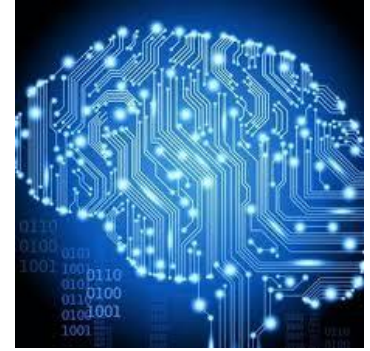




UNIVERSITY OF LAGOS  
DEPARTMENT  
OF  
COMPUTER SCIENCES



MACHINE INTELLIGENCE RESEARCH GROUP  
(MIRG)

## **BOOK OF ABSTRACTS**

**1<sup>ST</sup> INTERNATIONAL (VIRTUAL) CONFERENCE  
ON ARTIFICIAL INTELLIGENCE AND  
ROBOTICS (ICAIR 2021)**

**September 21 – 22, 2021**

### **THEME:**

**HARNESSING DEEP LEARNING ALGORITHMS  
FOR POST COVID-19 NATIONAL DEVELOPMENT  
IN LOW- AND MEDIUM-INCOME  
COUNTRIES (LMIC'S)**

## A. SCIENTIFIC COMMITTEE

Dr. B. A. Sawyerr  
Chairman, Machine Intelligence Research Group,  
Department of Computer Sciences  
University of Lagos, Akoka  
Email: [bsawyerr@unilag.edu.ng](mailto:bsawyerr@unilag.edu.ng)  
Mobile: +234 803 326 3578

Dr. Ebun P. Fasina  
Chairman, Mathematical Analysis and Optimization Research Group,  
Department of Computer Sciences  
University of Lagos, Akoka  
Email: [efasina@unilag.edu.ng](mailto:efasina@unilag.edu.ng)  
Mobile: +234 802 522 3896

Dr. Victor T. Odumuyiwa  
Ag. Director NITDA IT Hub  
University of Lagos  
Email: [vodumuyiwa@unilag.edu.ng](mailto:vodumuyiwa@unilag.edu.ng)  
Mobile: +234 807 326 2764

Dr. Oladipupo A. Sennaike  
Machine Intelligence Research Group,  
Department of Computer Sciences  
University of Lagos, Akoka  
Email: [osennaike@unilag.edu.ng](mailto:osennaike@unilag.edu.ng)  
Mobile: +234 803 332 2378

Dr. Chika O. Yinka Banjo  
Machine Intelligence Research Group,  
Department of Computer Sciences  
University of Lagos, Akoka  
Email: [cyinkabanjo@unilag.edu.ng](mailto:cyinkabanjo@unilag.edu.ng)  
Mobile: +234 803 342 4289

Dr. Hudson Akewe  
Machine Intelligence Research Group,  
Department of Mathematics  
University of Lagos, Akoka  
Email: [hakewe@unilag.edu.ng](mailto:hakewe@unilag.edu.ng)  
Mobile: +234 803 3601 1788

Dr. Solomon A. Akinboro  
Machine Intelligence Research Group,  
Department of Computer Sciences

University of Lagos, Akoka  
Email: [sakinboro@unilag.edu.ng](mailto:sakinboro@unilag.edu.ng)  
Mobile: +234 810 631 6876

Dr. Adewole U. Rufai  
Machine Intelligence Research Group,  
Department of Computer Sciences  
University of Lagos, Akoka  
Email: [arufai@unilag.edu.ng](mailto:arufai@unilag.edu.ng)  
Mobile: +234 803 433 6246

Dr. Femi O. Alamu  
Machine Intelligence Research Group,  
Department of Computer Sciences  
University of Lagos, Akoka  
Email: [falamu@unilag.edu.ng](mailto:falamu@unilag.edu.ng)  
Mobile: +234 803 490 5719

Professor Christopher Thron  
Texas A & M University, Central Texas, USA  
Email: [thron@tamuct.edu](mailto:thron@tamuct.edu)

Dr. Clement Nyirenda  
Department of Computer Science  
University of the Western Cape (UWC),  
Cape Town, South Africa  
Email: [cnyirenda@uwc.ac.za](mailto:cnyirenda@uwc.ac.za)

## **B. LOCAL ORGANIZING COMMITTEE**

Dr. B. A. Sawyerr	-	Chairman
Dr. Ebun P Fasina	-	Member
Dr. Victor T. Odumuyiwa	-	Member
Dr. Oladipupo A. Sennaike	-	Member
Dr. Hudson Akewe	-	Member
Dr. Adewole U. Rufai	-	Publications
Mrs. Chika P. Ojiako	-	Secretary
Mr. Ugot Ogban Asuquo	-	Member

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Mr. Fatai Adewale

## **CHIEF HOST**

Professor Oluwatoyin T. Ogundipe  
Vice Chancellor,  
University of Lagos, Akoka, Yaba, Lagos

## **CONFERENCE VIRTUAL LINK**

**Zoom Meeting link:**

<https://us02web.zoom.us/j/86037419498?pwd=anhKcDIMWWNzTk9Bc0VlZlh3SkM0dz09>

**Meeting ID:** 860 3741 9498

**Passcode:** 724660

## TIMETABLE FOR THE CONFERENCE

Day	9.00am–10.50am	11.00am – 1.00pm	1.00pm-2.00pm	2.00pm – 2.40pm	2. 50pm -5.00pm
Tuesday September 21, 2021	Conference Opening Ceremony	<b>Session I</b> Paper Presentation	LUNCH BREAK	<b>First Plenary</b> Dr. EP. Fasina	<b>Session II</b> Paper Presentation
	<b>9.00am – 9.40am</b>	<b>9.50am – 1.00pm</b>	<b>1.00pm</b>		
Wednesday September 22, 2021	<b>Second Plenary</b> Dr. C. Nyirenda	<b>Session III</b> Paper Presentation	Closing Ceremony		

### Tuesday, September 21<sup>st</sup> 2021 Time

<b>Conference Opening Ceremony</b>	<b>9.00 am - 10.50 am</b>
Opening Prayer	5 minutes
National Anthem	5 minutes
Introduction of Dignitaries	10 minutes
Opening Remarks from <b>Head</b> , Department of Computer Sciences	5 minutes
Welcome Address from Chief Host, <b>Vice- Chancellor</b> , University of Lagos	10 minutes
Message from <b>Dr. B. A. Sawyerr</b> , Chairman, MIRG	5 minutes
Keynote Address by <b>Prof. Christopher Thron</b>	40 minutes
Message from President, Nigeria Computer Society (NCS)	5 minutes
Message from President Computer Professional Registration Council of Nigeria (CPN)	5 minutes
Message from Deputy Vice Chancellor (Academic & Research)	5 minutes
Message from Director (Research & Innovation)	5 minutes
Message from Dean, Faculty of Science, University of Lagos	5 minutes
Closing Remarks & Vote of Thanks by <b>Chairman</b> , LOC	5 minutes

### Wednesday, September 22<sup>nd</sup> 2021 Time

<b>Closing Ceremony</b>	<b>1.00 pm – 1.30 pm</b>
Interactive Session	15 minutes
Farewell Remarks from Chairman, MIRG	5 minutes
Vote of Thanks by Secretary, MIRG	5 minutes
Closing Prayer	5 minutes

## PAPER PRESENTATION SCHEDULE

**11.00am – 1.00pm**

**Session 1**

**MODERATORS:**

*Dr. V. T. Odumuyiwa and Dr. C. O. Yinka Banjo*

**Mohammed M. Abubakar, Bashir Z. Adamu, Muhammad Z. Abubakar**

*Pneumonia Classification Using Hybrid CNN Architecture on Chest X-ray Images*

**Igor K. Kouam and Marcellin A. Nkenlifack**

*Intrusion Detection in Healthcare Systems*

**Tosho A. AbdulRahman and Raimot A. Ajiboye**

*Performance Evaluation of Improved Model for Spectrum Occupancy Prediction on TV Band*

**Nasir Umar, Oyefolahan I. Ishaq, Idris M. Kolo and Adelowo S. Adepoju**

*Heart Disease Prediction Based on Improved Feature Set Using Weighted Moving Averaging Technique*

**1.00pm – 2 .00pm**

**Lunch Break**

**2.00am – 2.40pm**

**First Plenary Session**

**Ebun Fasina**

*Deep Learning Architectures*

**2.00–5.00pm**

**Session 2**

**MODERATORS:**

*Professor A. P. Adewole and Dr. S. A. Akinboro*

**Ifeoluwa Akanmu and Victor Odumuyiwa**

*Lightweight Machine Learning Model for Mirai Detection in IoT Devices*

**Ebun P. Fasina, Babatude A. Sawyerr, and Chibueze Analogbei**

*Towards A Discrete Event Simulator of All Things*

**Ibrahim U. Haruna and Lawal Umar**

*Mathematical Skills and Professional Development in Covid-19 Era; Implications for Teacher Education in STEM and stakeholders in Nigeria*

**Festus S. Ajiboye and John A. Adebisi**

*Information Technology A Panacea for An Economically Independent Life in Southwest Nigeria*

**Ibrahim Ahmad Muhammad, Babatunde A. Sawyerr and Ebun P. Fasina**

*Image Classification in Convolutional Neural Network with evolutionary random Search method activation functions*

**Murja S. Gadanya, Hafsa K. Ahmad and Bello A. Muhammad**

*Video Recommendation in Online Education using Meta-path Based Knowledge Graph Embedding*

## Wednesday, September 22<sup>nd</sup> 2021

### 9.00am – 9.40am                      Second Plenary Session

**Clement Nyirenda**

*An Overview of Recent Deep Learning Projects at Honours Level at the University of the Western Cape, South Africa*

### 9.45am – 1.00pm                      Session 3

**MODERATORS:**

*Dr. E. P. Fasina and Dr. F. O. Alamu*

**J. A. Ajiboye, B. A. Adegboye, A. M. Aibinu, J. G. Kolo, M. A. Ajiboye and A. U. Usman**

*Ensemble Autoregressive Neural Network (ARNN) Model for Spectrum Occupancy Prediction*

**D. T. Afolabi, T. Bamgbade and A. P. Adewole**

*Near-Optimal Parameter Setting for Decision Tree Data Mining Algorithm*

**Damilola Sanda, Babatunde A. Sawyerr and Ebun P. Fasina**

*Enhanced Image-Based Plant Species Identification Using Deep Convolutional Generative Adversarial Networks under limited training datasets*

**Chinedu Mc-Neil**

*Ant Colony Optimization for Continuous Spaces*

**Oluwashola D. Adeniji**

*An Optimized Cloud Based Proxy Server Techniques to Improve User Experience Of Spectrum Utilization*

**Umar U. Bello, Bello Usman and Aliyu U. Bello**

*Layer 2 Security for Wi-Fi, how 802.11w addresses some of the security issues of 802.11 standard and Experimental De-authentication and De-association denial of service attacks.*

**Ebun P. Fasina, Babatude A. Sawyerr, Chika P. Ojiako and Ogban U. Ugot**

*A Review of Swarm Intelligence Algorithms*

**I. J. Okafor and A. U. Rufai**

*Quantum Machine Learning: A Critical Review*

# Pneumonia Classification Using Hybrid CNN Architecture on Chest X-ray Images

Mohammed M. Abubakar,  
almansurbukar@gmail.com

Bashir Z. Adamu

Muhammad Z. Abubakar

Department of Computer Engineering  
Department of Digital Forensics Engineering  
Firat University,  
Elazig, Turkey.

Infectious diseases are amongst the biggest threat to human health today. Analyzing chest x-ray images to potentially automate detection of diseases in a more timely and accurate fashion will have tremendous benefit to populations with inadequate access to expert radiologists. This proposed model plays an important role in the use cases of artificial intelligence for clinical purposes. Thus, correct examination of pathogens and inflammatory context in X-ray images using AI makes it easy for clinicians to identify conditions and follow up with patients. In this article, the Hybrid CNN method which can classify normal, bacterial pneumonia, and viral pneumonia, is proposed.

**Keywords:** Infectious disease, CNN, Classification, Deep learning, Chest X-ray

## Intrusion Detection in Healthcare Systems

Igor K. Kouam  
igorkouam5@gmail.com

Marcellin A. Nkenlifack  
marcellin.nkenlicak@gmail.com

Research Unit in Fundamental Computer Science, Engineering and Applications  
Department of Mathematics and Computer Science, Faculty of Science, University of Dschang

Cybercrime has been evolving exponentially in recent years, and this has put pressure on system administrators to secure their computer networks properly. In recent days, several major attacks have been recorded in Europe, but also in Africa. In Africa, there has been an increase in computer threats, but also an evolution of malware. In 2013, in French-speaking Africa, cyber-attacks cost nearly 26 billion FCFA, which is a huge amount. Indeed, cybercrime has become a problem at the heart of information systems, and more particularly health systems, which have been and continue to be targeted by hackers. The objective of this work is to propose a model for detecting intrusions in healthcare systems. More specifically, it will be a question of securing the information system's data server against any intrusions. To achieve this, we



relied on the behaviour of the users of the system by using an inductive learning technique. This technique allows us to build the rules of behavioural validation. Given the time taken by this method for detection, we used an optimal algorithm to reduce its execution time.

**Keywords:** Cybercrime, Intrusion detection, Behavioural study, Health system

## **Performance Evaluation of Improved Model for Spectrum Occupancy Prediction on TV Band**

Tosho A. AbdulRahman  
Abdulrahman.tosho@yahoo.com  
Department of Computer Science,  
Kwara State Polytechnic,  
Ilorin, Nigeria

Raimot A. Ajiboye  
ajiboyera@gmail.com  
Department of Statistics,  
Kwara State Polytechnic,  
Ilorin, Nigeria

Spectrum under-utilization is a challenge in achieving efficient spectrum usage, as most spectral spaces allocated are rarely maximized. To achieve optimal spectrum utilization, there is a need for anticipatory spectrum occupancy prediction scheme that will ensure wireless devices know the status (occupied or free) of channel(s) at any given time and location. In ensuring this, several prediction models such as the Bayesian Inference model, Hidden Markov model, Artificial Neural Network model and recently deep learning based (DL-based) models have been used. Many of these models were faced with two main challenges; first is the computational cost, second is the re-training requirement of the whole model whenever there is information shortage. Moreover, the combination of optimizer(s) and cross validation feature (agent) that can improve prediction accuracy of DL-based models has not been duly considered. Therefore, this study combined different libraries from Python 3 (Anaconda version) to design, configure and train DNN model using data obtained from 21 days continuous radio frequency measurement carried out at the Faculty of Communication and Information Sciences (FCIS) UNILORIN building using dedicated N9342C (100Hz-7GHz) spectrum Analyzer. The study further combined GridSearch cross validation (GridSearchCV) optimized with Taguchi method to modify the designed model and performance of both models (DNN and modified DNN (mDNN)) in terms of accuracy, precision and Root Mean Square Error (RMSE) were evaluate and compared. mDNN performed well with accuracy of 89.64%, precision of 0.865, train and test RMSE of 0.961 and 0.712 compared to 86.59%, 0.791, 1.129 and 1.085 for base DNN.

**Keywords:** Deep Learning, Model, Cross Validation, Whitespace

## Heart Disease Prediction Based on Improved Feature Set Using Weighted Moving Averaging Technique

Nasir Umar nasirmaali67@gmail.com	Oyefolahan I. Ishaq o.ishaq@futminna.edu.ng	Idris M. Kolo idris.kolo@futminna.edu.ng	Adelowo S. Adepoju solo.adepoju@futminna.edu.ng
Department of Computer Science, Federal University of Technology, Minna, Nigeria.	School of Information and Comm. Technology, Federal University of Technology, Minna, Nigeria	Department of Computer Science, Federal University of Technology, Minna, Nigeria	Department of Computer Science, Federal University of Technology, Minna, Nigeria

Heart disease is among the leading causes of mortality worldwide. As a result, it's critical to diagnose patients appropriately and promptly. Several studies on heart disease prediction have been conducted, however present methodologies have shown to be ineffective. This poor performance is due to the fact that most of these studies concentrated solely on classification models, ignoring the heart disease dataset features that serve as inputs to these models. The quality of dataset features is critical because they capture crucial patterns that can be utilized to distinguish between patients with heart disease and those who are healthy. As a result, this study presents an effective feature engineering strategy for improving attribute quality. Data imputation and data smoothing are two feature engineering processes in the proposed technique. The weighted moving average data smoothing technique was used to eliminate noise and identify essential trends in the data, while the nearest neighbour data imputation technique was utilized to restore missing values. The proposed technique was evaluated using the Cleveland heart disease dataset. In this study five classifiers were trained with the unprocessed Cleveland dataset and the Cleveland dataset which underwent data smoothing pre-processing. The results obtained showed all the classifiers performed better when trained with the pre-processed dataset with an accuracy of 98.11% than when trained with the unprocessed dataset with an accuracy of 92.45%. The proposed technique performed better than previous works. These results shows that feature pre-processing using data smoothing is effective for improved heart disease prediction.

**Keywords:** Heart Disease, Feature Improvement, Prediction, Data Smoothing, Feature Engineering.

# **Lightweight Machine Learning Model for Mirai Detection in IoT Devices**

Ifeoluwa Akanmu  
ijakanmu@gmail.com

Victor Odumuyiwa  
vodumuyiwa@unilag.edu.ng

Department of Computer Science  
University of Lagos,  
Lagos, Nigeria

The Internet of Things (IoT) is recognized as one of the most important areas of technology today. It has brought in a new age of data connectivity and has vast applications in a wide range of industries. This proliferation of IoT devices has led to an increase in IoT-based botnet attacks. IoT devices are particularly vulnerable to the Mirai malware; a botnet responsible for one of the largest Distributed Denial-Of-Service (DDoS) attacks ever recorded. Due to the massive scale and heterogeneity of IoT deployments, traditional security solutions have proven ineffective. Machine Learning approaches can provide the lightweight and optimal approach needed for IoT security. In this research, Machine Learning (ML) models are employed for the detection of Mirai in IoT devices. Data was extracted from the N-BaIoT dataset, which was generated by injecting botnet attacks into IoT devices. The Mirai and Benign datasets were merged, and binary classification was used to build Machine Learning Models with Logistic Regression, Support Vector Machines (SVM), Decision Trees and Random Forest Algorithms. This research compares and analyses these models based on their precision, recall, accuracy and F1-scores. The results showed that the precision, recall, accuracy and F1-scores of Decision Tree and Random Forest models were very high while that of the SVM was above average, and the Logistic Regression (LR) model was low. The ML models based on decision trees and random forests will be an effective way to reliably detect Mirai in IoT devices.

**Keywords:** IoT, Mirai, Machine Learning, Decision Tree

## **Towards A Discrete Event Simulator of All Things**

Ebun P. Fasina  
efasina@unilag.edu.ng

Babatunde Sawyerr  
bsawyerr@unilag.edu.ng

Chibueze Analogbei

Machine Intelligence Research Group (MIRG)  
Department of Computer Sciences,  
University of Lagos,  
Lagos, Nigeria

In this paper a new open-source software library is presented for building discrete event simulators for a diverse range of simple and complex objects and systems. The software library is codenamed SALT which is an acronym for Simulator of All Things. The library may not be used for equation-based modeling but can be extended for building simulators for all dynamic systems such as digital systems, industrial and manufacturing systems, production systems, oil pipeline networks, mining operations, and agent-based systems such as robot swarms, human societies, and animal migration. SALT is written in the C# programming language using the .NET Class Library. It is a framework class library that can be extended by users with multiple level of expertise in discrete event simulation. The class library has few easily extensible components that can configured into simulators that are easily integrated into video and game engines such as Unity and Unreal, quickly adapted for Agent Based Modeling (ABM) and Simulation and are lightweight enough for the optimization by simulation of complex systems. The architecture of SALT is presented, and its underlying design principles and inner workings are explained. To demonstrate its flexibility and ease of use the Job Shop Model of a manufacturing system is simulated and the output of its simulated run is evaluated. The result of our simulation runs show that the SALT framework is easily extended, lightweight, and supports the use of a minimal number of components that permit an accurate and detailed investigation of the Job Shop manufacturing system.

**Keywords:** Discrete Event Simulation, C# Programming Language, Job-Shop Model, Software Library, .NET Class Library

# **Mathematical Skills and Professional Development in Covid-19 Era; Implications for Teacher Education in STEM and stakeholders in Nigeria**

Ibrahim U. Haruna

Lawal Umar

Department of Mathematics, Federal College of Education, Zaria

The covid-19 pandemic pose an excellent opportunity to change the way we teach mathematics in schools. Because of pandemic, education has had to migrate to the online environment. This changes has impacted not only schools and their staff but also families by allowing mothers and fathers to be more involved with their children's education. The covid-19 global pandemic widely affected education across the world and engendered unprecedented scenarios that required expeditious responses. In Nigeria the pandemic came on top of pre-existing inequalities in the education system. The finding revealed that the whatsapp platform is a valuable tool that can support the teaching and learning of mathematics beyond the classroom in the contexts of historical disadvantage. The paper aim at focusing Nigerian Teachers, entrepreneurs and Communities with the knowledge and tools to innovate, design, develop and launch their own digital solution. Mathematics in the context of schooling play a key role in the process, the paper focusses on the mathematical skills and professional development during the Covic-19 pandemic and the quality of teaching and learning in STEM education, also the paper discourse about the ICT Competency for teachers in the Nigerian context. Also the paper provided insights into how mathematics teachers become learners themselves during emergency remote teaching (ERT) as they had to adapt to digital teaching, focus on the paper are the teachers challenges of transitioning from traditional face to face (F2F) classroom to ERT and how they were addressed and implication for the stakeholders. The recommendation are aim at making mathematics more relevant to the need of the society, making the students appreciate the value of science, technology, engineering and mathematics (STEM).

**Keywords:** Covic-19, Mathematics Skills, Professional Development, STEM and ICT.

## **Information Technology A Panacea for An Economically Independent Life in Southwest Nigeria**

Festus S. Ajiboye

ajiboye.festus@fssibadan.edu.ng

Department of Computer Science,  
Federal School of Statistics, Ibadan,  
Oyo State, Nigeria.

John A. Adebisi

adebisi\_tunji@yahoo.com

Department of Electrical Electronics and Computer  
Engineering, University of Lagos,  
Lagos, Nigeria

This research reveals the impact of information technology on economic independent entrepreneurial growth and its contribution to the family financial development; it shows the problems of entrepreneurship in Nigeria and the level of entrepreneurial skills on family's financial growth. The research was carried out through Phenomenology qualitative research approach, it demonstrates the ability to build economic independence through diverse means of earnings especially in the areas of information technology and not to depend on a monthly salary. The research work used a preliminary test on the questionnaire to authenticate the responses. The questionnaire retrieved was subjected to tables of frequency and statistical tools to test the hypotheses using chi-square. Self-employment strengthens ability to establish jobs including Information Technology (IT) opportunities, develop the well-being of people in the nation increase income, utilize and galvanized capital to promote economic productivity, and to change the lifestyle of the people. Thus, focusing on the growth of entrepreneurial skill that can improve the Gross Domestic Product (GDP) of Southwest Nigeria. Self-employment can be a means of reducing poverty and unemployment especially in the Southwestern part of Nigeria. Result of this research shows that information technology job establishment is a critical part of wages to earn a better living, with the sig-value  $(0.037) < 0.05$ , null hypothesis was rejected and conclude that Job establishment and growth in wages are part of the significance of IT Entrepreneurial growth to financial growth of families in the Southwest Nigeria. To an extent, support is expected from regional government in the development of entrepreneurial skills with respect to locations through provision of funds so that entrepreneurs can set up small medium enterprises and avoid unnecessary bureaucracy.

**Keywords:** Self-reliance, Entrepreneurship, Info-tech, Economic, Government.

# **Image Classification in Convolutional Neural Network with Evolutionary Random Search Method Activation Functions**

Ibrahim Ahmad Muhammad  
ibrahimcome3@gmail.com

Babatunde A. Sawyerr  
bsawyerr@unilag.edu.ng  
Machine Intelligence Research Group (MIRG)  
Department of Computer Sciences,  
University of Lagos,  
Lagos, Nigeria

Ebun P. Fasina  
efasina@unilag.edu.ng

Novel Activation functions discovered through evolutionary algorithm processes have shown that they can perform better and outperform legacy activation functions like Relu. Convolutional neural networks (CNN) are one of the most effective deep learning methods to solve image related problems, but the settings and configuration of the CNN architectures are mainly done manually, such as the choice of activation function, pooling and convolution operations being applied. There have been evolutionary approaches in optimizing such configuration by using search strategies such as exhaustive search, random search, Evolution with Accuracy-based Fitness among others. The activation functions of a CNN play one of the important roles in removing the redundant data while preserving important features, in addition activation functions retains "active neuron feature" and map out these features by nonlinear functions, which is essential for neural networks to solve the complex nonlinear problem. Some of the drawbacks of this legacy activation function include slow convergence speed, gradient dispersion problem found in Sigmoid and Tanh while the trend of the activation function in the neural network model is the unsaturated nonlinear, such as ReLu, Softplus, Softsign among others. Among them, ReLu is the most widely used and has multiple improvements, such as Relu6, Elu, Leaky\_RelU, PRelu, RRelu and so on, which greatly contributes to the improvements of neural network performance. This paper explores activation functions discovered through evolutionary processes like random search and relates it with legacy activations like ReLU, leaky\_relu, and RRelu activation functions for image classification in convolutional neural networks (CNN).

**Keywords:** CNN, Evolutionary Algorithm, Deep Learning, Activation Functions

# **Video Recommendation in Online Education using Meta-path Based Knowledge Graph Embedding**

Murja S. Gadanya  
msgadanya.cs@buk.edu.ng

Hafsa K. Ahmad  
hkahmad.cs@buk.edu.ng  
Bayero University,  
Kano, 700241,  
Nigeria

Bello A. Muhammad  
bamuhammad@snnu.edu.cn

MOOCs courses can be too rigid preventing learners from having flexible access to learning resources. Courses are made up of videos targeting some particular concepts. Therefore, recommending videos to learners offer a more personalized experience because learners can have access to videos from a variety of courses. Video recommender systems provide a list of relevant videos containing different knowledge concepts from multiple courses that fit users personal needs. Existing works on video recommender systems are based on collaborative filtering and content-based recommender systems. However, the high order preference of learners is not considered when making a recommendation, which can improve recommendation results. Therefore, we propose a method, video recommendation using knowledge graph embedding short for VRKGE that utilizes information from a knowledge graph to infer high-order preference of learners. Our method encodes the knowledge graph into low dimensional space capturing the semantics relations using meta-path embedding. The results indicate that our method outperforms the existing methods with an improvement of 18.8% based on MRR.

**Keywords:** Video recommendation, knowledge graph, high order preference, MOOCs



## Ensemble Autoregressive Neural Network (ARNN) Model for Spectrum Occupancy Prediction

J. A. Ajiboye<sup>1</sup> B. A. Adegboye<sup>2</sup> A. M. Aibinu<sup>3</sup> J. G. Kolo<sup>4</sup> M. A. Ajiboye<sup>5</sup> A. U. Usman<sup>6</sup>  
ajiboye2003@yahoo.com

<sup>1,2,4</sup>Department of Electrical and Electronic Engineering, School of Electrical Engineering and Technology (SEET), Federal University of Technology, P.M.B 65, Minna, Nigeria.

<sup>3</sup>Department of Mechatronic Engineering, School of Electrical Engineering and Technology (SEET), Federal University of Technology, P.M.B 65, Minna, Nigeria.

<sup>5</sup>Abuja Electricity Distribution Company (AEDC), ICT Department, Niger Regional Office, Minna, Nigeria.

<sup>6</sup>Department of Telecommunication Engineering, School of Electrical Engineering and Technology (SEET), Federal University of Technology, P.M.B 65, Minna, Nigeria.

A secondary spectrum user cannot transmit in a channel before sensing and knowing the spectrum occupancy state as this may cause interference. This poses a major challenge because these operations ought to be performed in each time slot and thereby causing a substantial delay before the user gains access to the spectrum, leading to inefficient utilization. Therefore, a channel predictive system will mitigate this problem. In this work, an ensemble machine learning model for spectrum occupancy prediction was developed. The developed model was trained using a sample of Power Spectrum Density (PSD) data collected from the field for a period of twenty-four hours within a frequency range of 30-300 MHz. The frequency range was grouped into sub bands. Based on the training data and the corresponding output data, the neural network model trains itself to come up with the best weights which can generally be used by the AR model for unseen data. After computing the weights, the performance is first tested on the entire training data, on the validation dataset and on the test dataset. Prediction results reveal an overall accuracy of 98.32% with band 4 (74.85-87.45 MHz) having the highest accuracy of 99.01% and the lowest accuracy of 89.39% in band 2 (47.05-68 MHz).

**Keywords:** Cognitive Radio, FM, Primary Users, Secondary Users, VHF, PSD

## Near-Optimal Parameter Setting for Decision Tree Data Mining Algorithm

D. T. Afolabi  
doyinsolalove@gmail.com

T. Bamgbade

A. P. Adewole  
aadewole@unilag.edu.ng

Department of Computer Sciences,  
University of Lagos,  
Lagos, Nigeria

Decision tree classification is a classification algorithm that works by building a tree, and classifying instances passed into it. To build decision trees, parameters are usually passed into it, specifying certain factors of the tree such as the maximum depth, the minimum number of instances, etc. Parameter tuning has been shown to be an important analytical procedure in past years. This study is directed towards obtaining the best parameter values for the classifier using Differential evolution algorithm in other to obtain an optimal accuracy rate. The Differential Evolution algorithm was implemented on the classifier to optimize the population and select the individual with the best fitness. Results obtained showed the efficiency of the Differential Evolution algorithm on the Decision tree classifier.

**Keywords:** Data mining, Evolutionary Algorithms, Parameter Optimization

## Enhanced Image-Based Plant Species Identification Using Deep Convolutional Generative Adversarial Networks under limited training datasets

Damilola Sanda  
damiisaac23@gmail.com

Babatunde Sawyerr  
bsawyerr@unilag.edu.ng

Ebun P. Fasina  
efasina@unilag.edu.ng

Machine Intelligence Research Group (MIRG)  
Department of Computer Sciences,  
University of Lagos,  
Lagos, Nigeria

Before the advent of machine learning models, plant species were identified visually by humans using the leaves, stem, fruits and/or other specific parts. This method can be time consuming and strenuous. In order to tackle the drawbacks of the traditionally process, machine learning techniques for classifying plant leave images are proposed. Models such as Convolutional Neural Networks have enormous acceptance rate in this field because it has proven to be successful. The problem of limited training dataset persists despite the success rate and effectiveness of CNNs.

As a result of variety of factors, overfitting is a common occurrence in CNN model training. A wide gap between training error and test error is referred to as overfitting. So, the model's complexity is larger than the problems, and it performs well on the training set, but not so well on the test set.

Deep convolutional generative adversarial network (DCGAN) with gradient penalty is integrated in this article to increase prediction accuracy and handle the overfitting problem while training with limited data.

**Keywords:** Deep Convolutional Generative Networks, Convolutional Neural Networks,

## **Ant Colony Optimization for Continuous Spaces**

Chinedu Mc-Neil  
iammcniel@gmail.com  
Department of Computer Sciences,  
University of Lagos,  
Lagos, Nigeria.

Swarm intelligence is a relatively new problem-solving method based on the social behaviour of insects and other animals. Ant Colony Optimization (ACO), one of the most popular Swarm Intelligence techniques is based on the foraging behaviour of certain ant species that deposit pheromones in the soil to indicate faster favourable food source routes to other members of the ant colony. ACO algorithms have been applied to many different discrete optimization problems. In this work, ACO was used to solve continuous space optimization problems. The first proposed algorithm for optimising continuous functions is Continuous Ant Colony Optimization (CACO) It uses the structure of the ant colony to perform a local search, while the global search is handled by a genetic algorithm. Here probability density functions were used to model the ACO's pheromone and the new ACO was benchmarked using standard benchmark functions.

**Keywords:** Ant Colony Optimization, Optimization Algorithms

## **An Optimized Cloud Based Proxy Server Techniques to Improve User Experience of Spectrum Utilization**

Oluwashola D. Adeniji  
od.adeniji@ui.edu.ng  
Department of Computer Science,  
University of Ibadan,  
Ibadan, Nigeria.

The global growth and popularity of user experience with the Internet from academia research to multimedia has significantly increased the amount of information online and services available to public domain. This growth has created an unprecedented level of congestion on network infrastructures; scarce network bandwidths, valuable resources which are important and are obstacle to Internet access. The emerging data access can be priced per-byte at high cost, consuming up to 25% of a user's total income, while in developed markets, data usage caps are a persistently zero, requiring users to track and manage consumption to avoid overage fees. In order to address this bandwidth problem, caching algorithm of proxies is employed at network access points to reduce the round trips of client server connections. However, caching is limited during queries of database because most of the content on the web today are dynamic. The focus of the study is to provide data compression techniques for reducing network access latency and to analyse the network traffic based on users' experience.

**Keywords:** cloud, data compression, optimization algorithm, Latency, bandwidth efficiency

## **Layer 2 Security for Wi-Fi, How 802.11w Addresses some of the Security Issues of 802.11 Standard and Experimental De-Authentication and De-Association Denial of Service Attacks**

Umar U. Bello  
uubello@atbu.edu.ng  
Directorate of ICT,  
Abubakar Tafawa Balewa University,  
PM 0248, Bauchi State,  
Nigeria

**Bello Usman**  
atbello2001@gmail.com  
Dept. of Computer Science  
FCT College of Education  
FCT, Abuja,  
Nigeria

**Aliyu U. Bello**  
bello.aliyu@fud.edu.ng  
Dept. of Information Tech,  
Faculty of Computing,  
Federal University Dutse.  
Dutse, Nigeria

The Technical Paper appreciated the wide acceptability and inevitable need of Wireless Network in this 21<sup>st</sup> Century but cautiously outlining the vulnerabilities of Wi-Fi Technology. It showed how 802.11w addressed some but not all of the security issues associated with the 802.11 standard. The Experimental

Results demonstrated the pathetic vulnerability of wireless Network clients as a result of Deauthentication and Disassociation Denial of service attacks.

## **A Review of Swarm Intelligence Algorithms**

Ebun P. Fasina      Babatunde Sawyerr      Chika P. Ojiako      Ogban U. Ugot  
efasina@unilag.edu.ng    bsawyerr@unilag.edu.ng    cojiako@unilag.edu.ng    ogbanugot@gmail.com  
Machine Intelligence Research Group (MIRG)  
Department of Computer Sciences,  
University of Lagos,  
Lagos, Nigeria

Nature-inspired swarm intelligence algorithms have provided a fresh alternative to classical informed and uniformed search algorithms in artificial intelligence. These algorithms have proven to be successful in both benchmark optimization problems as well in practical real-world applications. We provide a review and analysis of some of the most successful swarm intelligence algorithms with a focus on each algorithm's operation, theoretical formulation, merits, and demerits. We follow up with a discussion of the application of these optimizers for solving real-life optimization problems and the opportunities for future research work on nature inspired swarm intelligence algorithms.

**Keywords:** Nature-inspired Swarm Intelligence, Artificial Intelligence, Optimization, Real-life Optimization problems

# **Quantum Machine Learning: A Critical Review**

I.J. Okafor

A.U. Rufai

arufai@unilag.edu.ng

Machine Intelligence Research Group (MIRG)  
Department of Computer Sciences,  
University of Lagos,  
Lagos, Nigeria

Quantum Machine Learning (QML) is designed to build on the leveraging power of quantum computing. It is a computational paradigm based on the laws of quantum mechanics in which particles such as electrons, photons or ions (quantum bits) when cooled to almost 460 Fahrenheit, can either represent zero (0) or a one (1) simultaneously. These quantum bits, called qubits, can therefore perform virtually endless operations in parallel (or concurrently) such as complex mathematical computations. Recent research progress implies that the interface between machine learning and quantum computing benefits both fields. Quantum algorithms are being developed to solve typical problems of machine learning using the efficiency of quantum computing. Quantum machine learning is executed by adapting the classical machine learning algorithms to run on quantum computers. This research is to provide a critical review of literature on Quantum Machine Learning.

**Keywords:** Quantum Machine Learning, Quantum Computing, Qubits