Communication Engineering, Chaitanya Bharathi Institute of Technology (Autonomous Institute affiliated to Osmania University), Telangana, Gandipet, Hyderabad, 500075, India

[b] Department of Electronics & amp; Communication Engineering, COER UNIVERSITY, Uttarakhand, Roorkee, India

Abstract

In this article, a two-port aperture coupled silicon-graphene based THz radiator is structured and investigated. The focused points of given radiating structure are: (a) a suspended polarization convertor (metasurface) over dual port antenna produces the circular polarized (CP) waves from 5.65 THz to 5.85 THz; (b) designed metasurface also improves the isolation level to more than 30 dB; (c) coating of graphene makes the designed radiator frequency agile; and (d) computational time significantly reduced with the assistant of two different machine learning (ML) techniques i.e. Artificial Neural Network and Random Forest. With the help of CST/HFSS and ML prediction, it is confirmed that the designed antenna works effectively in between 5.1 and 5.9 THz. Stable Far-field patterns and diversity parameters makes the designed radiator suitable for THz based wireless applications. © The Author(s), under exclusive licence to The Optical Society of India 2024.

Author keywords

Ceramic antenna; Circular polarization; Graphene Material; MIMO Antenna

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Kushwah, V.S.; Department of Electronics & amp; Communication Engineering, Chaitanya Bharathi Institute of Technology (Autonomous Institute affiliated to Osmania University), Telangana, Gandipet, Hyderabad, India;
email:drviveksinghkushwah@gmail.com

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Design and analysis of frequency agile LP to CP convertor loaded silicon–graphene based MIMO array antenna in THz regime

Kushwah, Vivek Singh[a] ; Reddy, M. Ramana[a]; Charyulu, M. Lakshmi Narasimha[a]; Sastry, P. Narahari[a]; Goyal, Shally[b]

Save all to author list

[a] Department of Electronics & amp; Communication Engineering, Chaitanya Bharathi Institute of Technology (Autonomous Institute affiliated to Osmania University), Gandipet, Telangana, Hyderabad, 500075, India

[b] Department of Electronics & amp; Communication Engineering, Amity School of Engineering & amp; Technology, Amity University Madhya Pradesh, Maharajpura Dang, Madhya Pradesh, Gwalior, 474005, India

Abstract

In this communication, a hybrid radiator (graphene-silicon ceramic) in THz frequency regime is designed and discussed. Three main features of proposed antenna are: (a) array-based structure enhance the gain of radiator to 10.0 dBi; (b) a suspension of polarization convertor creates the CP waves in between 6.01–6.45 THz; (c) machine learning (ML) algorithms i.e. random forest and XGboost are utilised to predict the reflection coefficient characteristics of designed antenna, which reduces the effective simulation time for designing of proposed radiator. A reconfigurability in operating band as well as circular polarization band is achieved by coating of graphene over the silicon ceramic and by making graphene-based polarization convertor respectively. HFSS/CST-MWS and with assistance of ML algorithms, it is confirmed that the designed operates in between 5.2–6.55 THz with an isolation level more than 25 dB. Good value of diversity factors and steady far-field features make the antenna design suitable for THz based wireless applications. © The Author(s), under exclusive licence to The Optical Society of India 2024.

Author keywords

Array antenna; Dielectric resonator antenna; Machine learning; MIMO antenna

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Performance Analysis of Multi-Hop Hybrid FSO/mm Wave Communication System for Next-Generation Wireless Networks

Kumar, Mogadala Vinod[a] ; Minchula, Vinodh Kumar[b] ; Kumar, M. Hemanth[c] ; Krishna, M. Vamshi[d] ; Gottapu, Sasibhushana Rao[e]

Save all to author list

[a] Department of Electronics and Communication Engineering, Dhanekula Institute of Engineering and Technology (A), Vijayawada, 521139, India

[b] Department of Electronics and Communication Engineering, Chaitanya Bharathi Institute of Technology(A), Telangana, India

[c] Department of Electronics Engineering, IIT (BHU), Uttar Pradesh, Varanasi, 221005, India

[d] Department of Electronics and Communication Engineering, Dhanekula Institute of Engineering and Technology, Vijayawada, 521139, India

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Abstract

Next-generation wireless networks are facing increasing demand for high data rates, low latency, and seamless connectivity. To address these challenges, a multi-hop hybrid communication system integrating Free Space Optics (FSO) and millimeter wave (mm Wave) technologies for backhaul communication is proposed. This system combines the advantages of FSO, such as high bandwidth and low latency, with the robustness and reliability of mm Wave technology. The multi-hop architecture enables the formation of a network of interconnected nodes, providing improved coverage and flexibility. Each node is equipped with FSO and mm Wave transceivers, allowing for seamless handovers and adaptive routing. For the proposed system, analytical formulas for outage probability (OP) and average bit error rate (ABER) are derived and validated using simulations. The Monte Carlo simulations provide evidence of enhanced performance in the proposed Multi-Hop Hybrid FSO/mm Wave (MHFM) system compared to the FSO system.

Author keywords

Average BER; Free-Space Optics; Hybrid FSO/mm Wave; Millimeter Wave; Multi-Hop; Outage Probability

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Industry 5.0 Enablers in Consumer Electronics Market Assessment under T-Spherical Fuzzy Integrated Decision-Making Approach

Dhumras, Himanshu[a] ; Shukla, Prashant Kumar[b] ; Bajaj, Rakesh K.[a] ; Boulila, Wadii[c] ; Shukla, Varun[d] ; Shukla, Piyush Kumar[e] ; Minchula, Vinodh Kumar[f] ; Chauhdary, Sajjad Hussain[g]

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[a] Jaypee University of Information Technology, Department of Mathematics, Solan, 173234, India

[b] KL Deemed to Be University, Department of Computer Science and Engineering, Guntur, 522502, India

[c] Prince Sultan University, Robotics and Internet-of-Things Laboratory, Riyadh, 12435, Saudi Arabia

[d] Pranveer Singh Institute of Technology, Department of Electronics and Communications Engineering, Kanpur, 209305, India

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Abstract

Abstract

The prime focus on the deliberations related to Industry 5.0 lies in creativity, efficiency and resilience for adapting various organic components such as accurate decisions, customized demands in consumer electronics with promising/sustainable solutions. This transformation and paradigm shift inside the Industry 5.0 frame can be comprehensively understood by integrating the factors related to human values with the cutting-edge technologies of consumer electronics for compatibility with the issue of sustainable development. The present work proposes an integrated approach for extensive study with a set of criteria and possible Industry 5.0 enablers in consumer electronics using a novel decision-making approach. The approach comprises of T -spherical fuzzy information containment/processing through an analytic hierarchy process (AHP) and then utilizing the weighted aggregated sum product assessment (WASPAS) sequentially to obtain the necessary weights of selected criteria. Further, the obtained weights from AHP would be used in WASPAS for the computational assessment while finding the prioritization/ranking of industry 5.0 enablers. The results with the sensitivity analysis validate the robustness-cum-resilience of the proposed integrated approach with standard managerial implications and the findings take care of cognitive in the human socio-technical environment. The regulated adoption of Industry 5.0 enablers would help consumer electronics manufacturers in finding optimized solutions. © 1975-2011 IEEE.

Author keywords

analytical hierarchy process; enablers in consumer electronics; Industry 5.0; multi-criteria decision-making; T-spherical fuzzy information

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Bajaj, R.K.; Jaypee University of Information Technology, Department of Mathematics, Solan, India; email:rakesh.bajaj@juit.ac.in

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Development of a Double-Resampling-Based Least-Squares Particle Filter for Accurate Position Estimation of a GPS Receiver in Visakhapatnam Region of the Indian Subcontinent

Kumar, N. Ashok[a] ; Kumar, P. Sirish[b] ; Victor, Nancy[c] ; Gadekallu, Thippa Reddy[c, d, e, f, g] ; Mohiddin, Md. Khaja[h] ; Tiwari, Sourabh[i] ; Minchula, Vinodh Kumar[j]
Save all to author list

[a] Department of Electronics and Communication Engineering, Anil Neerukonda Institute of Technology and Sciences, Sangivalasa, Visakhapatnam, 531162, India
[b] Department of Electronics and Communication Engineering, Aditya Institute of Technology and Management, Tekkali, 532421, India
[c] School of Information Technology and Engineering, Vellore Institute of Technology, Tamil Nadu, Vellore, 632014, India
[d] Zhongda Group, Haiyan, Zhejiang, Jiaxing, 314312, China
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Abstract

Urban sensing plays a significant role in improving resource management, citizen engagement, environmental monitoring, urban planning, safety, and social equality. Global positioning system (GPS) is a crucial part in urban sensing as it provides accurate location tracking, real-time data collection, location-based services, mobility and transportation solutions, intelligent urban planning, and disaster management. However, there are various challenges associated with accurately estimating positions in urban environments due to various factors such as signal obstruction, urban canyons, multipath interference, noise and signal degradation, and differential GPS limitations. In the context of GPS-based urban sensing applications, the use of a navigation algorithm plays a critical role in extracting reliable data from corrupt sources, which can significantly impact inference performance for various signal processing applications. However, modeling all error sources that affect data quality can significantly increase system complexity, leading to challenges in terms of hardware and computation. To address this challenge, this article proposes a novel particle filter-based algorithm, called the double-resampling-based least-squares particle filter (DR-LPF), designed specifically for estimating the position of a GPS receiver without the need to model all error sources. By integrating current measurements (CMs) into the particle before resampling through the least-squares (LS) method, the DR-LPF allows the double-resampled particles to move toward high-likelihood regions, leading to improved estimation accuracy, reduced computation time, and reduced computational load. The application of the proposed DR-LPF algorithm finds wide applications in urban sensing environments where data quality can be affected by multiple error sources. By reducing the computational load and improving the estimation accuracy, the proposed DR-LPF algorithm can provide valuable insights into the movement and behavior of individuals and objects within an urban environment, enabling a wide range of smart city applications, such as traffic monitoring, environmental sensing, and crowd management. © 2001-2012 IEEE.

Author keywords

Estimation; global positioning system (GPS); least-squares (LS) estimator; particle filter; resampling; signal processing

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email:thippareddy@ieee.org

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Area Efficient High-Speed Binary Divider Using Xilinx IP Core

Khaleelu Rehman B.[a] ; Vallathan G.[b] ; Rajamani, Vetriveeran[c]; Basha, Mudasar[d]; Kumar, Raman[a]

Save all to author list

[a] Dept. of Ece, Nalla Malla Reddy Engineering College, Telangana, Hyderabad, India

[b] Dept. of Ece, Geethanjali College of Engineering & Technology, Telangana, Hyderabad, India

[c] School of Electronics Engineering (SENSE), Dept. of Micro and Nano Electronics, Vellore Institute of Technology, Vellore, India

[d] Dept. of Ece, B.V. Raju Institute of Technology, Telangana, Narsapaur, India

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Abstract

The Research article focuses on the Xilinx intellectual property (IP) cores and the process that allows in the simple way of incorporating the IP'S and its functionality. The developed IP'S are interfaced with the high end recent Xilinx FPGAs. Binary division circuit is designed using VHDL style of programming by using Xilinx ISE 14.7 version and the IP cores associated with Xilinx ISE environment and targeted by using FPGAs like Spartan 3E (xc3s500e-5fg320), Spartan-6 (xc6slx45t-3csg324) Virtex-5 (XC5VXT50T) devices which works on 90nm technology, 60nm technology and 45 nm technology respectively. Xilinx X power analyzer is used to calculate power analysis of the design. Restoring algorithm and non-restoring algorithm for the binary divider is implemented and its RTL verification, simulation analysis (timing and functional simulation), Synthesis, place and route and power analysis. The comparison of hardware utilization summary (percentage of FPGA resources) with the latest research articles is compared and the proposed design got the area optimized solution for the stand-alone system. © 2024 Author(s).

Author keywords

FPGA; ISE; VHDL; Virtex-5; Xilinx IP

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Khaleelu Rehman, B.; Dept. of Ece, Nalla Malla Reddy Engineering College, Telangana, Hyderabad, India; email:afridi.1156@gmail.com

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Joint optimal beam forming and resource allocation in intelligent reflecting surface aided wireless power transfer rate splitting multiple access system

Naresh M.[a]; Pradeep Kumar G.V.[b]; Sireesha V.[c]; Satyanarayana Tallapragada V.V.[d]

Save all to author list

[a] Department of ECE, Matrusri Engineering College, Saidabad, Telangana, Hyderabad, India

[b] Department of ECE, Chaitanya Bharathi Institute of Technology, Telangana, Hyderabad, India

[c] Department of Computer Science and Engineering, School of Technology, GITAM University, Telangana, Hyderabad, India

[d] Department of ECE, School of Engineering, Mohan Babu University (Erstwhile Sree Vidyanikethan Engineering College), Andhra Pradesh, Tirupati, India

Abstract

The intelligent reflecting surface (IRS) has recently become the most promising technology to achieve maximum beam-forming gain with a simultaneous wireless information and power transfer (SWIPT) system. Many existing studies perform a single IRS deployment or utilize space division multiple access (SDMA) and non-orthogonal multiple access (NOMA) schemes. However, the existing schemes face high time complexity and block signal transmission for larger indoor communications. Hence, this article introduces a dual IRS-aided multiuser SWIPT system by implementing rate-splitting multiple access (RSMA) systems. To enhance the minimum achievable rate and ensure the minimum harvesting energy (HE), this study proposes a joint successive convex approximation with an integrated optimization algorithm (SCA-IOA). The proposed algorithm jointly optimizes the reflecting beam forming and power splitting (PS) coefficient of all the users effectively. The simulation results demonstrate the effectiveness of the proposed techniques and produce an outstanding performance for deploying dual IRS and implementing RSMA compared to traditional SDMA and NOMA systems. © 2024 John Wiley & Sons Ltd.

Author keywords

beam forming design; intelligent reflecting surface; min-max rates; rate splitting multiple access; resource allocation; signal-to-interference noise ratio; simultaneous wireless information and power transfer

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Satyanarayana Tallapragada, V.V.; Department of ECE, School of Engineering, Mohan Babu University (Erstwhile Sree Vidyanikethan Engineering College), Andhra Pradesh, Tirupati, India; email:satya.tvv@gmail.com

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Optimized deep learning based hypernet convolution neural network and long short term memory for joint pilot design and channel estimation in MIMO-OFDM model

Silpa C.[a, b] ; Vani A.[c]; Naidu, K. Rama[a]

Save all to author list

[a] Department of Electronics and Communication Engineering, JNTUA, Anantapur, India

[b] Department of Electronics and Communication Engineering, Malla Reddy Engineering College, Hyderabad, India

[c] Department of Electronics and Communication Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, India

Abstract

In multiple input multiple output-orthogonal frequency division multiplexing (MIMO-OFDM) systems, efficient pilot design (PD) and channel estimation (CE) greatly influences the reliability and robustness of pilot-based CE methods. But, accurate estimationof the channel remains a challenge in a high-mobility environment with non-linear channel characteristics. Many techniques have been introduced to overcome the pilot contamination and CE problems in the MIMO-OFDM system to overcome this issue. However, these techniques take multiple paths at the receiver, resulting in delay spread and interference in the communication. Hence, this study presents a novel deep learning (DL) based technique for channel estimation based on channel state information (CSI). A DL technique based on a hyper convolutional neural network (Hyper-CNN) is introduced for the optimal pilot design. The selection of the pilot position can be made using the tunicate swarm optimization (TSO) approach. Finally, a DL-based long short-term memory (LSTM) model is proposed for the CE in the MIMO-OFDM system. The proposed method is implemented in the MATLAB platform, and the outcome is compared under different metrics like mean square error (MSE) and bit error rate (BER). In the experimental scenario, the proposed method attains the BER of 0.20 and 0.03 for CP (cyclic prefix) and without CP, respectively. In addition, the proposed method attains the MSE of 1.14, 0.99, 1.08 and 0.97 for 8, 16, 48 and 64 pilots, respectively. The performance of a proposed method is compared with the existing method and proves the efficacy of the proposed method. © 2023 John Wiley & Sons Ltd.

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Silpa, C.; JNTUA, Andhra Pradesh, Anantapur, India; email:srsilpavasu@gmail.com

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SIS Error Estimation for Fault Detection of IRNSS Using Beeline Method

Sony D.[a] ; Reddy, D. Krishna[a]; Kumar, P. Naveen[b]

Save all to author list

[a] Chaitanya Bharathi Institute of Technology, Hyderabad, India

[b] Osmania University College of Engineering, OU, Hyderabad, India

Abstract

Receiver autonomous integrity monitoring (RAIM) is a technique mainly used to evaluate the integrity of global navigation satellite system (GNSS) signals. There is every possibility, that the GNSS satellites will broadcast slightly erroneous information which leads to inaccurate navigation information. GNSS systems do not carry any information related to the integrity of the signals. Therefore, in this paper, Signal in Space (SIS) errors are evaluated to detect errors/faults broadcasted by the Indian regional navigation satellite systems (IRNSS). Further, it focuses on implementing Beeline method for IRNSS to estimate SIS errors where the precise ephemeris is unavailable. To carry out the trust analysis of IRNSS signals using Beeline method, the User equipment errors (UEE) and User equivalent range error (UERE) are estimated to evaluate the SIS error. UEE constitutes the ionospheric, tropospheric, multipath errors and receiver noise error. UERE depends on the position error and the geometry of the satellites. It is found from the simulated results that the peak value of SIS error is 4.17 m for 1C geostationary satellite and the minimum value was found to be 0.4 m with 1D, which is a geosynchronous satellite. © 2023, The Author(s), under exclusive licence to The Korean Society for Aeronautical & Space Sciences.

Author keywords

Fault detection; IRNSS; Receiver autonomous integrity monitoring; Signal in space errors; User range accuracy

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Sony, D.; Chaitanya Bharathi Institute of Technology, Hyderabad, India;
email:sonyd_ece@cbit.ac.in

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PAPER

Improving the power quality and hydrogen production from renewable energy sources based microgrid

Vankudothu Balu [1], K Krishnaveni [2], Priyanka Malla [3] and Siva Ganesh Malla [4,5]

[1] Department of Electrical Engineering, University College of Engineering, Osmania University, Hyderabad, Telangana, India
[2] Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India
[3] Department of Electrical and Electronics Engineering, AMET University, Chennai, Tamil Nadu, India
[4] Research and Development, ESG Foundation, Anakapalli, Andhra Pradesh, India
[5] Author to whom any correspondence should be addressed.

E-mail: [redacted]

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Abstract

The world is looking for utilization of renewable energy sources to reduce global warming as well as the consumption of fossil fuels. In this scenario, solar and wind energy are widely used at many places worldwide. However, both solar irradiance and wind speed are depending on nature. Hence, an energy storage device must be required to operate at their best utilization level by converting them to electricity. One of the best energy storage devices for medium power range is the battery. However, batteries require high maintenance and suffering from self-discharge as well as storage capacity will be decreased day by day. Hence, storing hydrogen can be an economically feasible solution instead of using batteries for high power range. Usually an aqua electrolyzer can easily convert water to hydrogen and oxygen through electricity. However, due to slow dynamics of heat transfer from electricity, the generation of hydrogen cannot meet the fast response like electrical devices. Therefore, a novel controlling technique is required to increase the production quality of hydrogen during random changes in both solar irradiance and wind speed. In order to achieve the best utilization, both photovoltaic panels and wind turbines are operated at their maximum power point levels. In this research boost converters are used to operate as maximum power point tracking devices. The whale optimization technique is integrated to respective controllers of all the converters to achieve stable production of hydrogen during rapid changes in irradiance and wind speed. The Whale Optimization Algorithm (WOA) technique is compared with Genetic Algorithm (GA), Particle Swarm Optimization (PSO) and Grey Wolf Optimization (GWO) to show the benefits of tracking response of the system on improving production of hydrogen from hybrid renewable energy sources based Microgrid. Hardware—in the—Loop (HIL) is developed to analyze the results with the help of OPAL-RT modules. Along with HIL results, a Real Time Digital Simulator (RTDS) based results are also presented to evaluate the performance of the proposed method.

1. Introduction

Worldwide, it is still hard to provide electricity to consumers with utility grids in many places. To provide electrification in such remote places, a locally established small scale standalone Microgrid can become a better solution [1]. Further the Microgrid consists of renewable energy sources that can make the system eco-friendly to nature. The integration of two or more renewable energy sources can make systems more reliable for supplying stable and quality power to consumers in remote locations. The famous renewable energy sources such as Photovoltaic (PV) based solar and PMSG based wind are available in many remote locations to generate electricity.

Both solar irradiance and velocity of wind always fluctuates which reflects on their power generation. Therefore an energy storage device should be used to stabilize the generated power for maintaining proper

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ORIGINAL PAPER

Optimization of ANFIS controller for solar/battery sources fed UPQC using an hybrid algorithm

Koganti Srilakshmi[1] · Gummadi Srinivasa Rao[2] · Katragadda Swarnasri[3] · Sai Ram Inkollu[4] · Krishnaveni Kondreddi[5] · Praveen Kumar Balachandran[6] · Ilhami Colak[7]

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Abstract

This study introduces an integrated power quality (PQ) conditioner, referred to as UPQC, that is linked with photovoltaic (PV) and battery energy systems (BSS) in order to address and solve PQ issues. It is proposed to employ the Levenberg–Marquardt (LM) backpropagation (LMBP) trained artificial neural network control (ANNC) technique for generating reference signal for converters in UPQC. This approach eliminates the need for traditional abc to dq0 to αβ conversions. Additionally, the hybrid algorithm (FFHSA) in combination of harmony search algorithm (HSA), and firefly algorithm (FFA) is also implemented for the optimal selection of adaptive neuro-fuzzy interface system (ANFIS) parameters to maintain direct current link capacitor voltage (DLCV) constant. The prime goal of the developed hybrid ANNC-FFHSA is to stabilize the DLCV with low settling time during load and solar irradiation (G), Temperature (T) changes, minimization of distortions in the source current signal to diminish total harmonic distortion (THD) in turn boosting the power factor (PF), suppression of fluctuations like disturbances, swell, sag and unbalances in the supply voltage. The suggested method is validated by four test cases with several combinations of variable irradiation (G), temperature and loads. On the other hand, to reveal the superiority of the developed method, the comparison is carried out with the genetic algorithm (GA) and Ant colony algorithm (ACA) along with instantaneous power (p–q) and Synchronous reference frame (SRF) conventional methods. The proposed approach significantly diminishes the total harmonic distortion to values of 3.61%, 3.48%, 3.48%, and 4.51%, which are notably lower compared to the values reported in the existing literature and also improves the power factor to almost unity. The design and implementation of this method were carried out using MATLAB/Simulink software.

Keywords Harmony search optimization · Firefly algorithm · Unified power quality conditioner (UPQC) · Power factor · Power quality

✉ Praveen Kumar Balachandran
praveenbala038@gmail.com

Koganti Srilakshmi
kogantisrilakshmi29@gmail.com

Gummadi Srinivasa Rao
vasu1in@vrsiddhartha.ac.in

Katragadda Swarnasri
swarnasrik@gmail.com

Sai Ram Inkollu
inkollusairam@gmail.com

Krishnaveni Kondreddi
krishnaveni_eee@cbit.ac.in

Ilhami Colak
ilhcol@gmail.com

1 Department of Electrical and Electronics Engineering, Sreenidhi Institute of Science & Technology, Hyderabad, Telangana 501301, India

2 Department of Electrical and Electronic Engineering, Velagapudi Ramakrishna Siddhartha Engineering College, Kanuru, Vijayawada, Andhra Pradesh, India

3 Department of Electrical and Electronics Engineering, R.V.R. & J.C. College of Engineering, Guntur, Andhra Pradesh, India

4 Department of Electrical and Electronics Engineering, R. K. College of Engineering, Vijayawada, Andhra Pradesh, India

5 Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India

6 Department of Electrical and Electronics Engineering, Vardhaman College of Engineering, Hyderabad, Telangana 501218, India

7 Department of Electrical and Electronics Engineering, Faculty of Engineering and Architectures, Nisantasi University, 34398 Istanbul, Turkey

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Research Article

Multiobjective Neuro-Fuzzy Controller Design and Selection of Filter Parameters of UPQC Using Predator Prey Firefly and Enhanced Harmony Search Optimization

Koganti Srilakshmi,[1] Gummadi Srinivasa Rao,[2] Katragadda Swarnasri,[3] Sai Ram Inkollu,[4] Krishnaveni Kondreddi,[5] Praveen Kumar Balachandran,[6] C. Dhanamjayulu,[7] and Baseem Khan[8]

[1]*Department of Electrical and Electronics Engineering, Sreenidhi Institute of Science and Technology, Hyderabad, Telangana 501301, India*
[2]*Department of Electrical and Electronic Engineering, Velagapudi Ramakrishna Siddhartha Engineering College, Kanuru, Vijayawada, Andhra Pradesh, India*
[3]*Department of Electrical and Electronics Engineering, R.V.R. and J.C. College of Engineering, Guntur, AP, India*
[4]*Department of Electrical and Electronics Engineering, Dhanekula Institute of Engineering and Technology, Vijayawada, AP 521139, India*
[5]*Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, Telangana, India*
[6]*Department of Electrical and Electronics Engineering, Vardhaman College of Engineering, Hyderabad, TS 501218, India*
[7]*School of Electrical Engineering, Vellore Institute of Technology, Vellore, India*
[8]*Department of Electrical and Computer Engineering, Hawassa University, Hawassa 05, Ethiopia*

Correspondence should be addressed to C. Dhanamjayulu; dhanamjayuluc6947@gmail.com and Baseem Khan; baseem_khan04@rediffmail.com

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This research introduces a unified power quality conditioner (UPQC) that integrates solar photovoltaic (PV) system and battery energy systems (SBES) to address power quality (PQ) issues. The reference signals for voltage source converters of UPQC are produced by the Levenberg–Marquardt back propagation (LMBP) trained artificial neural network control (ANNC). This method removes the necessity for conventional dq0, abc complex shifting. Moreover, the optimal choice of parameters for the adaptive neuro-fuzzy inference system (ANFIS) was achieved through the integration of the enhanced harmony search algorithm (EHSA) and the predator-prey-based firefly algorithm (PPFA) in the form of the hybrid metaheuristic algorithm (PPF-EHSA). In addition, the algorithm is employed to optimize the selection of resistance and inductance values for the filters in UPQC. The primary objective of the ANNC with predator-prey-based firefly algorithm and enhanced harmony search algorithm (PPF-EHSA) is to enhance the stability of the DC-link capacitor voltage (DLCV) with reduced settling time amid changes in load, solar irradiation (G), and temperature (T). Moreover, the algorithm seeks to achieve a reduction in total harmonic distortion (THD) and enhance power factor (PF). The method also focuses on mitigating fluctuations such as swell, harmonics, and sag and also unbalances at the grid voltage. The proposed approach is examined through four distinct cases involving various permutations of loads and sun irradiation (G). However, in order to demonstrate the performance of the suggested approach, a comparison is conducted with the ant colony and genetic algorithms, i.e., (ACA) (GA), as well as the standard methods of synchronous reference frame (SRF) and instantaneous active and reactive power theory (p-q). The results clearly demonstrate that the proposed method exhibits a reduced mean square error (MSE) of 0.02107 and a lower total harmonic distortion (THD) of 2.06% compared to alternative methods.

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A receiver-side power control method for series-series magnetic topology in inductive contactless electric vehicles battery charger application

Bhukya Bhavsingh[1], Gotluru Suresh Babu[2], Bhukya Mangu[3], Ravikumar Bhukya[1]
[1]Department of Electrical Engineering, Faculty of Electrical Engineering, Rajiv Gandhi University of Knowledge Technologies Basar, Telangana, India
[2]Department of Electrical and Electronics Engineering, Faculty of Electrical Engineering, Chaitanya Bharathi Institute of Technologies, Telangana, India
[3]Department of Electrical Engineering, Faculty of Engineering, University College of Engineering, Osmania University, Telangana, India

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ABSTRACT

Wireless power transfer (WPT) can be used to charge the battery conveniently and efficiently. In this paper, the investigation of high-efficiency S/S resonant magnetic topology in inductive wireless battery charging of electric vehicles (EVs) is analyzed, designed, and controlled. To regulate the output power efficiently rather than controlling the supply voltage, novel bidirectional switches are introduced to control the output power by using the duty cycle control method. The output power of the secondary side is derived and discussed based on the fundamental harmonic approximation (FHA) approach. A 1.5 kW, 120 mm distance, and 85 kHz resonance frequency are verified in MATLAB/Simulink.

Corresponding Author:

Bhukya Bhavsingh
Department of Electrical Engineering, Faculty of Electrical Engineering,
Rajiv Gandhi University of Knowledge Technologies Basar
Nirmal District, Telangana, 504107, India.
Email: bhavsingh.eee@rgukt.ac.in

1. INTRODUCTION

In the current generation, greenhouse gas emissions and fossil pollution have become big issues [1]–[3]; these can be overcome by using renewable energy sources as the best solution, plug-in hybrid electric vehicles (PHEVs) and electric vehicles (EVs). So the usage of PHEVs and battery-operated electric vehicles EVs has dramatically increased [4]–[7]. The traditional plug-in charging path is not convenient and sometimes unsafe; also this is the main reason for promoting and applying plug-in hybrid EVs and EVs. Wireless power transfer (WPT) system has many advantages like high reliability, flexibility, and security [8], [9]. It is accepted as a preferred technology for the charging of EVs in tailless TV; wireless flat-panel chargers designed for suitable electronic products, biomedical devices, and academia. The research in WPT systems is concentrated on coil design, compensation circuits, battery management systems, power transfer efficiency (PTE), and control techniques.

Figure 1 depicts the typical wireless EV charging system, this tells about several stages for charging an EV without any contact. The transmitter side will be on the ground and the receiver's side will be in the vehicle. To get supply to the transmitter side, the utility grid of alternating current (AC) supply is converted

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Intelligent Solar PV Grid Connected and Standalone UPQC for EV Charging Station Load

Bomma Shwetha [a,*], G. Suresh Babu [b], G. Mallesham [a]

[a] Department of Electrical Engineering, University College of Engineering, OU, Telangana, India
[b] Department of Electrical and Electronics Engineering, CBIT, Telangana, India

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ABSTRACT

The insertion of renewable energy sources into the grid, as well as the development of power electronics technology to regulate loads that are not linear, had an impact on power quality (PQ). This study focuses on the PQ enhancement of grid-connected and standalone solar PV systems (SPVS) with battery energy storage device (BESD) for the Electric vehicle (EV) charging station (EVCS) load in addition to the local load. Here, a hybrid control strategy that uses both the superior qualities of the sliding mode controller (SMC) and the fuzzy logic controller (FLC) is suggested for the unified power quality conditioner (UPQC's) shunt filter. It's major goal is to achieve steady DC capacitance voltage (SVDC) during load (like EVCS, non linear balanced/unbalanced etc.) and irradiation variations, diminish of total harmonic distortion (THD) in source current and load voltage, and mitigate sag, swell disturbances, and source voltage unbalances. The created model's performance is assessed using two scenarios (grid and island) under four case studies with varying combinations of loads and grid voltage circumstances. However, to establish the superiority of the proposed technology, comparative research with standard technologies such as proportional integral controller (PIC) and SMC controllers is required. THD is reduced by the proposed method to 2.25 %, 2.36 %, and 1.71 %, It is inferior to the current approaches found in the survey.

1. Introduction

PQ Issues can cause disturbances in devices connected to the power supply. For instance, voltage sags or surges, harmonics, voltage fluctuations, and interruptions can lead to equipment malfunction, data loss, or even damage. Maintaining good power quality is essential, especially in sensitive environments like hospitals. It's also crucial for utility companies to ensure stable and reliable power distribution to maintain good PQ for consumers. Besides, integrating renewable sources into distribution networks is a crucial step toward creating a more sustainable and environmentally friendly energy system. However, this integration poses various challenges due to the intermittent and variable nature of renewable sources like solar and wind power. THD is the top priority PQ issue among all. Lower THD values are preferred in electrical systems, as higher THD can cause issues such as overheating in electrical equipment, interference with communication systems, and reduced system efficiency. In power systems, maintaining low THD is crucial for good PQ and efficient operation of equipment. Hence, ensuring the stability of PQ has become the primary concern for electrical designers.

* Corresponding author.
E-mail addresses: bomma.swetha243@gmail.com (B. Shwetha), gsureshbabu_eee@cbit.ac.in (G.S. Babu), drgm@osmania.ac.in (G. Mallesham).

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PERFORMANCE ANALYSIS OF MULTILEVEL INVERTERS FOR BATTERY SUPPORTED SOLAR PV PANELS

Thota Srinivas[1], K Krishna Veni[2], P Satish Kumar[1]

[1]Dept. of Electrical Engineering, University College of Engineering (Autonomous), Osmania University, Hyderabad, Telangana.

[2]Dept. of EEE, Chaitanya Bharathi Institute of Technology (Autonomous), Hyderabad, Telangana.

Corresponding author: pace.thota@gmail.com

Abstract:

This study aims to investigate the effectiveness of different multilevel inverter (MLI) topologies for integrating photovoltaic (PV) and energy storage systems. A thorough literature survey was conducted on recent MLI configurations, and a new reduced switch MLI topology is proposed and compared with three different MLI configurations, including the conventional cascaded and two variations of modified cascaded h-bridge. The MLI configurations are modeled and simulated using MATLAB/SIMULINK, and the results are analyzed based on the Total Harmonic Distortion (THD) values obtained. The results indicate that the proposed MLI converter is the most suitable configuration for renewable energy applications.

Keywords: Photovoltaic systems, Energy storage devices, Multilevel inverters, Reduced switch count.

I. Introduction:

Solar PV technology has seen significant growth and development in recent years, driven by declining costs and advancements in technology. Recent developments in the field of solar PV have focused on improving the efficiency and reliability of the technology, as well as reducing costs. This has led to the introduction of new and innovative solar PV products and solutions, including flexible solar panels, integrated building-integrated photovoltaic (BIPV) systems, and battery-integrated solar PV systems.

The choice of inverter technology is crucial in battery integrated solar PV systems as it impacts the overall efficiency and reliability of the system. Proper inverter technology can extend battery lifespan and improve system performance. A well-designed inverter can help address challenges such as power quality, energy efficiency, and harmonic distortion. Recent research shows that Multi-Level Inverters help address these challenges. The multi-level structure of MLI enables a more accurate representation of the output waveform and provides greater flexibility in terms of voltage range and the ability to integrate with high-voltage distribution lines.

MLIs were first introduced by Nabae in 1975 and are commonly used in medium voltage and high-power applications such as electrical motor drives, energy storage systems, and FACTS [1, 2]. The most widely used MLI configurations are NPC inverters, Diode-Clamped MLI (DC MLI), Flying Capacitor MLI (FC MLI), and Cascaded H-Bridge MLI (CHB MLI) [3, 4]. CHB converters are preferred due to the lower likelihood of unbalanced DC link voltage and high switch stress, which are common issues in NPC and FC inverters [5, 6]. Despite their wide range of applications, traditional MLI topologies require a large number of power components.

In recent years, researchers have focused on reducing the number of components in MLIs to improve reliability and decrease cost and loss. As a result, new Reduced Switch MLI (RS MLI) topologies have been proposed, with ongoing research aimed at further reducing the number of required components. These topologies can be used in both grid-tied and standalone applications. RS MLIs are broadly categorized into three types: reduced switch symmetric H-bridge type MLI (RSS MLI), reduced switch asymmetrical H-bridge type MLI (RSA MLI), and reduced switch modified MLI (RSM MLI) topologies. The modified type MLI includes all hybrid and topologies not based on H-bridge.

Engineering Research Express

PAPER

Design and control of LSTM-ANN controllers for an efficient energy management system in a smart grid based on hybrid renewable energy sources

Bhukya John Wesley[1,*], G Suresh Babu[2] and P Satish Kumar[1]

[1] Department of EE, University College of Engineering, Osmania University, Hyderabad, Telangana, India
[2] Department of EEE, CBIT, Gandipet, Hyderabad, Telangana, India
* Author to whom any correspondence should be addressed.

E-mail: Wesley.bhukya@gmail.com

Keywords: renewable energy sources, smart grid, microgrid, energy management system, LSTM, ANN

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Abstract

Many isolated locations, including hilly areas, remote sites, and military camps, lack feasible access to the main power grid. In these conditions, locally established Microgrids can provide the necessary power supply. However, to meet the demands of these isolated areas, numerous individual Microgrids are required. Although some of these Microgrids might be integratable, geographical constraints may preclude full integration. Under these circumstances, the establishment of a smart grid—integrating multiple Microgrids with a battery management system—can potentially solve many power supply issues. A smart grid control system paired with a centralized battery management system is proposed in this paper. The system considers the use of multiple renewable energy sources at various locations for stable and reliable power generation. The proposed method incorporates a long short-term memory (LSTM)-based artificial neural network (ANN) to ensure a stable, high-quality power supply at different load buses. Additionally, this work introduces an artificial intelligence-based operating system designed to maintain energy management under various conditions. To enhance voltage quality, a 7-level aligned multilevel inverter is incorporated into the system. As compared with PI and Fuzzy controllers, the proposed method with LSTM-ANN controller is improved the power quality under sudden changes in the system which are also presented in results, Voltage variation of PI, Fuzzy, and LSTM-ANN is 370V,180V,and 70V . The effectiveness of the proposed energy management system (EMS) is verified by using a hardware-in the-loop approach with OPAL-RT modules, yielding realistic results.

Abbreviation

AI	Artificial Intelligence
AMI	Aligned Multilevel Inverter
ANN	Artificial Neural Networks
BAPA	Battery Aging and Price Aware
BEMS	Battery Energy Management System
EMS	Energy Management System
HIL	Hardware-In-the-Loop
FLC	Fuzzy Logic controller
ICT	Information and Communication Technology
LSTM	Long Short-Term Memory
PI	Proportional Integral

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An Artificial Intelligent Hybrid Controller for Solar and Battery Fed Five-Level UPQC for Power Quality Improvement

Guguloth MohanBabu *, G. Suresh Babu **, E. Vidya Sagar *

* Department of Electrical Engineering, Osmania University, Hyderabad, Telangana, India.

** Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Telangana

(mohanbabuguguloth1985@gmail.com, gsureshbabu_eee@cbit.ac.in , evsuceou@gmail.com)

‡ Corresponding Author: Guguloth MohanBabu, Department of Electrical Engineering, Osmania University, Hyderabad, Telangana, India, Tel: +91-8328180776,

mohanbabuguguloth1985@gmail.com.

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Abstract: This study examines the diode-clamped five-level unified Power quality conditioner coupled with photovoltaic and battery storage systems to handle the power quality related problems. The traditional SRF and p-q theories require the transformations like abc, dq0, αβ etc to generate reference signal generation. In this paper, eliminates that conventional complex transformations and adopts the artificial neural network-based control scheme with levenberg- marquardt back propagation training method is adopted for the diode clamped 5L-UPQC to generate the necessary reference signals for the voltage source converters. In addition, an adaptive neuro-fuzzy interface system hybrid controller is suggested for DC link error current minimization, which adapts both the properties of fuzzy and ANN. The prime goal of the developed scheme is to maintain constant DLCV during load changes, diminish of total harmonic distortion in the source current and load voltage waveforms, and maximum elimination of source voltage distortions like sag/swell and disturbances. The suggested method was demonstrated in two cases with various combinations of loads. However, to exhibit the performance of the proposed technique, the comparison is carried out with the ANN, PIC and SMC.

Keywords- Unified Power Quality Conditioner, Total Harmonic Distortion, Power Quality, Shunt Active Power Filter, and Series Active Power Filter

Nomenclature:

Five-level-UPQC	5L-UPQC	THD	Total harmonic distortion
PV	Photovoltaic	PF	Power factor
PQ	Power Quality	GA	Genetic algorithm
SRF	Synchronous reference frame theory	PSO	Particle swarm optimization
p-q	Instantaneous reactive power theory	PIC	Proportional integral controller
ANN	Artificial neural network	SHAPF	Shunt Active Power Filter
LMBP	Levenberg- marquardt back propagation	GWO	Grey wolf optimization
DLCV	Direct current link capacitor voltage	BC	Boost converter
		PWM	Pulse width modulation
		BSS	Battery system storage
		SMC	Sliding mode control

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Software Impacts
Volume 17, September 2023, 100550

Original software publication

MATLAB software/code for optimal placement of GIPFC device in power networks using AALO algorithm

Balasubbareddy Mallala ✉

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https://doi.org/10.1016/j.simpa.2023.100550 ↗

Highlights

- MATLAB software code for a novel Ameliorated Ant Lion Optimization (AALO) Algorithm.
- MATLAB software code for optimal location of Generalized Interline Power Flow Controller (GIPFC) in the power system.
- Implications of LSZ (Lehmann, Symanzik and Zimmermann) formula for identifying the optimal location for GIPFC.
- OPF problems for a single objective optimization for generation fuel cost minimization.

Secure trust aware multi-objective routing protocol based on battle competitive swarm optimization in IoT

Published: 11 October 2023

Volume 56, pages 1685–1709, (2023) Cite this article

N. V. Rajeesh Kumar, N. Jaya Lakshmi, Balasubbareddy Mallala & Vaishali Jadhav

Abstract

A true routing system for the Internet of Things (IoT), Routing Protocol for Low Power and Lossy Networks (RPL) offers protection against many types of routing threats. The attacker can exploit the routing structure of RPL for launching devastating and destructive attacks counter to an IoT network. Moreover, Sybil and Rank attacks are most familiar among IoT attacks. Additionally, the resource-constrained design of IoT devices results in a routing protocol for RPL that is susceptible to a number of assaults. Even though the RPL condition offers encryption protection for controlling messages, RPL is susceptible to selfish behaviors

I. J. of Electrical & Electronics Research
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Research Article | OPEN ACCESS

An Enhanced Multi-Objective Evolutionary Optimization Algorithm based on Decomposition for Optimal Placement of Distributed Generation and EV Fast Charging Stations in Distribution System

Author(s): Varun Krishna Paravasthu*, Balasubbareddy Mallala and B. Mangu

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RESEARCH ARTICLE

Multi-Objective Optimization in the Presence of OGIPFC Using NSMMP Algorithm

Author(s): Balasubbareddy Mallala*, Venkata Prasad Papana and Kowstubha Palle

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Page: [60 - 81]

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Pages: 22

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Abstract

Background: Customers expect quality, uninterrupted power with cost-effective electricity in the latest trend. However, outages, severe storms, old infrastructure, and cost pressures can lead to ambiguity in power generation and transmission. To improve line power transmission capability, the right flexible AC transmission systems (FACTS) device may save millions of dollars.

Methods: In this study, a FACTS controller named Optimal Generalized Interline Power Flow Controller (OGIPFC) was developed. Furthermore, for optimization, the Modified Marine Predator Algorithm (MMPA), which is a modification of the recently developed Marine Predator Algorithm (MPA). The optimum technique was used to evaluate a set of prioritized considered objective minimizations. A variety of factors must be maximized, such as generation cost, emissions, and power loss.

Results: The performance of the proposed algorithm was analysed on benchmark test functions, and then single objective optimization problems of standard IEEE-30 bus system were solved and compared with the existing algorithms. The proposed algorithm was restricted to solving the single objective problem only, so it was further implemented with non-dominating sorting to solve the multiobjective optimization problem. The proposed multi-objective version is named as Non-dominating Sorting Modified Marine Predator Algorithm (NSMMPA), and it was validated on benchmark test functions and the IEEE-30 bus system.

Conclusion: Finally, the OPF problem was solved with the incorporation of OGIPFC using the proposed methods, which resulted in better solutions and made the system more effective in operation.

Keywords: Optimal generalized interline power flow controller (OGIPFC), modified marine predator algorithm (MMPA), nondominating sorting modified marine predator algorithm (NS-MMPA), optimal power flow (OPF), power injection model (PIM), flexible AC transmission systems (FACTS).

Research Articles

Smart Performance Evolution of a Solar Water Heating System with PCM by Using Deep Learning Approach

Archana Tamizharasan, M. G. Ramanath Kini, B. Suresh Kumar, R. Manjunath, Shaik Shafi, Syed Noeman Taqui, ...show all

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Cite this article https://doi.org/10.1080/15325008.2023.2243458 Check for updates

Abstract

The solar water heating business by itself accounts for approximately 80% of the total market for solar thermal energy. The construction sector all around the world has discovered several applications for solar water heating over the course of the past few decades. In this paper, we develop a deep learning approach for a solar water heating system built with Phase-change materials. The results demonstrate that the proposed Phase-change materials and deep neural network model outperforms other methods in terms of accuracy and cost reduction. The use of Phase-change materials in solar water

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Original Article

Performance Analysis of EV Battery Module with Different Charging Techniques for Better Stability

Tipirisetti Rakesh[1], B. Suresh Kumar[2], J. Upendar[3]

[1,3]*Elelctrical Engineering Department, University College of Engineering, Osmania University, Telangana, India.*
[2]*Electrical and Electronics Engineering Department, Chaitanya Bharathi Institute of Technology, Telangana, India.*

[1]*Corresponding Author : traki284@gmail.com*

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Abstract *- Electric vehicles are the replacement for conventional fossil fuel engine vehicles. The EV is installed with a battery pack to store electrical power which drives the vehicle. The charging circuit and the driving circuit have independently isolated circuit topologies. Each circuit operates individually and complimentarily, as during charging, the vehicle does not move. There are different types of charging circuits that control the charging current of the battery. In this paper, we consider a conventional buck-boost circuit topology for charging the battery, controlled by different charging techniques. The converter is controlled by either CV or CC charging which need voltage and current feedback, respectively. The different charging techniques include i) Continuous, ii) Pulse, iii) Burp, and iv) Taper. To improve the health of the battery, these charging techniques are employed which change the way of charging. For testing of the charging techniques, a high capacity (40kWh) battery of the 'TATA Nexon EV' vehicle is considered in the simulation. A comparative analysis is done in MATLAB software on the proposed charging circuit with different charging techniques and the results are presented concerning time.*

Keywords *- Electric Vehicle (EV), Constant Voltage (CV), Constant Current (CC), Matrix Laboratory (MATLAB).*

1. Introduction

To reduce environmental pollution caused by conventional fossil fuel engine vehicles, Electric Vehicles (EVs) are introduced. These vehicles have no carbon emissions and no residue generation. They run on a power storage module which needs to be charged through mains. The charging of the vehicle can be either done by renewable sources or a conventional grid connection.

It is recommended to use renewable sources to charge the battery pack of the EV to eliminate carbon footprint. This way of charging the vehicle and utilizing it for transportation, either for commercial or domestic purposes, reduces environmental pollution. In the EV circuit structure, the charging and driving circuits are isolated and operate individually. Both the circuits have their control modules controlling the power electronic switches in the circuits. This paper discusses the charging side of the EV where the battery pack is charged with different charging techniques [1].

In previous research, many charging circuits are used to charge the EV battery. Converters like Buck, Boost, Power Factor Correction (PFC), Active Full Bridge (AFB), resonant bridge, and Partial Power Charging (PPC) circuits are used for the charging of the battery. Every circuit has its significance, which is installed as per the requirement and rating of the EV battery. The basic converters are buck and boost converters, which either decrease or increase the voltage, respectively. These basic circuits have heavy ripple and low efficiency but are economically low-cost and less complex [2].

For low-cost applications, these circuits may be integrated. The next generation circuits are PFC, AFB, Resonant bridge, and PPC converters which have very little ripple and disturbances. However, the advanced circuits are very complex to fabricate, and high-rating components need to be used. With a greater number of power electronic and passive components in the advanced circuits, the cost of the design will also go high. These circuits are recommended for high-rating applications in commercial charging stations where multiple EVs are charged [3].

The basic charging circuits are generally installed for domestic charging applications where a single EV is charged to a point. Therefore, a simple and less complex low-cost module is applicable for charging the EV battery. For wide-range voltage applications, the conventional Buck-Boost converter can be utilized as it can in buck and also in boost mode as per the requirement.

For low-voltage applications (two-wheeler EV battery charging), the converter can be operated in buck mode and for

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Comparative analysis and validation of advanced control modules for standalone renewable micro grid with droop controller

Savitri Swathi[1], Bhaskaruni Suresh Kumar[2], Jalla Upendar[1]
[1]Department of Electrical Engineering, University College of Engineering, Osmania University, Hyderabad, India
[2]Department of Electrical and Electronics, C.B.I.T, Osmania University, Hyderabad, India

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ABSTRACT

A micro grid system with renewable source operation control is a complex part as each source operates at different parameters. This renewable micro grid with multiple sources like solar plants, wind farm, fuel cell, battery backup has to be operated in both grid connected and standalone condition. During grid connection the micro grid, inverter has to inject power to the grid and compensate load in synchronization to the grid voltages. And during standalone condition the inverter is controlled with droop control module which stabilizes the voltage and frequency of the system even during grid disconnection. The droop control module is further updated with new advanced controllers like fuzzy inference system (FIS) and adaptive neuro-fuzzy inference system (ANFIS) replacing the traditional proportional integral derivative (PID) and proportional integral (PI) controllers improving the response rate and for achieving better stabilization. This paper has comparative analysis of the micro grid system with different droop controllers under various operating conditions. Parameters like voltage magnitude (V_{mag}), frequency (F), load and inverter powers (P_{load} and P_{inv}) of the test system are compared with different controllers. A numeric comparison table is given to determine the optimal controller for the inverter operation. The analysis is carried out in MATLAB/Simulink software with graphical and parametric validations.

Corresponding Author:

Savitri Swathi
Department of Electrical Engineering, University College of Engineering, Osmania University
Hyderabad, India
Email: eee.swathi48@gmail.com

1. INTRODUCTION

Micro grid systems (MGS) in today's technological advancements are very efficient and robust to the disturbances and sudden variations of load. These MGS are becoming an integral part of main grid system sharing a very huge power to the grid. In the MGS many small or large sources can be included which can accumulate the power and compensate the load. These MGS sources can be renewable or non-renewable, but due to the present day scenario of climatic disasters due to global warming [1] it is preferable to have renewable sources MGS. These renewable sources can be wind farms, fuel cell plants, photovoltaic (PV) plants, tidal energy, and biogas plants, which produce power from available natural sources like blowing wind, tidal waves, biomass, and solar irradiation [2].

As per the source these modules do not reproduce any hazardous gases or residue which causes pollution and hence they are considered as green energy sources. The power from these source can be

International Journal of Renewable Energy Research-IJRER

Optimal Coordinated Voltage Control in Distribution System Considering Smart Inverter Interfaced Solar PV Penetration

RAVINDHAR BANOTHU, Suresh kumar, B Mangu

Abstract

The intermittent nature of photovoltaic power causes a voltage control issue. This study will evaluate the effect that the smart inverter capabilities of a photo voltaic (PV) based distributed generator has on voltage regulation. The goal of this work is to better understand how distributed generators work. In high-penetrated PV-based DG in distribution systems, a coordinated voltage control (CVC) technique is suggetsed in this paper. This method makes use of both conventional voltage regulating devices and the coordinated reactive power capabilities of smart inverters to reduce voltage violations brought on by the intermittent nature of photovoltaic energy. The objective of this study is to reduce energy losses while keeping a voltage within reasonable bounds. A discrete jellyfish search algorithm has been presented to attain the best optimization. With the help of the IEEE standard 33 bus distribution network, the suggested solution was assessed. The evaluation's conclusions show that the proposed approach significantly reduces energy usage as well as losses and voltage variation.

Full Text:

PDF

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White Shark Optimization for Efficient Conservation Voltage Reduction in Photovoltaic-Enriched Distribution Grids with Smart Inverters and Network Reconfiguration

B Ravindhar[1]* B Suresh Kumar[2] B Mangu[3]

[1]*Department of Electrical and Electronics Engineering, B V Raju Institute of Technology Narsapur, Telangana, India*
[2]*Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, India*
[3]*Department of Electrical Engineering, University College of Engineering, Osmania University, Telangana, Hyderabad, India*
* Corresponding author's Email: ravinderuitr@gmail.com

Abstract: This research paper addresses the limitations inherent in conventional volt-VAR control (VVC) mechanisms, such as on-load tap changers (OLTC) and voltage and capacitor banks (CBs), when applied to the implementation of efficient conservation voltage reduction (CVR) strategies within active distribution networks. In this paper, we present a cost-effective strategy that synergizes the rapid-response capabilities of PV smart inverters with traditional VVC mechanisms to enhance CVR operations. This study delves into the optimal coordination between photovoltaic smart inverters and conventional VVC systems for effective CVR operations. The investigation takes into account the implications of distribution network reconfiguration (DNR) on the overall operational costs, encompassing grid power procurement, emissions, losses, and switching expenses related to OLTC, CB, and remote controlled switches (RCS). To attain the optimal solution, we leverage the recent advancements of the white shark optimization (WSO) technique, meticulously validating its performance through extensive trials conducted on the 119-bus distribution system. The empirical results vividly showcase the substantial advantages of integrating VVC devices and smart inverters, particularly in scenarios characterized by fluctuating load conditions. Notably, the synergistic approach achieves a remarkable 6.51% reduction in energy consumption. Additionally, active and reactive power loss reductions of up to 33.67% and 28.55%, respectively, underscore the potency of the proposed strategy.

Keywords: Smart inverter, Volt/Var control, Conservation voltage reduction, Power loss reduction, Optimization.

1. Introduction

Conservation voltage reduction (CVR) has emerged as a promising strategy to enhance energy efficiency and minimize power losses in active distribution networks [1, 2]. However, the efficacy of traditional volt-VAR control (VVC) devices, such as on-load tap changers (OLTC) and voltage and capacitor banks, has been hampered by their slow response and inability to handle sudden voltage fluctuations [2]. These disturbances often arise from intermittent photovoltaic (PV) power generation. Additionally, the distribution network reconfiguration (DNR) technique has proven effective in reducing losses, balancing loads, and enabling service restoration [3]. To address these limitations, this paper proposes a cost-effective approach that integrates PV smart inverters with traditional VVC devices and leverages DNR to enhance CVR operations.

1.1 Literature survey

In recent literature, various approaches were presented to address different objectives in distribution systems through volt-var optimization (VVO). In [4], volt-var control systems are

FEB 24.

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Original Article

Performance Improvement of UPQC with Sliding Mode Fractional Order Proportional Integral Control with Enhancement of Harmonics Mitigation

M. Serabanda[1], B. Suresh Kumar[2], G. Mallesham[3]

[1,3]*Department of Electrical Engineering, University College of Engineering, Osmania University, Hyderabad, India.*
[2]*Department of Electrical and Electronics, C.B.I.T, Osmania University, Hyderabad, India.*

Corresponding Author : sharathm84@gmail.com

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Abstract - For the increasing load demand in the distribution network there is a vast incline of power quality issues in the system. Due to modern load demand, more nonlinear devices are connected to the network, inducing more harmonics and voltage fluctuations. To mitigate these issues, a UPQC device is recommended to be connected on the load side. The UPQC device comprises series and shunt converters for the reduction of voltage fluctuations and harmonics, respectively. The series controller of UPQC is less complex, with only voltage differentiation calculations, whereas the shunt controller has a voltage regulator. The voltage regulator (PI) is updated by FOPI and SM-FOPI controllers improving the performance of the voltage regulator. A comparative analysis is carried out with different controllers for the shunt converter of UPQC, and the parametric comparisons determine better control modules. All the results and graphs are validated and plotted using MATLAB software.

Keywords - UQPC (Unified Power Quality Conditioner), PI (Proportional Integral), FOPI (Fractional order PI), SM-FOPI (Sliding Mode – FOPI), MATLAB (Matrix Laboratory).

1. Introduction

In modern power systems, there is a gradual increase in electrical power demand as the number of loads and previous load capacities are increasing. Most urban networks need electrical power for production and manufacturing goods for utility. In the present scenario, new nonlinear loads are in great increments, demanding more power from the grid. These nonlinear loads are electric vehicle (EV) charging stations that use high-rated power electronic devices for the conversion of voltages [1]. The EV batteries need very high power for charging, leading to the injection of huge harmonics in the network, which may impact other regular loads [2]. To avoid these harmonics entering the network and reduce the effect on the regular loads, an Active Power Filter (APF) device needs to be connected at the charging station.

The APF connected at the load side filters the harmonics generated by the nonlinear charging station.Previous research has shown that Flexible AC Transmission (FACT) devices are used to compensate for harmonics and stabilize voltage. To stabilize voltage, a Dynamic Voltage Restorer (DVR) is connected in series to the line. These devices are connected at the load and source side and are operated with individual controllers. However, this can cause unsynchronized operation and require an extra DC source for the DVR device, which increases the cost of the modules. To address this issue, a combined FACT device, which can perform both voltage stabilization and harmonic compensation with a single device, is recommended.

This device can be UPQC, which is integrated with a 6-IGBT switches series converter and a 6-IGBT switches shunt converter connected back-to-back with a DC link capacitor connected. The series converter mitigates the voltage fluctuations caused on the network side through series transformers connected to the lines [4]. The shunt converter mitigates or filters the harmonics caused by the nonlinear load (EV charging station) by connection in parallel to the load. These two converters are connected on the DC to a common capacitor for storage and injection of power into the system. Each converter is integrated with filters for conversion of PWM AC voltages to Sin voltages [5]. The series transformers connected have a specific turn ratio with respect to DC link voltage. The complete configuration of the test system network with nonlinear load can be seen in Figure 1.

As defined in Figure 1, the source voltages and currents are denoted as V_{sabc} and I_{sabc}, Load voltages and currents are given as V_{Labc} and I_{Labc}, Series filters are R_{sr}, L_{sr} and C_{sr}, Shunt filters are R_{sh}, L_{sh} and C_{sh}, series injected voltages are V_{srabc}, shunt compensation currents are I_{srabc}. The series converter has 6-IGBT switches (S1-S6) and shunt converter has 6-IGBT switches (P1-P6) [6]. These switches are controlled by individual control modules operated by different PWM techniques for voltage and harmonics compensation. The series converter is controlled by the Sin PWM technique, and the shunt converter is controlled by the hysteresis current controller [7].

Optimizing simultaneous energy management for slow- and fast-charging electric vehicles: a hybrid approach

Jayarama Pradeep, M. Vijayaragavan, V. Krishnakumar & B. Su

B. Suresh Kumar

Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Gandipet, Near Financial District, Hyderabad, Telangana, India

Abstract

This manuscript introduces a hybrid technique designed to enhance the simultaneous energy management (EM) of slow and fast-charge electric vehicles (EVs) within a smart parking lot. The proposed hybrid method combines the Archerfish Hunting Optimizer (AHO) and the Tree Hierarchical Deep Convolutional Neural Network (THDCNN), collectively referred to as the AHO-THDCNN technique. The primary objective of the AHO-THDCNN method is to reduce costs and alleviate the strain on the electrical grid. The THDCNN, a neural network model, plays a crucial role in forecasting valuable data by learning from and recognizing patterns within the training input-data samples. The AHO Approach is responsible for effectively managing the distribution of resources and addressing the energy requirements of both slow- and fast-charging EVs. The performance of the AHO-THDCNN approach is rigorously evaluated using the MATLAB software and compared with different existing approaches. The proposed method reaches its maximum energy

Energy & Environment

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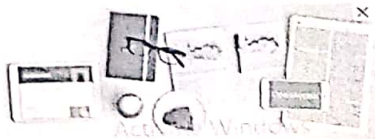
Optimal integration of long- and short-term operational planning decisions to design and manage electronic vehicle charge stations by CQOCRO technique

B Venkata Prasanth, B Mouli Chandra, and T Murali Krishna +1 View all authors and affiliations

OnlineFirst https://doi.org/10.1177/0958305X231190352

Abstract

This article proposes a hybrid method to design and manage the electronic vehicle payment station network in the event of power demand uncertainty. The proposed method is an integrated process with confusing virtual-anticipation and chemical reaction enhancement, hence named as chaotic quasi-oppositional chemical reaction optimization (CQOCRO) method. The key objective of the CQOCRO method is to develop a



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Research Paper

Optimizing virtual power plant allocation for enhanced resilience in smart microgrids under severe fault conditions using the hunting prey optimization algorithm

T. Yuvaraj [a], R. Krishnamoorthy [b,*], S. Arun [d], Sudhakar Babu Thanikanti [e,*], Nnamdi Nwulu [f]

[a] Centre for Computational Modelling, Chennai Institute of Technology, Chennai 600069, India
[b] Centre for Advanced Wireless Integrated Technology, Chennai Institute of Technology, Chennai 600069, India
[c] Department of Intelligence and Control Systems, Kyushu Institute of Technology, Fukuoka 8200067, Japan
[d] Department of Electronics and Communication Engineering, Saveetha College of Engineering, Chennai 600100, India
[e] Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad 500075, India
[f] Centre for Cyber Physical Food, Energy and Water Systems, University of Johannesburg, Johannesburg 2006, South Africa

ARTICLE INFO

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Resilience
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Virtual power plant
Distributed energy resources
Renewable energy sources
Radial distribution system

ABSTRACT

The rapid expansion of renewable energy sources (RESs), such as photovoltaic (PV), wind turbine (WT), micro turbine (MT), and fuel cell (FC), has presented both opportunities and challenges to power systems, particularly in terms of environmental sustainability and economic feasibility. While RESs offer benefits like reduced environmental pollution, decreased power losses, and enhanced power quality, their intermittent nature and uncertainties pose challenges, resulting in variable generation and instability in distribution systems. To address these challenges, the concept of aggregating distributed energy resources (DERs), battery energy storage system (BESS), electric vehicles (EVs), and controllable loads into a virtual power plant (VPP) managed by an energy management system (EMS) has emerged. This study aims to determine the optimal location and size of VPPs within radial distribution system (RDS) while considering network resilience to severe weather events. The problem is formulated as an optimization task with dual objectives: minimizing the operating cost of VPPs and reducing energy not supplied (ENS) during natural disasters such as floods and earthquakes. To address this optimization problem, a novel meta-heuristic optimization algorithm called the hunting prey optimization algorithm (HPOA) is applied. HPOA serves various functions within the RDS, specifically targeting the optimization of VPP location, VPP resource management, and the objective functions. A case study is conducted, incorporating RESs, BESS, and EVs, and compared against existing algorithms such as BESA and SMA using a standard IEEE 85 bus RDS. Simulation results conducted in MATLAB demonstrate that the proposed HPOA algorithm effectively determines the optimal size and location of VPPs, leading to improved economic, operational, and resilience indices in the network.

1. Introduction

1.1. Motivation and concept

The world is presently witnessing a surge in demand for a diverse array of energy resources, spanning both renewable and traditional sources, alongside the incorporation of energy storage systems and responsive demand mechanisms. This collective endeavor seeks to mitigate pollution emissions, collectively referred to as DERs. DERs encompass various DGs, both renewable and non-renewable, demand response (DR) systems, BESSs, and EVs. These resources include prominent renewable and non-renewable sources such as PV, WTs, FCs and diesel engines, gas-based MTs integrated into RDS.

The effective management of DERs within RDS aims to achieve both economic and technical objectives while promoting green energy (Qu et al., 2023). Skillful management of energy production from various sources, storage devices, and responsive loads can significantly reduce operating costs and the overall cost of energy generation, thereby providing savings and addressing the economic dynamics of the system (Qu et al., 2023). Moreover, strategically siting these DERs near demand

* Corresponding author at: Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad 500075, India.
E-mail address: sudhakarbabu668@gmail.com (S.B. Thanikanti).

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Research paper

Optimizing smart microgrid performance: Integrating solar generation and static VAR compensator for EV charging impact, emphasizing SCOPE index

Monica P Suresh [a], Yuvaraj T [b], Sudhakar Babu Thanikanti [c,*], Nnamdi Nwulu [d]

[a] Department of Electrical and Electronics Engineering, Saveetha Engineering College, Chennai 602105, India
[b] Centre for Computational Modeling, Chennai Institute of Technology, Chennai 600069, India
[c] Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad 500075, India
[d] Centre for Cyber Physical Food, Energy and Water Systems, University of Johannesburg, Johannesburg 2006, South Africa

ARTICLE INFO

Keywords:
Electric Vehicle
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SCOPE
Improved Bald Eagle Search Algorithm
Smart Microgrid
Radial Distribution Network

ABSTRACT

The rapid global increase in electric vehicle (EV) usage, driven by its low CO_2 emissions, uncomplicated maintenance, and minimal operating costs, has prompted extensive research in the field of electric vehicle charging station (EVCS). The integration of EVCS into the current distribution grid poses challenges due to potential power losses and voltage variations beyond acceptable limits. This complexity is heightened by the growing penetration of randomly dispersed solar-based distributed generation (SDG) and battery energy storage system (BESS). To address these challenges, distribution static VAR compensator (DSVC) systems have been introduced, offering benefits such as enhanced power transfer capacity, improved voltage regulation, and increased system security without requiring extensive infrastructure upgrades. This study offers SCOPE, a novel multi-objective framework that unites the optimization goals of minimizing real power loss, lowering bus voltage variation, maximizing system voltage stability, minimizing system operating costs, and mitigating CO_2 emissions. The EVCS problem is optimized within the multi-objective framework utilizing an improved bald eagle search algorithm (IBESA). The proposed model accounts for vehicle to grid (V2G) capabilities and the actual driving patterns of users over a 24 h horizon. The formulation of a smart microgrid (SMG) structure is based on modifying the standard IEEE 33-bus test radial distribution network (RDN), comprising three interconnected SMGs serving residential, commercial, and industrial users. The optimization approach based on IBESA is utilized to optimize both the siting and capacity of EVCS as well as renewable energy sources (RESs). The findings show that SDG and DSVC are effective at lowering the SCOPE index, highlighting the advantages of the suggested approach.

1. Introduction

1.1. Motivation and incitement

The surge in fossil fuel consumption, particularly in power generation and transportation, intensifies environmental pollution and contributes to global warming (Sovacool et al., 2016). In response, nations seek sustainable and ecofriendly energy alternatives to mitigate the substantial threat posed by fossil fuels, which account for 42% and 22% of global CO_2 emissions in the electricity/heat and transportation sectors respectively (e.g.,) (Arif et al., 2021). The prevalent use of Internal Combustion Engines (ICE) in vehicles exacerbates climate change, making Electric Vehicles (EVs) a cleaner and more resilient alternative with minimal or no CO_2 emissions (Arif et al., 2021).

Many countries are actively promoting EVs coupled with renewable energy sources (RES) to address environmental concerns (Amini et al., 2016). The appeal of EVs lies in their emission-free operation and reliance on clean energy, positioning them as a viable alternative to traditional transportation (Mwasilu et al., 2014). Ongoing research trends reflect a growing acceptance of EVs, contributing to reduced greenhouse gas emissions and decreased reliance on fossil fuels (Sovacool and Hirsh, 2009). The automotive industry is undergoing transformation with the escalating adoption of EVs, projected to reach 66 million units by 2040 (BloombergNEF, 2021). This surge is driven by incentives, a growing cost-benefit ratio, and environmental advantages. However, challenges

* Corresponding author at: Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad 500075, India.
Email address: sudhakarbabu@cbit.ac.in (S.B. Thanikanti).

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A novel argyle puzzle for partial shading effect mitigation with experimental validation

Dalia Yousri [a,b,*], Thanikanti Sudhakar Babu [c], Rupendra Kumar Pachauri [d], Hatem Zeineldin [a,e], Ehab F. El-Saadany [a]

[a] Advanced Power and Energy Center, Electrical Engineering Department, Khalifa University, Abu Dhabi, United Arab Emirates
[b] Electrical Engineering, Faculty of Engineering, Fayoum University, Fayoum, 63514, Egypt
[c] Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology (CBIT), Hyderabad, India
[d] School of Engineering, University of Petroleum and Energy Studies, Dehradun, Uttarakhand, India
[e] Electric Power Engineering Department, Cairo University, Giza, Egypt

ARTICLE INFO

Keywords:
Photovoltaic reconfiguration
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Partial shade pattern
Argyle puzzle
Total-cross-tied scheme

ABSTRACT

Reconfiguring partially shaded photovoltaic (PV) arrays emerges as a potent solution for mitigating power loss and prolonging the array's lifespan. Among the proposed strategies, static reconfiguration involves a one-time rearrangement, necessitating a reliable and effective approach for universal application. However, existing literature often exhibits a significant deficiency in uniformly scattering shade across sub-arrays, leading to disparate row currents and multiple peaks in array characteristics. To address this challenge, this paper introduces an innovative approach known as the Argyle puzzle, designed to provide a one-time layout for a total-cross-tied (TCT) PV array. The Argyle puzzle comprises diamond-shaped patterns and eight intersecting diagonal areas, each uniquely numbered. This design aims to maximize the dispersion of shading patterns. The superiority of the Argyle puzzle is demonstrated across fifteen shading patterns, underscoring its advantages over recent literature. Furthermore, experimental validation through real-time hardware implementation confirms the practicality of this approach. Ultimately, employing the Argyle approach proves instrumental in mitigating power loss during partial shading, consolidating array characteristics into a singular peak, and significantly enhancing the overall harvested power of the PV array.

1. Introduction

The adoption of photovoltaic (PV) systems has experienced significant growth in recent years, primarily attributed to the technological advancements in this domain [1,2]. Solar PV's generation of electrical energy stands as a highly lucrative choice; nevertheless, the actual harvested power is intricately tied to atmospheric conditions influencing sun radiation [3]. Moreover, the efficiency and performance of PV systems tend to decline when encountering the partial shading phenomenon (PS). PS introduces distortions in the PV system's output, resulting in multiple power peak points in its characteristics. This, in turn, leads to power loss, decreasing fill factor, and formulating hotspots, presenting a significant challenge in pinpointing the maximum power point [4].

To address the PS effect, numerous strategies were proposed, including employing efficient maximum power point tracker (MPPT) strategies [5,6] or reorganizing the layout of PV modules in the array, known as PV reconfiguration [7,8]. PV array reconfiguration, particularly, is highly regarded due to its promising solutions [9,10]. Consequently, researchers developed various techniques for PV reconfiguration, categorized into static and dynamic methods. A comprehensive review of these techniques was outlined in [11–13]. In static reconfiguration, the physical rearrangement of PV modules occurs once to balance the row currents. On the other hand, dynamic array reconfiguration involves altering electrical connections between PV modules through a switching matrix [14]. Several real-time optimization algorithms were implemented to optimize dynamic array reconfiguration and determine optimal switching patterns for a total-cross-tied array (TCT). Notable optimization methods for dynamic reconfiguration include the flower pollination algorithm [15], a hybrid variant of the simulated annealing (SA)-genetic algorithm (GA) [16], the greedy algorithm [17], and a vectorized structure mechanism [18], which required extensive matrices and stochastic procedures. Furthermore, other optimization

* Corresponding author at: Advanced Power and Energy Center, Electrical Engineering Department, Khalifa University, Abu Dhabi, United Arab Emirates.
E-mail address: Dalia.arashed@ku.ac.ae (D. Yousri).

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Frequency Locked Loop-Based Control Algorithm with Enhanced Second-Order Generalized Integrator for PV-Battery Integrated System to Improve Power Quality

Nirmal Kumar Pandey*, Rupendra Kumar Pachauri *, Sushabhan Choudhary*, Sudhakar Babu Thanikanti**

*Electrical Cluster, School of Engineering, University of Petroleum and Energy Studies, Dehradun, 248007, India

**Electrical Engineering Department, Chaitanya Bharathi Institute of Technology, Telangana, 500075, India.

(nirmalpande84@gmail.com, rpachauri@ddn.upes.ac.in, schoudhury@ddn.upes.ac.in, sudhakarbabu66@gmail.com)

‡Corresponding Author: Nirmal Kumar Pandey, University of Petroleum and Energy Studies, Tel: +91 8109167303, nirmalpande84@gmail.com

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Abstract- This study proposes a control approach based on a frequency-locked loop with an Enhanced Second-Order Generalized Integrator (ESOGI-FLL) to mitigate power quality (PQ) problems in a grid-linked photovoltaic (PV) battery scheme. In order to enhance PV power production, charge the battery, pump it into the grid, and maintain the constant voltage across the DC bus of the voltage source inverter, particle-swam optimized Adaptive Neuro Fuzzy Inference System (PSO-ANFIS)-controlled peak power point extracting methods are employed in this study. This paper utilizes the ESOGI-FLL-based control technique to achieve grid current balancing, mitigate harmonics, operate at unity power factor, and accommodate various levels of PV energy generation. Frequency Locked Loop with Enhanced Second Order Generalized Integrator with Based Regulator Algorithm for PV Battery Integrated System for PQ Improvement is created and tested in MATLAB software. Simulation results are tested under various operating situations, such as grid current balancing, Nonlinear load conditions, and changing irradiance conditions. Additionally, grid and currents have total harmonic distortions of 0.95% and 2.03% for unbalanced load changes in irradiance conditions, and these are under the IEEE power quality standard.

Keywords- ANFIS, Battery system, ESOGI-FLL, MPPT, PSO, PV system, Power quality

1. Introduction

According to sources [1, 2], the majority of electricity production in India, which accounts for 68% of total power generation, is reliant on non-renewable fossil fuels such as coal and oil. This conventional method of power generation through fossil fuels contributes to the emission of greenhouse gases, resulting in environmental impacts [2]. Energy security faces significant challenges due to high peak power demand, reliance on imports for oil and, to a growing extent, coal, and inadequate energy supply. These factors collectively contribute to major concerns regarding energy security. Energy consumption and output have to be in equilibrium. In order to slow down the effects of climate change, household power production must be started in the distribution system utilizing standalone Photovoltaic (PV) arrays. As a result, small-scale applications for rooftop PV arrays are rapidly expanding [3]. But PV power is available only during the daytime, and we are not able to use it at night. This can be overcome by combining PV power generation with battery storage elements and connecting to the grid system. Quality of power issues in the delivery network primarily stem from loads with nonlinear properties, which include motor drives, variable speed drives, arc furnaces, UPSs, residential loads, and other equipment that consumes imaginary power at the connecting point of PV inverters. These nonlinear loads have a negative impact on the power quality of the grid. In [4], GMPP tracking for a grid-connected PV system under partial shade conditions has been presented using a hybrid artificial neural network utilizing deep reinforcement learning. The Voltage Source Converter (VSC), which links PV and batteries to the grid, may be set up in a number of different ways, as suggested in [5]. The literature [6] demonstrates the loss examination for two phase and single stage PV power generation schemes (PGSs). Compared to double stage-PGS, single-stage PGS

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EDITED BY
Sudhakar Kumarasamy,
Universiti Malaysia Pahang, Malaysia

REVIEWED BY
Priya Ranjan Satpathy,
Council of Scientific and Industrial Research (CSIR), India
Surender Reddy Salkuti,
Woosong University, Republic of Korea

*CORRESPONDENCE
Praveen Kumar Balachandran,
praveenbala036@gmail.com
Devakirubakaran Samithas,
krubathas@gmail.com

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Modeling and simulation of a Renzoku puzzle pattern-based PV array configuration for a partially shaded PV system

Belqasem Aljafari[1], Praveen Kumar Balachandran[2]*, Devakirubakaran Samithas[3,4]*, Sudhakar Babu Thanikanti[5] and Nnamdi I. Nwulu[6]

[1]Department of Electrical Engineering, College of Engineering, Najran University, Najran, Saudi Arabia, [2]Department of Electrical and Electronics Engineering, Varsitharam College of Engineering, Hyderabad, India, [3]Center for Electric Mobility, Department of Electrical and Electronics Engineering, SRM Institute of Science and Technology, Chennai, Tamil Nadu, India, [4]Center for Nonlinear Systems, Chennai Institute of Technology, Chennai, India, [5]Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, India, [6]Center for Cyber-Physical Food, Energy and Water Systems, University of Johannesburg, Johannesburg, South Africa

The world depends heavily on electrical energy for accessing technologies. For the generation of electricity, technology can utilize renewable energy sources like solar energy and wind energy. Solar photovoltaic (PV) systems occupy space among consumers due to their feasibility, flexibility, cost, and simple implementation procedures. The solar PV system experiences many factors causing power loss like partial shading, hotspots, and diode failure. In this work, a new static PV array configuration, named Renzoku puzzle pattern-based array configuration, is proposed. This proposed configuration technique was designed to overcome the drawbacks of the previously proposed array configurations in terms of power generation, fewer mismatch losses, a high shade-dispersion rate, and consistent performance under any level of partial shading. The proposed array configuration has been validated using both simulation and hardware. The simulation is carried out in a 9 × 9 PV array in MATLAB/Simulink®. The performance analysis, results, and corresponding characteristic curves are presented in this manuscript.

KEYWORDS

photovoltaic effect, mismatch loss, compensation current, partial shading, reconfiguration, puzzle pattern

1 Introduction

Due to fossil fuel depletion and the global shift to low-carbon energy, distributed renewable energy generation has increased over the past decade (Vidyabhu et al., 2015; Bryant et al., 2023). In 2021, China's National Energy Administration reported 107.5 GW of distributed solar energy generation infrastructure, an increase of 29 GW from 2020 (Wang et al., 2024). Distributed PV solar power generation is becoming more important in green energy (Yang et al., 2020).

Despite their importance, distributed photovoltaic (PV) systems face technical challenges, especially array mismatch losses. These losses occur when the PV module current–voltage (I–V) characteristics vary within an array. Connecting PV modules in series

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RESEARCH ARTICLE

A Harmony Search Switching Matrix Algorithm for Enhanced Performance of Solar PV Arrays During Non-Uniform Irradiance Scenarios

PRADYUMNA MALLICK[1], RENU SHARMA[1], (Senior Member, IEEE), PRIYA RANJAN SATPATHY[2], SUDHAKAR BABU THANIKANTI[2], (Senior Member, IEEE), AND NNAMDI I. NWULU[3], (Senior Member, IEEE)

[1]Department of Electrical Engineering, ITER, Siksha 'O' Anusandhan Deemed to be University, Bhubaneswar 751030, India
[2]Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad 500075, India
[3]Center for Cyber-Physical Food, Energy and Water Systems, University of Johannesburg, Johannesburg 2006, South Africa

Corresponding author: Sudhakar Babu Thanikanti (sudhakarbabu66@gmail.com)

ABSTRACT The power loss in the arrays due to non-uniform irradiances in the site is the most common scenario observed in a PV system. The irradiance non-uniformity occurs due to obstacles between actual irradiance and modules caused by dust and shadow of clouds, trees, and buildings in some portions of the array. This results in complications like mismatch, power reduction, deformed characteristics curves, failure of power tracking algorithms, and sometimes physical damage to the PV modules. Numerous solutions are present for mitigating the above complications among which the array reconfiguration gained a huge audience for ease of implementation, lower cost, and higher reliability but, each technique exhibits certain drawbacks. In this paper, a harmony search reconfiguration (HSR) algorithm for dynamic reconfiguration is proposed that has advantages in terms of simplicity, adaptability, convergence speed, reduced switch count, and arbitrary array application. The modeling and validation are done in the MATLAB platform using 5×5, 9×9, 9×5, and 3×3 arrays under various shading cases and compared with the 22 existing conventional, static, and dynamic techniques. The depth investigation shows the higher performance of the HSR with 24.64% and 12.28% higher performance than conventional and static techniques with lowest actual power deviation of -1.10% and equivalent performance to that of existing techniques with reduced complexities.

INDEX TERMS Hotspot, mismatch, partial shading, photovoltaic, power generation, reconfiguration.

I. INTRODUCTION

Partial shading in photovoltaic (PV) arrays is a pressing issue with multifaceted causes, effects, and impacts on system performance [1]. The causes of partial shading are diverse, ranging from natural sources like clouds, trees, and buildings, to soiling and the degradation of individual solar panels within an array [2]. These factors can lead to non-uniform irradiance distribution across the array, resulting in adverse effects such as mismatch losses, reduced energy production, and thermal imbalances [3]. Moreover, partial shading exacerbates the risk of hotspots and can induce reverse-bias conditions in shaded modules, increasing the chances of permanent damage [4]. Beyond its immediate effects, partial shading has a cascading impact on the entire PV system, diminishing its overall energy yield, harming the reliability of the entire array and forming multiple peaks in the power curves that confuse traditional maximum power point tracking (MPPT) algorithms, causing them to make incorrect decisions in selecting the optimal operating point [5]. So, addressing these challenges is crucial for improving the efficiency, longevity, and economic viability of PV systems.

Hybrid MPPT techniques have emerged as a powerful solution for enhancing global peak tracking in photovoltaic systems under partial shading [6]. These techniques use various optimization algorithm to decide the actual or global

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Research article

Investigations of the performance of 3D printed micro wind turbine composed of PLA material

Suresh A [a], Raja kumar S [b,**], Belqasem Aljafari [c], Sudhakar Babu Thanikanti [d,*]

[a] Department of Electrical and Electronics Engineering, Vaiveen Vadivelan Institute of Technology, Dharmapuri, Tamil Nadu, India
[b] Department of Mechanical Engineering, Regional Campus of Anna University, Tirunelveli, Tamil Nadu, India
[c] Department of Electrical Engineering, College of Engineering, Najran University, Najran 11001, Saudi Arabia
[d] Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology (CBIT), Hyderabad 500075, India

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Wind energy conversion systems

ABSTRACT

Wind energy conversion systems (WECS) have gained increasing attention in recent years as promising renewable energy sources. Despite their potential, a clear research gap exists: the majority of WECS underperform in low wind speed conditions, limiting their applicability in many regions. To address this problem, this study proposes a novel approach by developing a 100 W micro wind turbine using Polylactic Acid (PLA) to generate efficient power in low wind speed conditions. The proposed wind turbine design employs Blade Element Momentum Theory (BEMT), which is commonly used for modeling wind turbine performance. Geometric design, mechanical analysis, and aerodynamic analysis are the fundamental considerations for designing any machine. In this work, the CREO 3.0 three-dimensional modeling software is used to create the geometric design of the proposed work. The airfoil SD7080 is selected due to its superior aerodynamic performance, and mechanical properties such as Young's modulus, density, and Poisson's ratio are attained to evaluate the wind blade's performance. Additionally, ANSYS 15.0 is used to conduct a detailed analysis of the proposed wind turbine, evaluating properties such as equivalent stress, deformation, and equivalent strain. Both simulation (ANSYS 15.0) and experimental setups are used to investigate the proposed wind turbine's performance, and the corresponding results are presented and discussed in this manuscript. The results indicate a significant performance improvement of the proposed wind blade when compared to conventional and ABS wind blades, demonstrating its potential as a more efficient solution for WECS. This proposed wind turbine design overcomes the problems like underperformance in low wind speed conditions and the wind turbine efficiency in all regions.

1. Introduction

Energy resources available in nature can be converted and utilized for various useful purposes. The available energy sources on the earth can be classified into two different types conventional energy sources and non-conventional sources. In recent decades, conventional energy resources are almost depleted because of more consumption which increases pollution and fuel cost. The whole world

* Corresponding author.
** Corresponding author.
E-mail addresses: [illegible] (S. A), rajkumar1908@yahoo.co.in (R. S), bhaljafari@nu.edu.sa (B. Aljafari), sudhakarbabu66@gmail.com (S.B. Thanikanti).

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ORIGINAL PAPER

Enhancement of photovoltaic array characteristics and global maximum power using Padovan transform-based image encryption strategy

Kanasottu Anil Naik, Rayappa David Amar Raj ✉, Thanikanti Sudhakar Babu, Belqasem Aljafari

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Summary

During shading, the mismatch between the panels in the photovoltaic (PV) array mitigates the global maximum power (GMP). Besides, the mismatch in the irradiation levels of distinct rows of the PV array instigates multiple power peaks (MPPs) in the array characteristics. Distinguishing the local and global peaks among MPPs for tracking the GMP is highly challenging for maximum power point tracking (MPPT) controllers. So, to mitigate the MPPs and enhance the GMP, array reconfiguration is preferred. Nevertheless, most existing reconfiguration techniques exhibit poor shade dispersal, distorted electrical characteristics, multiple MPPs, increased mismatch, scalability issues, etc. To overcome these challenges, this paper proposes a new Padovan transform-based encryption strategy for array reconfiguration. The proposed method was evaluated for both symmetric and unsymmetrically sized arrays. Its performance has also been compared to that of 23 other strategies. The proposed reconfiguration strategy integrated with MPPT is validated experimentally using a prototype model. A nonparametric statistical hypothesis test with a *p*-value of 0.05 has been used for a pairwise fair comparison study among the examined approaches. The proposed approach constantly outperforms the current methods because of its unique shade dispersion generated through intelligent reconfiguration offering the GMP improvement of 34.429%, 12.51%, 5.05%, and 37.40%, 22.93%, 16.51% for 9 × 9 and 4 × 8 PV arrays, respectively.

CONFLICT OF INTEREST STATEMENT

No potential competing interest was reported by the authors.

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ve Review and Analysis of the ectric Vehicle Charging ribution Networks

ALAJI[2], J. ANISH KUMAR[3],
ANTI[4,5], (Senior Member, IEEE),
, (Senior Member, IEEE)
Institute of Technology, Chennai 600069, India
ineering, Aarupadai Veedu Institute of Technology, Vinayaka Mission's Research Foundation, Chennai 603104,

ineering, Saveetha Engineering College, Chennai 602105, India
ineering, Chaitanya Bharathi Institute of Technology, Hyderabad 500075, India
Water Systems, University of Johannesburg, Johannesburg 2006, South Africa

Thankanti (sudhakarbabu66@gmail.com)

es, the limited availability of fossil fuels and growing concerns regarding the es (GHGs) have directly impacted the shift from conventional automobiles to litionally, there have been notable advancements in new energy research, which l the viability of EVs. Consequently, EVs have gained widespread recognition pted in many countries worldwide. However, the rapid growth of EVs has given uch as insufficient charging infrastructure, unequal distribution, high costs, and which have become increasingly significant. The limited availability of charging widespread adoption of EVs. However, as more people embrace EVs, there has llation of electric vehicle charging stations (EVCSs) in public locations. Recent dentifying the ideal locations for EVCSs in order to assist the electrification of t the growing demand for EVs. A well-developed EVCS infrastructure can help acing EVs, such as pricing and range limitations. Researchers have used various functions, and constraints to formulate the problem of identifying the best sites for is focused on determining the best locations for EVCSs. This endeavor intends lectrified transport networks while also addressing the growing demand for EVs. es various optimization techniques to achieve optimal solutions while considering g load on the distribution system (DS), environmental implications, and economic d a standard IEEE 33-bus radial distribution system (RDS) with a full variety of to improve understanding of the subject. The use of the bald eagle search algorithm uch algorithm (CSA) aided in the best identification of energy source locations ities. In addition, the examination of EV charging techniques, including both the nique (TCT) and the innovative charging technique (ICT), is being undertaken to of these approaches. The study included ten separate scenarios, each of which was demonstrate the individual and synergistic usefulness of various energy sources in EV charging on the DS. The collected data fr... piric... y was aggregated d.

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Review Article

Advances in controller design of pacemakers for pacing control: A comprehensive review

Rijhi Dey [a,b], Naiwrita Dey [c], Rudra Sankar Dhar [a,*], Ujjwal Mondal [d], Sudhakar Babu Thanikanti [e,**], Nnamdi Nwulu [f]

[a] Department of Electronics and Communication Engineering, National Institute of Technology, 796012, Mizoram, India
[b] Department of Electronics and Communication Engineering, Sikkim Manipal Institute of Technology, 737136, Sikkim, India
[c] Department of Electronics and Communication Engineering, RCC Institute of Information Technology, 700015, West Bengal, India
[d] Instrumentation Engineering, Applied Physics Department, University of Calcutta, 700009, West Bengal, India
[e] Department of Electrical Engineering, Chaitanya Bharathi Institute of Technology, 500075, Telangana, India
[f] Centre for Cyber Physical Food, Energy and Water Systems, University of Johannesburg, 2006, Johannesburg, South Africa

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Repetitive Controller (RC)

ABSTRACT

This paper provides an extensive literature review focusing on the modeling of artificial pacemakers and the various mechanisms employed for their pacing control. In this survey, we initially gone through the fundamental concept of artificial pacemakers. Subsequently, we expound on their modeling techniques. Additionally, we furnish a holistic overview of diverse control methodologies tailored for the continuous pace tracking and control of pacemaker signals. Our discussion extensively reviews and scrutinizes various control algorithms and deployment approaches. Moreover, we spotlight the application of the IMP-based Repetitive Control (RC) technique for ensuring uninterrupted pace tracking in pacemakers. Conclusively, we address the spectrum of research challenges inherent in controller design advancements, underscoring the journey towards achieving precise and accurate pace control in pacemakers.

1. Introduction

Cardiac failures and other cardiovascular diseases are a primary cause of death worldwide (Ponikowski et al., 2014). The patients' life quality is improved with the development of new devices and this is major concern of health care systems. The primary objective is to promptly determine and detect abnormalities in the human heart to ensure timely intervention and potentially save the patient's life (Vihn et al., 2012). Precise monitoring and diagnosis of alterations in the electrical properties of the patient's heart serve as a safeguard against potentially severe health issues (Elnazzar, Ashour, Guo, El-Khobby, & Abd Elnaby, 2019). The Electrocardiography (ECG) is considered the most common scheme to monitor and detect patient's heart abnormalities. In 1903, Einthoven introduced enduring electrophysiological concepts that continue to be employed today. This included the labeling of the waves that characterize the electrocardiogram (ECG) (Bronzino, 1999). To designate these waves, he assigned the letters P through U, wisely avoiding conflicts with other physiological waves that were under study at that time. A representative ECG signal is depicted in Fig. 1.

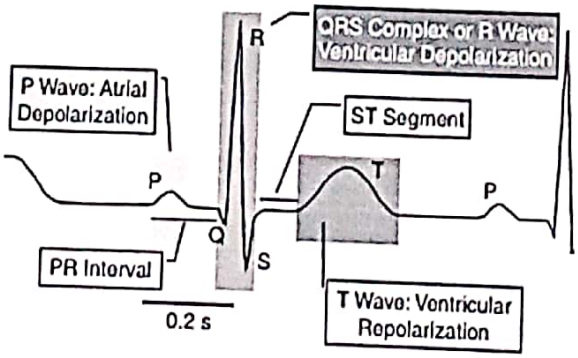

Fig. 1. Typical electrocardiogram (Bronzino, 1999).

The entire number of annual pacemaker implantation's continues to raise globally. It helps patients with heart rhythm disorders with an enhanced quality of life and reduced mortality (Cazeau et al., 2001).

* Corresponding author.
** Corresponding author at: Department of Electrical Engineering, Chaitanya Bharathi Institute of Technology, 500075, Telangana, India.
E-mail addresses: rudra.ece@nitmz.in (R.S. Dhar), sudhaaakrbabu66@gmail.com, sudhakarbabu@iece.org (S.B. Thanikanti).

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Optimizing the allocation of renewable DGs, DSTATCOM, and BESS to mitigate the impact of electric vehicle charging stations on radial distribution systems

Yuvaraj T [a], Suresh T D [b], Ulagammai Meyyappan [b], Belgasem Aljafari [d], Sudhakar Babu Thanikanti [c]

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Abstract

The increasing global adoption of Electric Vehicles (EVs) necessitates a greater supply of electricity for charging these cars. The popularity of EVs is also driven by their minimal maintenance requirements, enhanced performance, and eco-friendly nature. However, the expanding usage of EVs poses challenges to the distribution system's efficiency, thereby impacting its reliability. Consequently, ensuring the precise placement of electric vehicle charging stations (EVCS) becomes crucial for maintaining a dependable infrastructure. Solar and wind-based Renewable Distributed Generations (RDGs), Distribution STATic COMPensator (DSTATCOM), and Battery Energy Storage System (BESS) have become an important part of a Radial Distribution System (RDS) for mitigating the impact of EVCS as environmental sensitivity has grown and technology has advanced. Improper placement and sizing of components in can significantly impact the performance of a RDS. This research proposes a unique approach utilizing the Slime Mould Algorithm (SMA) and other optimization algorithms to identify the optimum positioning and sizing of RDG/DSTATCOM/EVCS/BESS within the RDS. The presented approach's efficacy is showcased by employing it on two commonly used IEEE RDSs: specifically, the 33-bus and 69-bus systems. The main objective of this research is to address actual power loss in these systems, subsequently enhancing voltage stability and bus voltage profiles. Findings from the test cases demonstrate that optimizing with the SMA algorithm produces more precise results in mitigating real power loss, enhancing bus voltage levels, and improving overall system stability when compared to existing algorithms.

Previous

Next

Keywords

Electrical vehicles (EVs); Slime mould algorithm (SMA); Renewable distributed generations (RDGs); Distribution STATicCOMpensator (DSTATCOM); Battery energy storage system (BESS); Electric vehicle charging stations (EVCSs); Voltage stability index (VSI); Radial distribution system (RDS)

Nomenclature

EV
: Electric Vehicle

EVCS
: Electric Vehicle Charging Station

RDGs
: Renewable Distributed Generations

DSTATCOM

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Research paper

Bidirectional converter based on G2V and V2G operation with time of usage-based tariff analysis and monitoring of charging parameters using IoT

Sarasij Adhikary [a], Pabitra Kumar Biswas [a], Chiranjit Sain [b], Sudhakar Babu Thanikanti [c,d,*], Nnamdi I. Nwulu [d]

[a] Department of Electrical and Electronics Engineering, National Institute of Technology, Mizoram 796012, India
[b] Ghani Khan Chowdhury Institute of Engineering and Technology, West Bengal 732141, India
[c] Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad 500075, India
[d] Centre for Cyber-Physical Food, Energy and Water Systems, University of Johannesburg, Johannesburg 2006, South Africa

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ABSTRACT

In recent days the high penetration of EVs have an impact on the load demand and it will be increased further. This results in stress on the grid and proper energy management in the charging stations. Recent development also enables smart communication between EV user and charging station. A bidirectional converter-based charging station works on V2G and G2V modes for charging the EV battery and supports the grid or isolated power station when it is needed. In this paper, a brief discussion on the previous development of bidirectional conversion is presented. A bidirectional converter is modeled and simulated in Simulink. In G2V mode, the time of energy-based tariff is used for the cost calculation, and for V2G mode, the system monitoring of the EV charging parameters is presented where the pricing varies from 11.09 Rs. To 16.27 Rs. For an hour of power consumption using a 2.54 kW charger on a probabilistic model. For V2G operation, the inverter voltage and grid voltage in synchronization is presented. An IoT-based system is initiated in Simulink using thing speak. This put the data in the cloud and further the data is monitored and fetched from the cloud using a web application.

1. Introduction

Deploying the use of IC engine vehicles is under restriction, and EVs are expanding that decrease pollution and are used with renewable sources for cost-saving operation. Consumers are encouraged to use it for its running cost instead; it is limited due to a lack of good charging infrastructure at home, public or parking charging. Using the bidirectional converter, power electronics devices with controlling techniques can achieve the vehicle to the grid. At the same time, it needs a bunch of EVs support through an aggregator for effective operation. The bidirectional charging concept will help the grid support at the peak load period, and consumers will be benefited from the incentives as per energy provided by the EV. EV charge scheduling and charging station assignment lead the researcher to deliver the optimum solution with ease of operation. Changing station assigning is scaled as a linear optimization problem, and an intelligent charging scheduling algorithm is proposed to minimize charging price. The whole process is done through the Monte Carlo simulation technique (Das et al., 2021). High penetration of EVs on the road impacts the voltage and loading power system. Taking the variable System voltage, the SOC of the battery, and the requirement of the consumer controller should provide a linear distribution and mitigate the negative aspect of the power system. The control technique is categorized as centralized control, which needs deep communication, and the decentralized control technique has lesser communication and analysis (Faddel et al., 2018). An MPC control algorithm is proposed for the V2G, G2V, and V4G modes, where the controller is provided for the AC and DC buses to determine the grid's active and reactive power controller. The topology is suitable for the bidirectional power flow, and the MPC strategy tracks both end commands using simulation; the comparison result is presented (He et al., 2020). Unidirectional Vehicle to Grid charging is investigated with the flexibility resources provide better regulation and service. V2G unidirectional service gives a potential benefit, and the use of

* Corresponding author at: Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad 500075, India.
E-mail address: sudhakarbabu66@gmail.com (S.B. Thanikanti).

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An efficient power extraction technique for improved performance and reliability of solar PV arrays during partial shading

Priya Ranjan Satpathy [c], Belgacem Aljafari [a], Sudhakar Babu Thanikanti [b], Renu Sharma [c]

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Abstract

Partial shading in the arrays reduces the power output, creates hotspots and damages the modules affecting the performance of the system. The modules bypass diodes create non-convexity in the power curves causing additional power losses. Hence, this work proposes a black widow reconfiguration (BWR) with reduced switch counts for mitigating the effects of partial shading in the arrays. The methodology effectively reduces the current difference between rows of the PV array within a short period with a faster calculation rate and electrically reconnects the modules. The reconnection ensures reduced mismatch among modules, higher power output and smoother power curves during partial shading. To show the effectiveness of the BWR in arbitrary-sized arrays, three arrays of 2×4, 5×5, and 9×9 sizes are considered and tested under static and dynamic partial shadings. The results are then compared with three conventional, six static, and three dynamic techniques using power curves and various parameters. Besides validation in the MATLAB environment, the experimental setup and OPAL-RT platform are considered to show the application in real-time environment. From the investigation, an average power improvement of 25.49%, 15.47%, and 9.29% in BWR compared to the existing conventional, static, and dynamic techniques with 99.60% efficiency have been observed.

Introduction

The demand for solar photovoltaic (PV) power generation is increasing at a faster rate due to its wide availability, low maintenance, and recent developments in power electronics [1]. The modules that are the core and costliest components of a PV system are utilized to generate a specific amount of voltage and current depending upon the nature of the connection i.e., series and parallel [2]. However, the overall power output is the main objective of the PV system that can be only obtained from the efficient operation of all the connected modules [3]. However, the modules suffer from internal mismatch due to manufacturing differences along with external mismatch caused due to partial shading causing sort of power losses in the system [4]. During partial shading, the modules receive non-uniform irradiance due to the coverage of shadow caused by nearby buildings, trees, dust, or clouds which creates performance differences among the modules [5]. This mismatch can create a serious scenario of hotspots that can permanently damage the internal parts of the modules such as soldier wires, cracks, etc., and are not repairable [5]. However, the bypass diodes in the modules help the system to reduce the hotspot probability and generate higher power but, it compromises the generated voltage of the respective module resulting in a voltage difference in the system [6]. The voltage difference in the system leads toward the non-convexity of the power curves with the exhibition of numerous peaks and hence creating additional complications in terms of actual peak tracking by the conventional maximum power point tracking (MPPT) algorithms [7].

The advancement in power electronics control strategy has provoked the development of advanced algorithms that can track the actual power peak from the numerous existing peaks in the system [8]. These algorithms utilize various optimization techniques to locate the power peaks with higher values by ignoring the local peaks with lower values. Among recent research, a grey wolf optimization-based MPPT algorithm has been proposed, compared with particle swarm optimization (PSO) and conventional MPPT methods, and found to be effective under transient partial shading conditions [9]. Similarly, a modified honey badger algorithm for MPPT has been proposed which has shown a better performance as compared to the other nine existing hybrid techniques [10]. Another novel GWO-PSO hybris MPPT algorithm has been proposed in Ref. [11] that shows more effective performance in terms of tracking accuracy, speed, and efficiency than the PSO, GWO, and conventional methods. Various other modified and hybrid MPPT algorithms have been reviewed in depth in Ref. [12] under uniform and partial shading conditions and conclude that the combination of conventional and intelligent techniques can be the

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Research paper

Minimizing the electric vehicle charging stations impact in the distribution networks by simultaneous allocation of DG and DSTATCOM with considering uncertainty in load

Yuvaraj T. [a], Devabalaji K.R. [b], Sudhakar Babu Thanikanti [c,d,e,*], Belqasem Aljafari [f], Nnamdi Nwulu [d]

[a] Centre for Computational Modeling, Chennai Institute of Technology, Chennai, 600069, India
[b] Department of Electrical and Electronics Engineering, Aarupadai Veedu Institute of Technology, Vinayaka Missions Research Foundation, Chennai, 603104, India
[c] Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad 500075, India
[d] Centre for Cyber Physical Food, Energy and Water Systems, University of Johannesburg, Johannesburg 2006, South Africa
[e] Department of Electrical and Electronics Engineering, Nisantasi University, 34398 Istanbul, Turkey
[f] Department of Electrical Engineering, College of Engineering, Najran University, Najran 11001, Saudi Arabia

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Voltage stability index (VSI)
Distribution network operators (DNOs)
Radial distribution system (RDS)
Electric vehicle charging stations (EVCSs)
Uncertainty in load

ABSTRACT

The rise in popularity of electric vehicles (EVs) is attributable to their economical maintenance, excellent performance, and environmentally-friendly nature due to zero carbon emissions. Nevertheless, the increased utilization of EVs poses challenges for the distribution system's efficiency. The strategic placement of electric vehicle charging stations (EVCS) is crucial in maintaining the reliability of the radial distribution system (RDS). The improper allocation of EVCS can result in degradation and affect the distribution system. To overcome this issue, a potential solution involves integrating the charging stations with the RDS by utilizing distribution static compensators (DSTATCOMs) and distributed generation (DG) to mitigate the adverse effects of EVCS on the RDS. The appropriate sizing of DG/DSTATCOM depends on variations in load stages, as it impacts the stability of the RDS. Additionally, the uncertainty of distribution loads can lead to an underestimation of power within the system, posing a primary challenge. In this proposed work, two studies were examined: (i) DG and DSTATCOM allocation considering load uncertainty without EVCS impact, and (ii) DG and DSTATCOM allocation considering load uncertainty with EVCS impact. To address this multi-objective problem, an objective function was developed to reduce real power loss while adhering to system equality and inequality constraints. To tackle the challenge, the researchers used the bald eagle search algorithm (BESA), a revolutionary metaheuristic optimization methodology. The efficacy of the proposed approach was validated using two test systems: a 34-bus system and a 118-bus system. The results obtained from these test cases demonstrate that the BESA-based solution is highly exact in reducing real power loss, increasing bus voltage, and enhancing system stability with a significantly high convergence rate. Hence, the proposed approach presents a promising solution for optimizing RDS with multiple objectives.

1. Introduction

Electric vehicles offer great potential in reducing pollutants associated with transportation. These vehicles are specifically designed to deliver high performance while minimizing or completely eliminating exhaust emissions. In comparison to traditional internal combustion engines, EVs provide a plethora of advantages. These benefits include lower fuel consumption and emissions, making it a critical solution for addressing issues such as limited fossil fuel availability, energy emergencies, and the considerable environmental degradation caused by transportation (Zeb et al., 2020). Moreover, the widespread adoption of EVs can potentially lead to reduced petrol prices due to the efficient operation of electric drive units (Steen and Tuan, 2017). However, integrating EVCSs into the RDS introduces challenges in terms of increased power consumption, higher distribution line load, and voltage drop. These factors can lead to voltage instability and increased power losses, posing difficulties in ensuring power

* Correspondence to: Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology (CBIT), Hyderabad, 500075, India.
E-mail address: sudhakarbabu66@gmail.com (S.B. Thanikanti).

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Article

Modelling and Allocation of Hydrogen-Fuel-Cell-Based Distributed Generation to Mitigate Electric Vehicle Charging Station Impact and Reliability Analysis on Electrical Distribution Systems

Thangaraj Yuvaraj [1], Thirukoilur Dhandapani Suresh [2], Arokiasamy Ananthi Christy [3], Thanikanti Sudhakar Babu [4] and Benedetto Nastasi [5,*]

1 Centre for Computational Modeling, Chennai Institute of Technology, Chennai 600069, India; yuvaraj4252@gmail.com
2 Department of Electrical and Electronics Engineering, Saveetha Engineering College, Chennai 602105, India; tdsureshee@gmail.com
3 Department of Marine Engineering, AMET University, East Coast Road, Kanathur, Chennai 603112, India; christanan13@gmail.com
4 Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad 500075, India; sudhakarbabu@ieee.org
5 Department of Planning, Design and Technology of Architecture, Sapienza University of Rome, Via Flaminia 72, 00196 Rome, Italy
* Correspondence: benedetto.nastasi@outlook.com

Abstract: The research presented in this article aims at the modelling and optimization of hydrogen-fuel-cell-based distributed generation (HFC-DG) to minimize the effect of electric vehicle charging stations (EVCSs) in a radial distribution system (RDS). The key objective of this work is to address various challenges that arise from the integration of EVCSs, including increased power demand, voltage fluctuations, and voltage stability. To accomplish this objective, the study utilizes a novel spotted hyena optimizer algorithm (SHOA) to simultaneously optimize the placement of HFC-DG units and EVCSs. The main goal is to mitigate real power loss resulting from the additional power demand of EVCSs in the IEEE 33-bus RDS. Furthermore, the research also investigates the influence of HFC-DG and EVCSs on the reliability of the power system. Reliability is crucial for all stakeholders, particularly electricity consumers. Therefore, the study thoroughly examines how the integration of HFC-DG and EVCSs influences system reliability. The optimized solutions obtained from the SHOA and other algorithms are carefully analyzed to assess their effectiveness in minimizing power loss and improving reliability indices. Comparative analysis is conducted with varying load factors to estimate the performance of the presented optimization approach. The results prove the benefits of the optimization methodology in terms of reducing power loss and improvising the reliability of the RDS. By utilizing HFC-DG and EVCSs, optimized through the SHOA and other algorithms, the research contributes to mitigating power loss caused by EVCS power demand and improving overall system reliability. Overall, this research addresses the challenges associated with integrating EVCSs into distribution systems and proposes a novel optimization approach using HFC-DG. The findings highlight the potential benefits of this approach in terms of minimizing power loss, enhancing reliability, and optimizing distribution system operations in the context of increasing EV adoption.

Keywords: electrical vehicles (EVs); spotted hyena optimizer algorithm (SHOA); bat algorithm (BA); African vulture optimization algorithm (AVOA); bald eagle search algorithm (BESA); hydrogen-fuel-cell-based distributed generation (HFC-DG); electric vehicle charging stations (EVCSs); reliability; radial distribution system (RDS)

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Research Article

Maximizing techno-economic-environmental benefits of renewable energy allocation with smart inverter in distribution system: a two-layer stochastic optimization framework

Belqasem Aljafari, Vijay Babu Pamshetti & Sudhakar Babu Thanikanti

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ABSTRACT

The rapid proliferation of renewable energy sources (RES), such as photovoltaic (PV) generation and wind generation, poses severe challenges to distribution systems. Their intermittent nature leads to voltage profile deterioration and significant losses. Allocating RES with a smart inverter is a promising solution to address these issues. This study introduces an integrated two-layer stochastic optimization framework for RES allocation with a smart inverter in active distribution networks, aiming for techno-

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Article

Innovative Methodologies for Higher Global MPP of Photovoltaic Arrays under PSCs: Experimental Validation

Belqasem Aljafari [1], Rupendra Kumar Pachauri [2], Sudhakar Babu Thanikanti [3,*] and Bamidele Victor Ayodele [4,*]

[1] Department of Electrical Engineering, College of Engineering, Najran University, Najran 11001, Saudi Arabia; bhaljafari@nu.edu.sa
[2] Electrical and Electronics Engineering Department, School of Engineering, University of Petroleum and Energy Studies, Dehradun 248007, India; rpachauri@ddn.upes.ac.in
[3] Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad 500075, India
[4] Department of Chemical Engineering, Universiti Teknologi PETRONAS, Seri Iskandar 32610, Malaysia
* Correspondence: sudhakarbabu@ieee.org (S.B.T.); bamidele.ayodele@utp.edu.my (B.V.A.)

Abstract: Partial shading conditions (PSCs) are responsible for the root causes of photovoltaic (PV) system performance deprivation such as hotspots (damaged PV cells), mismatch power losses and multiple power maxima. Recently, PV array reconfiguration strategies have proven to be beneficial in improving PV system performance and achieving improved shade dispersion properties. This research analyzes the improved Su-Do-Ku (I-SDK) PV array configuration in order to counteract the shading effect. This approach implements a 6 × 6 size PV array configuration and performance evaluation under different realistic shading scenarios. The performance of the I-SDK configuration is assessed and compared to that of the total-cross-tied (TCT) and Su-Do-Ku (SDK) arrangements. The performance indices such as power loss (PL), power at global maximum power point (GMPP), fill-factor (FF), performance ratio (PR), power enhancement (PE) and execution ratio (ER) are analyzed to show comprehensive comparison. An experimental analysis confirms the MATLAB/Simulink findings, demonstrating that the I-SDK configuration outperforms both the TCT and SDK array setups. The GMPP values of 143.5 W, 141.7 W, 138.1 W and 129.3 W also show the superiority of I-SDK during four shading instances compared to conventional SP, TCT, SDK and SM arrangements. Moreover, under similar PSCs, higher %FF (74.61%, 76.10%, 77.1%, 75.92%) and lower PL (36.7 W, 38.5 W, 42.1 W, 50.9 W) support the adoptability of I-SDK for experimental validation/commercial viability.

Keywords: power loss; photovoltaic system; shading scenarios; fill factor; improved Su-Do-Ku; mismatch loss

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1. Introduction

As a climate-sustainable solution, the world needs urgent and rapid incorporation of renewable energy (RE) into the global energy scenario. RE sources are commonly known as clean energy solutions, gaining the deep attention of energy users in commercial and domestic applications. The PV energy conversion method has received immense attention from researchers in recent days [1]. Concerns about the worldwide energy problems and the threat of climate change posed by existing energy sources have spurred the research for alternative energy sources. The most popular renewable energy source is solar PV, which is nonpolluting and requires no maintenance [2].

During the first half of 2020, thirteen countries pledged the largest amount of new RE ever, nearly 50 GW, to be installed in the year span of 2021–2024. Global demand in 2021 is expected to be 25% higher than in 2020 [3,4]. The researchers performed different studies to establish an effective and stable conversion of solar PV energy. Module mismatching and PSCs are two key contributors to PV system losses. Under these conditions, the PV system

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Study on Meta-heuristics techniques for shade dispersion to enhance GMPP of PV array systems under PSCs

Rupendra Kumar Pachauri [a], Mohit Kumar [b], Sudhakar Babu Thanikanti [c], Neeraj Kumar Shukla [d], Piyush Kuchhal [a], Ahmad Faiz Minai [e], Akhilesh Sharma [f]

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Abstract

Reconfiguring the photovoltaic modules in an array is one option for reducing the influence of partial shadowing circumstances, which shows the shade dispersion property on the entire photovolatic array. This paper proposes a novel *meta*-heuristic optimization technique named Vommi that resolves the reconfiguration process of shaded modules in a photovoltaic array. Using the proposed objective function, the major goal of this unique optimization technique is to maximize the power extracted from the shaded PV array during shading conditions. The proposed *meta*-heuristic Vommi optimization algorithm is compared to conventional total cross-tied, and particle swarm optimization algorithm-based configurations in terms of power at the global maximum power point, improved fill factor, power losses, execution ratio, etc. The global maximum power point of the Vommi optimization algorithm configuration delivers such as 990W, 1283W, 1181W, and 1173W, which are higher than conventional approaches during all four partial shodowing circumstances and smoother power-voltage characteristics.

Introduction

Because of the major environmental consequences of fossil fuels, the renewable energy sources such as PV systems, wind turbines, biofuel, and tidal energy, among other things, are being investigated [1]. Due to the low conversion efficiency of a single solar PV module, a low-power capacity-based PV system is unable to deliver sufficient power to load applications. In this context, the PV modules may be connected in series, parallel, SP to enhance power output as per load power demand. The PV performance reduction due to PSCs are observed in terms of high power losses and low efficiency [2], [3]. The causes of PSCs, their effects, and solutions for overcoming the shading effect are given, and the behavior of P-V and I-V curves are explored in Fig. 1.

PV module reconfiguring is used to reduce the influence of PSCs,. Furthermore, several researchers are aiming to eliminate shade by relocating PV modules in an array using physical re-allocation of modules and fixed electrical connection technologies [1], [5], [13], [18], [26], [38]. In this context, various game puzzle approaches such as Su-Do-Ku, magic square, Latin square, symmetric matrix, etc. are explored for the purpose of achieving shade dispersion. However, the long cable length is required to change the electrical connections of the PV array modules, which are responsible for line loss [4], [5].

Due to the perturbing effects of PSCs, multiple peaks (GMPP and LMPP), exist on P-V characteristics. Researchers are currently using metaheuristic techniques to limit the number of MPP (Table 1).

The present simulation study compares the available TCT and PSO-based PV array configurations with the proposed VOA configuration under the four considered shading scenarios through the MATLAB/Simulink. A number of essential performance indicators, including GMPP locations, enhanced FF, and PG are examined during the study.

During the investigation of PV systems under shading scenarios from 200 to 900 W/m^2 irradiation levels, multiple GMMP points are observed as 402W, 5444W and 5647W (three shading cases). Performance parameters in terms of GMPP enhancement are found as 25.90%, 7.23%, and 6.78% for respective cases [6]. In [7], it is observed that low power capacity in terms of GMPP as 160W, which is investigated during 400 W/m^2, 700 W/m^2, and 1000 W/m^2 irradiance levels. Moreover, a modified PSO algorithm is introduced and compared it with the existing PSO algorithm-based PV array configuration to show percentage improvement (5.67%) as GMPP (254.66W)

sustainability

A New Hybrid Multi-Population GTO-BWO Approach for Parameter Estimation of Photovoltaic Cells and Modules

[redacted]

[redacted]

[redacted]

1. Introduction

[redacted]

Experimental investigation and multi-objective optimization of eco-friendly near-dry electrical discharge machining of shape memory alloy using Cu/SiC/Gr composite electrode

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Nagarajan Vasantha Gowri, Jaiprakash Narain Dwivedi, Kondreddi Krishnaveni, Sampath Boopathi ✉, Murugesan Palaniappan & Nageswara Rao Medikondu

Abstract

The near-dry electrical discharge machining processes have been conducted using air-mist or gas mist as a dielectric fluid to minimize the environmental impacts. In this article, near-dry electrical discharge machining (NDEDM) experiments have been performed to improve machining performance using an oxygen-mist dielectric fluid, a copper composite electrode, and Cu-Al-Be polycrystalline shape memory alloy (SMA) work materials. The copper composite electrode is made up of 12 wt% silicon carbide and 9 wt% graphite particles. The oxygen-mist pressure (Op), pulse or time (Ton), spark current (Ip), gap voltage (Gv), and flow rate of mixed water (Fr) were used as process parameters, and the material removal rate (MRR), tool wear rate (TWR), and surface

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An optimization approach control of EV solar charging system with step-up DC–DC converter

R. J. Venkatesh[1] · R. Priya[2] · P. Hemachandu[3] · Chinthalacheruvu Venkata Krishna Reddy[4]

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Abstract
An optimization technique for the control of a photovoltaic (PV)-fed electric vehicle (EV) solar charging station with a high gain of step-up dc-to-dc converter. An optimization approach is the Namib beetle optimization (NBOA) approach. This approach is used to control the EV solar charging station. Also, the principles of a switched capacitor and a coupled inductor are integrated into the interleaved structure of the NBOA converter to produce low-current, high-efficiency, and high-voltage gain. However, the major contribution is to minimize the total harmonic distortion (THD) and to control the EV solar Charging Station. The bi-directional DC-to-DC converter in an energy-storage-system has the advantages of high efficiency and fast response speed. By then, the NBOA technique is done in MATLAB software, and the performance is evaluated with the existing techniques. The NBOA system has low THD and high efficiency, which is compared with the existing ant-lion optimizer, wild horse optimizer, and salp-swarm algorithm, methods. From the analysis, the NBOA method provides a better outcome than the existing one.

Keywords Energy storage system · Photovoltaic · Electric vehicle · Step-up DC to DC converter · Charging station · Electric vehicle charging station

1 Introduction

Fossil fuels, like coal, oil, and flammable gas, are unsustainable, possess lesser qualities, and their by-products are costly and environmentally toxic [1]. Consequently, the requirement to utilize environmentally friendly power is inescapable. A larger part of the transportation across the world depends on oil-based vehicles which discharges ozone-depleting substances [2, 3]. In addition, the expansion in fuel rate rouses scientists to deal with photovoltaic (PVs) and electric vehicles (EVs). In sunlight-based and wind energy change frameworks the age voltage level is such a long way from matrix voltage [4, 5]. The depletion of non-sustainable power assets entices the scientists to makeover on to the inexhaustible wellsprings of energy [6]. For changing energy obtained from clean sources, a DC power converter with a hurled gain is moving these days [7]. In these applications, power electronic circuits, particularly high-arrangement dc converters assume a crucial part in electric vehicles [8]. The bulk of the researchers are focusing on the automotive industry due to its rapid growth worldwide [9]. Additionally, conventional power sources are becoming increasingly scarce. EV charging stations are laid out around the world

P. Hemachandu is alumnus of Sri Venkateswara University, Tirupati, India.

✉ R. J. Venkatesh
rjv@svce.ac.in

R. Priya
rmdpriya29@gmail.com

P. Hemachandu
hemachandu@ieee.org

Chinthalacheruvu Venkata Krishna Reddy
chkrishnareddy_eee@cbit.ac.in

1 Department of Electrical and Electronics Engineering, Sri Venkateswara College of Engineering, Affiliated to Anna University, Sriperumbudur, Chennai, Tamil Nadu 602117, India

2 Department of Physics, R.M.D. Engineering College, Kavaraipettai, Tamil Nadu, India

3 Department of Electrical and Electronics Engineering, Sasi Institute of Technology and Engineering, Tadepalligudem, India

4 Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, India

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An internet of health things-driven skin cancer classification using progressive cyclical convolutional neural network with ResNexT50 optimized by exponential particle swarm optimization

K.S. Bhuvaneshwari [a], L. Rama Parvathy [b], K. Chatrapathy [c], Ch. Venkata Krishna Reddy [d]

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Abstract

Skin cancer has become more common in the last few decades according to reports by the World Health Organization. Currently, 1,32,000 melanoma skin cancer cases and around three million non-melanoma cases are reported annually worldwide. Early skin cancer identification with classification allows for effective diagnosis and therapy for patients. Therefore, an internet of health things-driven deep learning approach for identification with classification of skin cancer based on Progressive Cyclical Convolutional Neural Network with ResNexT50 transfer learning optimized by Exponential Particle Swarm Optimization (IoHT-SC-PCCNN-RNT-EXPSO) is proposed in this manuscript. Here, the input skin cancer images are amassed from international Skin Imaging Collaboration (ISIC) image archive dataset. The Dynamic Temporal Filter (DTF) is used for removing the noise, and also enhances the skin cancer images quality. In which, PCCNN does not adopt any optimization methods for determining the optimum parameter to offer accurate skin cancer classification. So, Exponential Particle Swarm Optimization (EXPSO) is proposed for optimizing PCCNN to help it precisely classify the skin cancer. The proposed IoHT-SC-PCCNN-RNT-EXPSO method is implemented in MATLAB. The metrics, like accuracy, recall, precision, f1-Score, specificity, computation time, error rate are evaluated to evaluate the effectiveness of the proposed technique. The proposed MSCC-DI-SDRN-JSOA demonstrated improved specificity with percentages of 27.35%, 28.64%, and 24.38%. Additionally, it showed lower computation time by 37.28%, 29.39%, and 28.44%, and higher accuracy by 30.50%, 32.39%, and 31.54% compared to the existing methods, like IoHT-SC-CNN, IoHT-SC-KNN and IoHT-SC-DWNN-EPO respectively.

Introduction

Approximately 18 million cancer cases were reported globally in 2018, with 9.5 million of those cases occurring in men and 8.5 million in women [1]. Normal body cells that experience a mutation and start to proliferate and reproduce uncontrollably are how cancer develops [2]. Cancer is caused mostly by undifferentiated cell proliferation, which results in the formation of a mass-like structure termed as a tumor [3]. Only if the tumors are malignant are they cancerous. Neighboring tissues suffer severe damage as a result of malignant tumors infiltrating them [4]. Tumors can potentially spread to other body parts through the systemic circulation [5]. Metastasis is the process through which cancer spreads from one bodily area to another [6]. Adjacent tissues are engulfed by tumors because they attack them and rob them of the nutrients and oxygen they need to survive and function [7]. With this expanding worldwide burden, cancer suppression is one of the most critical public health concerns of the twenty-first century [8]. Skin cancer is the most common kind of cancer worldwide, and its prevalence is increasing. Skin cancer is broadly classified into two types: non-melanoma and melanoma [9]. There are 2 forms of non-melanoma skin cancer: basal cell carcinoma (BCC), squamous cell carcinoma (SCC) [10], [11]. Such skin malignancies are common in older adults. These varieties do not spread to other regions of the body, but if not treated promptly, they can cause local harm [12]. Melanoma skin cancer is sporadic, yet it is dangerous and spread to other regions of the body [13]. These are prevalent malignancies in adolescents. If these tumors are not treated promptly, they can be fatal [14]. These types of skin malignant development that has caused skin illness adverse effects. BCC often appears as a raised, smooth lump on sun-exposed body skin [15]. SCC is typically a red, firm lump on sun-exposed skin. It may ulcerate, discharge. If left untreated, it grow to be quite large [16]. The malignant melanomas are darkly pigmented lesions [17]. Skin lesions are classified as benign or malignant. Since benign is more prevalent than malignant tumors, they must be accurately diagnosed [18]. These are often identified by qualified medical practitioners based on manual observations and common symptoms. Due to their similarities, both types of lesions are difficult to distinguish. As a result, there should be an automated

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RESEARCH ARTICLE-COMPUTER ENGINEERING AND COMPUTER SCIENCE

Classification of Skin Lesions by Incorporating Drop-Block and Batch Normalization Layers in Representative CNN Models

T. R. Vijaya Lakshmi[1] · Ch. Venkata Krishna Reddy[2]

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Abstract
Due to increased exposure to severe environmental elements and an aging population, the prevalence of skin cancer has been progressively rising in recent decades. When the type of skin infection is not identified in the early stages, it can lead to skin cancer and even death. Low-level visual characteristics directly connected to color and shape have traditionally been employed in studies on skin-lesion identification. The performance features of deep-based models profoundly made them applicable in diverse domains. Indeed, balancing the size of the deep networks with limited and unbalanced training data to meet the real-time demand in a computationally limited platform is an ongoing challenge. Often fine-tuning the last layers is performed to tackle unbalanced and shortage of data. However in the current study, layers like global average pooling, drop-block, and batch normalization are incorporated to the base models to classify unbalanced skin-lesion data. This boosts the performance of the model compared to fine-tuning with drop-out. The effectiveness of the incorporated layers are evaluated on three popular representative models having different depths. Comparisons are provided with the results obtained with conventional fine-tuning and a four-layer CNN scratch model. The best classification accuracy obtained with the proposed approach on DenseNet-121 model is 91.54%, and the average macro-F1 score obtained is 0.774.

Keywords Skin malignancy · CNN representative models · Drop-block layer · Batch normalization layer · Global Average pooling layer

1 Introduction

Melanoma, a malignant skin tumor, is the most attacker as its susceptibility and mortality rate are higher to prevail the nearby tissues. Its influential factors are individual immunity, genetic, and exposure to ultraviolet radiation. It is one of Australia's most rampant malignancies caused by long-term ultraviolet exposure. The melanocytic cells create an excessive amount of melanin, and more than 60% of the total tumors were diagnosed as melanoma.

The fact that melanoma accounts for around 75% of skin cancer-related deaths can be used to evaluate the severity of this type of cancer. According to various UK statistics, more than six people die from melanoma skin lesions everyday, or about 2400 people annually [1]. Similar studies carried out in Canada reveal that one in 74 males and one in 90 females in that country have a lifetime risk of developing skin-lesion melanoma. After reviewing a variety of publications on skin lesions from 1992 to 2006, the researchers found that malignant melanoma incidence rates were rising at a rate of roughly 3% per year for white men and women and for ages 15–30 [1].

Due to increased exposure to severe environmental elements and an aging population, the prevalence of skin cancer has been progressively rising in recent decades [2–4]. In 2008, 0.43 million Australians were diagnosed with one or the other non-melanoma skin malignancy. In 2016, 679 of them died due to melanoma [5], and in 2019, the number of skin cancer cases diagnosed is 96,480 [6], of which 7.5% constitute deaths due to melanoma lesions. Not only in Australia, but also in the USA and New Zealand, its incidence

T. R. Vijaya Lakshmi and Ch. Venkata Krishna Reddy have contributed equally to this work.

✉ T. R. Vijaya Lakshmi
trvijayalakshmi_ece@mgit.ac.in

Ch. Venkata Krishna Reddy
chkrishnareddy_eee@cbit.ac.in

1 ECE, Mahatma Gandhi Institute of Technology, Gandipet, Hyderabad, Telangana 500075, India

2 EEE, Chaitanya Bharathi Institute of Technology, Gandipet, Hyderabad, Telangana 500075, India

Multimedia Tools and Applications
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Classification of multi-spectral data with fine-tuning variants of representative models

T. R. Vijaya Lakshmi[1] · Ch. Venkata Krishna Reddy[2] · Padmavathi Kora[3] · K. Swaraja[3] · K. Meenakshi[3] · Ch. Usha Kumari[3] · L. Pratap Reddy[4]

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Abstract
Due to rapid urbanization, agriculture drought, and environmental pollution, significant efforts have been focused on land use and land cover (LULC) multi-spectral scene classification. Identifying the changes in land use and land cover can facilitate updating the geographical maps. Besides, the technical challenges in multi-spectral images with implicit deep learning models due to the nature of multi-modal, it tackles real-life issues such as the collection of large-scale high-resolution data. The limited training samples are considered a crucial challenge in LULC deep learning classification as requiring a huge number of training samples to ensure the optimal learning procedure. The present work has focused on considering the fraction of multi-spectral data (EuroSAT data) and evaluated the exemplary CNN architectures such as shallow network (VGG16) and deep network (ResNet152V2) with different tuning variants along with the additional layers prior to classification layer to improve the optimal training of the networks to classify the multi-spectral data. The performance of the thirteen spectral bands of EuroSAT dataset that contain ten scene classes of land use and land cover were analyzed band-wise and combination of spectral bands. For the scene class 'Sea & lake' the best accuracy obtained was 96.17% with individual band B08A and 95.7% with Color Infra Red (CIR) band combination. The analysis provided in this work enables the remote sensing research community to boost performance even if the multi-spectral dataset size is small.

Keywords Multi-spectral data · Tuning variants · Land use and land cover classification · Global average pooling layer · Batch normalization · Feature maps

✉ T. R. Vijaya Lakshmi
trvijayalakshmi_ece@mgit.ac.in

1 Department of ECE, Mahatma Gandhi Institute of Technology, Hyderabad, India
2 Department of EEE, Chaitanya Bharathi Institute of Technology, Hyderabad, India
3 Department of ECE, GRIET, Hyderabad, India
4 Department of ECE, JNTUH CESTH, Hyderabad, India

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ORIGINAL PAPER

Modeling and simulation of bacterial foraging variants: acoustic feature selection and classification

T. R. Vijaya Lakshmi[1] · Ch. Venkata Krishna Reddy[2]

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Abstract
The field of human–computer interaction greatly benefits from the significant role of speech emotion recognition (SER), which finds applications across various domains. However, practical applications of SER still face certain challenges. One such challenge is the variation in emotional expressions among individuals, while another issue arises from the presence of indistinguishable emotions, which can impact the stability of SER systems. This study investigates the application of variants of the Bacterial Foraging Optimization Algorithm (BFOA) in the domain of SER. Experiments are conducted on multiple emotion datasets, including Emo-DB, SAVEE, and SUBESCO, to evaluate the effectiveness of the proposed variants. The findings of this study emphasize the potential of BFOA variants as powerful tools for SER.

Keywords Prosodic features · Gram-tone frequency cepstral coefficients · Adaptive BFOA · BFOA with Variable-based population

1 Introduction

Detecting emotions in individuals can be achieved through speech, transcripts, facial expressions, and brain signals (EEG). The process of speech-based emotion involves analyzing the acoustic properties of speech to identify vocal changes associated with different emotions [1]. However, the accuracy of emotion classification can be hindered by the presence of irrelevant or redundant information in emotional databases. To mitigate this issue, effective feature selection strategies can be applied, enabling the identification and use of pertinent features to determine the presence of specific emotions.

Emotions are complex psychological and physiological states that arise in response to stimuli or events. They play a crucial role in human experience and behavior, influencing our thoughts, actions, and interpersonal interactions. Understanding emotions is essential for overall psychological well-being, healthy relationships, and successful communication. Speech emotion recognition (SER) has practical applications in various fields, including psychology, healthcare, education, human–computer interaction, aircraft cockpits, language translation, and social sciences. By studying emotions, researchers and practitioners can gain valuable insights into human behavior, enhance mental health interventions, improve communication strategies, and develop technologies that are more responsive to human needs.

Research in SER primarily focuses on two main aspects: the extraction of speech emotional features and the selection of emotional classifiers. Over the years, numerous features have been studied and employed for SER. Additionally, optimization algorithms like ACO [2], DE [3, 4], and PSO [5] have been utilized for feature selection. Irrelevant or redundant features can introduce noise and lead to overfitting, where a model learns to perform well on the training data but fails to generalize to new, unseen data [6]. By selecting only the most relevant features, the model's performance can be improved by focusing on the most informative aspects of the data. With fewer dimensions, it becomes easier to visualize the data and model behavior in lower-dimensional spaces

T. R. Vijaya Lakshmi and Ch Venkata Krishna Reddy have contributed equally to this work.

✉ T. R. Vijaya Lakshmi
trvijayalakshmi_ece@mgit.ac.in

Ch. Venkata Krishna Reddy
chkrishnareddy_eee@cbit.ac.in

1 ECE, Mahatma Gandhi Institute of Technology, Gandipet, Hyderabad, Telangana 500075, India

2 EEE, Chaitanya Bharathi Institute of Technology, Gandipet, Hyderabad, Telangana 500075, India

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REGULAR PAPER

Anonymity and security improvements in heterogeneous connected vehicle networks

S. A. Sivasankari[1] · Deepak Gupta[2] · Ismail Keshta[3] · Ch. Venkata Krishna Reddy[4] · Pavitar Parkash Singh[5] · Haewon Byeon[6]

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Abstract

The connected vehicle network is an important part of intelligent transportation since it provides a wide variety of online vehicle services and helps to lower the risk of accidents for drivers while also being a prominent example of the IoT inside futuristic smart vertical networks. However, the connected vehicle network's communication protocols reveal a great deal of private data, including individual vehicles' whereabouts and travel plans. Sensitive data, including vehicle positions and trajectories created during communication, must be protected as wireless communication technology by its very nature entails broadcasting and allows for open communication between vehicles. Therefore, a key objective in vehicular network security is to increase the anonymity of vehicle identities within secure services. Using a batch verification technique, we present a novel approach to anonymous identity authentication in this research. The approach uses zero-knowledge proofs and other forms of anonymized authentication to bolster the privacy of IEEE WAVE's security services. It also provides a new way to retrieve lost identification with the help of an independent party. This study primarily contributes to the improvement of privacy in IEEE WAVE security services and applications such as near-field vehicle payment and DSRC security services by proposing an improved anonymous authentication system based on batch verification and zero-knowledge proofs. According to experimental findings, the recommended method has a lower computational overhead than a number of competing systems up until the batch of signatures that have to be checked contains more than eleven. Furthermore, we suggest the optimal batch processing verification cycle, tailored to the scheme's use in the near-field vehicle payment and basic safety message (BSM) use cases of DSRC.

Keywords IoT · Connected vehicle network · Security · Intelligent transportation

1 Introduction

In intelligent transportation systems, vehicular networking enables real-time information exchange between vehicles and infrastructure, playing a positive role in enhancing traffic safety, reducing environmental pollution, alleviating traffic congestion, and providing convenience. Current standards

✉ S. A. Sivasankari
s.a.sivasankari@gmail.com

Deepak Gupta
drdeepakg80@gmail.com

Ismail Keshta
imohamed@um.edu.sa

Ch. Venkata Krishna Reddy
Chkrishnareddy_eee@cbit.ac.in

Pavitar Parkash Singh
pavitar.19476@lpu.co.in

Haewon Byeon
hhwpuma@naver.com

1 Vignan's Foundation for Science, Technology and Research (Deemed to be University), Guntur, India

2 Department of CSE, Institute of Technology and Management, Gwalior, India

3 Computer Science and Information Systems Department, College of Applied Sciences, AlMaarefa University, Riyadh, Saudi Arabia

4 Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, India

5 Department of Management, Lovely Professional University, Phagwara, India

6 Department of Digital Anti-aging Healthcare, Inje University, Gimhae 50834, Republic of Korea

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Research papers

Hybrid method based energy management of electric vehicles using battery-super capacitor energy storage

Omar A. AlKawak [a,*], Jambi Ratna Raja Kumar [b], Silas Stephen Daniel [c], Chinthalacheruvu Venkata Krishna Reddy [d]

[a] Department of Energy Engineering, College of Engineering/Al-Mussaib, University of Babylon, Hilla, Babylon, Iraq
[b] Department of Computer Engineering, Genba Sopanrao Moze College of Engineering, Balewadi, Pune, India
[c] Department of Electrical and Electronics Engineering, Panimalar Engineering College, Chennai, Tamil Nadu, India
[d] Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, India

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ABSTRACT

This paper presents a hybrid technique for managing the Energy Management of a hybrid Energy Storage System (HESS), like Battery, Supercapacitor (SC), and integrated charging in Electric Vehicle (EV). The proposed hybrid method combines the Namib Beetle Optimization (NBO) and Quantum Neural Networks (QNN) technique and is commonly known as the NBO-QNN approach. The proposed energy management technique reduces EV power use and maximizes battery life. QNN forecasts and combines power supply and charge levels to fulfill load needs. EV energy management uses NBO to regulate the output voltage, generate references, and regulate current continuously. Higher energy density battery and power density SC meet vehicle needs. An uncontrolled rectifier with a DC-to-DC buck converter balances charging and ensures energy transmission. The Proposed technique is implemented using the MATLAB platform, and its performance is compared to existing methods. HESS performance is evaluated by comparing it to existing systems. The research shows that the proposed strategy reduces the primary and secondary source stress, enhances performance of charging unit, and extends the life of battery. Furthermore, the NBO-QNN technique outperforms other existing methods, such as the Cooperation Search Algorithm (CSA), Latent Semantic Analysis (LSA), and Grasshopper Optimization Algorithm (GOA). The proposed method displays the best output in all existing Cooperation Search Algorithm (CSA), Latent Semantic Analysis (LSA), and Grasshopper Optimization Algorithm (GOA) methods. The result concludes that the NBO-QNN approach based on THD value is less than existing methods.

1. Introduction

Recently, there has been a notable shift within the automatic industry towards EVs as a sustainable and eco-friendly mode of transportation [1]. This transition is primarily motivated by climate change, air pollution, and fossil fuel depletion concerns [2]. Governments, businesses, and individuals worldwide acknowledge the significance of transitioning from internal combustion engine vehicles to EVs [3]. The current status of electric vehicles indicates rapid growth and increasing market penetration [4]. Global sales of electric vehicles have been consistently rising, with major automakers making substantial investments in EV technology and expanding their electric vehicle product lines [5].

Additionally, advancements in battery technology have significantly enhanced EVs' performance and driving range, alleviating one of the primary concerns for potential buyers. The importance of electric vehicles extends beyond personal transportation [6]. The transportation sector contributes significantly to greenhouse gas emissions, and the widespread use of EVs can be crucial to lowering carbon dioxide emissions and combating climate change. Moreover, electric vehicles offer the potential for decentralized energy storage and grid integration, facilitating the incorporation of renewable energy sources and enabling a more sustainable energy ecosystem [7]. To lower battery aging costs and increase fuel economy, researchers have recently concentrated on understanding the application of improved HESS in plug-in hybrid EVs (PHEVs). They have developed a new PHEV power system configuration

* Corresponding author.
E-mail addresses: [illegible] (O.A. AlKawak), [illegible] (J.R.R. Kumar), [illegible] (S.S. Daniel), [illegible] (C.V.K. Reddy).

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Research Article

Jing Chang, Huiqin Li, Na Xiao, Pavitar Parkash Singh*, Prashant Vats, and Chinthalacheruvu Venkata Krishna Reddy

Fault diagnosis of electrical equipment based on virtual simulation technology

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Abstract: In order to efficiently and accurately diagnose train electrical faults, we propose a fault diagnosis method for electrical equipment based on virtual simulation technology. First, Creo software was used to build a subway train model. Then, 3DMAX software was used to make animation and demonstrate the working principle and action process of the train electrical system. Finally, using Unity 3D software, a human–computer interaction mechanism was established, achieving presence and realism. This system realizes the functions of knowledge learning, student assessment, principal display, and troubleshooting of the electrical system of subway trains and is compared with the method of manual diagnosis. Experimental results show that in the designed fault diagnosis system, the detection time for various types of faults is shorter than 30 s, whereas the diagnosis time of the manual diagnosis method is 30–52 s. It shows that the electrical equipment fault diagnosis system based on virtual simulation has the advantages such as short fault diagnosis time and high efficiency. In addition, the highest diagnostic accuracy of the manual diagnosis method is 75.48%, which is far lower than the accuracy of the diagnostic system. Conclusion: It is proved that the designed fault diagnosis system has the advantages such as short detection time and high accuracy and can meet the safety requirements of industrial production.

Keywords: virtual reality, subway train, electrical system, simulation

1 Introduction

There are two methods for the inspection and maintenance of electrical equipment in the production plant: the first is the maintenance method after an accident occurs. This method is to be repaired after the electrical equipment in the installation has a fault problem; in this way of maintenance, the accident of the production device has occurred, and it has an impact on the continuous, stable, and safe production operation of the device; therefore, the economic loss and time loss that the production enterprise has to bear under this maintenance method are also the largest. Since the economic loss of this maintenance method is the largest, in this enterprise, among the requirements for electrical equipment management, the inspection and maintenance work after the failure is only used during the operation of the production plant; the normal production and operation of the production device does not have a substantial impact; the degree is very small; it does not require electrical equipment that must be running at all times, and has spare electrical equipment, or uses other forms of inspection and maintenance methods that are uneconomical and unscientific device [1]. The second maintenance method is preventive regular maintenance. In this method, based on the operating time of the equipment, the maintenance staff usually divide the maintenance of electrical equipment into medium repairs and minor repairs; whether the electrical equipment needs to be overhauled is judged by the sound of the electrical equipment running and the temperature of the equipment during the staff patrol inspection process; this requires employees to summarize their experience, so there will be errors in judgment; especially for new employees with less experience, the probability of errors will increase, for electrical equipment that is not in operation for a long time; because there are established management regulations, employees must follow the content of the

* **Corresponding author: Pavitar Parkash Singh,** Department of Management, Lovely Professional University, Phagwara, India, e-mail: pavitar.19476@lpu.co.in
Jing Chang: Engineering Department, Huanghe Science and Technology College, Zhengzhou, Henan 450063, China, e-mail: JingChang13@163.com
Huiqin Li: Engineering Department, Huanghe Science and Technology College, Zhengzhou, Henan 450063, China, e-mail: HuiqinLI6@126.com
Na Xiao: Engineering Department, Huanghe Science and Technology College, Zhengzhou, Henan 450063, China, e-mail: NaXiao28@163.com
Prashant Vats: Department of CSE, SCSE, Manipal University Jaipur, Jaipur, Rajasthan, India, e-mail: Prashantvats12345@gmail.com
Chinthalacheruvu Venkata Krishna Reddy: Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, India, e-mail: Chkrishnareddy_eee@cbit.ac.in

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ORIGINAL PAPER

Energy management of solar photovoltaic fed water pumping system based BLDC motor drive using NBO–SDRN approach

Kanthapitchai Paul Joshua[1] · Lenin Vadugapalayam Rangasamy[2] · Chinthalacheruvu Venkata Krishna Reddy[3] · Rajangam Veeruchinnan[4]

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Abstract

This paper proposes a hybrid NBO–SDRN approach for a solar PV (SPV) array fed water pumping system utilizing a single-ended primary inductor converter (SEPIC) based BLDC motor drive. The proposed hybrid method combines Namib beetle optimization algorithm (NBO) and spiking deep residual networks (SDRN). Commonly, it is named the NBO–SDRN technique. The main goal of the NBO–SDRN method is enhanced energy efficiency, improved control algorithms, and optimal utilization of available solar energy resources. This paper focuses on integrating a SEPIC converter-based brushless DC motor drive in such systems to optimize energy conversion, enhance control, and promote environmentally friendly water supply. The BLDC (brushless direct current) motor drive and advanced control algorithms enable precise speed and torque control, improving overall energy efficiency and adaptability to varying water demand. By then, the NBO–SDRN method is done in the MATLAB working stage, and the execution is calculated with the present procedures. The proposed approach performs better outcomes in all existing singular spectrum analysis (SSA), heap-based optimization (HBO), and bee circle search algorithm (CSA) methods. From the result, the NBO–SDRN method-based efficiency is 95% higher than the existing methods.

Keywords Brushless DC (BLDC) · Domestic water supply · Maximum power point tracking (MPPT) · SEPIC · SPV · Water pumping systems (WPS)

1 Introduction

The popularity of SPV (solar photovoltaic) systems for sustainable energy [1] has driven the development of SPV array-fed water pumping systems, which are crucial for remote areas with limited power access. These systems address water needs for irrigation, livestock, and domestic use while avoiding the cost and environmental impact of fossil fuel or grid-powered pumps. They integrate power converters, PV arrays, and BLDC (Brushless DC) motors for efficient power transfer. The SEPIC converter optimizes power extraction from solar arrays and provides stable DC bus voltage for the BLDC motor drive [2]. The BLDC motor drive offers advanced control features, including MPPT algorithms, ensuring optimal use of solar energy. By integrating these components, a reliable and efficient system for harnessing solar energy to power water pumps is achieved, contributing to sustainable water pumping solutions [3].

This system provides a sustainable solution for water pumping, particularly in remote regions with limited access to electricity [4]. Integrating the SEPIC converter and BLDC

✉ Kanthapitchai Paul Joshua
k.pauljoshua@gmail.com

Lenin Vadugapalayam Rangasamy
leninrangasamy@gmail.com

Chinthalacheruvu Venkata Krishna Reddy
chkrishnareddy_eee@cbit.ac.in

Rajangam Veeruchinnan
rajangam.accet@gmail.com

1 Department of Electronics and Communication Engineering, St. Peter's College of Engineering and Technology, Chennai, Tamil Nadu 600054, India

2 Department of Mechanical Engineering, Anil Neerukonda Institute of Technology and Sciences, Sangivalasa, Visakhapatnam, Andhra Pradesh 531162, India

3 Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, India

4 Department of Mechanical Engineering, Panimalar Engineering College, Chennai, Tamil Nadu, India

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Intelligent Driverless Delivery Solutions Using Recent Ai Technology

[1]Dr. G. Raghavendra, [2]Abhay Chaturvedi, [3]Dr. Amrapali S. Chavan, [4]Dr. Puran Singh, [5]Dr. S. Farook, [6]Dr. Ch.Venkata Krishna Reddy, [7]Dr. Anurag Shrivastava

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Abstract: In this article, we investigate how the introduction of completely autonomous automobiles may alter the current state of the transportation industry. This article examines the benefits and drawbacks of autonomous cars, as well as the ways in which these vehicles may influence the travelling behaviours of individuals and the future of transportation infrastructure, such as roadways, parking lots, and public transportation. According to this forecast, fully autonomous Level 5 vehicles that can function with no interference from humans may be commercially accessible and legally deployed in some regions by the late 2021s, despite the fact that their prices are likely to be extremely costly and that their performance will be below par. We won't see the majority of the effects, such as reduced parking and traffic congestion, independent movement for low-income people (and thus a reduced need for public transportation), increased safety, energy conservation, and pollution reductions, until driverless cars become commonplace and affordable in the 2040s to the 2060s. It's possible that only autonomous vehicles should be driven from this point on in order to get the maximum benefits.

Keywords: *driverless delivery, last-mile automation, autonomous driverless vehicle, last-mile delivery and artificial Intillenegce.*

1. Introduction

It is unavoidable that conventional warehouses, which are sometimes referred to as distribution centres, will see substantial transformations as the logistics sector continues to advance. Alterations in client expectations, features of demand, and service needs are also factors in new methods to success and distribution. This change is driving the development of an entirely new sort of warehouse that is extremely adaptable, scalable, and responsive, and that makes the most of the complimentary capabilities that people and robots have to offer. As a second item to consider, the physical and mechanical qualities of a certain era make for wonderful keepsakes since they capture the essence of that age. The term "smart warehouse" is being used to refer to a new type of warehouse that is being made possible by recent advancements in areas such as collaborative robotics, augmented reality, autonomous automobiles, sensor technologies, and the internet of things. For example, a so-called "warehouse four.0" that implements a lean strategy throughout its whole supply chain has the potential to be successful. In addition, standard operating procedures for warehouses need to give simulation of overall performance measurements the highest priority before they can be evaluated in the real world [1].

[1]Associate Professor, Department of Electrical and Electronics Engineering, Sapthagiri College of Engineering, Bangalore
meeraga81@gmail.com
[2]Associate Professor, Department of Electronics and Communication Engineering, GLA University, Mathura, Uttar Pradesh, 281406
abhay.chat@gmail.com
[3]Assistant Professor, Department of Computer Engineering, AISSMS Institute of Information Technology, Pune
amrapali.chavhan@aissmsioit.org
[4]Assistant Professor, Department of Mechanical and Automation Engineering,
AIT, Amity University, Noida
puran.singh010@gmail.com
[5]Professor, Department of Electrical and Electronics Engineering, Sree Vidyanikethan Engineering College, Mohan Babu University, Tirupathi, Andhra Pradesh
farook_205@yahoo.co.in
[6]Assistant Professor, Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad
Chkrishnareddy_eee@cbit.ac.in
[7]Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamilnadu, India
*anuragshri76@gmail.com

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ORIGINAL PAPER

Cancer prediction with gene expression profiling and differential evolution

T R Vijaya Lakshmi[1] · Ch. Venkata Krishna Reddy[2]

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Abstract
In the field of bioinformatics, the classification of tumors is a difficult and time-consuming task. When diagnosing cancer, gene expression levels are typically one of the most useful tools. However, the biological noise present in microarray data leads to unsatisfactory precision and accuracy. The utilization of thousands of genes in the process of diagnosing tumors is an important task. The two levels of feature selection have been proposed in order to determine the genes that are the most informative to diagnose cancer. Using three different statistical methods, the first level of selection reveals the prognostic genes. In the second level, the differential evolution algorithm considers the prognostic genes that were obtained from statistical measures as initial members to identify the most relevant features. The scaling factor in the modified differential evolution algorithm was made to vary in a dynamic manner in order to evolve the mutant member of the population. The proposed model is a hybrid of statistical approach and evolutionary computation with modified differential evolution algorithm that identifies the candidate genes from thousands of genes from gene expression data. The findings obtained through this hybrid approach upon using five gene expression datasets provide evidence that it has outperformed when compared to the existing systems for DLBCL outcome, prostate outcome, prostate, and colon tumor datasets with improved classification accuracies of 14%, 4%, 0.62%, and 0.13%, respectively.

Keywords SVM classifier · Differential evolution · Fitness measures · Gene expression data · Statistical measures

1 Introduction

Cancers of the urinary tract accounted for 13.1% of the 19.3 million new cases of cancer that were diagnosed worldwide in 2020 [1]. It is the most common type of urologic cancer to be diagnosed, followed by malignancies of the bladder, kidneys, testes, and penile tissue [1]. It most usually affects males who are over the age of 65. More than 80 percent of men are found to have localized illness at the time of diagnosis, and the majority of these individuals will have indolent tumors that develop slowly and have a low risk of dying specifically from prostate cancer [2]. Active surveillance, curative purpose surgery, or radiotherapy are the most successful treatments for these men, resulting in a disease-specific survival rate of more than 90 percent after 10 years.

When compared to normal tissues, prostate cancer causes considerable changes to occur in the transcription of genes and the metabolic signaling pathways, which in turn affect changes in the selection of metabolic substrates and the acquisition of nutrients [3]. On the other hand, some people are diagnosed with indolent tumors, which almost never develop into a more advanced stage or have an impact on their quality of life. It is critical for doctors to inform patients about the possibility of cancer cure before therapy begins [4].

Microarray method is extensively used to measure thousands of gene expression (GE) levels. These expression profiles are capable to diagnose tumors. The gene expression matrix is formed from the raw microarray data [5,6]. Every row of the gene expression matrix contains the gene expression levels of a sample. The columns of the matrix represent the number of trial conditions or samples. The problems with these gene data are that the number of samples is low and the expression levels are high in number. Removing irrele-

✉ T R Vijaya Lakshmi
trvijayalakshmi_ece@mgit.ac.in

Ch. Venkata Krishna Reddy
chkrishnareddy_ece@cbit.ac.in

[1] ECE, Mahatma Gandhi Institute of Technology, Gandipet, Hyderabad 500075, Telangana, India

[2] EEE, Chaitanya Bharathi Institute of Technology, Gandipet, Hyderabad 500075, Telangana, India

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A Novel Optimization Approach for Smart Grid Systems with Nano-sized Objects

[Новий підхід до оптимізації для систем Smart Grid для нанорозмірних об'єктів]

Chiranjivi M.[a]; Obulesu O.[b]; Loganathan, Ganesh Babu[c]; Kayalvili S.[d]; Naregalkar, Prajakta[e]; Reddy, Ch. Venkata Krishna[f]; William P.[g]

Save all to author list

[a] Department of EEE, Hyderabad Institute of Technology and Management, Telangana, 501401, India
[b] Department of Electrical & Electronic Engineering, CVR College of Engineering, Telangana, Hyderabad, India
[c] Department of Mechatronics, Faculty of Engineering, Tishk International University-Erbil, Kurdistan Region, Iraq
[d] Department of Computer Science and Engineering, Vellalar College of Engineering and Technology, Tamil Nādu, Erode, India

View additional affiliations

Abstract

Rapid technological advancement has led to breakthroughs in several fields, including the smart grid and the nano sized objects. The usage of nano objects has grown dramatically during the recent years on a global scale. Integration of different supporting protocols and technologies addressing storage, sensing, processing power, connectivity, and other areas is a barrier to effective nano-based deployment. Future power grid generations are anticipated to rely heavily on sensors, actuators, and transducers to deliver real-time energy monitoring services. While this may appeal to consumers because it offers them the ability to manage and monitor their energy consumption in real-time, the

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Том 15 № 4, 04022(5сс) (2023)

Distributed Electromagnetic Radiation Based Renewable Energy Assessment Using Novel Ensembling Approach

Avinash Kumar[1], Chetan More[2], Namita K. Shinde[2], Nikale Vasant Muralidhar[3], Anurag Shrivastava[4], Ch. Venkata Krishna Reddy[5], P. William[6,*]

[1] *Guru Gobind Singh Educational Society's Technical Campus, Bokaro Jharkhand- 827013, Jharkhand University of Technology, Ranchi, India*
[2] *Department of E&TC, Bharati Vidyapeeth (Deemed to be University) College of Engineering, Pune, India*
[3] *Department of Physics, Rayat Shikshan Sanstha's Dada Patil Mahavidyalaya, Karjat Dist Ahmednagar, Maharashtra, India*
[4] *Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamilnadu, India*
[5] *Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Hyderabad, India*
[6] *Department of Information Technology, Sanjivani College of Engineering, SPPU, Pune, India*

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Using a sophisticated resembling based machine learning (ML) algorithm, this research looks at the direction of renewable energy generation based on distributed electromagnetic radiation and how it relates to the consumption of traditional energy sources. For a feasibility analysis of the energy system design strategy, a forecasting model for renewable energy with a long-time horizon may be used. In this paper, an enhanced attribute-scaled naive Bayesian (EASNB) method is proposed for assessing sustainable renewable energy. For this study, we first collect a dataset on renewable energy sources, and then we normalize the actual data as a pre-processing step to get an accurate energy assessment. Then, the relevant attributes from the pre-processed data are extracted using linear discriminant analysis (LDA). Consequently, the efficient assessment of sustainable renewable energy is accomplished using the suggested EASNB approach. The suggested method's ability is measured in terms of R2 value, MASE, AMRE, accuracy indicators, and is compared with that of existing approaches. The findings of this research indicate that, when it refers to the evaluation of sustainable renewable energy, our method performs better than the ones currently in use. A healthy environment results from determining the exact and appropriate consumption of energy and promoting the use of sustainable energy. Future estimates expect the consumption of renewable energy at around 79.03 EJ in 2025 as well as 55% of energy output on average in 2040.

Keywords: Electromagnetic radiation, Energy consumption, Machine learning (ML), Linear discriminant analysis (LDA), Enhanced attribute-scaled naive Bayesian (EASNB).

DOI: 10.21272/jnep.15(4).04022 PACS number: 88.05.Np

1. INTRODUCTION

Globally, the use of renewable energy sources considering wind power, solar energy, and fuel cells has been encouraged via the implementation of sustainable and renewable energy networks and laws. Information regarding renewable energy may have an effect on the economic and environmental feasibility of renewable energy sources in a number of ways, including the choosing of renewable energy facilities in light of their capabilities and the daily complex patterns of energy demand and supply [1]. For a feasibility analysis of the energy system design strategy, a forecasting model for renewable energy with a long-time horizon may be used. In addition, this approach can cut down on unneeded regulatory expenses while integrating renewable energy sources into the energy system [2].

The electric power system faces difficulties as a result of the increasing penetration of renewable energy since its supply is erratic and may not match demand perfectly. As an illustration, a sudden variation in frequency may result from days that are gloomy, wet, and windless. These energy resources instability and low producing inertia lead to an imbalance in the power system, which can compromise the stability of the electric grid. It is necessary to continually manage the balance between supply and demand in order to preserve the stability and dependability of power networks with significant penetrations of renewable energy sources [3]. The investigation of connected issues is nonlinear and unpredictable since the electric and sustainable energy networks are undergoing continuous dynamic change. Its study is mostly hindered by the fact that most of the time it is hard to develop precise mathematical formulas or to define it using statistical models [4]. For the purpose of evaluating sustainable renewable energy sources, an enhanced attribute-scaled naive Bayesian (EASNB) technique has been presented.

The further part of the study includes section II indicates the related works, section III indicates the suggested work, phase IV indicates the result and discussion, and phase V indicates the conclusion.

* william160891@gmail.com
The results were presented at the 3rd International Conference on Innovative Research in Renewable Energy Technologies (IRRET-2023)

Unbalanced operation of integrated power distribution system for optimal energy flow using LSO-vCANNs approach

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Environment, Development and Sustainability

Aims and scope

Submit manuscript

M. Bhoopathi, Venkata Prasad Papana, ch. Venkata Krishna Reddy & U. Arun Kumar

Abstract

The integrated energy distribution system (IEDS) integrates the natural gas, thermal, and electrical networks at the distribution level. Because of its high cost and complicated operation of the imbalanced electrical distribution network, the load flow problem of the IEDS was disregarded in the operation of integrated energy distribution systems (IESs). This paper focuses on the operation optimization of IEDSs by introducing a novel hybrid approach for an unbalanced operation of the power distribution system for optimal energy flow. The

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Research Article

Microgrids with day-ahead energy forecasting for efficient energy management in smart grids: hybrid CS-RERNN

C. P. Shirley, Jagannath Pattar, P. Kavitha Rani, Sumit Saini, Jarabala Ranga, D. Elangovan & ...show all

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RESEARCH PAPER

Intelligent mobility planning for a cost-effective object follower mobile robotic system with obstacle avoidance using robot vision and deep learning

Sai Nikhil rao Gona[1] · C. H. Harish[1]

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Abstract
Few industries use manually controlled robots or automobiles to carry material to the desired position, and in some cases, man power are used due to a lack of money. This cannot be used all the time, in all places and all conditions. So, it is very tranquil to have robots which can follow a specific human by following the unique coloured object held by that person. So, we propose a robotic system that uses robot vision and deep learning to get the required linear and angular velocities, which are v and ω, respectively, making the robot avoid static and dynamic obstacles when following the unique coloured object. We propose a novel LSTM cell called TF-LSTM, which makes the proposed methodology very accurate in tracking the object in 3D space. TF-LSTMs or target follower LSTMs are inspired by the traditional LSTMs and give a meagre error in linear and angular velocity prediction. The PI controller, which was used to control the linear and angular velocities, which in turn controls the position of the robot, gave us impressive results, and this methodology outperforms all other methodologies for precise target tracking in performance comparision. The proposed TF-LSTM gave us an accuracy of 96.1%, average linear jerk of 0.4 m/s^3, average angular jerk of 30 $degrees/s^3$, average clearance of 0.514 m, maintaining no collosions with the obstacles.

Keywords TF-LSTMs · Computer vision · Neural networks · TF-loss · PI controller · Obstacle avoidance

1 Introduction

The field of artificial intelligence and robotics is playing an imperative role in our lives these days [1], human efforts have abridged a lot due to artificial intelligence, and research is still being done in artificial intelligence [2] to make household and domestic works simpler with minimal physical efforts. Artificial neural networks with computer vision are one of the essential techniques for producing intelligent domestic and industrial robots. Carrying weights from one place to the other is where a lot of human effort is required, and the labour cost has increased a lot in the past couple of years, so it is getting complicated for industrialists to hire more labour in industries, airports and shopping malls for carrying weights from one place to the other. So, in order to reduce the cost spent on labour, we need to adopt an automatic mechanism instead of employing many people as labours. The most crucial factor that we need to consider while adopting an automatic mechanism is the cost of the mechanism. In this kind of scenario, we can adopt mobile robotic systems which can do the work efficiently, which is to carry heavy objects from one place to the other. This brings down the amount of money spent on labour and the overall money spent on manufacturing.

In countries like the US and the UK, the labour shortage has been a substantial problem in the industries, and 8 out of 10 manufacturing executives feel that workforce shortages or skill deficiencies in production roles have a negative and significant impact on their ability to meet customer demand. For this reason, industries have adopted artificial intelligence techniques, intelligent systems, and robotics. Robots can replace any work in the industrial sector, which requires a lot of labour. Adopting robots also reduces the amount of money spent on the workforce since robots are developed in such a way that the work done by one robot is

✉ Sai Nikhil rao Gona
gonasainikhil@gmail.com

C. H. Harish
harishch_eee@cbit.ac.in

[1] Department of Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology, Gandipet, Telangana, India

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RESEARCH ARTICLE

Load frequency control in deregulated power system with renewable energy sources: Hybrid GOA-SNN technique

C. Srisailam ✉, M. Manjula, K. Muralidhar Goud

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https://doi.org/10.1002/oca.3099

Abstract

This paper proposes a hybrid technique for load frequency control (LFC) in an inter-connected deregulated power-system. The proposed method is the combination of a gannet optimization algorithm (GOA) and spiking neural network (SNN), hence, it is named as GOA-SNN technique. The objective of the proposed method is to minimize frequency deviations within the power system (PS). By lessening the frequency-deviation and tie-line power variation, this approach ensures system frequency-control under the effect of load disturbances. The GOA method is utilized to generate the set of control signals of the controller. The SNN method is used to predict the optimum gain parameter of the controller. By then the proposed method is run in MATLAB software and evaluated their performance with various existing approaches. The proposed metho shows better results than other existing methods, such as Ant Lion Optimization (ALO), particle swarm optimization (PSO), and Salp Swarm Algorithm (SSA). The GOA-SNN approach shows a low Area control error is 0.48% and a high efficiency is 96% compared with other existing approaches.

Open Research

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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ORIGINAL RESEARCH

Design of multi-input single output DC–DC converter with preserved output voltage under source-fault

M. Dhananjaya[1] | B. Krishna Chaitanya[2] | Thanikanti Sudhakar Babu[2] | Devendra Potnuru[3] | Belqasem Aljafari[4] | Ramani Kannan[5] | Tarun Kumar Lohani[6]

[1]Department of Electrical and Electronics Engineering, ANITS, Visakhapatnam, Andhra Pradesh, India

[2]Department of Electrical and Electronics Engineering, CBIT, Hyderabad, Telangana, India

[3]Department of Electrical and Electronics Engineering, GVP College of Engineering for Women, Visakhapatnam, Andhra Pradesh, India

[4]Department of Electrical Engineering, College of Engineering, Najran University, Najran, Saudi Arabia

[5]Electrical and Electronics Engineering Department, Universiti Teknologi PETRONAS, Seri Iskandar, Malaysia

[6]Faculty of Hydraulic and Water Resources Engineering, AWTI, Arba Minch University, Arba Minch, Ethiopia

Correspondence
Tarun Kumar Lohani, Faculty of Hydraulic and Water Resources Engineering, AWTI, Arba Minch University, Arba Minch, Ethiopia.
Email: tarun.kumar@amu.edu.et

Abstract

Multi-input converters play an important role in integrating the independent energy sources utilized in the grid-connected system and electric vehicle (EV) applications. In this scenario, several types of multi-input converters are presented in the literature. Most of the MICs are operated using a time-sharing scheme. This leads to a restricted duty cycle which limits the energy sources utilization and output voltage. To overcome the aforementioned limitations, a multi-input single-output (MISO) boost converter is proposed. It can improve the utilization of energy sources and output voltage with a reduction in the part count. To verify the feasibility of the proposed scheme, a 200 W prototype circuit is developed; simulation and experimental results are validated.

1 | INTRODUCTION

Renewable energy sources have seen a surge in demand for electric vehicles (EVs), auxiliary power, and grid-connected applications over the last decade. Multiport DC–DC converters are required in these applications for hybridizing energy sources, which reduces the number of components, complexity, and cost of the system [1–5].

In [6], a MISO converter with a lower device count is presented. However, produce a negative output voltage. In [7] and [8], this constraint has been addressed, and the converter can be used in all converter modes like buck-boost (BB), boost, and buck configuration. Nonetheless, one energy source is used to give energy at the same time, which leads to reduce the input source utilization. In [9, 10], suggested an enhanced version of the existing design given in [7]. However, it is operated in buck-boost mode. Ref. [11] designed a structure with fewer components and higher output voltage. On the other hand, may have an impact on MISO functioning, when the energy source $V_1 < V_2$ instance.

The above-mentioned topologies structure is improved in [12, 13], and [14] such as positive output voltage and can also operate in boost, buck, and buck-boost modes, energy storage. MISO boost topologies with decreased semiconductor devices have been developed in recent years for integrating the sources in EV applications and grids [15–20]. These converters, on the other hand, increase energy storage elements, which may have an impact on cost. A New DISO converter is designed in [21] for an energy harvesting system in IoT sensor nodes. The key features of the topologies are low voltage stress and power components. However, it has a constraint on the duty ratio, that is, $D_1 < 0.5$. The dual-input boost converter is proposed in [22]

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