



AFRICA' LEADING EDUCATION SOLUTION

FlexISAF presents a start-to-finish school management solution for institutions. Enhance efficiency and productivity with the all-inclusive school solution. Collect applications, process fees payment, generate reports, and run all components of the school, all in one place.

Our Products

SAFRECORDS
School Records and Transcript Management Software

SAFAPPLY
Online Admission & Registration Solution

Abuja:
No. 3, Egbedi Close, off Samuel Ladoke Akintola Boulevard, Carki 2, Abuja, Nigeria.
Tel: +234 800 102 1401

Dubai
R5-011 Cluster R, Retail Level, Jumerah Lake Towers
Dubai, UAE.
Email: info@flexisaf.com



ACADEMIA IN INFORMATION TECHNOLOGY PROFESSION (AITP)

5TH INTERNATIONAL CONFERENCE ON INFORMATION TECHNOLOGY IN EDUCATION AND DEVELOPMENT (ITED 2022)

THEME:
CHANGING THE NARRATIVES THROUGH BUILDING A SECURE SOCIETY WITH DISRUPTIVE TECHNOLOGIES

Tues. 1st - Thur. 3rd
November, 2022

Nile University,
Abuja

Opening: 2nd November, 2022 @University Auditorium
10:00am prompt



www.academiainformationtechnology.com

academia.infotech@gmail.com

Proceedings

Proceedings of the
**2022 5th Information Technology for Education
and Development (ITED) Conference**
Theme:
**Changing the Narratives Through
Building a Secure Society with Disruptive
Technologies)**

1st – 3rd November 2022.
Nile University Abuja, Nigeria.

IEEE Catalog Number: CFP17NIG-ART

ISBN: 978-1-5090-6422-9

Online ISSN: 2377-2697

Print ISSN: 2377-2689

<http://ieeenigercon.org>



Copyright and Reprint Permission:

Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923. For reprint or republication permission, email to IEEE Copyrights Manager at pubs-permissions@ieee.org. All rights reserved. Copyright ©2017 by IEEE.

ISBN 978-1-5090-6422-9

Online ISSN 2377-2697

Print ISSN 2377-2689

Program Committee

Ajao Adewale	FUTMinna
James Agajo	Federal University of Technology Minna
Ebenezer Ajayi	AITP
Azubiike Nzubechukwu Aniedu	Nnamdi Azikiwe University Awka
Kelvin Anoh	University of Bolton, Bolton, United Kingdom
Ikechukwu Ayogu	FUTO
Folasade Mojisola Dahunsi	Federal University of Technology Akure
Irene Samy Fahim	Nile University Egypt
Faithpraise Fina Otoni	University of Calabar
Francis Ibikunle	Landmark University Otta
Charles Ikerionwu	Federal University of Technology Owerri, Nigeria
Rasheed Gbenga Jimoh	University of Ilorin, Nigeria
Olamide Jogunola	Manchester Metropolitan University, UK
Okokpujie Kennedy	Covenant University
Mu'Azun Jibrin Musa	ABU
Faruk Nasir	Sule Lamido University
Agha Francis Nnachi	Tshwane University of Technology
Nkolika Ogechukwu Nwazor	University of Port Harcourt, Rivers state
Afolayan Obiniyi	Ahmadu Bello University. Zaria - Kaduna State
Afolayan Obiniyi	Academia in Information Technology Profession
Kennedy Okafor	FEDERAL UNIVERSITY OF TECHNOLOGY OWERRI
Lanre Olatomiwa	Federal University of Technology, Minna
Adeniran Oluwaranti	Obafemi Awolowo University, Ile-Ife
Salifu Osman	ACCRA TECHNICAL UNIVERSITY
Abdulrahman Okino Otuozu	University of Ilorin, Ilorin, Nigeria
Atanda Raji	Cape Peninsula University of Technology Center for Dis-
	tributed Power and Electronics Systems
Abdullah Shoukat	COMSATS UNIVERSITY ISLAMABAD, Wah Campus
Aderonke Thompson	Federal University of Technology, Akure
Elochukwu Ukwandu	Cardiff Metropolitan University
Edwin Umoh	Federal Polytechnic Kaura Namoda
Olufunke Rebecca Vincent	Federal University of Agriculture, Abeokuta

Preface

This volume contains the papers presented at ITED 2022: Information Technology for Education and Development held on 1-3rd December 2022 in ABUJA, Nigeria.

On behalf of the organizing committee, it is my honor to welcome you to ITED22. After previous editions with the IEEE consultants' network and Computer society, we are finally able to provide an on-site edition hosted by AITP at Nile University Abuja, Nigeria. There were 177 submissions. Each submission was reviewed by at least 1, and on average 2.0, program committee members. The committee decided to accept 143 papers. The program also includes 7 invited talks.

On top of the disruptive research in technology evolution, we have presented technical tracks, and have also gathered panel sessions, keynotes, and workshops. These are all valued by our experts and knowledge leaders. As is known, the ITED 2022 Conference considered evolving trends in both academic and industry research domains. We believe that ITED 2022 provides the needed opportunity to gain new understanding and record significant progress across multi-disciplinary fields. I will be looking forward to meeting you in Abuja Nigeria.

Putting together a good conference is feasible with only a winning team. I thank the leadership of the IEEE Nigeria Section and I give special appreciation to the publication Chair, Prof Faruk Nasir, and other members of the Technical Program Committee as well as the members of the organizing committee. Without you, this conference would not have been possible. The efforts of the reviewers working at Universities and Institutions from around the world are appreciated. They devoted their resources to ensure a high-quality review process. Many thanks!

Â

Finally, I would like to express my gratitude to all authors whose research results have been published in ITED 2022 Proceedings and IEEE Xplore digital library for their in-depth evaluations.

We hope that ITED 2022 inspires and entices you to submit your contributions to the upcoming IEEE Nigeria Section Conference in 2023.

Â

Thank you for sharing your wisdom.

Â

Kennedy Chinedu Okafor, *PhD, FASI, Senior Member, IEEE*
General Conference Co-Chair & Chair, Technical Program Committee.
ITED 2022.

December 30, 2022

Kennedy Okafor
Afolayan Obiniyi
Faruk Nasir
Ebenezer Ajayi

Additional Reviewers

Abdulkarim Zarewa, Abubakar
Abdulkarim, Abubakar
Abdulrahman, Abdulhakeem
Abioye, Abiodun
Agbeyangi, Abayomi
Airoboman, Abel
Ajani, Ayodeji
Ajayi, Banke
Ajayi, Ebenezer
Akande, Oluwatobi
Akinwale, Adio
Alabi, Christopher
Alaran, Misturah
Aneke, Ezekiel
Aniedu, Azubuike
Apata, Oluwagbenga
Arogundade, Oluwasefunmi
Arumugam, Dr Senthilkumar
Asianuba, Ifeoma

Babale Suleiman, Aliyu
Bakwa, Dunka
Balogun, Abdullateef

Chidzonga, Richard Foya

Duru, Chukwuemeka

Ekong, Uyinomen
Ekong, Victor
Elechi, Promise
Emmanuel, Osaji
Essiet, Ima
Euphemia, Nwokorie

Folorunso, Sakinat

Haruna, Zaharuddeen

Ifada, Emmanuel
Ikerionwu, Charles
Imoize, Agbotiname

Jegede, Abayomi

Jimoh, Rasheed
Jogunola, Olamide
Joseph Bamidele, Awotunde

Larik, Raja Masood
Lukman, Olawoyin

Mikail, Shamsuddeen Abdullahi
Mojisola, Folasade
Molo, Mbas
Mughole, Daniella
Mustapha, Rabi
Musyoka, Paul

Noma-Osaghae, Etinosa
Nwakanma, Cosmas Ifeanyi

Obakhena, Hope Ikoghene
Odeniyi, Latifat
Odun-Ayo, Isaac
Ogbuju, Emeka
Ogundokun, Roseline
Ojo, Oluwafolake
Okoth, John
Olaide, Oyelade
Oloruntoba, Timilehin
Otuoze Salihu, Yahaya

Peter, Geno

Sanusi Kazaure, Dr. Jazuli
Soumana, Ricsa Alhassane
Sule, Dr Aliyu Hamza

Ughegbe, Glory
Umar, Abubakar
Umar, Armayau Zango
Umoh, Edwin

Vingi, Nzanzu

Yau, Isiyaku

Table of Contents

A SURVEY OF DIGITAL WATERMARKING TECHNIQUES FOR DATA PROTECTION IN CLOUD COMPUTING	1
<i>Halima Nna Abbas, Mohammed Danlami Abdulmalik, Solomon Adelowo Adepoju and Enesi Femi Aminu</i>	
Application of Machine Learning Algorithms to Path Loss Modeling: A Review.....	9
<i>Abubakar Abdulkarim, Nasir Faruk, Emmanuel Alozie, Olugbenga Sowande, Yusuf Imam-Fulan, Aliyu D. Usman, Kayode Adewole, Abdulkarim Oloyede, Haruna Chiroma, Salisu Garba, Sani Lawan, Agbotiname Imoize and Abdulwaheed Musa</i>	
A Review of Data-Driven Approaches with Emphasis on Machine Learning Base Intrusion Detection Algorithms.....	15
<i>Maryam Abdullahi, Kabiru Musa Ibrahim, Abdulsalam Yau Gital, Haruna Chiroma, Mustapha Lawal and Ibrahim Muhammad Umar</i>	
Mitigation of Electricity Theft at Low Distribution Voltage End Using Matrix Converter .	23
<i>Sunday Abel, Tsado Jacob and Tola Omokhafa</i>	
Performance Evaluation of Middle block Convolutional Regularization Algorithm on CNN Architecture.....	28
<i>Sanusi Abu and Fatma Susiluwati Mohd</i>	
Personal Data and Privacy Protection Regulations: State of compliance with Nigeria Data Protection Regulations (NDPR) in Ministry, Department, and Agencies (MDAs)....	36
<i>Muhammad M Abubakar, Armaya'U Z. Umar and Mansir Abubakar</i>	
RING LEARNING WITH ERROR-BASED ENCRYPTION SCHEME FOR THE PRIVACY OF ELECTRONIC HEALTH RECORDS MANAGEMENT.....	42
<i>Umar Abulkadir, Prof Victor Waziri, Dr John Alhassan and Idris Ismala</i>	
A Fuzzy-Bayesian Model for Evaluating Customer Satisfaction in an Online Store	47
<i>Ijegwa Acheme, Samuel Omaji, Ayodeji Makinde, Olufunke Vincent, Wilson Nwankwo and Akinola Olayinka</i>	
Functional Steganographic Techniques: Containing Cloud-based Access and Privacy Breaches	53
<i>Samuel Acheme, Henry Ovili, Irikefe Friday Eti, Wilson Nwankwo and Chukwuemeka Pascal Nwankwo</i>	
Real-Time Face Mask Detection Using Cascaded Bi-level Feature Extraction Techniques for Access Restriction in Public Buildings	61
<i>Enobong Thomas Adahada, Solomon Adelowo Adepoju, Abdulmalik Danlami Mohammed and Opeyemi Aderiike Abisoye</i>	
A Procedure for Achieving Network-on-Demand for Intent-driven purposes in the 5G Era using Network-Slicing Technique	67
<i>James Agajo, Joseph Emeshili, Ram Ov Vishnu, Odun Ayo Imoru, Blessed Guda and Kennedy Amadasun</i>	

Convergence of Blockchain, AI and IoT for Effective Monitoring and Securing Smart City Infrastructure	72
<i>James Agajo, Odun Ayo Imoru, Clinton Aigbavboa Aigbavboa, Emeshili Joseph and Amit Mishra</i>	
A Comparative Analysis of Optimization Heuristics Algorithms, as Optimal Solution for Travelling Salesman Problem.....	77
<i>Binyamin Adeniyi Ajayi, Mohammed Abubakar Magaji, Samaila Musa, Rashidah Funke Olanrewaju and Abdullahi Salihu Audu</i>	
Development of Interagency Crime Management System.....	85
<i>Binyamin Adeniyi Ajayi, James Nweke and Muhammad Usman Ogah</i>	
DESIGN OF NATIVE LANGUAGE SENTENCE PREDICTOR USING RECURRENT NEURAL NETWORK	93
<i>Olusola Olajide Ajayi, John O. Adewole, Adewuyi Adetayo Adegbite, Modupe A. Fashakin, Omojokun Gabriel Aju and Joy Rotimi Obafemi</i>	
Residential Load simulator for Demand-side Management (DSM).....	99
<i>Josiah Godwin Ajisafe and Folasade Mojisola Dahunsi</i>	
A Review of Vehicular Ad-Hoc Networks and Its Security Challenges.....	105
<i>Emmanuel Ajulo and Zachaeus Adeyemo</i>	
BIOCRYPTOSYSTEMS FOR TEMPLATE PROTECTION: A SURVEY OF FUZZY VAULT	112
<i>Mulikat Bola Akanbi, Rasheed Gbenga Jimoh and Joseph Bamidele Awotunde</i>	
IMPROVING OPTIMIZATION PROWESS OF ANT COLONY ALGORITHM USING BAT INSPIRED ALGORITHM	118
<i>Hakeem Babalola Akande, Oluwakemi Abikoye, Oluwatobi Akande and Rasheed Jimoh</i>	
Predictive analytics of numeric image descriptors for digital forensics using blind steganalysis	123
<i>Wasiu Akanji, Ogobuchi Okey, Saheed Adelanwa, Oluwafunsho Odesanya, Taiwo Olaleye, Mary Amusu, Akinfolarin Akinrinlola and Abiodun Oladejo</i>	
Static Hand Gesture Recognition Using Deep Learning Technique	130
<i>Kolawole Akintola</i>	
Reliability Assessment of 132/33kV Transmission Substation feeders: Omu-Aran 132/33kV Transmission Station Case Study	136
<i>John Alabi, Paul Olulope and Babatunde Kareem</i>	
Exploring Factors Influencing Social Commerce Adoption in Small and Medium Enterprises: A Systematic Literature Review	143
<i>Hamisu Alhaji Ali, Mahadi Bahari and Noorminshah A. Iahad</i>	
Neural Network (NN) based Classification for UAV Detection	150
<i>Surajo Alhaji Musa, Sa'Idu Adamu Abubakar and Abdelmajid Husam Hussein Habush</i>	
Quantitative Approach to Automated Diagnosis of Malaria from Giemsa-Thin Blood Stain using Support Vector Machine.....	156
<i>Sheriff Alimi, Adetokunbo Adenowo, Afolashade Kuyoro and Awodele Oludele</i>	

Design and Implementation of a GSM and Wi-Fi Based Low Cost Smart Prepaid Energy Meter	164
<i>Henry Amhenrior, Ibrahim Oloma and Braimoh A. Ikharo</i>	
An Automatic Railway Level Crossing System with Crack Detection	172
<i>Akinwumi Amusan and Yusuf Adebakin</i>	
Modelling Machine Learning-based Energy Loss Detection and Monitoring System for Advanced Metering Infrastructure	179
<i>Azubuike Aniedu, Sandra Nwokoye, Chukwunyenye Okafor and Kingley Anyanwu</i>	
CASCADE OF DEEP NEURAL NETWORK AND SUPPORT VECTOR MACHINE FOR CREDIT RISK PREDICTION	186
<i>Oludele Awodele, Sheriff Alimi, Olufunmilola Adunni Ogunyolu, Oluwole Solanke, Seyi Iyawe and Foladoyin Adegbe</i>	
A MACHINE LEARNING TECHNIQUE FOR DETECTION OF DIABETES MELLITUS	194
<i>O. M. Awoniran, M. O. Oyelami, R. N. Ikono, R. F. Famutimi and T. I. Famutimi</i>	
An Enhanced DFFNN for location-based services of Indoor device-free submissive localization	200
<i>Joseph Bamidele Awotunde, Agbotiname Lucky Imoize, Akash Kumar Bhoi, Nasir Faruk, Rasheed Gbenga Jimoh, Ranjit Panigrahi and Stephen Ojo</i>	
An Assessment of Security Techniques for Denial of Service Attack in Virtualized Environments	207
<i>Ayanseun Ayanboye, John Efiog, Grace Alilu, Adedoyin Oyebade and Bodunde Akinyemi</i>	
Development of Smart (Light Dependent Resistor, LDR) Automatic Solar Tracker	214
<i>Idowu Ayoade, Oluseyi Adeyemi, Rasheed Rufai, Oyetunde Adeaga and Sukuroh Olalere</i>	
Machine Learning Model for Classifying Free Space Optics Channel Impairments	221
<i>Kareem Sunday Babatunde, Frank A Ibikunle, Micheal Olaolu Arowolo and Ayodele John Alabi</i>	
Early Detection of Chronic Kidney Disease (CKD) Using Machine Learning Approach	229
<i>Bukola Badeji-Ajisafe, Stephen Obamiyi, Abiodun Oguntimilehin and Emmanuel Ajulo</i>	
A novel hybrid method for text Graph classification using 6DoSCC framework. (A case study of Nigerian hate speech)	234
<i>Oluwatobi Balogun and Oludele Awodele</i>	
Comparative Analysis of Deep Learning Models for the Detection and Classification of Diabetes Retinopathy	242
<i>Temitayo Balogun, Rilwan Saliu, Samuel Faluyi and Kofoworola Fapohunda</i>	
A Cognitive Analysis of Covid-19 on Africa Economy Using Linear Regression	248
<i>Jesufunbi Damilola Bolarinwa, Olufunke Rebecca Vincent, Oluwafolake Esther Ojo, Omeike M.O, Abayomi Victor Opakunle and Olawale David Oyedeji</i>	
Implementation of Internet of Things for Structural Health Monitoring in Nigeria	254
<i>Olutayo K. Boyinbode, Fiyinfoluwa G. Oyesanmi, Olumide O. Obe and Oladeji F. Boyinbode</i>	

PREDICTING THE UPSHOT OF COVID-19 ON CRUDE-OIL PRICES IN NIGERIA USING MLPARIMA MODEL.....	259
<i>Adenusi Cecilia Ajowho, Vincent Olufunke Rebecca, Abayomi-Alli A, Olayiwola Olaniyi Mathew, Bakare Olawunmi Shamsudeen and Sayikanmi Titilayo Mary</i>	
FORECASTING OF FOOD ITEM PRICES USING MULTILAYERED PERCEPTRON ARTIFICIAL NEURAL NETWORK.....	267
<i>Adenusi Cecilia Ajowho, Olufunke Rebecca Vincent, Adebisi Bukola Taibat, Emmanuel Izuchukwu Ofoegbunam and Alomaja Victor Ojumu</i>	
PREDICTION OF MOSQUITO PREVALENCE IN A WARM SEMI-ARID CLIMATE USING ARTIFICIAL NEURAL NETWORK (ANN).....	273
<i>Felicia Cletus, B Y Baha and Omega Sarjiyus</i>	
SmartCall: A Real-time, Sign Language Medical Emergency Communicator.....	281
<i>Mustapha Deji Dere, Roshidat Oluwabukola Dere, Adewale Adesina and Aliyu Rufai Yauri</i>	
A Study of the Effectiveness of Monophasic Electrical Stimulation in Enhancing Neuromuscular Tissue Function.....	287
<i>Babatunde Emmanuel</i>	
Study of the Output Characteristics of Freestanding Triboelectric Nanogenerators with Interdigitated Electrodes for Self-Powered Sensing Application.....	293
<i>Babatunde Emmanuel, Paul Okpe Michael and Omotayo Oshiga</i>	
Adaptive Fuzzy Sliding Mode Control for an Aerial Manipulator as a Payload on a Quadcopter.....	298
<i>Joy Eneh, Solomon Nwafor, Emmanuel Nnadozie and Ozoemena Ani</i>	
Overview of Interference Management Techniques in 5G Cellular Networks.....	304
<i>Adama Jiya Enoch, Lfrancis A. Ibikunle, Aaron B Adedayo, Ilesanmi B. Oluwafemi, Akorede Kola-Junior and Kareem Sunday Babatunde</i>	
A MODEL FOR CRIME PREDICTION USING MACHINE LEARNING.....	311
<i>Joshua Etuk, Teddy Mbato and Aweh Opani</i>	
An Improved Buck Conventional DC –AC Power Converter.....	373
<i>Candidus Eya, Chinedu Obe, Luke Omeje and Benjamin Ugwu</i>	
Career Progression of Electronic Engineering Graduates: A Study of LinkedIn Career Profiles.....	379
<i>Ijeoma J.F. Ezika, Moses Olayemi and Chibueze Tobias Orji</i>	
33kV Distribution Feeder Line Sag and Swell Mitigation using Customized DVR.....	385
<i>Seyi Fanifosi, Sam Ike, Elutunji Buraimoh and Innocent Davidson</i>	
DEVELOPMENT OF YORUBA PRODUCT EXPIRATION ALERT MANAGEMENT SYSTEM.....	390
<i>Modupe A. Fashakin, Adewuyi Adetayo Adegbite, Olusola Olajide Ajayi, John O. Adewole, Omojokun Gabriel Aju and Joy Rotimi Obafemi</i>	
Towards Finding An Optimal S-box For Lightweight Block Cipher.....	396
<i>Sani Garba, Afolayan Obiniyi, Barroon Ahmad and Musa Ibrahim</i>	

On the Key Schedule of Lightweight Block Cipher	404
<i>Sani Garba, Afolayan Obiniyi, Barroon Ahmad and Musa Ibrahim</i>	
Implementation of Malaria Parasite Detection and Species Classification Using Dilated Convolutional Neural Network	410
<i>Suleiman Garba, Muhammad Bashir Abdullahi, Sulaimon Adebayo Bashir and Opeyemi Adenike Abisoye</i>	
DETECTION OF ONION LEAF DISEASE USING HYBRIDIZED FEATURE EXTRACTION AND FEATURE SELECTION APPROACH	416
<i>George O. Gbadebo, Alhassan John Kolo and Oluwaseun A. Ojerinde</i>	
Development of an Autonomous Floor Mopping Robot Controller using Android Application	422
<i>Suleiman Haruna, Abubakar Umar and Ore-Ofe Ajayi</i>	
Design and Implementation of a Google Assistant Home Automation System	428
<i>Aruna Hussien, Edekin M. J. Ebobgbai, Henry Amhenrior, Vincent K. Abanihi, Lawal O. Bello and Victor Oisamoje</i>	
Framework for Hausa Speech Recognition	433
<i>Umar Adam Ibrahim, Moussa Boukar Mahatma and Muhammed Aliyu Suleiman</i>	
Concept Based Review on Generative Adversarial Network for Generating Super Resolution Medical Image Using SWOT Analysis	437
<i>Saba Ibrahim David, Bashir A. Sulaimon and Mohammed Danlami Abdulmalik</i>	
IoT Based Motion Detector Using Raspberry Pi Gadetry	443
<i>Bartholomew Idoko, Yusuf Zubair Mahmud Kazoure, Yahanasu Mohammed Ibrahim, Fatai A Akinsola, Rasak Raji Adereti and John Bush Idoko</i>	
A Descriptive Evaluation of Unmanned Aerial Vehicles and Internet of Things for Agricultural Production: A Review	448
<i>Saheed Idowu, Olufunke Vincent and Gboyegba Akinboro</i>	
Classification and recommendation of food intake in West Africa for healthy diet using Deep Learning	455
<i>Chigoziem Iheanacho and Olufunke Vincent</i>	
An ensemble statistical evaluation of medical image embedding with SqueezeNet neural network	461
<i>Solanke Ilesanmi, Agbaegbu Jonhbosco, Taiwo Olaleye, Janet Akiode, Wilson Ahiara, Olalekan Okewale and Uchenna Udeani</i>	
Reconfigurable Intelligent Surfaces Enabling 6G Wireless Communication Systems: Use Cases and Technical Considerations	467
<i>Agbotiname Lucky Imoize, Hope Ikoghene Obakhena, Francis Ifeanyi Anyasi, Joseph Isabona, Stephen Ojo and Nasir Faruk</i>	
Resilience and Security on Enterprise Networks: A Multi-Sector Study	474
<i>Donatus Irughe, Wilson Nwankwo, Chukwuemeka Nwankwo and Francis Uwadia</i>	

Higher Order Sectorization for Antenna Gain, Signal Quality and Erlang Capacity Maximization	481
<i>Joseph Isabona, Agbotiname Lucky Imoize, Ituabhor Odesanya, Lanlege David Ibitome, Ikechi Irisi and Nasir Faruk</i>	
An Empirical Comparative Analysis of 4G LTE Network and 5G New Radio	487
<i>Joseph Isabona, Christian Chizoba Ugochukwu, Agbotiname Lucky Imoize and Nasir Faruk</i>	
State-of-the-Art Particle Swarm Optimization Algorithm for Feature Selection: A Survey .	492
<i>Jeremiah Isuwa, Mohammed Abdullahi, Sahabi Ali Yusuf and Ibrahim Hayatu Hassan</i>	
Development of an Adaptable Model for Abnormalities Detection in Clinical Chest X-Ray Reports	499
<i>Abimbola Iyanda, Omolara Ogungbe and Adeniyi Aderibigbe</i>	
Improved XM-18 Controller using Petroleum Liquid Gas-Based Automatic Heating Alternative for Egg Incubation in Developing Countries	507
<i>Muazu Jibrin Musa, Yahaya Otuoze Salihu, Moshood Yusuf and Zubair Gatugel Usman</i>	
An Enhanced Deep Neural Network Enabled with Cuckoo Search Algorithm for Intrusion Detection in Wide Area Networks	511
<i>Rasheed Gbenga Jimoh, Agbotiname Lucky Imoize, Joseph Bamidele Awotunde, Jesufemi Ayotomide Bamigbaye, Nasir Faruk, Mulikat Bola Akanbi and Stephen Ojo</i>	
An ANN model for prediction of goal scores by individual team	516
<i>Eric Jones, B. Y Baha and Omega Sarjiyus</i>	
Enhanced Optical Double Phase Image Encryption Using Random Gaussian Noise	520
<i>Okokpujie Kennedy, Damola Akinola, Innocent Nwokolo, Olisaemeka Fredrick Isife, Oghorchukwuyem Obiazi and Oghenetega Owivri</i>	
Comparative Analysis of the Performance of Various Support Vector Machine kernels.....	525
<i>Afolashade Kuyoro, Sheriff Alimi and Ohudele Awodele</i>	
Fast Tree Model for Predicting Network Security Incidents	532
<i>Musa Magaji, Abayomi Jegede, Nentawe Gurundimma, Moday Onoja, Gilbert Aimufua and Ayodele Oloyede</i>	
Improved Load Frequency Control of Four Area Thermal Power System Using Ant Lion Optimization Based Fractional Order PID Controller	538
<i>Ahmed Mohammed Saba, Tajudden Humble Sikiru, Ibrahim Bello, Ahmed Tijani Salawudeen and Usman Alhaji Dod</i>	
Measuring Smart Education Readiness: A case of Nigeria.....	547
<i>Timothy Moses, Tajudeen Adeleke Badmos and John Abiodun Oladunjoye</i>	
Design and Implementation of an IoT Based Home Energy Monitoring System	553
<i>Abdul-Waliyi O Muhammed, Victor Oisamoje, Henry E. Amhenrior, Edekin M. J. Evbogbai, Vincent K. Abanihi, Lawal O. Bello and Chukwuemeka C. Obasi</i>	
Performance Evaluation of Strict Fractional Frequency Reuse and Frequency Reuse Factor-3 in 5G Networks	560
<i>Abdulwaheed Musa, Faruk Adekola and Nasir Faruk</i>	

Development of Interference Mitigation Technique for Low Power Wide Area Network	565
<i>Abdulwaheed Musa, Mojeed Adio and Nasir Faruk</i>	
Blockchain-Based Smart Contract System Model for Land Registration Management	570
<i>Adam Musa Safiyanu, Aimufua G.I.O. and Umar Ibrahim</i>	
Optimal Distributed Generation and D-STATCOM Allocation in Radial Distribution System using Firefly Algorithm	576
<i>Musa Mustapha, Ganiyu Ayinde Bakare, Yau Shuiabu Haruna, Babagana Mallambe Mustapha, Musa Baba Lawan and Abdulkadir Abubakar Sadiq</i>	
A consensus Based Bank loan Prediction Model Using Aggregated Decision Making and cross Fold Validation Techniques	582
<i>Ibrahim Hadiza Ndanusa, Solomon Adelowo Adepoju and Oluwaseun Adeniyi Ojerinde</i>	
Time Series: Predicting Nigerian Food Prices using ARIMA Model and R-Programming . .	588
<i>J. N. Ndunagu, Rasheed Gbenga Jimoh, E. H. Aderemi and Joseph Bamidele Awotunde</i>	
ENHANCED OPEN AND DISTANCE LEARNING USING CHATBOT: A CONCEPTUAL FRAMEWORK	594
<i>Juliana Ndunagu, Rasheed Jimoh, Chidi Ugwuegbulam and Deborah George</i>	
Effective Industrial Internet of Things Vulnerability Detection Using Machine Learning . .	598
<i>Cosmas Ifeanyi Nwakanma, Love Allen Chijiokwe Ahakonye, Judith Nkechinyere Njoku, Joy Eze and Dong-Seong Kim</i>	
An Improved Password-authentication Model for Access Control in Connected Systems . .	606
<i>Chukwuemeka Nwankwo, Wilfred Adigwe, Wilson Nwankwo, Anazia Kizito, Susan Konyeha and Francis Uwadia</i>	
Privacy and Security of Content: A Study of User-resilience and Pre-checks on Social Media	614
<i>Chukwuemeka Nwankwo, Francis Uwadia, Wilson Nwankwo, Wilfred Adigwe, Paschal Chinedu and Emmanuel Ojei</i>	
A Community Cloud-Based Store for Forensic Operations in Cybercrime Control	622
<i>Wilson Nwankwo, Anazia Kizito, Wilfred Adigwe, Chukwuemeka Pascal Nwankwo, Francis Uwadia and Samaila Mande</i>	
Transitive Grouping for Internet of Things Support IEEE 802.11ah using Integrated Approach	630
<i>Obioma Uchenna Nwogu, Udora Nwabuoku Nwawelu and Cosmas Ikehukwu Ani</i>	
ANDROID APPLICATION FOR HUMAN RESPIRATORY SYSTEM DIAGNOSIS: A SYSTEMATIC REVIEW	638
<i>Adaora Obayi, Obinna Onyedeke, Izuchukwu Uzo and Azuka Ijomah</i>	
A Critical Analysis of Cloud Computing Adoption in Some West African Countries	646
<i>Isaac Odun-Ayo, Abayomi Agbeyangi and Latifat Odeniyi</i>	
Performance and Accessibility Evaluation of University Websites in Nigeria	653
<i>Emeka Ogbuju, Bolaji Ayodeji and Abdulsamod Azeez</i>	

YOLO v3: Visual and Real-Time Object Detection Model for Smart Surveillance Systems(3s)	660
<i>Kanyifeechukwu Jane Oguine, Ozioma Collins Oguine and Hashim Ibrahim Bisallah</i>	
Mobile Banking Transaction Authentication using Deep Learning.....	668
<i>Abiodun Oguntimilehin, Michael Lotachukwu Akukwe, Kehinde Adebola Olatunji, Oluwatoyin Bunmi Abiola, Oluwaseyi Adesina Adeyemo and Adeola Ibukun Abiodun</i>	
Internet of Things (Iot) Enabled Automobile Accident Detection and Reporting System ..	675
<i>Abiodun Oguntimilehin, Akeem Oyefiade, Kehinde Adebola Olatunji, Oluwatoyin Bunmi Abiola, Stephen Eytayo Obamiyi and Bukola Badeji-Ajisafe</i>	
Artificial Intelligence-based Expert System for Hepatitis B Diagnosis	683
<i>Deborah Ojie and Justin Ogala</i>	
Solving the House Numbering Problem in Nigeria: Internet of Things (IoT) As An Emerging Solution	688
<i>Timothy Okediran, Olufunke Vincent, Adebayo Abayomi-Alli, Olusola Adeniran and Abayomi Agbeyangi</i>	
Securing Text-based Medical Information with Advanced Encryption Standard Algorithm	693
<i>Folasade Okikiola, Abiodun Mustapha, Christiana Alonge and Oluwakanmi Oladiboye</i>	
Automatic Text Summarization of Scientific Documents using Transformer Architectures: A review	699
<i>Raliyat Okivo, Afolayan Obiniyi, Muhammed Abdulkarim and A. A. Afolorunsho</i>	
Multilingual Cyberbullying Detector (CD) Application for Nigerian Pidgin and Igbo Language Corpus	705
<i>Christiana Amaka Okoloegbo, Udoka Felista Eze, Gloria A. Chukwudebe and Obi Chukwuemeka Nwokonkwo</i>	
Hybrid Solar/Heat Pump System for Water Heating in Nigeria: Techno-economic assessment	711
<i>Ayodeji Okubanjo, Alexander Okandeji and Patrick Oshevire</i>	
Performance Comparison of the efficiency of selected Cryptographic Algorithms	717
<i>Stephen Olabiyisi, Adeolu Afolabi and Rofiat Akanbi</i>	
Simulation of a 46KVA Micro –Inverter with Maximum Power Point Tracking Method (MPPT) Algorithm for Optimal Harvesting of Solar Radiation	725
<i>Abiodun Oladejo, Ligali Abdulraheem, Boluwatife Ojo, Paul Okhiria and Ibukun Babatunde</i>	
A HEURISTIC EVALUATION OF THE STATE OF GROUNDWATER USING AN ELECTROMAGNETIC METHOD	731
<i>Victoria Olagoke</i>	
Opinion mining analytics of IoT ecosystem by Profile of Mood State with Logistic Regression	738
<i>Taiwo Olaleye, Adeola Olaleye, Emmanuel Ofoegbunam, Gbenga Abodunrin, Temitope Abioye and Wilson Ahiara</i>	

Skin Disease Classification using Deep Learning Methods.....	745
<i>Kehinde Adebola Olatunji, Abiodun Oguntimilehin, Oluwaseyi Adesina Adeyemo, Opani Mesark Aweh, Adeola Ibukun Abiodun and Oniyide Alabi Bello</i>	
Predicting Epileptic Seizures using Ensemble Method.....	753
<i>Kehinde Adebola Olatunji, Abiodun Oguntimilehin, Oluwaseyi Adesina Adeyemo, Prosper Chiemezuo Noble-Nnakenyi, Oluwatoyin Bunmi Abiola and Gbemisola Babalola</i>	
A THREE TIER MODEL FOR INTRUSIONS CLASSIFICATION ON A COMPUTER NETWORK.....	760
<i>Sunday Olofintuyi</i>	
PROGNOSTICATE TRENDING DAYS OF YOUTUBE VIDEOS TAGS USING K-NEAREST NEIGHBOR ALGORITHM.....	766
<i>Olukumoro Olugbenga S., Adenusi Cecilia Ajowho, Emmanuel Izuchukwu Ofoegbunam, Oguns Yetunde Josephine and Opakunle Victor Abayomi</i>	
PARIS AIRBNB RENTAL PRICES MODELING BASED ON NATURAL LANGUAGE PROCESSING AND XGBRegressor MODEL.....	774
<i>Olukumoro Olugbenga S., Alomaja Victor Ojumu, Olufunke Rebecca Vincent, Egbedokun Gabriel Olumide and Adenusi Cecilia Ajowho</i>	
Development of an Autonomous Vehicle for Smart Irrigation.....	782
<i>Temidayo Oluwabunmi, Oluwajuwon Adenugba, Idowu Ayoade, Joseph Azeta and Christian Bolu</i>	
Drug Recommender Systems: A Review of State-of-the-Art Algorithms.....	789
<i>Theresa Omodunbi, Grace Alilu and Rhoda Ikono</i>	
Exploring the Effectiveness and Efficiency of LightGBM Algorithm for Windows Malware Detection.....	797
<i>Monday Onoja, Abayomi Jegede, Jesse Mazadu, Gilbert Aimufua, Ayodele Oloyede and Kolawole Olibodun</i>	
Fraud Detection System for Effective Healthcare Administration in Nigeria using Apache Hive and Big Data Analytics: Reflection on the National Health Insurance Scheme	803
<i>Ogala Onyarin, Sophia Mughele and Stella Chiemeke</i>	
Visual Exploratory Data Analysis of the Covid-19 Pandemic in Nigeria: Two Years after the Outbreak.....	809
<i>Ugochukwu Orji, Modesta Ezema, Elochukwu Ukwandu, Chikodili Ugwuishiwu, Obianuju Ezugwu and Malachi Egbugha</i>	
A Comparative Study of Efficient Supervised Learning Algorithms for Breast Cancer Detection.....	815
<i>Ugochukwu Orji, Kidochukwu Ezieshi, Jonathan Agbo, Uchechukwu Agomuo, Prince Ezeali and Obioma Nmezi</i>	
Design and Simulation of Collision Avoidance Algorithm for an Unmanned Aerial Vehicle.	822
<i>Emmanuel Otsapa, Suleiman Sani and Oluwatobiloba Ayofe</i>	
Inset Fed Circular Microstrip Patch Antenna at 2.4 GHz for IWSN Applications.....	827
<i>Emmanuel Otsapa, Abdoulie Tekanyi, Kabir Abubilal, S.M. Sani, M.T Kabir and O. A Ayofe</i>	

Using Smart Antenna for Interference Resistant Industrial Wireless Sensor Networks: A Review.....	833
<i>Emmanuel Otsapa, Abdoulie Tekanyi, Kabir Abubilal, Suleiman Sani, Mahmud Kabir and Oluwatobiloba Ayofe</i>	
BERTopic Modelling with P53 in Ovarian Cancer.....	841
<i>Richard Oveh, Mary Adewunmi and Grace Aziken</i>	
Mitigating Social Engineering Attack: A Focus on the Weak Human Link.....	845
<i>Richard Oveh and Grace Aziken</i>	
Development of Alcohol Detection with Engine Locking and Short Messaging Service Tracking System.....	849
<i>Samuel Owwoeye, Folasade Durodola and Akinade Adedayo</i>	
A Review of Existing Farmland Intrusion Detection Systems.....	855
<i>Iyinoluwa Oyelade, Olutayo Boyinbode and Olumide Adewale</i>	
EXPERIMENTAL EVALUATION OF ENSEMBLE LEARNING-BASED MODELS FOR TWITTER SPAM CLASSIFICATION.....	861
<i>Akinyemi Moruff Oyelakin, Rasheed Gbenga Jimoh, I. S. Olatinwo, Y. K. Obiwusi, S. Muhammad-Thani, T. S. Ogundele, A. Giwa-Raheem and O. F. Ayepeku</i>	
DYNAMIC ANALYSIS OF MALWARE INTRUSION IN MOBILE DEVICES USING ADABOOST ALGORITHM, K-NEAREST NEIGHBORS AND SUPPORT VECTOR MACHINE BASE CLASSIFIERS.....	869
<i>Samuel Oyong, Uyineme Ekong and Okure Obot</i>	
Development of an Artificial Intelligence Model for Small and Medium Enterprises.....	877
<i>Patrick Ozoh and Patrick Ozoh</i>	
Enhanced Chest X-Ray Classification Model for Covid-19 Patients Using HOG and LBP.....	883
<i>Hafiz Salau, Opeyemi Abisoye, Ishaq Oyefolahan and Solomon Adepoju</i>	
DETECTION OF PHISHING URLs USING HEURISTICS-BASED APPROACH.....	890
<i>Shakirat Aderonke Salihu, Idowu Dauda Oladipo, Abdul Afeez Wojuade, Muyideen Abdulraheem, Abdulrauph Olanrewaju Babatunde, Adeleke Raheem Ajiboye and Ghaniyyat Bolanle Balogun</i>	
A Real-time Privacy System for Electric Vehicles using Blockchain Technology.....	897
<i>Omaji Samuel, Ijegwa David Acheme, Ayodeji Samuel Makinde, Akogwu Blessing Omojo, Adamu Sani Yahaya, Hosam Alhakami and Wajdi Alhakami</i>	
An Ensemble-based Shill Billing Prediction Model in Car Auction System.....	905
<i>Akintunde Segun Micheal, Vincent Olufunke Rebecca and Tinubu Oreoluwa Carolyn</i>	
An Ensemble-based Shill Bidding Prediction Model in Car Auction System.....	911
<i>Akintunde Segun Micheal, Vincent Olufunke Rebecca and Tinubu Oreoluwa Carolyn</i>	
Machine Learning Based Student Performance Prediction in E-learning: A Survey.....	917
<i>God'Swill Theophilus and Christopher Ifeanyi Eke</i>	
Classification performance of supervised learners in intrusion detection on CICIDS2018 dataset.....	936
<i>Emmanuel Uwazie, Afolayan Obiniyi and Morufu Olalere</i>	

Handling class imbalance in intrusion detection dataset using undersampling and oversampling techniques.....	944
<i>Emmanuel Uwazie, Afolayan Obiniyi and Morufu Olalere</i>	
Sound Parameter Analysis for Early Detection and Prevention of Home Fire Outbreak ...	952
<i>Maudlyn Ireju Victor-Ikoh and Bunakiye Richard Japheth</i>	
Heart Disease Diagnosis Using Data Mining Techniques and a Decision Support System ..	956
<i>Olufunke Rebecca Vincent and Lawal Ismail Olatunde</i>	
A Brief Survey on the Experimental Application of MPQUIC Protocol in Data Communication	963
<i>John S. Wejin, Joke A. Badejo, Oluranti Jonathan and Folasade Dahunsi</i>	
AUTOMATION OF DEPARTMENTAL COURSE ALLOCATIONS AND TIME TABLING (A CASE STUDY OF UNIVERSITY OF ABUJA, ABUJA)	971
<i>Umoru Yahaya Ibrahim, Bisallah Hashim Ibrahim and Okonkwo Ngozi Ukamaka</i>	
Spam Email Detection using TSVD and Bayesian Belief Network.....	979
<i>Umoru Yahaya Ibrahim, Ugochi Lovelyn Orji and Bisallah Hashim Ibrahim</i>	
Enhancing the Transmission Performance of Step Index Plastic Optical Fiber.....	987
<i>Isiyaku Yau, Suleiman M. Sani, Aliyu D. Usman, Abdoulie M. S. Tekanyi, Aminu M. Abba and Danasabe Gambo</i>	
A Framework For Critical Infrastructure Monitoring Based On Deep Reinforcement Learning Approach.....	992
<i>Kefas Yunana</i>	



Mohammed Abdulmalik Danlami <drmalik@futminna.edu.ng>

2022 IEEE ITED Conference Notification for paper 11

1 message

ITED 2022 <ited2022@easychair.org>

Tue, Oct 18, 2022 at 4:25 AM

To: Mohammed Danlami Abdulmalik <drmalik@futminna.edu.ng>

Dear Mohammed Danlami Abdulmalik,

On behalf of the Technical Program Committee for the 2022 IEEE ITED Conference, we are pleased to inform you that your paper, listed below, has been provisionally Accepted for presentation at the Conference subject to the reviewers comments.

Paper ID: 11

Paper Title: A SURVEY OF DIGITAL WATERMARKING TECHNIQUES FOR DATA PROTECTION IN CLOUD COMPUTING

The comments from the paper review process are enclosed in this notification email. You will receive the Final Acceptance notice when these concerns are dealt with satisfactorily.

You are requested to revise your paper following the reviewer's comments within the 8-page limit for Full Papers. Ensure you strictly use the IEEE conference template to avoid camera-ready Rejection.

Submit the Camera-Ready paper before October 22nd, 2022, through EasyChair. Detailed camera-ready submission instructions has been provided on the Conference page <http://event.academaiinformationtechnology.org/>

NB: ONLY papers NOT exceeding 30% will qualify for Xplore proceedings.

Information on registration requirements has been posted on the Conference website: <http://event.academaiinformationtechnology.org/>.

Send any registration inquiries to the conference email. Be reminded that Only papers duly registered and presented at the Conference will be published in IEEE Xplore. You can contact the TPC and Publications chairs via kennedy.okafor@ieee.org ; faruk.n@slu.edu.ng

We look forward to having an exciting and rewarding Conference.

Sincerely,

Kennedy Chinedu Okafor, Ph.D., Fellow ASI, SMIEEE
Chair, Technical Program Committee, ITED 2022

SUBMISSION: 11

TITLE: A SURVEY OF DIGITAL WATERMARKING TECHNIQUES FOR DATA PROTECTION IN CLOUD COMPUTING

----- REVIEW 1 -----

SUBMISSION: 11

TITLE: A SURVEY OF DIGITAL WATERMARKING TECHNIQUES FOR DATA PROTECTION IN CLOUD COMPUTING

AUTHORS: Halima Nna Abbas, Mohammed Danlami Abdulmalik, Solomon Adelowo Adepoju and Enesi Femi Aminu

----- Overall evaluation -----

SCORE: 2 (accept)

---- TEXT:

- The paper is well structured and organized.
- The abstract is not sufficient enough. It should at least contain an introduction, the methodology, the results obtained, and the conclusion.
- Two many words in the keywords section.
- There are missing texts in figure 1 I guess.
- Different graphics should be added in the paper to showcase the several approaches presented.

----- REVIEW 2 -----

SUBMISSION: 11

TITLE: A SURVEY OF DIGITAL WATERMARKING TECHNIQUES FOR DATA PROTECTION IN CLOUD COMPUTING

AUTHORS: Halima Nna Abbas, Mohammed Danlami Abdulmalik, Solomon Adelowo Adepoju and Enesi Femi Aminu

----- Overall evaluation -----

SCORE: 1 (weak accept)

---- TEXT:

1. The references have to be arranged according to their order of appearance and half of the references have to be rewritten as vital information like year and conference name missing
2. The literature reviewed is not diverse. Most points are taken from a single point of view at a time.
3. The authors' point of view is not aired and the summary is not comprehensive
4. The novelty of the review has to be explicitly stated

----- REVIEW 3 -----

SUBMISSION: 11

TITLE: A SURVEY OF DIGITAL WATERMARKING TECHNIQUES FOR DATA PROTECTION IN CLOUD COMPUTING

AUTHORS: Halima Nna Abbas, Mohammed Danlami Abdulmalik, Solomon Adelowo Adepoju and Enesi Femi Aminu

----- Overall evaluation -----

SCORE: -2 (reject)

---- TEXT:

The paper is a review of digital watermarking techniques for cloud computing.

Comments:

1. There are lots of grammatical errors in the paper.

2. The paper's abstract is poorly written.
3. The survey provided does not adequately address the strengths and weaknesses of the existing techniques reviewed.
4. Provide a research gap which would be addressed as a consequence of the survey.
5. The paper has no preliminary results and very few pictorial illustrations that would have made it a better write-up.

----- REVIEW 4 -----

SUBMISSION: 11

TITLE: A SURVEY OF DIGITAL WATERMARKING TECHNIQUES FOR DATA PROTECTION IN CLOUD COMPUTING

AUTHORS: Halima Nna Abbas, Mohammed Danlami Abdulmalik, Solomon Adelowo Adepaju and Enesi Femi Aminu

----- Overall evaluation -----

SCORE: 0 (borderline paper)

----- TEXT:

The authors presented a survey on the Digital Watermarking Techniques for data protection in Cloud Computing. However, the following corrections should be made to improve the quality of the manuscript.

1. The Abstract MUST be extended. The current abstract does not give a good description of the survey.
2. The introduction needs to be revised to highlight the major contribution of the survey.
3. the process of literature review (inclusion and exclusion criteria) should be included. It is not appropriate to select random studies for review.
4. The "Related Literature" section be revised. It is not appropriate to add the reviewed paper to the "Related Literature" section.
5. Table 1 should not be split into two columns.
7. Some references (30 and 31) were not cited in the body of the manuscript. The first in-text reference should be [1] and not [2].
8. Endeavor to use the appropriate template for the revised version of the manuscript.

A Survey of Digital Watermarking Techniques for Data Protection in Cloud Computing

Abbas Nna Halima
Department of Computer Science
Federal University of Technology
Minna, Nigeria
Halimanna1983@gmail.com

Mohammed Danlami Abdulmalik
Department of Computer Science
Federal University of Technology
Minna, Nigeria
drmalik@futminna.edu.ng

Solomon Adelowo Adepoju
Department of Computer Science
Federal University of Technology
Minna, Nigeria
solo.adepoju@futminna.edu.ng

Enesi Femi Aminu
Department of Computer Science
Federal University of Technology
Minna, Nigeria
enesifa@futminna.edu.ng

Abstract - Recently digital watermarking techniques played an essential role in protecting and authenticating the copyright of multimedia content in a cloud. Based on the literature, there are several digital watermarking techniques used for data protection in cloud computing. However, each of these techniques has its own limitations such as high levels of piracy, theft, and unauthorized distribution of multimedia content. This Survey employs a content-based analysis approach to investigate the watermarking techniques that are more secure, imperceptible, and robust against various kinds of multimedia attacks. The survey shows that the hybridization of watermarking techniques and feature descriptors is more efficient in comparison to a single watermarking technique. This research work concludes that the hybridization technique and use of descriptors are more secure.

Index Terms: Digital Watermarking, multimedia contents, feature descriptors, authentication, robustness, hybridization.

I. INTRODUCTION

Cloud computing has emerged as one of the most efficient computing paradigms in the world of information technology in recent years. This is due to an increase in parallel, grid-distributed, and other paradigms form of computing [1]. In Cloud, computing customers are offered three basic service models; the SaaS model, the IaaS model, and the PaaS model. The SaaS model which means Software as a service is primarily designed for the end user who has to use the software in performing their day-to-day activities. However, the Platform as a service (PaaS) is primarily designed for developers that require a platform environment to develop their software and application [1]. While Infrastructure as a service (IaaS) is built for network architect development requirement service. User data and information can be stored and accessed via the cloud without the knowledge of data located in the cloud. Security in cloud computing has been frequently raised as one of the most pressing issues in computing. In order to establish ownership authenticity and prevent the issues of data misusing, multimedia information or content can be secure using the watermarking approach. Cloud computing has three categories which include public cloud computing; this cloud computing service are been provided by a third-party body that is built on the internet,

this service is accessibly by any customer or users who want to use it by paying for the specific service they are consuming [2]. Secondly, Private Cloud computing services are being provided or accessed via the internet or a private network. In this category, services are offered to only a specific set of users, though a high level of security and privacy is implemented through internet hosting and firewall. Finally, the hybrid cloud service provides a combination of private and public cloud services to users. Within the hybrid cloud, both public and private clouds can be managed independently but applications and data can be distributed or shared among the clouds in the hybridized cloud (private and public cloud) [2].

The massive inventions of digital multimedia products lead to the high demands on authenticity, protection, and security of any digital multimedia content [3]. The potential solution is presented with the inventions of digital watermarking approaches, which tends to secure ownership rights and interest by embedding certain form of information secretly that is only known to the owner into the digital media intended to be secure.

Furthermore, watermarking can be defined as the method of embedding a dual or single watermark item into digital multimedia content such as audio, images, and video content [3]. The three types of watermarking techniques are spatial domain, frequency domain, and hybrid domain. The most common examples of frequency domain watermarking techniques or approaches include SVD (Singular Value Decomposition) and the Karhunen-Loeve Transform (KLT). The spatial domain approaches are basically the initial techniques adopted, in which embedding of the watermarked image can be achieved by modifying the pixels of the image directly [3]. The spatial domain is widely used due to the advantages derived in terms of low computational cost and accessibility to implementation. For example, the LSB (Least Significant Bit), spectrum, and correlation base are the most common spatial domain algorithm. Additionally, there are three types of watermarking systems; blind watermarking, non-blind watermarking, and semi-blind watermarking. Although the original image is not required in the blind watermarking, because the techniques only extract the watermarked image. The blind watermarking approach is

widely adopted in the field of healthcare and copyright protection. The Nonblind approach of watermarking copies the source or original image and the watermark that is embedded alongside the test data for extraction, the methods are frequently used in covert communication and copyright protection. The Final method of watermarking system is the Semi blind watermarking, this deprived to requiring the original data for detection. In the area of image authentication and CAD models, semi-blind watermarking is adopted [4].

Digital Content or media can also be secured using Cryptography techniques. After the media content has been decrypted, there will be no further protection on the media content, hence this results in illegal access to private information. This limitation is being rectified using digital watermarking. This has improved multimedia content protection and authentication without reducing the visual quality of the original image. A certain factor is considered while securing multimedia content, this includes the robustness of the image, the ability to authenticate and validate ownership, security, capacity, and imperceptibility. All these factors determine the efficiency of various watermarking algorithms [5]. However, the features descriptors algorithm has a significant positive impact on almost all computer vision, this area includes object tracking, mobile robot mapping, panorama stitching, and 3D surface reconstruction by taking the description and detection of several points on an image. Example of feature detection algorithms includes the SURF algorithm, SIFT algorithm, ORB algorithm, and finally the BRIEF algorithm [6]. Features descriptors are divided into two main classes namely, floating point descriptors and binary descriptors. The most common example of floating-point descriptor is SIFT and SURF while BRIEF, ORG, BRISK, and FREAK are a typical example of binary descriptors. Feature descriptions are known to be at the core of various computer vision technologies, such as the reconstruction of 3D images, object recognition, image retrieval, and localization of the camera. Technologies that can handle a large amount of data, and run on modern devices with minimum computational power are in high demand in the field of information technology [6]. Hence, the development of these fast descriptors algorithms is growing exponentially with the capability of fast computational description, fast feature matching, efficient memory utilization, and accurate feature description [7]. Various feature descriptors algorithm has been developed. These include Scale Invariant feature transform (SIFT) which is now described as the cutting edge to feature descriptors due to its robustness against rotation and scaling attacks. In addition to the SIFT algorithm, other faster descriptors are developed that include Speed Up Robust Features (SURF), and Binary Robust Independent Elementary Features (BRIEF) [8]. The brief algorithm is incredibly good in performance and yet still a simple feature descriptor. Other descriptors include; Features from accelerated segment tests (FAST) and rotated binary robust independent elementary features (ORB). [9], [10].

The research problem identifies that security has been a challenging aspect for the past decade. The Cybertheft of multimedia content has increased exponentially due to the advancement in technology. [11] already stated that

multimedia content should include authenticity and ownership stamps due to the theft, piracy, or modification of this multimedia. Many techniques have been proposed to secure multimedia data (images or video). A comprehensive survey on existing and trending (either single or hybrid) techniques has not been diligently analyzed or surveyed.

Consequently, this research work aims to review previous research papers that adopt single techniques and hybrid watermarking techniques. In addition, feature descriptors techniques can drastically improve watermarking techniques in terms of capacity, speed, robustness, imperceptibility, and security.

The goal of this study is to undertake a comprehensive review of watermarking schemes for safeguarding multimedia content. The considered domain in this survey includes a frequency domain, a spatial domain, a hybrid domain, and feature descriptors along with their hybridization.

In this survey, the contribution achieved is that the hybridization of watermarking techniques and the use of feature descriptors are found more effective, based on the majority of reviewed papers that identify hybridization techniques and descriptors in terms of merits (strength).

II. LITERATURE REVIEW

A. Survey Approaches

Many approaches have been proposed to improve digital watermarking, in protecting multimedia content from piracy. A comparative analysis will be employed based on existing single or large algorithms (methodology), merits (the advantages of using these algorithms), and demerits (the limitation or drawbacks) in terms of robustness, imperceptibility, security, and capacity [12].

B. Approaches of Digital Watermarking Algorithm

Digital information has been protected using various watermarking schemes over the years. This technique helps in verifying the integrity and authenticity of the carrier signal. Technically watermark could be a text or secondary image that is embedded into another host image for protection [13]. Digital watermarking is being widely used in areas such as copyright protection, broadcast monitoring, tamper detection, image processing, authenticity verification, and the like.

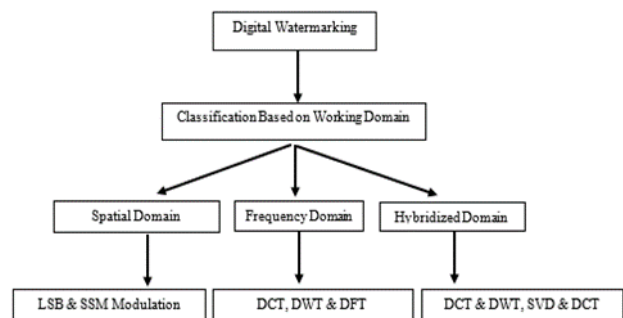


Fig. 1: Pictorial depiction of various categories of digital watermarking

i. Spatial Domain Techniques:- Techniques under the spatial domain branch work quite well on image pixels, by modifying the pixel value for embedding watermark data. The Least Significant Bit (LSB) is rank the most frequently adopted techniques use under the spatial domain. The primary or main benefit of spatial domain watermarking algorithms is the simplicity, low computational complexity, and less time consumption. the estimated computational speed of spatial domain techniques is very fast in comparison to the frequency domain and it can be easily applied to any image. One potential drawback of spatial domain techniques is the less robustness to many attacks than that of the frequency domain techniques [3], [13]

ii. Frequency Domain Techniques:- The frequency domain is more efficient than the spatial techniques. Images are represented in form of frequency. Hence, the frequency domain techniques are more adopted in digital watermarking in comparison to the spatial domain techniques. The major aim of this technique is to take a host image and embed a watermark in the spectral coefficients. The most frequently used algorithm in the frequency domain includes the Discrete Wavelet Transform (DWT), Discrete Fourier Transform (DFT), Singular Value Decomposition (SVD), and finally the Discrete Cosine Transform (DCT) [13]

Spatial Domain and hybridize watermarking algorithms

The mode widely used digital watermarking method in the spatial domain is described in this section.

1. Least Significant Bit (LSB): - Considering the spatial domain the least significant bit approach for watermarking is the simplest, and it holds a small amount of relevant information. Hence, LSB modification on the image does not cause visible changes. Watermark embedding is easier using LSB by randomly selecting pixels of the source image. For a given image each pixel is represented using an 8-bit stream and the watermark is added to selected pixels of the host image. Considering the implementation point of view LSB approach is easier [14]. In addition, the LSB does not result in severe distortion of the image. It is however not highly resistant to attacks [13].

2. Spread Spectrum Modulation Techniques: - The spectral-based modulation techniques generate energy at different discrete frequencies. Increase in resistance to natural interference as to be established for communication to be established. The SSM watermarking algorithm embeds information and data in the context of image watermarking. Hence, when the context of image watermarking is applied it embeds information or messages by adding up the cover image with a little pseudo-noise signal modulation [13].

Frequency Domain and hybridize watermarking algorithm

1. Singular Value Decomposition (SVD)

SVD is an effective technique for handling matrix problems generally. SVD decomposes a rectangular matrix into two orthogonal matrices and a single diagonal matrix [15]. Singular value decomposition is a very sophisticated numerical analysis approach for metrics that produce the smallest truncation error [16]. It's a widely used metric because of the total possible level of freedom offered by the matrices, which is equal to the input cover image. The key property of SVD in image processing is the singular value of an image that has good stability, the intrinsic algebraic image properties are represented using singular value [17].

2. Discrete Cosine Transform (DCT)

The discrete cosine transform is used to convert spatial domain signals into frequency domain signals, hence it is used in signal processing. Various fields such as pattern recognition, data compression, and other aspects of image processing. However, the discrete cosine transform is more robust than that of the spatial domain watermarking algorithm. The DCT algorithm is similar to the discrete Fourier Transform; though, it represents data in a form of frequency space not in amplitude space. In DCT signals are converted into elementary frequency components [13].

3. Discrete Wavelet Transformation (DWT)

Many signal processing applications adopt the use of discrete wavelet transformation. Applications such as video, audio compression, and wireless antenna distribution, are used in removing noise from audio. The signal of DWT changes in relation to time, which makes it suitable for most applications. The wavelets' energy is centrally based on time and this makes it more suitable for transient analysis, and varying time signals. The discrete wavelet transformation is faced with the tradeoff between robustness and imperceptibility [13]. In DWT multi-resolution representations of the image are given in a simple framework to describe image information. Analysis of the signal is carried out in different resolutions by the DWT. Images are decomposed into high-low and low-frequency quadrants

4. Discrete Fourier Transform (DFT)

Discrete Fourier transform is well known due to its high robustness to attacks such as cropping, rotation, translation, and scaling attacks. Images are spat into sine and cosine forms in DFT. They are two main classifications of DFT techniques based on the approach of embedding which includes; direct embedding (though, DFT magnitude and the phase coefficient are adjusted for watermark embedding) and template base embedding (which proposed the use of template). Templates are basically the structure that is embedded in the DFT domain and is used for computing the transformation factors when the image goes under transformation. The

central component which contains the low frequency is the primary component of DFT [13].

5. Hybridized DWT and SVD Banjarnahor et al [18] Techniques

Discrete wavelet Transformation and Singular Value Decomposition hybridization are adopted in various research papers such as the work of Singh et al [13], Banjarnahor et al [18], Yadav et al [19], and many others. This study considers hybridized SVD and DWT techniques to strive to achieve great security and efficiency in comparison to other frequency domain watermarking. However, the performance of the hybridized techniques is evaluated using the PSNR, SSIM, and NC. Based on this approach the strength of DWT and SVD are merged together. Nonstationary signal processing and image decomposition are carried out using DWT, while the singular value decomposition is utilized in the manipulation of data with minimum loss and data denoising. The SVD also contributes intrinsic geometric attribute of the image. In this paper, both algorithms are proposed to improve efficiency in terms of robustness and imperceptibility [18]. The techniques show better performance by giving a result of PSNR above 37dB.

6. Hybridized DCT and SVD (Kanche & Gnanasekaran [20] Techniques.

Few types of research such as Kanhe & Gnanasekaran [21] adopted the hybridization of discrete cosine transform and singular value decomposition, in other to attain a high level of robustness and imperceptibility. this survey work will only consider the research paper of [21], which uses both DCT and SVD transform techniques to achieve a robust image in audio watermarking. This is achieved by selecting the audio signal low-frequency component for embedding the watermark image data, this makes the watermarked audio to be highly robust and imperceptible. The researcher evaluates or measures the robustness of the proposed hybrid techniques using the bit error rate and computed average information loss. The robustness is highlighted using Shannon's entropy to compute the information loss in retrieving the watermarked image. A high value of SNR is confirmed which shows that the hybridized approach is highly imperceptible. high embedding capacity of 6kbps is achieved [16, 17].

7. Hybridized BPNN and DWT Ananth, et al [22] techniques.

Multiple watermarking for images is achieved in this research work of Ananth, et al., [22] which adopts a hybridized Back Propagation Neural Network (BPNN) and Discrete Wavelet Transformation. Using the improved BPNN, watermark images are inserted into multiple cover images, which maximize or improved learning space, and minimum error, and qualified neural networks are extricated with various watermarks as of the embedded images. With this technique. There is an excellent achievement in the visual effect of the watermark schedule and high robustness while extracting the multiple watermarks [22]

8. Hybridized Speed-up robust features (SURF), DCT, and SVD

In the proposed hybridized algorithm, a chaotic is used for watermarking medical images and providing adequate security on medical images. The SVD algorithm is used to decompose or split the original matrix into three different matrices. The watermarked image is produced by merging the watermark image with the cover image using the SURF-DCT-SVD technique. The researchers carried out various research on the proposed method and based on the experimental result it was shown that SVD can enhance the resistance of DCT and SURF-based watermarking schemes to attacks. The proposed watermarking scheme is able to resist JPEG compressional attacks, signal processing, noise addition, and geometric attacks [23].

9. Hybridized watermarking Scheme using SIFT with Reversible Rotation Huang et al [23]

This research work proposed a watermarking method using scale invariant feature transformation (SIFT) to save guide medical data using integer rotation in protecting the confidentiality of medical data. Hence, the position of the original data is extracted using SIFT, the reversible integer rotation algorithm is used to rotate the host image. Steganography data is generated by estimating the distortion and the histogram scale. The variant of the histogram scale is used to embed after applying integer rotation using the angles as the alternative parameter. The method resulted in imperceptible with an average peak signal-to-noise ratio (PSNR) of 50.595 and an average entropy of 5.16 [23].

10. Hybridized RDWT-SVD approach Sharma et al [24]

These watermarking techniques are used for adaptive color image watermarking. Various existing scheme of watermarking uses a grayscale or binary image for watermarking, but the researcher proposed new adaptive and robust techniques for watermarking, the watermark and the host image are both colored images and image with equal dimensionality. Moreover, this technique is improved by scrambling both the colored cover image and watermark image using the map of Arnold chaotic. The redundant discrete wavelet transforms (RDWT) decompose the host image in a smaller matrix of four with equal dimensions, each sub-matrix undergoes a singular value decomposition in other to get the principal component (PC). This approach overcomes the primary security challenge of false error (FPE), which mostly surface in the traditional watermarking scheme using SVD [24]

11. Medical Image Watermarking Based on SIFT-DCT Perceptual Hashing (Lui et al [25])

This approach was developed to solve the issue of medical data protection. The algorithm hybridizes the Scale Invariant Feature Transform and the discrete cosine transform using perceptual hashing. Initially, the approach uses SIFT-DCT perceptual hashing to get the attribute of the main or original medical images, then

quantize it to generate the hashing sequence. In order to encrypt the watermarking and integrate it into the medical image, the hybridizing process uses a chaotic map. Finally, the correlation coefficient of the extracted watermarking and embedding sequence is calculated to show the algorithm's robustness. However, the proposed hybridized algorithm shows the result of good robustness with respect to geometric attacks, conventional attacks, and most important terms of rotation, translation, and cropping [25].

12. A SIFT Feature-based blind watermarking for DIBR

The approach is used for blind watermarking a Depth Image Based Rendering (DIBR). It is a promising method for deducing viewpoint using a monoscopic middle image which is grouped per-pixel depth map. Based on various merit which includes low-cost bandwidth, adjustment of depth condition, two dimensional to three-dimensional compatibility. These advantages make depth image-based rendering gain much attention in the three-dimensional research community. Based on the case of the broadcasting system using DIBR, a malicious adversary can unauthoritatively distribute both a middle view and synthesized virtual view as two-dimension and three-dimension content. However, to protect the copyright of a depth image-based rendering, the Scale Invariant Feature Transform (the SIFT algorithm) feature based for blind watermarking is proposed in this paperwork. The proposed techniques show a low Bit Error Rate for signal processing attacks and geometric distortion processes based on translation and cropping [26].

13. Hybridized DWT, DCT, and SIFT Hamidi et al., [20] technique

The researcher adopts hybridized techniques for copyright protection. The method includes DCT, DWT, and SIFT. However, the major focus of the researchers is to develop a feature-based image watermarking technique, which is capable of withstanding both image processing and geometric modification, while maintaining imperceptibility. The SIFT feature point is registered to be used in the extraction procedure in order to correct the geometric attack, and the DCT and DWT are for embedding. While maintaining imperceptibility, the techniques have proven strength or robustness against traditional image processing attacks and geometric modification [20].

14. Hybridized LBP and DWT Based Fragile watermarking scheme for Image Authentication

The researchers considered merging two techniques for image authentication and fragile-based watermarking. The Discrete Wavelet Transform (DWT) uses better multi-resolution decomposition attribute and the frequency component is low, which contain primary or basic data of an image. Then the low-frequency wavelet coefficients pattern of a local binary pattern is utilized as

a watermark feature. Which is now included in the least significant bit. However, this researcher proposes the application of a logistic map to secure the watermark in order to ensure the security of the hybridized logic. The result of this technique presents a higher visual quality. In comparison to other techniques, it has a low watermark payload and also achieved better performance in localization and tamper identification for various attacks [23, 24].

III. FINDINGS

This review gathers and identifies facts and showcases the performance of the most popularly used watermarking approach and hybridize watermarking techniques. Hence, the table below summarizes various approaches adopted in watermarking and feature descriptors domain.

Table 1. Strengths (Merits) and Weakness (Demerits) of the Existing Techniques Reviewed

S/No.	Approach	Usability	Merits	Demerits
A	Least Significant Bit: (LSB)	It converts the host image into a shaded grayscale image, it hides text represented using 8 bits by referencing the converted image.	The LSB is very simple and easy from its point of implementation	This approach is defenseless against the Stegano-analysis. The techniques are not robust to all attacks
B	Discrete Cosine Transform (DCT)	The algorithm is used to carry out signal processing by converting or transforming spatial domain signals into frequency domain signals. It also represents the signal in frequency space rather than using amplitude space	Robust on an image with low pass filtering, contrast brightness, and blurring effect	Not Robust to all geometric attacks such as rotation, cropping, and scaling.
C	Discrete Wavelet Transformation (DWT) algorithm	Widely used in signal preprocessing, such as audio and video compression, noise removal, and simulation of wireless antenna distribution	Scalable in nature and is good in multi-resolution techniques and spatial domain localization.	High computational cost, and it takes a longer time in performing computation.
D	Discrete Fourier Transform (DFT) algorithm	DFT is applied in the area direct embedding or template embedding is required.	The main benefit it is found to be rotation, scaling, and transition (RST) invariant over DCT, DWT and RST. Easily overcome geometric distortion.	Computational inefficient, complex values and more frequency rate are required.
E	Singular Value Decomposition (SVD) algorithm	It is used in image compression, watermarking, de-noising forensics, and analyzing rectangular matrices.	Achieves high stability against variation in histogram equalization, filtering, noise histogram, and compression due to the addition of a weighted watermark.	The major issue of SVD occurs when its use for non-blind watermarking, though not robust to intentional attack in terms of fast extraction from watermark image.
F	Hybridize DWT, SVD Banjahor <i>et al</i> [18] algorithm	Hybridized techniques are used to secure digital medical images.	It provides higher security and efficiency in comparison to other frequency domains. It also overcomes the limitation of conventional SVD techniques.	Not design for colored images and for videos
G	Hybridize DCT, SVD (Kanhe & Gnanasekaran, [21] Techniques.	The hybridized approach is used to design a more robust image in audio watermarking.	High data payload, low pass filtering, and high pass filtering attack.	It is not Robust to withstand pitch-shifting attacks, random cropping attacks, and time-scale modification attacks.
H	Hybridize BPNN, DWT Ananth, [22] Techniques.	The hybridized techniques are used for multiple watermarking of images	Enable multiple embedding with the advancement of learning space and error reduction. Imperceptibility on watermarking and high robustness on the extracted watermark.	Computationally complex, and computationally inefficient.
I	Hybridize DWT, DCT, and SIFT Hamidi <i>et al.</i> , [20] Techniques.	The primary usage of this approach is to protect the owner's copyright.	High robustness against image processing and geometric manipulation attack while high imperceptibility is maintained	No usage of a meta-heuristic algorithm in finding optimal watermarking strength.
J	Hybridize SIFT, DCT Liu, <i>et al.</i> , [25] Perceptual Hashing Techniques.	The hybridized approach is used to secure medical data and images.	Highly robust to translation, rotation, and shared attack. It is also applicable in the field of identification	Not robust to other attacks such as time scale attacks, shifting attacks, image processing attacks, and the like.
K	Hybridization of SURF and DCT Utami <i>et al.</i> , [23] on SVD Techniques.	Robust hybridization for watermarking and securing medical images.	The hybridize robust scheme is able to resist JPEG compressional attack, signal processing, noise addition, and geometric attack	Not robust to other image's extensional attack apart from JPEG compression attack.

L	Hybridization of LBP and DWT Wang et al., [26] techniques based on Fragile watermarking.	Fragile watermarking hybridize approach for image authentication.	Higher image quality, resist various attacks and locate tempered areas accurately with minimum payloads.	The hybridized technique is not capable of detecting edge region that is tempered.
M	Novel LBP Wang et al., [9] techniques for blind feature image steganography	The techniques are used in preserving the local structure of the cover image in the resulting steganography image.	High embedding capacity and robustness in stegno-analysis comparison to LSB	The techniques are unable to handle payload specific for hand-crafted descriptors use in embedding data.

IV. RECOMMENDATION

In this study, thirteen (13) different hybridized techniques have been elaborately analyzed accordingly. Six techniques from the watermarking scheme are looked into, five hybridization techniques from both watermarking domain and feature descriptor have been surveyed, from the spatial domain two algorithms are showcased, and finally, eleven watermarking techniques from the frequency domain are comprehensively explained. It is observed in this work that the hybridization of watermarking techniques and feature descriptors has improved the robustness, capacity, security, and imperceptibility of multimedia content. based on the efficient digital description and matching capability of feature descriptors on multimedia content, even in a situation where the multimedia content is distorted. Considering table 1, The research approach that utilizes both domain techniques (watermarking and feature descriptors) help to build a better and more robust system in term of rotation attack, translation attack, scale attack, and shared attack, and it is not limited to other geometric attacks and compression attack. However, a single watermarking technique is not as robust, imperceptible, and secure as paperwork with hybridized techniques. It is recommended to adopt a hybrid approach to support each technique's strengths and limitations in a merging technique. Furthermore, if needs warrant to enhance digital content security, feature descriptor has shown great promising strength.

V. CONCLUSION AND FURTHER STUDIES

In this paper, twenty-six (26) existing research papers on both single and hybrid approaches in watermarking techniques and feature descriptors have been surveyed. This includes their usability or functionality, with corresponding advantages (merits) and limitations (demerits). The capability of each technique in terms of robustness, imperceptibility, and capacity is also comprehensively stated in table 1. It identifies that hybridize techniques are more robust, imperceptible, and secure than adopting single techniques. However, the adoption of feature descriptors in recent work has shown better results in terms of robustness and capacity of multimedia content while still maintaining its quality, feature descriptors are currently the core of many multimedia processing technologies.

future studies should consider surveying and comparing machine learning techniques and deep learning approaches to achieve greater levels and much stronger security, robustness, and imperceptibility of multimedia content.

REFERENCES

- [1] T. Alam, "Cloud Computing and its role in the Information Technology," *Transactions on Sustainable Digital Innovation*, Madinah, vol. 1, no. 2, pp.108–115, <https://doi.org/10.34306/itsdi.v1i2.103>, 2020.
- [2] P. Srivastava and R. Khan, "A Review Paper on Cloud Computing," *Int. J. Adv. Res. Comput. Sci. Softw. Eng.*, vol. 8, no. 6, p. 17, 2018, doi: 10.23956/ijarcsse.v8i6.711..
- [3] N. Agarwal, A. K. Singh, and P. K. Singh, "Survey of robust and imperceptible watermarking," *Springer. Multimed. Tools Appl.*, vol. 78, no. 7, pp. 8603–8633, doi: 10.1007/s11042-018-7128-5, April 2019.
- [4] N. R. Zhou, W. M. X. Hou, R. H. Wen, and W. P. Zou, "Imperceptible digital watermarking scheme in multiple transform domains," *Multimedia Tools and Applications.*, vol. 77, no. 23, pp. 30251–30267, 2018, doi: 10.1007/s11042-0186128-9..
- [5] A. P. Tafti et al., "A comparative study on the application of SIFT, SURF, BRIEF and ORB for 3D surface reconstruction of electron microscopy images," *Computer Methods Biomech. Biomed. Eng. Imaging Vis.*, vol. 6, no. 1, pp. 17–30, 2018, doi: 10.1080/21681163.2016.1152201
- [6] S. Y. Tan, H. Arshad, and A. Abdullah, "Distinctive accuracy measurement of binary descriptors in mobile augmented reality," *PLoS One*, Beijing, China, vol. 14, no. 1, pp. 1–18, 2019, doi: 10.1371/journal.pone.0207191.
- [7] M. Calonder, V. Lepetit, M. Özuysal, T. Trzcinski, C. Strecha, and P. Fua, "BRIEF: Computing a local binary descriptor very fast," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 34, no. 7, pp. 1281–1298, 2012, doi: 10.1109/TPAMI.2011.222.
- [8] J. Zhang, X. Liu, and X. Liu, "Design of Binary Robust Independent Elementary Features through Compressive Sensing View," *Int. J. Appl. Phys. Math.*, vol. 5, no. 1, pp. 67–75, 2015, doi: 10.17706/ijapm.2015.5.1.67-75.
- [9] T. Wang, Z. Wang, Y. Cao, Y. Wang, and S. Hu, "A multi-BRIEF-descriptor stereo matching algorithm for binocular visual sensing of fillet welds with indistinct features," *Journal of Manuf. Process.*, vol. 66, no. April, pp. 636–650, 2021, doi: 10.1016/j.jmapro.2021.04.031.
- [10] M. Calonder, V. Lepetit, C. Strecha, and P. Fua, "BRIEF: Binary robust independent elementary features," *Lect. Notes Comput. Sci. (including Subser. Lect. Notes Artif. Intell. Lect. Notes Bioinformatics)*, vol. 6314, no. 4, pp. 778–792, 2010, doi: 10.1007/978-3-64215561-1_56.
- [11] M. Abdel-Basset, M. Mohamed, and V. Chang, "Neutrosophic Multi-Criteria Decision Analysis (NMCD): A framework for evaluating cloud computing services," *Elsevier, Futur. Gener. Comput. Syst.*, vol. 86, pp. 12–29, 2018, doi: 10.1016/j.future.2018.03.014.
- [12] O. P. Singh, A. K. Singh, G. Srivastava, and N. Kumar, "Image Watermarking Using Soft Computing Techniques: A comprehensive survey A comprehensive survey," *Multimedia*

Tools and Applications, Springer Nature, vol 80(7), pp. 30367–30398, 2021, doi: 10.1007/s11042-020-09606-x.

- [13] R. Rawat, N. Kaushik, and S. Tiwari, “Digital Watermarking Techniques,” *Int. J. of Advan. Res. in Comp. and Comm Eng*, Dehradun, India, vol. 5, no. 4, 2016, doi: 10.17148/IJARCCCE.2016.54123.
- [14] K. Bansal, A. Agrawal, and N. Bansal, “A survey on steganography using least significant bit (LSB) embedding approach,” *4th International Conference on Trends in Electronics and Informatics (ICOEI) (48184)*, IEEE, 2020, no. pp. 64– 69, doi: 10.1109/ICOEI48184.2020.9142896.
- [15] N. Singh, “Suitability of Singular Value Decomposition for Image Watermarking,” *2019 6th Int. Conf. Signal Process. Integr. Networks*, pp. 983–986, 2019. Corpus ID: 155107336, doi:10.1109/SPIN.2019.8711749
- [16] J. Dongarra et al., “The singular value decomposition: Anatomy of optimizing an algorithm for extreme scale,” *Manchester Research Explore SIAM Review*, vol. 60, no. 4, pp. 808–865, 2018, <https://doi.org/10.1137/17M1117732>.
- [17] D. M. K., “SVD based Image Watermarking Scheme,” *International Journal of Computer Applications (IJCA) Special Issue on “Evolutionary Computation for Optimization Techniques*, 1(4) pp. 21–24, ECOT 2010. doi: 10.5120/1531-134
- [18] J. Banjarnahor et al., “Digital Watermarking For Medical Images Using Dwt and Svd Technique,” 2021, *IOP Conf. Series: Materials Science and Engineering* 1084 (2021), doi: 10.1088/1757899X/1084/1/012034.
- [19] B. Yadav, A. Kumar, and Y. Kumar, “A Robust Digital Image Watermarking Algorithm Using DWT and SVD” *Soft Computing: Theories and Applications. Advances in Intelligent Systems and Computing*, vol 583, pp. 25–36. Springer, Singapore. 2018, https://doi.org/10.1007/978-981-10-5687-1_3.
- [20] M. Hamidi, M. El Haziti, and H. Cherifi, “A Hybrid Robust Image Watermarking Method Based on DWT-DCT and SIFT for Copyright Protection,” *Journal of Imaging* 2021, 7(10), 218; 2021, <https://doi.org/10.3390/jimaging7100218>.
- [21] A. Kanhe and A. Gnanasekaran, “Robust image-in-audio watermarking technique based on DCT-SVD transform,” *Eurasip J. Audio, Speech, Music Process.*, vol. 2018, no. 1, pp. 1– 12, 2018, doi: z10.1186/s13636-018-0139-3.
- [22] C. Ananth, M. Karthikeyan, N. Mohananthini, S. Saravanan, and M. Swathisriranjani, “Multiple watermarking for images using backpropagation neural network and DWT,” *Int. J. Eng. Adv. Technol.*, India, vol. 9, no. 1, pp. 4088–4093, 2019, doi: 10.35940/ijeat.A1327.109119.
- [23] X. Huang, “A New Watermarking Scheme Based on SIFT Feature Points with Reversible Rotation,” *2019 First Int. Conf. Digit. Data Process.*, pp. 59–64, doi: 10.1109/DDP.2019.00021.
- [24] S. Sharma, H. Sharma, and J. B. Sharma, “An adaptive color image watermarking using RDWT-SVD and artificial bee colony-based quality metric strength factor optimization,” *Appl. Soft Comput. J.*, vol. 84, p. 105696, 2019, doi: 10.1016/j.asoc.2019.105696.
- [25] J. Liu, J. Li, J. Chen, X. Zou, J. Cheng, and J. Liu, “Medical Image Watermarking Based on SIFT-DCT Perceptual Hashing” *International Conference on Cloud Computing and Security, (ICCCS)*. vol 11066, pp 334–345, Springer, Cham. 2018, https://doi.org/10.1007/978-3-030-00015-8_29
- [26] H. Karajeh and M. Maqableh, “An Imperceptible, Robust, And High Payload Capacity Audio Watermarking Scheme Based on The DCT Transformation and Schur Decomposition,” *Analog Integr. Circuits Signal Process.*, vol. 99, no. 3, pp. 571–583, 2019, <https://doi.org/10.1007/s10470-018-1332-0>