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Gangavaram (V), Kovur (M), S.P.S.R. Nellore - 524137

PROCEEDINGS

International Conference on Latest Trends in Electronics Communication and AI Technologies (ICLTECAT - 2025)

2 & 3 APRIL 2025

EDITORIAL BOARD :

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Professor, Dept. of CSE, GIST
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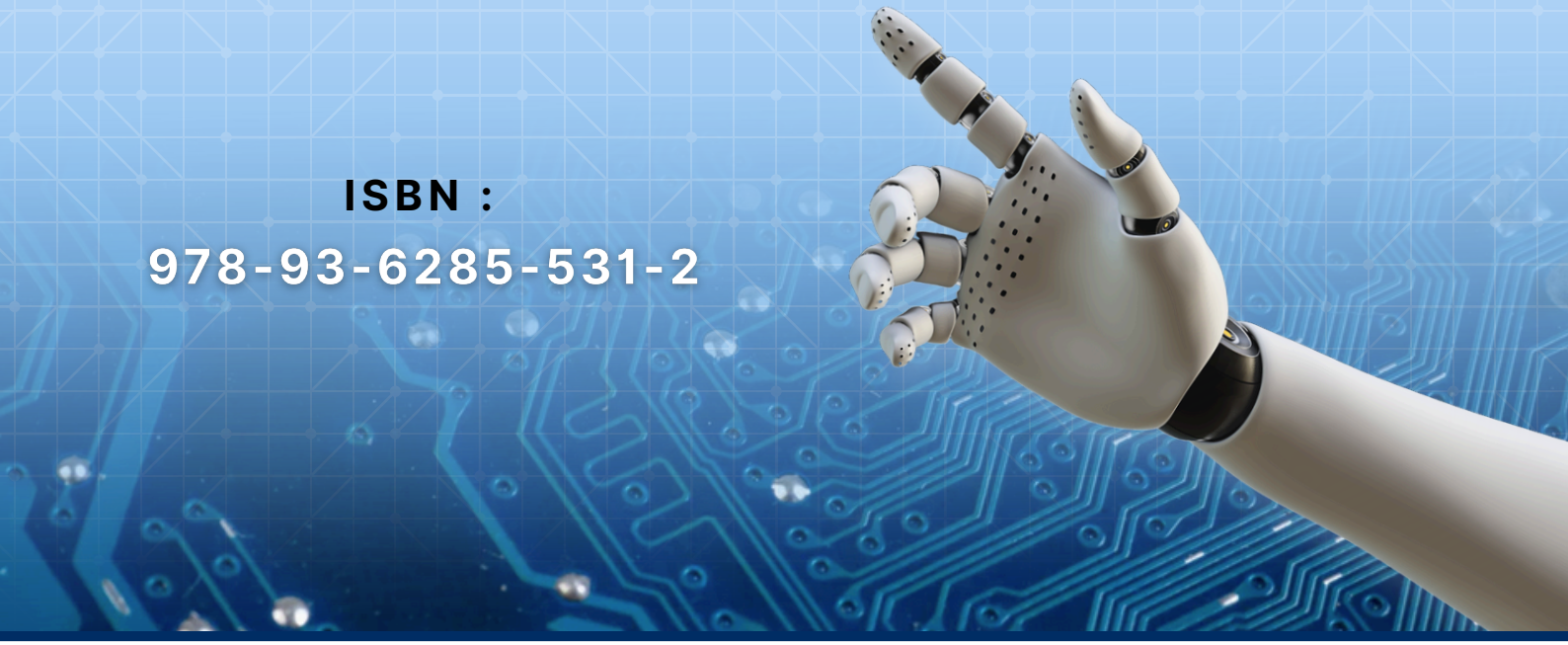

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ACKNOWLEDGEMENT

It is our immense pleasure to put forth the proceedings of the **ICLTECAT - 2025 International Conference on Latest Trends in Electronics Communication and AI Technologies**, held on 2nd-3rd April 2025. This compilation is, without mentioning it, the testament of collective effort and dedication of too many individuals and organizations to whom we are immensely grateful.

First and foremost, we extend our sincere thanks to our Principal, Dr. K. Sundeep Kumar, who provided us constant encouragement with his visionary leadership and kept on supporting us endlessly throughout the conduction of the conference and preparation of the book.

We would like to extend our heartfelt thanks to our Director, Sri. G. Subba Rao, for his unwavering support and guidance throughout the preparation and execution of this Conference.

We would like to express our deepest gratitude to our Chairman, Sri. D. B. Ravi Reddy, who always inspired and guided us with his valuable suggestions, and also to our Secretary & Correspondent, Sri. N. Sudhakar Reddy, for his continuous support and valuable contributions towards this noble initiative.

We would also like to place on record our deep appreciation for the hard work and dedicated work with a collaborative spirit displayed by the Faculty, Staff, and Students of Geethanjali Institute of Science and Technology in making this conference a grand success. We further acknowledge IETE – TIRUPATI & ISTE – AP Section, our partners in organizing the same, who has extended invaluable support in making the program memorable and very successful.

PREFACE

The prime theme of the ICLTECAT – 2025 is to provide a common platform to people from diverse backgrounds and regions to share knowledge. The topics addressed during the conference ranged from new developments in Electronics and Communication Engineering to Innovations in Artificial Intelligence and Machine Learning and Computer Science. The interdisciplinary approach gave insights into the various subjects that interplay at times and what role each plays in influencing others to come up with solutions to modern challenges.

This book is the Proceedings of the International Conference and comprises some of the papers presented at the conference. It embodies almost all dimensions of the deliberations that ensued. Spotlighted in these proceedings are areas that address the dynamism of engineering and technology with theoretical insights and practical applications. It is believed that this collection will be a rich source of inspiration and a very useful reference for further research and innovation in such important disciplines for researchers, practitioners, and students alike.

It is our earnest hope that the insights learned and the network established during this event shall further act, inspire, and push forward further advancements in engineering, technology, and management.

MESSAGE FROM CHAIRMAN

First and foremost, I express my esteemed pleasure in extending a warm welcome to all delegates of the **International Conference on Latest Trends in Electronics Communication and AI Technologies - ICLTECAT – 2025**, scheduled on 2nd-3rd April 2025. This Conference organized by Geethanjali Institute of Science and Technology in association with IETE – TIRUPATI & ISTE – AP Section to our quest for pursuit of excellence in academics and novelty.

I wish to commend all the researchers, academicians, professionals who participated actively and provided high-quality contributions. Your involvement makes it easier for an atmosphere of collaboration where knowledge and ideas can be allowed to freely aspire.

I extend my warm gratitude to our Principal, Dr. K. Sundeep Kumar, for his leadership and dedication in making this conference a success. I also extend my deepest appreciation to our faculty, staff, and students, and our partners at IETE – TIRUPATI &ISTE – AP Section, most especially for their hard work.

Thank you all for your invaluable contributions. I wish the organizers a productive and inspiring conference and all the best wishes for their contribution for the proceedings in the upcoming era and all the hard work carried out by the acknowledgment by for the institution.

Sri. D. B. Ravi Reddy
Chairman,
Geethanjali Institute of Science and Technology.

MESSAGE FROM PRINCIPAL

It is my great pride and pleasure to extend a warm welcome to each of you to the **International Conference on Latest Trends in Electronics Communication and AI Technologies** ICLTECAT - 2025, scheduled on 2nd-3rd April 2025.This will be a career milestone for the events organized by the Geethanjali Institute of Science and Technology, in association with IETE – TIRUPATI & ISTE – AP Section, as it would be regarded as an event signifying our commitment towards fostering innovation, research, and academic excellence.

This overwhelming response to the Conference, with persons of eminence among researchers, academicians, industry professionals, and students, adds to its importance and relevance for our chosen themes. Your participation and high-quality research contributions are the keystones of the success of this conference.

I would like to express my heartfelt thanks to our Chairman, Sri. D. B. Ravi Reddy for incessant support and encouragement.

I would like to acknowledge the tireless efforts of our faculty, staff students, and also appreciate the help from IETE – TIRUPATI & ISTE – AP Section in organizing this mega event.

Thank you all and I wish you a stimulating and inspiring conference.

Dr. K. Sundeep Kumar
Principal,
Geethanjali Institute of Science and Technology.

LIST OF SELECTED ABSTARCT FOR PROCEEDINGS IN ICLTECAT - 2025

		CONTROLLED APPLICATIONS	
17	**ICLTECAT-2025-017**	MULTI CLASS CLASSIFICATION OF PLANT LEAF DISEASES USING FEATURE FUSION OF DEEP CONVOLUTIONAL NEURAL NETWORK AND LOCAL BINARY PATERN	17
18	**ICLTECAT-2025-018**	GSM AND GPS BASED ALCOHOL SENSING AND ACCIDENT ALERT USING ARDUINO	18
19	**ICLTECAT-2025-019**	HIERARCHICAL REINFORCEMENT LEARNING (HRL): EMPOWERING AGENTS TO LEARN EFFICIENTLY	19
20	**ICLTECAT-2025-020**	USING DATA ANALYTICS TO INCREASE THE EFFICIENCY OF THE GEARBOX MACHINE SHOP	20
21	**ICLTECAT-2025-021**	DETECTING THE CLOUDS AND DETERMINING THE WEATHER CONDITION, COVERAGE AREA OF CLOUD SIMULTANEOUSLY USING CNN	21
22	**ICLTECAT-2025-022**	INFORMED CONSENT AND PATIENT AUTONOMY IN THE AGE OF AI: CHALLENGES AND SOLUTIONS	22
23	**ICLTECAT-2025-023**	UNDERGROUND CABLE FAULT DETECTION USING IOT	23
24	**ICLTECAT-2025-024**	DESIGN AND SIMULATION OF CARBON NANOTUBE FIELD EFFECT TRANSISTOR CIRCUITS	24
25	**ICLTECAT-2025-025**	IOT BASED INDOOR AIR QUALITY MONITORING SYSTEM	25
26	**ICLTECAT-2025-026**	AN ULTRA - ENERGY - EFFICIENT REVERSIBLE QUANTUM-DOT CELLULAR AUTOMATA (QCA) 8:1 MULTIPLEXER CIRCUIT USING MULTIPLIER	26
27	**ICLTECAT-2025-027**	COMPARISON OF DIFFERENT LOGIC CONFIGURATIONS BETWEEN CMOS AND FINFET TECHNOLOGY FOR DIFFERENT COMBINATIONAL CIRCUITS	27
28	**ICLTECAT-2025-028**	REAL TIME THROUGHPUT PREDICTION AND RESOURCE OPTIMIZATION IN LTE/5G NETWORKS	28
29	**ICLTECAT-2025-029**	FUTURISTIC EV INFRASTRUCTURE -EV CHARGING SLOT RESERVATION	29
30	**ICLTECAT-2025-030**	ML- DRIVEN APPROACH FOR PROGNOSIS OF JAMMER DEVICE MALFUNCTIONS IN TACTICAL OPERATIONS	30
31	**ICLTECAT-2025-031**	ML -DRIVEN ENHANCEMENT IN WIRELESS COMMUNICATION PERFORMANCE THROUGH SUPERVISED MODELING OF S11 DATA FOR PATCH ANTENNAS	31
32	**ICLTECAT-2025-032**	ML - DRIVEN THERMOGRAPHIC IMAGE CLASSIFICATION FOR FAULT DETECTION IN PHOTOVOLTAIC SYSTEMS	32
33	**ICLTECAT-2025-033**	IOT - ANDROID INTEGRATED SMART DINNING ROBOT	33

34	**ICLTECAT-2025-034**	REVOLUTIONIZING CROP DISEASE MANAGEMENT WITH DEEP LEARNING CLASSIFIERS FOR RICE LEAF IMAGES	34
35	**ICLTECAT-2025-035**	DEEP LEARNING-BASED APPROACH FOR CLASSIFICATION OF TUBERCULOSIS: A COMPREHENSIVE IMAGE DATA SET ANALYSIS	35
36	**ICLTECAT-2025-036**	ML MODELING FOR PATH LOSS IN 5G HIGH-FREQUENCY BANDS FOR ENHANCED NETWORK PERFORMANCE	36
37	**ICLTECAT-2025-037**	THE SMART BIN MANAGEMENT AND RESPONSE ROBOT SYSTEM	37
38	**ICLTECAT-2025-038**	AI POWERED FISH DISEASE CLASSIFICATION AND MEDICINE SUGGESTION TOWARDS SMART AQUACULTURE	38
39	**ICLTECAT-2025-039**	AI- DRIVEN SPEED VIOLATION AND SIGNAL JUMP	39
40	**ICLTECAT-2025-040**	TRANSFER LEARNING FOR CONTENT BASED IMAGE RETRIEVAL	40
41	**ICLTECAT-2025-041**	CUTTING-EDGE SECURITY: LI-FI-BASED SYSTEM FOR RELIABLE DATA AND AUDIO TRANSMISSION	41
42	**ICLTECAT-2025-042**	DEVELOPMENT OF HIGH MOBILITY SIX WHEELED ROBOT WITH ROCKER BOGIE SUSPENSION SYSTEM.	42
43	**ICLTECAT-2025-043**	IOT& ML INTEGRATED THREE STEP SMART DOOR ACCESSING SYSTEM	43
44	**ICLTECAT-2025-044**	VLSI EVALUATION AND EXPLORATION OF TCAM BASED TRIPLE LEVEL HYBRID CACHE SYSTEM	44
45	**ICLTECAT-2025-045**	ENERGY - DELAY EFFICIENT SEGMENTED APPROXIMATE ADDER WITH SMART CHAINING	45
46	**ICLTECAT-2025-046**	IOT - ANDROID INTEGRATED SMART DINNING ROBOT	46
47	**ICLTECAT-2025-047**	MACHINE LEARNING DRIVEN REGRESSOR FOR ENHANCING IOT NETWORK PERFORMANCE THROUGH PREDICTIVE MODELLING	47
48	**ICLTECAT-2025-048**	DEEP LEARNING BASED ON WHITE BLOOD CELL CLASSIFICATION WITH ADAPTIVE MOMENT ESTIMATION (AME) OPTIMIZATION	48
49	**ICLTECAT-2025-049**	DETECTION OF LUNG NODULES IN CT SCANS (EARLY DETECTION OF CANCER)	49
50	**ICLTECAT-2025-050**	MULTISENSOR ADAPTION OF DEEP LEARNING FOR ENHANCED DYNAMIC GESTURE RECOGNITION FROM MILLI METER WAVE RADAR DATA	50
51	**ICLTECAT-2025-051**	DEEP LEARNING BASED DATA-DRIVEN INSIGHTS INTO MICROSTRIP ANTENNA PERFORMANCE	51
52	**ICLTECAT-2025-052**	DEEP LEARNING APPROACH FOR TARGET CLASSIFICATION FROM FREQUENCY-MODULATED CONTINUOUS WAVE RADAR	52
53	**ICLTECAT-2025-053**	UNSUPERVISED DEEP LEARNING TECHNIQUES FOR ENHANCED FEATURE EXTRACTION IN MALARIA CELL CLASSIFICATION	53
54	**ICLTECAT-2025-054**	INVESTIGATING MACHINE LEARNING MODELS	54

		FOR DETECTING ABNORMAL RESPIRATORY SOUNDS IN PULMONARY DISEASE	
55	**ICLTECAT-2025-055**	VLSI DESIGN OF OTDS MODULATION WITH ZERO FORCING EQUILIZER	55
56	**ICLTECAT-2025-056**	SMART BIN MANAGEMENT AND RESPONSE ROBOT	56
57	**ICLTECAT-2025-057**	IOT AND RFID BUS ANNOUNCEMENT SYSTEM FOR BLIND	57
58	**ICLTECAT-2025-058**	VERSATILE HAND GESTER CONTROLLED ROBOT WITH ADXL ACCELEROMETER	58
59	**ICLTECAT-2025-059**	DESIGN AND IMPLEMENTATION OF HEXA POD ROVER WITH ROCKER BOGIE SUSPENSION	59
60	**ICLTECAT-2025-060**	MACHINE LEARNING CLASSIFICATION APPROACH ACROSS DIVERSE MOBILITY PATTERNS FOR ANALYSING SATELITE COMMUNICATION	60
61	**ICLTECAT-2025-061**	MILLITARY GRADE IOT SECURITY FOR MISSLE DETECTION	61
62	**ICLTECAT-2025-062**	IOT ENABLED URBAN UTILITY MANAGEMENT SYSTEM	62
63	**ICLTECAT-2025-063**	CLOUD BASED ROBUST SECURITY FRAMEWORK FOR LOGISTICS SURVEILLANCE	63
64	**ICLTECAT-2025-064**	SENSOR-FREE HUMAN ACTIVITY RECOGNITION USING CNN-LSTM DEEP LEARNING ARCHITECTURE	64
65	**ICLTECAT-2025-065**	A HYBRID DEEP LEARNING MODEL WITH FEATURE SELECTION FOR INTRUSION DETECTION IN SOFTWARE-DEFINED NETWORKS	65
66	**ICLTECAT-2025-066**	REAL-TIME END-TO-END TARGET-SPEAKER ASR WITH INTEGRATED ACTIVITY DETECTION IN MULTI-SPEAKER ENVIRONMENTS	66
67	**ICLTECAT-2025-067**	CLIP-GUIDED IMAGE CAPTIONING USING A LIGHTWEIGHT PREFIX MAPPING FOR GENERATIVE VISION-LANGUAGE MODELS	67
68	**ICLTECAT-2025-068**	PREDICTING AT-RISK STUDENTS IN VIRTUAL LEARNING ENVIRONMENTS USING A HYBRID DEEP LEARNING MODEL	68
69	**ICLTECAT-2025-069**	ATTENTION-BASED NEURAL QUESTION GENERATION FOR ENHANCED READING COMPREHENSION	69
70	**ICLTECAT-2025-070**	A CONTEXT-AWARE SENTIMENT ANALYSIS FRAMEWORK USING DECISION - BASED RECURRENT NEURAL NETWORKS	70
71	**ICLTECAT-2025-071**	A VISION TRANSFORMER FRAMEWORK FOR FINGER VEIN RECOGNITION WITH REGULARIZED MLP HEAD	71
72	**ICLTECAT-2025-072**	SIGNATURE VERIFICATION USING SIAMESE NETWORKS WITH ONE-SHOT LEARNING FOR OFFLINE BIOMETRIC AUTHENTICATION	72
73	**ICLTECAT-2025-073**	A HYBRID DATA FUSION APPROACH FOR	73

		CUSTOMER CHURN PREDICTION IN THE BANKING SECTOR USING HARD AND SOFT DATA	
74	**ICLTECAT-2025-074**	TREND DETECTION-DRIVEN AUTO-SCALING FOR CONTAINERIZED APPLICATIONS IN HIGH-CONCURRENCY CLOUD ENVIRONMENTS	74
75	**ICLTECAT-2025-075**	FUSION-BASED SENTIMENT ANALYSIS FOR EVALUATING E-COMMERCE PRODUCT EXPERIENCE	75
76	**ICLTECAT-2025-076**	NEURAL NETWORK-BASED PREDICTION OF SHORT-TERM CLOUD DATA TRANSFER THROUGHPUT IN DISTRIBUTED SYSTEMS	76
77	**ICLTECAT-2025-077**	A GRAPH NEURAL NETWORK FRAMEWORK WITH TEMPORAL ATTENTION FOR URBAN AIR QUALITY PREDICTION	77
78	**ICLTECAT-2025-078**	A LANGUAGE-AGNOSTIC AUTOMATED SYSTEM FOR DISCOVERING STATE-OF-THE-ART RESEARCH TOPICS USING TOPIC MODELING, BERT, AND ENTITY LINKING	78
79	**ICLTECAT-2025-079**	WEATHER-ENHANCED DEEP LEARNING FOR DEMAND FORECASTING IN RETAIL SUPPLY CHAINS: A CASE STUDY ON ROSSMANN STORES	79

International Conference on Latest trends in Electronics Communication and AI Technologies (ICLTECAT - 2025) ISBN: 978-936285-531-2

Implementation of Error Detection and Correction Codes for Space Engineering

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Abstract

On behalf of technology scaling, on-chip memories in a die undergoes bit errors because of single events or multiple cell upsets by the ecological factors such as cosmic radiation, alpha, neutron particles or due to maximum temperature in space, leads to data corruption. Error detection and correction techniques (ECC) recognize and rectify the corrupted data over communication channel. In this paper, an advanced error correction 2-dimensional code based on divide-symbol is proposed to weaken radiation-induced MCUs in memory for space applications. For encoding data bits, diagonal bits, parity bits and check bits were analyzed by XOR operation. To recover the data, again XOR operation was performed between the encoded bits and the recalculated encoded bits. After analyzing, verification, selection and correction process takes place. The proposed scheme was simulated and synthesized using Xilinx Vivado implemented in Verilog HDL. Compared with the well known existing methods, this encoding-decoding process consumes low power and occupies minimum area and delay.

Keywords: Xilinx Vivado, Verilog HDL, Error detection and correction techniques (ECC)

Real time IoT based smart integrated system for crop monitoring and protection in agriculture through CBPR

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Abstract

Community Based Participatory Research (CBPR) identifies and implements the needs of a community through partnership with few organizations. This research work was created for the farmers community at Veerapandi, Madurai District, TN, India under SAGY Scheme. Based on the requirements analysis, it was found that the Farmers needed a Smart System for monitoring the crops with respect to disaster and intrusion in their farms. After designing the experimental set up using ESP32 along with Sensors for rain, fire and proximity, a participatory intervention was performed with the farmers to ensure that the Real time IoT smart agriculture system meets their demands. The remote crop monitoring system includes temperature, humidity, PIR, smoke, and ultrasonic sensors, to monitor the farm and increase productivity. It detects and alerts farmers when an insect or mammal intrudes on crops and can take precautions if the temperature changes due to weather conditions. Implementation was done on Arduino IDE with the ESP32 Microcontroller. Testing of the proposed system along with the deployment phase was also carried out. The aim of the project is the holistic development of identified Gram Panchayats under SAGY scheme. The main objective of this project is to create a smart system for crop protection from fire, rain and intrusion alert. This Real time smart IoT system in agriculture will guarantee good crop development, and safety with minimal human intervention.

Keywords: Community Based Participatory Research (CBPR), Crop Protection, ESP32, Smart agriculture

Traversing the Recommender Landscape: A Comprehensive Survey

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Abstract

Recommender frameworks have turned into a vital piece of present day data frameworks, helping clients in finding important things in the midst of a plenty of decisions. This paper presents an exhaustive study of recommender frameworks, covering different procedures, applications, and difficulties. It investigates the development of recommender frameworks, digs into the hidden calculations and systems, talks about their applications across various spaces, and diagrams the arising patterns and difficulties. By orchestrating existing exploration and featuring key bits of knowledge, this review expects to give an all encompassing comprehension of recommender frameworks and proposition significant experiences for future innovative work.

Keywords: Recommender systems, survey, techniques, algorithms, applications, domains, challenges, evolution, methodologies, trends, research development.

Macular Lesion Detection in Diabetic Cases using Soft Clustering based Machine Learning Approach

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Abstract

Diabetic Macular Edema is impacted by exudates deposits from burst blood vessels, which impair vision. It is a progressive aliment of Diabetic Retinopathy (DR) in which a portion of the retina experiences potential damage to blood capillaries which results in the leakage of blood leakage in the retinal fundus. The affected patients may experience blurred vision; however, treatment can help lessen swelling and keep eyesight intact. Early detection of the condition may include a thorough examination of the optical fundus, the optical disc, and the ocular nerve's potential response. This study provides a unique and robust Fuzzy k-medoid clustering approach for segmenting retinal tumours in a kernel space. This technique is robust in identifying non-linear lesions clusters and do not rely on spatial measures, making them suitable for the identification of lesions with specific geometries. This paper uses kernel fuzzy k-medoid clustering to present a new and efficient method for exudates detection. They also encounter difficulties in identifying lesion pixels with non-spherical or non-ellipsoidal morphologies. Furthermore, these methods frequently entail several preprocessing steps, which can lengthen simulation times and raise the possibility of misclassification. The goal of the suggested K-FkM algorithm is to solve the problems with conventional clustering techniques. The method adds novelty and robustness by projecting the input data onto an N-dimensional space and assessing intra-cluster similarities in the kernel domain.

Keywords: Diabetic Macular Edema (DME), Diabetic Retinopathy (DR), Blood vessels, Retinal fundus, Fuzzy k-medoid, Soft-clustering, Machine Learning.

Deep Learning-Driven Smart Web Interface Paradigm for Real-time Handwritten Digit Recognition and Analysis

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Abstract

Handwritten digit recognition is crucial in various applications such as automated postal sorting, bank cheque processing, and educational tools. Traditional systems for handwritten digit recognition, such as K-Nearest Neighbors (KNN), Support Vector Machines (SVM), and simple neural networks, rely on manual feature extraction and are limited by their ability to generalize across diverse handwriting styles, resulting in reduced accuracy. These classical approaches often struggle with real-time applications due to their limited scalability and poor adaptability to noisy data. This research proposes the use of Convolution Neural Networks (CNNs) to automatically learn hierarchical features from image data, which allows for better recognition performance compared to traditional models. Comparisons are made with traditional machine learning classifiers such as KNN, PSVM, and simple neural networks. Additionally, the CNN-based model is integrated into a Flask-based web application, enabling real-time digit recognition and interactive user input, making the system easily accessible. The integration of the deep learning model into a web server application not only enhances user engagement but also provides practical solutions for real-time applications. The research highlights the significance of CNNs in overcoming the limitations of traditional systems and explores potential extensions to handwritten letter recognition and personalized handwriting analysis. These applications can have widespread implications in fields such as character recognition systems, financial transactions, postal services, education, and accessibility for people with disabilities, thus demonstrating the potential of deep learning for diverse real-world challenges.

Keywords: Handwritten digit recognition, Convolution neural network, Machine learning, deep learning, MNIST dataset.

Comparative Analysis of Zero-Shot Learning Techniques for Fake Image Detection: A Results-Oriented Review Analysis

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Abstract

The rapid advancement of AI-generated image synthesis has led to an increased prevalence of fake images, posing significant challenges for authenticity verification. Traditional fake image detection methods often rely on supervised learning, which demands extensive labeled datasets and struggles to generalize across unseen forgeries. Zero-Shot Learning (ZSL) techniques have emerged as a promising alternative, enabling detection without prior exposure to manipulated data. This paper presents a comprehensive comparative analysis of state-of-the-art ZSL techniques for fake image detection. Through an extensive literature review, we explore various approaches, including entropy-based detection, prompt learning, vision-language models, and distribution transfer methods. Each technique is evaluated based on accuracy, robustness to novel manipulations, and computational efficiency. Our results-oriented review highlights the strengths and limitations of each method, offering valuable insights into their practical applications. This study not only underscores the growing relevance of ZSL in combating deepfake proliferation but also identifies potential research directions to enhance detection accuracy and generalization.

Keywords: ZSL, prompt learning, deep fake.

A Block chain-Based Solution for Enhancing Academic Integrity and Preventing Fraud in Hiring Processes

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Abstract

Academic institutions and companies have traditionally relied on manual processes to verify student credentials, such as physical document submissions or online databases maintained by central authorities. This conventional approach is fraught with vulnerabilities. Universities typically issue physical certificates that require manual verification by employers, centralized servers storing credentials are susceptible to manipulation, and the reliance on paperwork and human oversight creates risks of tampering, bribery, and forgery. Such risks have led to widespread incidents of credential fraud, undermining the trustworthiness of academic qualifications and complicating the hiring process. In response to these challenges, this research proposes a secure, decentralized Blockchain-based solution for verifying student academic credentials. By leveraging Blockchain technology's inherent immutability, encryption, and distributed ledger capabilities, the proposed system aims to eliminate vulnerabilities associated with traditional verification methods. This approach not only minimizes the risk of fraud but also streamlines the verification process by providing a tamper-proof and efficient means of credential validation for employers. With the integration of smart contracts, the system can automate verification processes, thereby reducing manual oversight and operational delays. Ultimately, this research seeks to foster a more reliable, transparent, and efficient hiring process that reinforces academic integrity while mitigating the risks associated with conventional credentialing methods.

Keywords: Blockchain, Credential Verification, Decentralized Systems, Academic Integrity, Fraud Prevention.

A Decentralized Blockchain-IPFS Framework for Secure and Transparent Healthcare Data Exchange

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Abstract

This research introduces an innovative decentralized framework designed to empower patient sovereignty by securely managing and exchanging healthcare data. Leveraging the immutable properties of Blockchain and the distributed storage capabilities of the Inter Planetary File System (IPFS), the proposed model aims to revolutionize how sensitive medical information is stored, shared, and verified. Traditional centralized systems face numerous challenges, including single points of failure, data breaches, and unauthorized access. In contrast, our framework ensures enhanced data integrity and transparency by decentralizing the storage process while enabling patients to maintain full control over their personal records. Patient data is encrypted using Advanced Encryption Standard (AES) and stored securely on IPFS, with Blockchain storing only essential metadata such as file hashes to ensure data verification and immutability. The integration of smart contracts on the Ethereum platform automates access control and permission management, eliminating the need for intermediaries and reducing operational risks. This patient-centric approach not only improves data security but also facilitates a seamless, auditable trail of data interactions, thereby enhancing trust between patients and healthcare providers. The framework is designed to be scalable, addressing potential regulatory and interoperability challenges while providing a robust solution to contemporary cybersecurity threats in the healthcare industry. By shifting the paradigm from centralized control to decentralized management, the proposed system fosters a transparent, efficient, and secure environment for healthcare data exchange, ensuring that data privacy remains at the forefront of modern medical practices.

Keywords: Blockchain, IPFS, Healthcare Data, Patient Sovereignty, Decentralized Security.

Deep Learning-based Approach for Classification of Tuberculosis for Improved Patient Diagnosis

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Abstract

Tuberculosis (TB) remains a major global health challenge, particularly in low- and middle-income countries where timely and accurate diagnosis can be difficult. Traditional diagnostic methods, such as sputum smear microscopy, culture tests, and chest X-rays, often face limitations related to sensitivity, processing time, and the availability of trained medical personnel. These challenges can lead to delayed diagnoses, contributing to increased transmission rates and poor patient outcomes. To address these issues, this project proposes a deep learning-based approach for the classification of TB, aiming to improve diagnostic accuracy, speed, and reliability. Leveraging advanced deep learning techniques, particularly Convolutional Neural Networks (CNNs), the proposed system analyzes chest X-ray images to detect TB with high accuracy. The model utilizes customized CNN to automatically extract and classify image features indicative of TB. Key benefits of the deep learning-based TB classification system include improved sensitivity and specificity compared to traditional diagnostics, faster turnaround times, and reduced human error. The system's automated analysis can provide valuable support for radiologists, particularly in resource-limited settings where specialized expertise may be scarce. Additionally, AI-driven diagnostics enable scalable deployment, offering cost-effective and accessible solutions for TB screening in remote and underserved regions. This research underscores the potential of deep learning to transform TB diagnostics, providing a powerful tool to aid early detection, reduce transmission, and ultimately improve patient outcomes in global healthcare.

Keywords: Tuberculosis, Chest X-ray imaging, Predictive analytics, Deep learning, Convolutional neural networks, Global healthcare

EMOSENSE: Video Based Mental Health Assessment

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Abstract

"EmoSense" is an innovative application designed to revolutionize mental health assessment through the integration of video-based sentiment analysis and emotion detection. In this project, we introduce a platform where healthcare professionals can capture patients' video speech discussing their mental health concerns. Leveraging cutting-edge natural language processing and computer vision techniques, the application performs real-time sentiment analysis on the transcribed text and detects emotional cues from the facial expressions and vocal tones exhibited in the video. By analyzing both verbal and non-verbal signals, "EmoSense" provides a comprehensive understanding of the patient's emotional state, facilitating more accurate diagnosis and personalized treatment plans. Through the fusion of technology and psychology, this project aims to empower mental health services with actionable insights for improved patient care and well-being.

Keywords: EmoSense, Mental health assessment, Sentiment analysis, Emotion detection, personalized treatment plans

C-ROA-ATRGFM: A Hybrid Optimization Framework for Breast Cancer Detection

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Abstract

Breast cancer has recently claimed the lives of people all around the world. Early detection of breast cancer improves survival rates and allows for more effective therapies. Early detection of breast cancer is critical, thus automatic detection of anomalies in the breast is more important, increasing the odds of survival. In this study, mammography is used to detect and screen breast cancer at an early stage. Furthermore, early diagnosis of breast malignancies can be accomplished by the use of digital mammography, with 3-D breast mammography chosen as a complimentary modality. The Computer-Aided Detection system (CAD) is presented to aid in the interpretation of 3-D breast mammography pictures, with breast cancer segmentation playing a critical role in feature extraction and temporal evaluation. The primary goal of the research is to improve the breast cancer detection model by utilizing 3D mammography pictures. The median filtering and image scaling model handles the first picture preparation. As a result, picture segmentation is carried out utilizing the adaptive thresholding with region-growing fusion model (ATRGFM). The Cayote-Rider Optimization Algorithm (C-ROA) is a mixture of the Cayote Optimization Algorithm (COA) and the Rider Optimization Algorithm (ROA), which is used to perform adaptive tumor segmentation. The C-ROA model offers threshold values for the segmentation process, which improves segmentation accuracy.

Keywords — 3D Mammograms, Preprocessing, Coyote-Rider Optimization Algorithm(C-ROA), ATRGFM.

Evaluating Topic Modelling Techniques: A Comprehensive Literature Study

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Abstract

Text mining plays a vital role in the context of collecting and preprocessing important information from a corpus, for instance, tweets. Text mining employs Natural Language Processing (NLP) to analyse and structure the information within the corpus. It is difficult to analyse and use corpora in fields like linguistics, software engineering, bioinformatics, sentiment analysis, and education since they imply vast amounts of data. This study mainly focuses on topic modelling to uncover hidden patterns and define the structural connection between the text and the data. It reviews quantitative and qualitative research studies published from 2010 to 2024 with a view to identifying methodologies applied in different fields of study to establish the prevailing trends, innovation, and epistemology pertaining to topic modelling.

Keywords: Text Mining Corpus Natural Language Processing (NLP) Topic Modelling Latent Data Identification Data Relationships

Advanced Alternative Approaches in Natural Language Processing for Translation and Information Dissemination Systems

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Abstract

This paper introduces the core methodology and experimental foundation of the Adaptive AI-Driven Surveillance (AADS) framework, designed to address critical limitations in conventional video surveillance systems. By combining advanced object detection, anomaly detection, and multi-sensor fusion, this framework aims to deliver real-time, scalable, and context-aware security solutions. The section details the underlying models, algorithms, and experimental setups used to validate the system's performance in diverse environments. Through comprehensive analysis, the section demonstrates how the proposed approach enhances detection accuracy, minimizes false alarms, and ensures efficient monitoring, paving the way for robust, real-time threat identification and proactive decision-making. The AADS framework represents a major step forward in intelligent surveillance, blending adaptability, efficiency, and ethical considerations. Through its robust design and validation across multiple scenarios, the system promises significant contributions to public safety, operational efficiency, and overall security.

Keywords: smart visual sensors; surveillance; intelligent detection; security

6G HORIZONS: ADVANCING CONNECTIVITY BEYOND LIMITS

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Abstract

The evolution of wireless communication has reached a pivotal milestone with the emergence of 6G, poised to transcend the capabilities of 5G through the integration of artificial intelligence (AI). This paper explores AI-enhanced 6G wireless technologies, emphasizing their potential to outperform previous generations by achieving ultra-low latency, unprecedented data rates exceeding 1 Tbps. Unlike 5G, which primarily focused on enhanced mobile broadband and IoT scalability, 6G leverages AI-driven innovations such as intelligent resource allocation, predictive network optimization, and self-adaptive systems to dynamically address real-time demands. Advancements include the use of terahertz (THz) frequencies for wider bandwidth, holographic beamforming for precise signal targeting, and AI-powered edge computing for decentralized processing, significantly reducing energy consumption and improving spectral efficiency. These developments offer distinct advantages, including seamless support for immersive technologies like extended reality (XR), autonomous systems, and smart cities, while enhancing security through AI-based anomaly detection. By surpassing the limitations of 5G—such as static network management and constrained frequency bands—AI-enhanced 6G promises to redefine connectivity, enabling a hyper-connected, intelligent, and sustainable digital ecosystem. This paper synthesizes current research and outlines the transformative potential of these advancements for future global communication networks.

Key Words: 6G technology, terahertz frequencies, holographic beamforming, ultra-low latency, next-generation wireless

A Compact Design of Four Port Dual Band MIMO Antenna for 5G and mm-wave applications

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Abstract

This paper present a novel four element MIMO antenna is designed for 5G and mm wave applications. It features rectangular ring radiating elements with a defective ground structure (DGS) and has a compact size of 10×10×0.8 mm^3. It has impedance bandwidth of 20.9 GHz – 25.7 GHz (band1) and 38.3GHZ – 43.3 GHz (band2) respectively, and Rogers RT/Duroid-6002 used as a dielectric material which have relative permittivity 2.94 and loss tangent 0.0012. It has peak gain of 5.65 dB , radiation efficiency >85% and isolation >20 dB achieved with a decoupling network at ground. Diversity Gain (DG) is near 10, while the correlation between the antennas (ECC) is less than 0.05. According to simulated results, and compact size the suggested antenna is most suitable for millimeter wave and 5G applications.

Keywords: MIMO, Four port, peak gain, radiation efficiency, ECC, DG, 5G.

Embedded System and Remotely Controlled Applications

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Abstract

An embedded system is a special-purpose computer designed to perform one or a few dedicated functions, often with real time computing constraints. Embedded systems have become very important today as they control many of the common devices we use. An embedded micro controller is a chip, which has a computer processor and all its support functions, memory (Both program and data) and I/O (including bus interfaces) built within the device. The paper proposes a RCM (Remotely Controlled Model) which discusses significance of using Micro Controller to remotely control maximum number of devices so that the applications of Embedded System can be improved by connecting more devices to the Micro controller.

Keywords— Embedded System, Microcontroller, RCM (Remote Controlled Model), UART (Universal Asynchronous Receiver/Transmitter), GUI (Graphical User Interface).

Multi Class Classification of Plant Leaf Diseases Using Feature Fusion of Deep Convolutional Neural Network And Local Binary Pattern

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Abstract

Plant leaf diseases significantly impact agricultural productivity, leading to substantial economic losses. Early and accurate detection of these diseases is crucial for effective crop management. This project proposes a multi-class classification system for plant leaf diseases using feature fusion of Deep Convolutional Neural Networks (DCNN) and Local Binary Pattern (LBP). The DCNN extracts deep features from leaf images, while LBP captures texture information. The fusion of these features enhances the classification accuracy. The proposed system is evaluated on a publicly available dataset, demonstrating superior performance compared to existing methods. The results indicate that the fusion of deep and texture features provide a robust solution for plant disease classification.

Keywords: Deep Convolutional Neural Networks (DCNN), Local Binary Pattern (LBP), crop management

GSM and GPS based Alcohol Sensing and Accident Alert using Arduino

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Abstract

We often come across cases of drunk driving where a drunk driver causes an accident while drunk, causing loss of life and property. Therefore, we propose a new way to eliminate such situations. The system we plan to install on the cyclist or a place that can continuously monitor the driver's breathing, thus constantly monitoring the driver's breathing. In other words, if the driver is drunk and tries to drive, the system will detect the alcohol in his breath and turn off the engine, making it impossible to start the car. In other cases, if the driver is not drunk when starting the car and the engine starts, but he drinks while driving, the sensor will still detect the alcohol in his breath using the infrared sensors and turn off the engine. When a situation is detected, this information is transmitted to the right people. We use the AVR series microcontroller interface connected to the alcohol sensor and the LED with a buzzer. In other words, the user's breathing is monitored using an alcohol sensor and continuous signals are sent to the microcontroller. When the microcontroller receives a high alcohol signal from the alcohol sensor, it displays the alcohol information using an LED and a buzzer. The aim of this project is to locate the vehicle and send a message using the system installed in the vehicle to locate it. The microcontroller sends a warning message with the location information to the police station or rescue team via GSM modem. In this way, the police can instantly track the location via GPS modem after receiving the message.

Keywords-- Microcontroller (ATmega 328) Arduino nano micro controller, MQ3 Alcohol Sensor, IR sensor, Buzzer, Bread board, GSM, GPS, Arduino Compiler, MC Programming Language: C

Hierarchical Reinforcement Learning (HRL): Empowering Agents to Learn Efficiently

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Abstract

Reinforcement learning (RL) has become one of the most powerful paradigms in artificial intelligence, enabling agents to learn and adapt to complex environments by interacting with them. However, while traditional RL techniques have achieved impressive successes, they often struggle with scalability and complexity when dealing with high-dimensional state spaces and long-term tasks. Hierarchical Reinforcement Learning (HRL) is a promising way to deal with these issues because it provides a structured way to break down complicated problems into many levels of decision-making, with each level addressing a separate subproblem. By breaking down tasks hierarchically, HRL enables agents to learn more efficiently, reduce computational costs, and improve generalization across tasks.HRL addresses this by using a high-level policy (manager) & low-level policy (worker) policies. As research in HRL progresses, we can expect to see even more sophisticated and effective learning systems that will pave the way for smarter, more capable autonomous agents.

Key-points: HRL, RL, off-policy learning, reward shaping

Using Data Analytics to Increase the Efficiency of the Gearbox Machine Shop

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Abstract

Effective inventory management is crucial in manufacturing to ensure that essential components, like gearboxes, are available when needed. This project introduces a machine learning system to improve operating efficiency and streamline gearbox inventory management. Predictive analytics to predict demand trends, gear availability tracking, and user registration are all features of the system. Automated notifications save downtime and promote proactive inventory control by informing employees of low stock and reminding suppliers to refill.

Keywords—Inventory Management, Gearbox Manufacturing Efficiency, Stock-Out Elimination, Leveled Production Planning, Batch Sizing Optimization, Opening Stock, Gear Box(GB).

Detecting the Clouds and Determining the Weather Condition, Coverage Area of Cloud Simultaneously Using CNN

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Abstract

The cloud detection and weather condition determination system using Convolutional Neural Networks (CNN) leverages deep learning techniques to analyse satellite images and accurately classify cloud types, assess weather conditions, and calculate cloud coverage area. CNNs, known for their strong performance in image classification tasks, are trained on large datasets of satellite images with annotated cloud formations under various weather scenarios. The system can identify different types of clouds, such as cumulus, stratus, and cirrus, and simultaneously estimate the extent of cloud coverage. Additionally, by analysing these cloud types and their spatial distribution, the system can classify weather conditions like clear skies, overcast, or stormy weather. This automated approach offers real-time insights into weather patterns and cloud behaviour, which is highly beneficial for weather forecasting, climate research, and remote sensing applications. The integration of CNNs allows for more precise and scalable cloud detection and weather condition prediction compared to traditional methods, significantly improving the accuracy and efficiency of weather monitoring systems.

Keywords: Convolutional Neural Networks (CNN), Satellite Image Analysis, Cloud Coverage Area

Informed Consent and Patient Autonomy in the Age of AI: Challenges and Solutions

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Abstract

The integration of Artificial Intelligence (AI) into healthcare presents significant opportunities for improving patient outcomes and personalizing care. However, it also raises critical challenges related to informed consent and patient autonomy. This paper explores the ethical considerations and practical strategies for ensuring that patients and their families are well-informed about AI-assisted decisions in healthcare. The rapid advancement of AI technologies introduces complexities that challenge traditional principles of informed consent and patient autonomy. Healthcare providers must support informed decision-making by clearly communicating the capabilities and limitations of AI. Additionally, ethical and legal frameworks governing AI in healthcare need to be updated to address AI-specific issues, such as biases in algorithms, privacy, and security of patient data. International perspectives highlight the importance of preserving patient autonomy and fostering trust in AI-driven healthcare solutions. By addressing these challenges, healthcare providers, policymakers, and researchers can develop strategies to uphold the principles of informed consent and patient autonomy in the age of AI.

Keywords: Artificial Intelligence (AI) in Healthcare, Patient Autonomy, Ethical Frameworks, Legal Challenges, AI Biases, Privacy and Security.

Underground Cable Fault Detection Using IOT

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Abstract

The Underground Cable Fault Detection system using IoT (Internet of Things) offers an efficient solution to detect and localize faults in underground electrical cables, which are difficult to monitor and repair. The system employs a combination of current, voltage, and temperature sensors integrated with an Arduino microcontroller to continuously monitor the condition of the cables. By analysing data from these sensors, the system can detect anomalies such as short circuits, open circuits, or overheating, which indicate faults. When a fault is detected, the system sends real-time alerts to a cloud-based platform or mobile application, allowing operators to quickly respond and address the issue. The IoT-based solution not only provides real-time monitoring but also helps in precisely locating the fault, reducing downtime and minimizing repair costs by eliminating the need for extensive manual inspection. This system enhances the reliability and safety of power distribution networks, making it a cost-effective solution for utility companies and electrical maintenance teams.

Keywords: Fault Localization, Sensors (Current, Voltage, Temperature), Real-time Monitoring, Power Distribution Systems, SmartGrid.

Design and Simulation of Carbon Nanotube Field Effect Transistor Circuits

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Abstract

This project focuses on the design and simulation of CNTFET-based arithmetic circuits, including a half adder, full adder, and 2×2 multiplier, using LTspice netlists. The circuits utilize both N-type and P-type CNTFETs with a supply voltage of 0.7V, featuring channel lengths of 15 nm and 20 nm, respectively. The arithmetic operations sum, carry, and multiplication are implemented using basic logic gates, where XOR is employed for sum calculations, and AND gates handle carry and partial product generation. The half adder consists of 5 transistors, the full adder incorporates 9 transistors, and the 2×2 multiplier is built with 8 transistors. Transient analysis over 50 ns is conducted to evaluate circuit behaviour under pulsed inputs (ranging from 5 ns to 40 ns periods). The CNTFET models used include Level 1 parameters, with threshold voltages of 0.25V for N-type and -0.25V for P-type devices. LTspice serves as the primary simulation tool, facilitating netlist-based verification of logic functionality. While no explicit power or timing analysis is performed, this work highlights the potential of CNTFETs for low-power, high-performance digital applications. The project provides foundational insights into CNTFET-based logic design, contributing to the development of future nanoscale arithmetic units.

Keywords: CNTFET, Arithmetic Circuits, Half Adder, Full Adder, LTspice Simulation, Transient Analysis.

IOT Based Indoor Air Quality Monitoring System

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Abstract

Indoor air pollution is a growing concern affecting human health and productivity. This project proposes an IoT-Based Indoor Air Quality Monitoring System that continuously measures and analyzes key air quality parameters such as temperature, humidity, carbon dioxide (CO_2), particulate matter (PM2.5/PM10), and volatile organic compounds (VOCs). The system utilizes ESP8266 NodeMCU, MQ-135 gas sensor, DHT11/DHT22 for temperature & humidity, and a PM2.5 sensor to collect real-time data. The acquired sensor data is transmitted to an IoT cloud platform (Thingspeak, Blynk, or Firebase) via Wi-Fi, where users can monitor indoor air quality through a mobile application or web dashboard. If pollutant levels exceed predefined thresholds, the system triggers alerts via email, SMS, or app notifications and activates an air purification mechanism. This cost-effective and real-time monitoring system helps in early detection of harmful air conditions, promoting healthier indoor environments in homes, offices, and public spaces. Future improvements may include AI-based predictive analysis, integration with HVAC systems, and voice assistant compatibility for automated air quality control.

Keywords: IoT, ESP8266, Air Quality Monitoring, Gas Sensors, Smart Environment, Indoor Pollution

An Ultra Energy Efficient Reversible QCA 8 To 1 Multiplexer Using Multiplier

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Abstract

The aim of this project is to design and implement an ultra-energy-efficient reversible 8:1 multiplexer circuit. Using Quantum-Dot Cellular Automata (QCA) technology, the proposed circuit aims to minimize energy consumption. While maximizing computational efficiency, it addresses the scalability limitations of conventional CMOS logic. Conventional CMOS suffers from high energy consumption and scalability limitations.QCA technology offers a promising solution with ultra-low power consumption and high device density. The reversible 8:1 multiplexer circuit is designed to improve throughput and reduce latency. This project focuses on designing and implementing the proposed circuit using QCA technology. The goal is to achieve energy-efficient multiplier design and improve computational efficiency. The proposed circuit has the potential to overcome the limitations of conventional CMOS logic. By minimizing energy consumption, the proposed circuit can enable energy-efficient computing systems.

Keywords: Ultra-energy-efficient, Reversible 8:1 multiplexer circuit, Quantum-Dot Cellular Automata (QCA) technology, Energy consumption, Computational efficiency, CMOS logic, Scalability limitations, Energy-efficient multiplier design, Low power consumption.

FPGA Power Consumption Prediction using AI

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Abstract

The increasing adoption of FPGAs in AI and edge computing has elevated the demand for energy-efficient and power-aware hardware design. However, accurately predicting power consumption in FPGAs remains a challenge due to their complex architectures and design variability. Traditional power estimation methods rely heavily on CAD tools during post-synthesis or place-and-route stages, leading to increased design time and computational overhead. This project proposes a machine learning-based approach—specifically using a regression algorithms—for early-stage power prediction in FPGA designs. By analyzing design parameters such as logic utilization, bandwidth, and resource usage, the model enables fast and reasonably accurate power estimation without complete synthesis. The use of open-source datasets and benchmarking tools further strengthens the validity of this approach. The proposed system aims to assist designers in making timely, power-aware design choices and reduce dependency on exhaustive simulations. Future extensions include deployment in cloud-based environments and integration with intra-FPGA optimization techniques for enhanced efficiency.

Keywords: FPGA, Power Consumption Prediction, Machine Learning, Regression Algorithms.

Real-Time Throughput Prediction and Resource Optimization in LTE/5G Networks

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Abstract

The aim of the project "Real-Time Throughput Prediction and Resource Optimization in LTE/5G Networks" is to enhance forecasting accuracy using AI-based models. Mobile communication has evolved from 2G (237 kbps) to 5G (10 Gbps), improving data transmission for voice and video calls. Accurate throughput prediction is crucial for optimizing network resources and ensuring service quality. Traditional methods used by base stations and mobile devices often mis-predict due to dynamic network conditions. The proposed system integrates AI algorithms to analyze real-time network data for better predictions. Machine learning adapts to changing conditions, reducing errors in throughput estimation. AI-driven insights enhance user experience by maintaining consistent data rates and quality of service. For base stations, it enables proactive resource management, improving efficiency and reducing operational costs. The system also aids in handling network congestion and dynamic traffic patterns effectively. Overall, AI-based throughput prediction ensures robust and reliable mobile communication services.

Keywords: Throughput Prediction, AI-Based Models, Machine Learning, Network Optimization, Resource Management, 5G Communication.

Futuristic EV infrastructure- EV slot reservation

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Abstract

The aim of this project is to design and implement an efficient EV Slot Reservation System to optimize charging station utilization, reduce waiting time, and enhance user convenience. The proposed system leverages IoT and real-time data processing to allow EV users to pre-book charging slots, ensuring seamless access to charging infrastructure. By integrating cloud-based data management and smart scheduling algorithms, the system minimizes congestion and maximizes station efficiency. The reservation framework dynamically allocates slots based on demand patterns and availability, improving overall service reliability. Implemented using embedded systems and mobile applications, the system is evaluated in terms of response time, user accessibility, and station utilization. Experimental results demonstrate that the system significantly reduces charging delays while optimizing resource allocation, making it ideal for smart city and sustainable mobility applications.

Keywords: EV Charging, Slot Reservation, IoT, Smart Scheduling, Sustainable Mobility, Cloud-Based Management.

Ml- driven Approach for Prognosis of Jammer Device Malfunctions in Tactical Operations

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Abstract

In military tactical operations, jammer devices are crucial for blocking enemy communications in walkie-talkies and radios. Traditional rule-based systems for detecting malfunctions in hardware/software are slow, delaying repairs and compromising security. A rule-based approach in jammer devices ensures efficient detection and resolution of malfunctions like signal interference and power failures. To overcome above problems, this work introduced the jammer device malfunctions analysis using Machine Learning (ML). Here, jammer device dataset and its network properties are applied to ML algorithms. The ML algorithm's objective is to develop an intelligent fault detection system that can accurately classify and predict malfunctions in jammer devices. By leveraging machine learning techniques, the system will analyse various parameters such as signal strength, frequency stability, power levels, and temperature variations to identify potential issues. The goal is to automate the detection of specific malfunction types, such as signal interference, frequency drift, or overheating, and generate real-time alerts.

Key words: Jammer device, fault detection, signal interference, power failure, frequency drift, overheating, real-time alerts, network properties, predictive analysis.

Improving Patch Antenna Performance Parameters through Machine Learning Advancement

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Abstract

This paper aims to enhance the design and performance ofpatch antennas through machine learning (ML) techniques that optimize key parameters such as gain, return loss (S11), and efficiency. Patch antennas, which are commonly employed in applications such assmartphones,IoTdevices,GPS,andWi-Firequireprecisetuningtoensureoptimalsignal transmission and reception. Conventional measurement methods including anechoic chambers and two-antenna techniques, often suffer from environmental interference, fabrication imperfections, and measurement errors. The proposed method utilizes ML-based models, which include supervised learning techniques like linear regression and neural networks, to improve design accuracy while minimizing computational overhead. ML-driven optimization enables real-time tuning of antenna gain and impedance matching, enhancing overall performance for 5G Communications, Satellite Communications, and IoT applications. The design integration of machine learning with simulation and hardware testing results in greater accuracy and efficiency, ultimately improving the reliability of wireless communication.

Keywords: Patch Antenna, Machine Learning, Impedance Matching, Wireless Communication, 5G, IoT.

ML Driven Thermographic Image Classification for Fault Detection in Photo voltaic Cells

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Abstract

In India, there are three major sources of power: wind, coal, and solar energy. Among these, solar energy is considered more efficient due to its renewable nature, vast availability, and low environmental impact. As India pushes for sustainable energy solutions, solar power that is increasingly being integrated into the national grid. Faults and Failures in solar PV cells cause major power issues. Traditional methods of fault detection involved manual inspections or basic thermal analysis, which were slow, error-prone, and not always effective at identifying problems before they worsened. So, to overcome above problems, this work adopted Machine learning-driven thermographic image classification is a modern approach that enhances the efficiency of solar photovoltaic (PV) systems by automating fault detection. This technique uses machine learning algorithms to analyse thermal images of PV systems, identifying issues like panel defects or overheating, which can reduce overall system performance. With this approach, the performance and lifespan of solar power systems can be optimized, ensuring they operate at their full potential and contribute effectively to India's growing energy needs. Additionally, the use of this technology leads to cost savings by preventing major system failures and optimizing resource allocation for maintenance.

Keywords: Fault detection, Solar photovoltaic (PV) systems, Renewable energy, Thermal images, Panel defects, Sustainable energy.

IoT- Android Integrated Smart Dinning Robot

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Abstract

The IoT-Android Integrated Smart Dining Robot is an innovative solution designed to enhance the dining experience in restaurants, cafeterias, and smart homes. This system integrates Internet of Things (IoT) technology with an Android-based interface to automate food delivery, order management, and table service. The robot is equipped with autonomous navigation, voice recognition, and sensor-based obstacle avoidance to ensure smooth and efficient operation. Customers can place orders through an Android app, which communicates with the robot via Wi-Fi or Bluetooth. The robot then fetches the order from the kitchen and delivers it to the designated table, reducing human intervention and improving service efficiency. The proposed system enhances hygiene, reduces labor costs, and optimizes restaurant workflow, making it an ideal solution for smart dining applications. Future advancements may include AI-based decision-making, cloud-based analytics, and multi-robot coordination for large-scale deployments.

Keywords: IoT, Smart Dining, Android Robotics, Automated Food Delivery, AI in Restaurants.

Revolutionizing Crop Disease Management with Deep Learning Classifiers for Rice Leaf Images

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Abstract

Agriculture is the backbone of India's economy, with Andhra Pradesh playing a crucial role as a major producer of rice. Increasing water and land usage while effectively controlling diseases can significantly enhance rice crop yield. Proper disease management is essential for improving farmers' economic conditions by ensuring healthier crops and reducing disease rates. Traditionally, farmers relied on manual inspections and expert consultations to diagnose diseases and determine suitable pesticides. However, this process was time-consuming, required extensive labor, and sometimes led to inaccurate results. Additionally, the rise in various crop diseases increased the need for more manpower in disease management. To address these challenges, a deep learning-based approach is proposed. This method analyzes rice leaf images and applies deep learning techniques to identify diseases accurately. Based on the detected disease, the system suggests appropriate pesticides, ensuring timely and precise recommendations. By enhancing the accuracy and efficiency of disease management, this approach helps farmers improve their crop yield. Furthermore, it reduces reliance on manual inspections and labor-intensive processes, ultimately benefiting both farmers and the economy.

Keywords : Convolutional Neural Networks (CNNs), Transfer Learning, Image Preprocessing, Object Detection, Pesticide Recommendation System

Deep Learning – based Approach for Classification of Tuberculosis: A Comprehensive Image Dataset Analysis

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Abstract

The aim of this project is to design and implement a deep learning-based approach for the classification of Tuberculosis (TB) using a comprehensive image dataset. The proposed model leverages convolutional neural networks (CNNs) and other advanced deep learning techniques to achieve high accuracy in detecting TB from medical images. By utilizing a well-curated dataset, the model is trained to identify key patterns indicative of TB infection, reducing the dependency on manual diagnosis and enhancing diagnostic efficiency. The approach aims to optimize classification performance by employing techniques such as data augmentation, transfer learning, and hyperparameter tuning. Experimental evaluation demonstrates that the model achieves superior classification accuracy with minimal false positives, making it highly suitable for clinical applications. The proposed deep learning framework is particularly beneficial for automated TB screening, assisting healthcare professionals in early and accurate diagnosis, ultimately improving patient outcomes.

Keywords: Deep Learning, Tuberculosis, Convolutional Neural Networks (CNNs), Medical Image Analysis.

ML Modeling for Path Loss in 5G High-Frequency Bands for Enhanced Network Performance

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Abstract

The rapid growth of mobile users and data traffic has driven the evolution of wireless communication systems from 1G to 5G. Real-world issues like "real call jumps" cause rapid signal fluctuations due to reflections and diffractions in urban settings. Additionally, channel propagation errors and overlapping communication paths degrade signal quality, increasing path loss and potential communication failures. Currently, communication engineers at Base Stations (BS) and Mobile Switching Centers (MSC) rely on traditional methods to calculate path loss, primarily focusing on signal properties. These conventional techniques are proving inadequate, particularly with the advent of 5G and its higher frequency bands. This approach faces significant challenges, including higher complexity issues, synchronization problems, and elevated error rates. To overcome these challenges, a novel approach is proposed: utilizing machine learning for path loss prediction. The core of this solution lies in creating a "Path Loss Propagation" (PLP) dataset, which will serve as the input for training machine learning models. The primary objective is to develop a system capable of accurately predicting future path loss for each input within the PLP dataset.

Keywords: Path Loss Prediction, 5G High Frequency Band, Free Space Path Loss, Machine Learning, Wireless Communication, Line of sight(LOS), Network Optimization.

Smart Bin Management and Response Robot

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Abstract

The Smart Bin Management and Response Robot project aims to develop an intelligent waste management system that automates waste detection, sorting, and disposal using advanced sensor technology and AI-driven decision-making. The Smart Bin efficiently classifies waste into recyclable and non-recyclable categories, optimizing waste disposal while reducing human intervention. The Response Robot enhances efficiency by autonomously handling waste and responding to over floworm is classification scenarios, ensuring a cleaner and more sustainable environment. To achieve real-time processing and low power consumption, the system integrates embedded computing techniques that optimize response time and energy efficiency. The intelligent control system dynamically adjusts its operations based on sensor inputs, leading to faster decision-making and lower power consumption. Implemented with IoT-based monitoring, the project enables remote tracking of waste levels, automated alerts, and real-time data analysis for smart city applications. Experimental evaluations demonstrate that the Smart Bin Management and Response Robot significantly improve waste management efficiency, reduces operational costs, and enhances environmental sustainability. This solution is particularly suitable for smart cities, industries, and public spaces, where automated waste disposal and real-time monitoring are crucial for maintaining hygiene and sustainability.

Keywords: Smart Bin, Waste Classification, Response Robot, IoT-based Waste Management, Automated Sorting, Environmental Sustainability, AI-driven Waste Management, Embedded Computing.

AI powered Fish Disease classification and medicine suggestion towards Smart Aquaculture

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Abstract

The rapid growth of aquaculture has underscored the necessity for efficient disease management strategies to ensure sustainable production. Traditional diagnostic methods are often labor-intensive and may not provide timely results, leading to significant economic losses. To address this challenge, recent studies have explored the development of artificial intelligence (AI)-powered systems for fish disease classification and corresponding medicine recommendations, aiming to enhance smart aqua culture practices. For instance, a study utilized a comprehensive dataset of fish images, encompassing various species and disease conditions, to develop a Convolutional Neural Network (CNN) model capable of accurately classifying common fish diseases. The model's performance was benchmarked against existing state-of-the- art techniques to validate its efficacy. Subsequently, a recommendation system was designed to provide specific medicinal treatments corresponding to the diagnosed diseases. The integrationof AI in aquaculture practices has the potential to significantly reduce disease-related losses and promote sustainable practices.

Keywords: Aquaculture, Fish Disease Classification, Convolutional Neural Network, AI in Aquaculture, Sustainable Aquaculture.

AI Driven Speed violation and Signal Jump

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Abstract

AI-driven speed violation and signal jump detection is an intelligent traffic monitoring system that enhances road safety. It utilizes computer vision and machine learning to detect vehicles exceeding speed limits and violating traffic signals. Real-time video processing and automated number plate recognition (ANPR) help in identifying offenders accurately. The system integrates with databases for issuing fines and alerts. It reduces human intervention, improves enforcement efficiency, and minimizes traffic rule violations. Advanced AI models ensure high accuracy in detecting infractions. Cloud-based storage enables data management for further analysis. This solution contributes to smarter and safer urban traffic management.

Keywords: AI-driven traffic monitoring, speed violation detection, signal jump detection, computer vision, machine learning, automated number plate recognition (ANPR), real-time video processing, traffic rule enforcement, smart traffic management, road safety.

Transfer Learning model For Content Based Image Retrieval

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Abstract

Image searching plays a vital role in various applications, including person recognition and object recognition, enabling efficient retrieval of relevant visual data. It is a crucial technology that enables users to retrieve visually similar images from large datasets based on input images. Existing image search systems primarily rely on manual searching, color-based searching, and similarity-based retrieval. Manual searching requires users to input specific keywords or browse through large datasets, making it time-consuming and inefficient. Color- based searching extracts dominant colors from an image and retrieves images with similar color distributions, but it lacks the ability to recognize object structures or semantic meaning. However, these traditional methods struggle with variations in lighting, pose, and background clutter. So, this work implemented deep learning-based image retrieval with deep pixel analysis of features like texture, shape. The proposed system employs transfer learning VGG16 to extract deep feature representations from an input image and retrieve visually similar images with high accuracy. By using a transfer learning model, it enhances image recognition, ensuring efficient and intelligent image retrieval.

Keywords: Deep pixel analysis, transfer learning, feature extraction, texture recognition, shape recognition and colour recognition.

Cutting Edge Security: LI-FI Based Technology for Realiable Audio and Data Transmission

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Abstract

The main objective of this project is to design and develop a reliable, secure, and high-speed and Energy-Efficient wireless communication system using Light Fidelity (Li-Fi) technology. The proposed system consists of two sections: a transmitting section that converts electrical signals into light signals through a Light Source, and a receiving section that detects the light signal and converts it back into an electrical signal using an Light to Electrical (L-E) converter.In addition to text communication, we are also providing audio communication, which facilitates better understanding and more effective communication. Here, we are using Visible Light communication (VLC). The system provides a secure connection, minimizing the risk of interception and hacking, and reduces interference from other devices and physical barriers, ensuring a reliable connection. Additionally, Li-Fi enables high-speed data transfer, making it ideal for real-time applications.

Keywords: Light Fidelity (Li-Fi) Technology, Energy-Efficient wireless Communication, High-Speed Data Transfer, Audio Communication, Visible Light Communication (VLC).

Development of High Mobility Six Wheeled Robot with Rocker Bogie Suspension System.

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Abstract

The development of a high-mobility six-wheeled robot with a rocker-bogie suspension system aims to significantly enhance the robot's capability to navigate rough and uneven terrains, making it ideal for applications such as search and rescue, planetary exploration, and military reconnaissance. Traditional systems, including four-wheeled robots and simpler suspension mechanisms, often faced issues such as wheel slippage, tipping, and poor terrain adaptability, which reduced their effectiveness in challenging environments. The objective of this project is to design a robot that maintains constant wheel contact with the ground using the rocker-bogie system, providing superior traction, balance, and stability. This proposed rocker bogie system consists of six DC motors, two L293D motor drivers, and a wireless Bluetooth module(HC-05). These six DC motors are controlled through the two L293D motor drivers. The Bluetooth module allows for wireless control of the robot, enabling commands for movement such as left, right, forward, and backward. These commands are sent via Bluetooth from a mobile device to the Arduino micro-controller. In addition, an ultrasonic sensor is integrated into the system to detect obstacles and objects in the robot's path. Proposed Rocker Bogie potential applications include autonomous exploration on planetary surfaces like Mars, remote area search and rescue operations, monitoring and inspection in hazardous environments, such as mines or nuclear plants, military reconnaissance in difficult terrains, and even environmental monitoring in rugged landscapes.

Keywords: Rocker-bogie, Suspension System, Planetary Exploration, Military Reconnaissance, Superior Traction, Obstacles, Rescue Operations.

IoT& ML Integrated Smart Door 3- Step Verification Accessing System

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Abstract

In the past traditional methods, the smart door lock systems that using two-step verification (password and fingerprint) with less security. By integrating the traditional methods with modern technology. we are designing the Smart Door Lock System, designed to keep your home or office safe with three step verification to unlock the door with high security. This system gives you extra security and peace of mind, ensuring that only authorized people can enter your space. The smart door lock system with three step verification, where a user inputs their password via a keypad, scans their fingerprint using a fingerprint sensor, and undergoes facial recognition through a camera module. These inputs are transmitted to an ESP32 microcontroller, which verifies the data sequentially. If the password is incorrect, the system halts, and a buzzer sounds an alarm, preventing progression to the next step. However, if the password is correct, the ESP32 proceeds to verify the fingerprint and facial recognition data. Upon successful verification of all three inputs, the ESP32 sends a signal to open the door and stores the verified user data in the cloud via IoT connectivity. The objective of the smart door lock system is to offer advanced security by combining three key methods: a keypad for entering a PIN, a fingerprint scan, and facial recognition. This multi-layered approach ensures that only authorized individuals can gain access, significantly reducing the risk of unauthorized entry.

Keywords: Three step verification, High Security, Biometric Authentication, Facial Recognition,

VLSI Evaluation and Exploration of TCAM Based Triple Level Hybrid Cache System

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Abstract

VLSI (Very Large-Scale Integration) technology in conjunction with solid-state devices like CD or DVD, enabling the integration of millions of transistors onto a single chip, thus enhancing performance, reducing size, and minimizing power consumption in modern electronic systems. Memory usage is increasing every year along with digital data generation. As data usage increases then memory storage also increases .So it causes higher chances of error rates. By this speed of operation reduces. Traditional memory devices such as SRAM and DRAM are widely used in computing systems, but they face significant challenges, including slow access times, high power consumption, and data errors during retrieval or transmission. These limitations result in reduced system performance, especially in applications requiring high-speed and reliable data access. To address these issues, the proposed system introduces an efficient approach for processing digital data using write adders and read adders to facilitate fast and accurate data input and output. The core method employed is TCAM (Ternary Content Addressable Memory), which allows for parallel searching and matching of data, thus improving performance. Additionally, the system incorporates triple data error correction, which ensures that any data errors are detected and corrected, resulting in error-free data output. This approach improves both the reliability and speed of data handling, making it suitable for high-performance application.

Keywords: Error Detection and Correction (EDAC), Memory Storage Systems, Ternary Content Addressable Memory(TCAM), high-speed and reliable data access

Energy-Delay Efficient Segmented Approximate Adder with Smart Chaining

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Abstract

The aim of this project is to design and implement an Energy-Delay Efficient Approximate Adder with Smart Chaining in VLSI to optimize power consumption, speed, and area while maintaining acceptable accuracy for error-tolerant applications. The proposed adder utilizes smart chaining to intelligently propagate carry signals, reducing logic complexity and enhancing computational efficiency. By leveraging approximate computing techniques, the design aims to achieve a lower Energy-Delay Product (EDP) compared to conventional adders.The Smart Chaining methodology dynamically adjusts the carry propagation path based on input conditions, leading to faster computation with lower energy consumption. Implemented in CMOS technology, the proposed design is evaluated in terms of power, delay, and accuracy. Experimental results demonstrate that the adder achieves substantial power savings with minimal accuracy loss, making it ideal for real-time and power-constrained applications.

Keywords: Approximate Computing, Energy-Delay Product (EDP), Carry Speculation, Error-Tolerant Applications, High-Speed Arithmetic Circuits.

IoT-Android Integrated Smart Dinning Robot

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Abstract

The aim of the IoT Android Integrated Smart Dining Robot project is to design and develop an intelligent, automated dining assistant that enhances the dining experience using IoT (Internet of Things) and Android-based technologies. The system will enable a robot to autonomously deliver food, take orders, and interact with customers, while also being monitored and controlled through an Android application. The project aims to streamline restaurant operations, improve efficiency, reduce human error, and offer a personalized dining experience, all while collecting data to optimize service and performance. The proposed IOT - Android smart dining robot system aims to improve traditional restaurant operations by integrating real-time communication, autonomous navigation, and personalized customer interactions. Using IOT for seamless coordination between robots, kitchen systems, and customers, and Android for a user-friendly mobile app, the system enhances order management, route optimization, and customer feedback. Key benefits include increased efficiency, reduced human error, contact-less dining, cost savings, and scalability. This technology can be applied to commercial restaurants, hospitals, smart homes, and large events, offering smarter, more responsive, and sustainable dining solutions.

Keywords: Internet of Things (IoT), Android Integration, Smart Dinning, Robot Navigation, Sensors and Automation.

ML Driven Regressor for Enhancing IOT Network Performance Through Predictive Modeling

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Abstract

The increasing demand for efficient wireless communication networks has introduced challenges in maintaining optimal performance under dynamic conditions. Traditional optimization techniques often require extensive computational resources and manual tuning, making real-time adaptability difficult. This project leverages Machine Learning (ML)-based regression models to predict and enhance communication network performance, focusing on parameters such as latency, throughput, packet loss, and signal strength. By training supervised ML models, such as linear regression, decision trees, and neural networks, on datasets comprising network traffic and signal quality metrics, we aim to develop a predictive model that can dynamically optimize wireless communication performance. The system is validated using simulation tools and real-world network data, ensuring improved efficiency, lower latency, and enhanced data transmission reliability, enabling real-time predictive modelling for enhanced communication efficiency.The growing complexity of communication networks has led to challenges like network congestion, unpredictable latency, and signal degradation, affecting overall Quality of Service (QoS). Conventional network performance optimization relies on static models and heuristic-based approaches, which lack adaptability to real-time changes. Machine Learning (ML)-driven regression models offer a data-driven approach to predict and optimize communication network performance dynamically.

Keywords: Regression Analysis, Random Forest Regression, Real-Time Data Processing, Wireless Network Performance Analysis, IoT Network Optimization.

Deep Learning based on White Blood Cell Classification with Adaptive Moment Estimation

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Abstract

Blood primarily consists of several key components such as plasma, red blood cells (RBC), white blood cells (WBC), platelets, oxygen, carbon dioxide, and essential nutrients for survival. Disruptions in these components can result in various blood disorders, such as anemia, elevated WBC counts or thrombocytopenia. Identifying WBCs through imaging is vital for accurate diagnosis and treatment, enabling healthcare professionals to make precise assessments and provide suitable interventions. However, the traditional method of manually classifying WBCs is time-consuming, often struggles with differentiating multiple blood cell types and carries a high risk of errors. The primary issues are time consumption and misclassification, highlighting the need for an efficient and accurate automated solution. The proposed model combines a Convolutional Neural Network (CNN) with Adaptive Moment Estimation (Adam) for WBC classification. CNNs are proficient at analyzing and modeling the relationships between cells which enhances accuracy in complex scenarios where cells may interact. By examining microscopic images of blood cells, this approach increases diagnostic speed, reduces human error and enhances the efficiency of disease detection.

Keywords: White Blood Cell (WBC) Classification, Convolutional Neural Network (CNN), Adaptive Moment Estimation (Adam), Blood Cell Image Analysis, Automated Disease Diagnosis, Medical Image Processing, Machine Learning in Healthcare.

Detection of Lung Nodules in CT Scans (Early Detection of Cancer)

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Abstract

The aim of this project is to design and implement a system for detecting lung nodules, which are small growths in the lungs that may indicate serious diseases, such as cancer. Early detection through X-rays or CT scans is crucial for effective treatment. Air pollution, particularly in cities like Delhi, contributes to lung problems and increases the risk of nodules and respiratory diseases. AI and deep learning have significantly improved detection by analyse scans with greater accuracy. However, some nodules resemble normal tissue, making diagnosis challenging. Ongoing research aims to enhance AI models and imaging techniques to address these challenges. Early detection, combined with technological advancements, is vital for saving lives and combating lung diseases. The integration of advanced AI algorithms with medical imaging technologies is helping doctors detect lung nodules at earlier stages, significantly improving the chances of successful treatment. Additionally, continuous research to improve the accuracy of these AI models and reduce false positives is crucial for ensuring reliable diagnoses. Ultimately, this contributes to better healthcare outcomes. With ongoing efforts, AI will continue to play a transformative role in lung health diagnostics and the fight against respiratory diseases.

Keywords: Lung Nodules, Early Detection, AI Algorithms, Medical Imaging, Deep Learning, Respiratory Diseases.

Multi-Sensor Adopted DL Analysis for enhanced dynamic Gesture Recognition from mm-Wave Radar Data

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Abstract

The aim of project is typically to improve the accuracy and efficiency of gesture recognition systems. These systems leverage millimeter-wave (mm Wave) radar technology combined with advanced deep learning models to interpret dynamic gestures. The goal is to enhance human-computer interaction (HCI) by making it more intuitive, real-time, and robust, even in complex environments. These are electromagnetic waves with wavelengths ranging from 1 to 10 millimeters, corresponding to frequencies between 30 GHz and 300 GHz. Due to their high frequency, mm Waves offer excellent resolution and are ideal for applications such as radar, communications, and imaging. Traditional radar systems for gesture recognition often rely on manual systems, where human operators interpret raw data from sensors, leading to inefficiencies, errors, and limitations in real-time processing. These systems struggle with environmental interference, low accuracy, and scalability, especially in dynamic conditions with varying gestures.

Keywords: Dynamic Gesture Recognition, mmWaveRadar, Deep Learning (DL), Human-Computer Interaction (HCI), Feature Extraction, Temporal Data Analysis, Classification Algorithms, Multisensor Fusion

Deep Learning based Data-Driven Insights into Microstrip Antenna Performance

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Abstract

An electronic communication system is a method of exchanging information between two or more systems. It can involve electronic devices, software, and services. Most of these systems are working in wireless communication networks. In these wireless communication systems the transmission of information between devices takes place without the use of wires or cables. A microstrip antenna is a type of antenna that is printed on a circuit board or semiconductor chip it is mostly used in wireless communication networks. Antenna performance is measured by several parameters, including gain, bandwidth, radiation pattern, and polarization. It involves a sender, a message, a channel, a receiver, and feedback. In the context of microstrip antennas apply mathematical models and techniques to optimize antenna design and performance. In the case of microstrip antennas, these experts usually incorporate various mathematical rules to improve efficiency, minimize loss, enhance the bandwidth, and ensure that the antenna meets the required specifications (e.g., gain, directivity, and impedance matching). In this work a deep learning technique is applying in the analysis of various parameters of microstrip antenna and they are calculating antenna performance. These systems are designed for a variety of applications, such as wireless communication, remote sensing, and biomedical applications.

Keywords: Deep Learning, Data-Driven Insights, Microstrip Antenna, Antenna Performance, Neural Networks, Performance Prediction.

Deep Learning Approach For Target Classification From Frequency-Modulated Continuous Wave Radar

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Abstract

The aim of this project is to develop a deep learning-based radar object detection and classification system that enhances accuracy and robustness in identifying targets using Frequency-Modulated Continuous Wave (FMCW) radar data. Existing radar-based detection systems often struggle with accurately classifying object types and suffer from higher misprediction rates, especially in complex or noisy environments. To address these challenges, the proposed system processes radar signal data through advanced deep learning models, enabling precise object classification while improving performance across diverse conditions. By leveraging deep learning techniques, the system enhances classification accuracy, reduces error rates, and ensures reliable object detection in real-time applications such as military defense, autonomous vehicles, weather monitoring, and industrial surveillance. The integration of deep learning with radar technology enables better adaptability to complex scenarios, making it a valuable advancement in modern object detection systems.

Keywords: Radar Object Detection, Frequency-Modulated Continuous Wave (FMCW), Deep Learning, Object Classification, Autonomous Systems, Military Defense.

Machine Learning Techniques for Feature Extraction in Malaria Cell Classification

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Abstract

Malaria remains a major global health challenge, requiring accurate and efficient diagnostic methods for timely treatment. Traditional methods for diagnosing malaria, such as the microscopic examination of blood smears, are labour intensive and susceptible to human error. The current malaria treatment protocol involves early diagnosis followed by effective medication. Rapid diagnostic tests (RDTs) and microscopy are employed to confirm infections. The primary therapy consists of artemisinin-based combination therapies (ACTs), which are notably effective against Plasmodium falciparum, the most lethal malaria parasite. In severe cases, intravenous or injectable artesunate is recommended, followed by oral ACTs. To address these limitations, this paper suggests a machine learning approach to enhance feature extraction in malaria cell classification. The envisioned system for blood smear analysis aims to improve accuracy, efficiency, and accessibility in malaria diagnosis by leveraging advanced technology. It combines automated image processing, artificial intelligence (AI), and machine learning (ML) to refine the diagnostic process. Key applications of the proposed system include automated malaria detection to enhance diagnostic accuracy and decrease dependence on manual examination, as well as facilitating malaria diagnosis in remote areas where expert availability is limited.

Keywords: Blood smear images, artemisinin-based combination therapies (ACTs), KNN algorithm, Principal Component Analysis.

Investigating machine learning models for detecting abnormal respiratory sounds in pulmonary disease

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Abstract

India has been experiencing a significant rise in pollution due to rapid industrialization, vehicular emissions, and urban expansion, leading to deteriorating air quality. This has resulted in a surge of pulmonary diseases such as asthma, chronic obstructive pulmonary disease (COPD), and bronchitis, affecting millions of people. Traditionally, the diagnosis of these diseases relies on real-time manual analysis by medical experts who evaluate patient symptoms based on established clinical standards, making the process time-consuming and subjective. To address this, the proposed system utilizes machine learning to analyze lung sound datasets, enabling automated and accurate disease classification. The system takes lung sound recordings as input and processes them through trained machine learning models to detect and classify diseases accurately. This ML driven approach enhances diagnostic accuracy, reduces the dependency on expert availability, and enables early disease detection. By providing a non- invasive, fast, and reliable diagnosis, the proposed system can significantly improve healthcare accessibility, particularly in remote and underdeveloped areas. The integration of machine learning in pulmonary disease diagnosis can revolutionize the healthcare sector, offering a cost-effective and scalable solution for respiratory disease management.

Keywords: Pollution, Pulmonary diseases, Machine learning, Lung sound analysis, Automated diagnosis, Healthcare accessibility.

VLSI Design of OTFS Modulation with Zero Forcing Equalizer

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Abstract

The aim of this project is to Design of OTFS Modulation with Zero Forcing Equalizer Orthogonal time frequency space (OTFS) is a promising modulation technique that provides enhanced resilience to time-varying channels, making it suitable for high mobility scenarios. In this work, we focus on achieving a low complexity hardware implementation of the zero forcing (ZF) Equalizer for single-input-single-output (SISO) OTFS system. The proposed very largescale integration (VLSI) architecture leverages parallel processing and resource optimization techniques to reduce the computational complexity and hardware requirements of the ZF equalizer. We use the back-to-back connection of fast Fourier transform (FFT) and inverse fast Fourier transform (IFFT) that simplify matrix inversions and it updates without significantly compromising performance. By carefully designing the architecture, we aim to achieve real time processing capability while meeting are requirements and latency constraints. Through extensive simulations and performance evaluations, we analyze the trade-offs between complexity reduction and equalization performance. Metrics such as bit error rate (BER), latency and area are considered to assess the efficiency and effectiveness of the proposed architecture. We observe from the synthesis results on the 7vx485tffg1157-1 FPGA device that the architecture achieves 440ns latency with 100MHz clock frequency, 249,843 lookup tables (LUTs) and 74,611 flip flops (FF).

Keywords: Bit error rate, Latency, Orthogonal Time Frequency Space,Zero Forcing Equalizer, flip-flops.

Smart Bin and Prototype Robot Integration for Efficient Waste Segregation

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Abstract

With the increasing need for efficient waste management, automation plays a crucial role in maintaining cleanliness in public and private spaces. The "Smart Dustbin and Auto Cleaning System" is designed to optimize waste collection and disposal by integrating smart technology. This system consists of a smart dustbin equipped with sensors to detect the waste level and an autonomous cleaning robot that collects waste when the bin is full. The smart dustbin uses IoT-based sensors to monitor waste levels and sends realtime data to a centralized system. When the dustbin reaches a predefined threshold, the auto-cleaning robot is activated. Using advanced navigation and obstacle detection, the robot moves towards the dustbin, collects the waste, and transports it to the designated disposal area. Additionally, the system features a detection mechanism that identifies whether the waste is dry or wet when placed on a plate above the dustbin. Once detected, the system differentiates and segregates the waste accordingly, ensuring efficient waste disposal. The system is built using various components, including RBS, servo motors, LCD displays, LEDs, IoT modules, IR sensors, ultrasonic sensors, wet and dry sensors, ESP32, GPS for robot navigation, Arduino, robotic mechanisms, switches, and LCD screens. These components work together to enable seamless waste monitoring, sorting, and cleaning operations. By integrating IoT, automated navigation, real-time monitoring, waste differentiation, and a robust set of hardware components, this system enhances urban waste management, reduces human effort, and promotes a cleaner environment.

Keywords: Waste Segregation, Waste Management, Automation, IoT (Internet of Things), Sensors.

IoT and RFID Based Bus Announcement System

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Abstract

In the existing system bus transport system, blind people faced difficulties identifying the correct bus, leading to inconvenience and safety risks. They had to rely on the help of others or memorized routes, which were often unreliable. The Proposed project "IoT and RFID Bus Announcement System for Blind" helps visually impaired people by providing bus arrival information through voice and display. It uses an RFID system to detect the bus, an Arduino UNO as the microcontroller, and an IoT-based application for remote monitoring. The system ensures that blind individuals receive real-time updates about buses, making public transport more accessible. The project integrates RFID technology with IoT to improve transportation for visually impaired passengers. The proposed system uses RFID cards and readers to detect buses and provides output through an LCD display, a voice speaker, and an IoT app. It allows blind people to hear the bus details, ensuring they catch the right bus without external help. This system is useful in public transportation, smart cities, and assistive technology for the visually impaired. The project benefits include improved accessibility, enhanced safety, and real-time bus information. It also reduces dependence on others and increases travel confidence, efficient and smarter transportation for blind passengers.

Keywords: Bus transport system , Blind people, RFID system, Arduino UNO, IoT-based application, Real-time updates, Accessibility, Voice announcement, LCD display, Smart cities, Assistive technology, Travel confidence, Public transportation.

Versatile Hand Gesture-Controlled Robot with ADXL Accelerometer

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Abstract

The aim of this project is to provide an intuitive interface for human-robot interaction by recognizing a wide range of hand gestures. The ADXL accelerometer, capable of detecting acceleration in three axes, serves as the primary sensor for capturing hand motion to enhance the versatility and usability of robotic systems. The project integrates an ADXL MEMS accelerometer sensor to detect hand movements, enabling gesture-based control of the robot. The Arduino Uno processes the data from the MEMS sensor and sends commands to six motors, controlled by ana L293D motor driver. This configuration allows the robot to perform various actions like Forward, Backward, Left, Right, Stop. The system's performance is evaluated in terms of gesture recognition accuracy, response time, and real-world applicability. The results indicate that the integration of the ADXL accelerometer holds promise for enhancing the adaptability and precision of robotic control systems driven by hand gestures.

Keywords: Accelerometer, Arduino-Uno, Hand Gesture, Gesture-Controlled Robot, ADXL Accelerometer, MEMS Sensor, Hand Gesture Recognition.

Design and Implementation of HEXA pod Rover with Rocker Bogie suspension

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Abstract

This project aims to develop a high-mobility six-wheeled robot with a rocker-bogie suspension system, enhancing its ability to navigate rough terrain for applications like search and rescue, planetary exploration, and military reconnaissance. Unlike traditional four wheeled robots, which struggle with slippage and poor adaptability, the rocker-bogie system ensures constant wheel contact, providing superior traction and stability. The robot is powered by six DC motors controlled by two L293D motor drivers, with wireless movement commands sent via an HC-05 Bluetooth module to an Arduino Micro-controller. An ultrasonic sensor detects obstacles, enabling the robot to avoid collisions. Potential uses include planetary exploration, remote search and rescue, hazardous environment monitoring, military reconnaissance, and environmental monitoring. The rover's modular design allows for easy upgrades and integration of advanced sensors for enhanced autonomy. Its low-power consumption and durable construction make it suitable for long-duration missions in extreme environments.

Keywords: Rocker-bogie suspension, hexapod robot, planetary exploration, obstacle detection, terrain adaptability.

Machine Learning Classification Approach across Diverse Mobility Patterns for Analysing Satellite Communication.

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Abstract

Satellite communication connects the globe by transmitting data, voice, and multimedia through satellites in various orbits such as geostationary, polar, and elliptical, with these satellites moving at speeds between 7,000 and 28,000 km/h to cover extensive areas for telecommunications, navigation, and Earth observation. Traditional systems often depend on static models that struggle with the dynamic nature of satellite mobility, resulting in prediction errors in signal transmission, coverage, and network optimization. To address these challenges, the proposed system incorporates machine learning to analyze satellite movement more accurately by leveraging datasets that include parameters like speed, trajectory, signal strength, and coverage area. This approach involves a comprehensive workflow encompassing data preprocessing, feature selection, and the use of classification techniques such as decision trees, support vector machines, and deep learning models to identify distinct mobility patterns, optimize resource allocation, and ultimately enhance satellite network performance.

Keywords: Satellite Communication, Machine Learning, Mobility Analysis, Trajectory Analysis**,** Network Optimization

Military Grade IOT Security for Missile Detection

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Abstract

The aim of this project is to design and construct automatic missile detection and destroying system. This system is designed to detect the target (missile) moving in multiple directions. The target destroying system moves automatically in the direction of missile and fires it upon fixing the target. This system has an intelligent object tracking system based on sonar, which is constantly tracking the target. The ultrasonic sensor is mounted over the servo motor and the servo motor is rotated in fixed position continuously. When the ultrasonic sensor finds the target, it provides the location of the target to a microcontroller. The Arduino microcontroller performs the task of shooting the target by laser light which we place at the top of the servo motor and also trigger the buzzer for alerts. The device contains esp32 camera for sending alert mail along with captured mage to the respective email. The project's main controlling device is Arduino UNO microcontroller which loaded program written in embedded C language.

Keywords: Military Grade Security, End-to-End Encryption, Real-Time Data Processing, Intrusion Detection System, Sensor Fusion Technology.

IoT Enabled Urban Utility Management System

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Abstract

The IoT Enabled Urban Utility Management System represents a transformative approach to managing urban infrastructure by leveraging advanced IoT technology. This system integrates a network of sensors and actuators to enable efficient monitoring and control of critical urban utilities, including street lighting, water pumps, and drainage systems. At its core, the system is powered by an ESP32 microcontroller, which orchestrates the seamless operation of various components such as Real-Time Clock (RTC), Global Positioning System (GPS), Light Dependent Resistors (LDRs), and ultrasonic sensors. These components work in tandem to provide a robust and comprehensive solution for urban utility management. The primary objective of this project is to design and implement a smart urban utility management system that enhances the efficiency, sustainability, and reliability of city infrastructure. By harnessing the power of IoT, this system aims to optimize resource utilization, reduce operational costs, and improve the overall quality of urban living.

Keywords: IoT, ESP32 Microcontroller, Sensors and Actuators, RTC (Real-Time Clock), GPS (Global Positioning System),LDR (Light Dependent Resistor),Ultrasonic Sensors

Cloud Based Robust Security Framework for Logistic Surveillance

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Abstract

Traditional logistics and container monitoring systems are lacking real-time tracking and facing issues like data breaches and inefficiency. The logistics industry adopts cloud-based solutions for scalability, real-time data access, and efficiency. This project proposes a robust framework for cloud-based logistics, integrating IoT to address modern challenges. This project consists of a fingerprint sensor for securing the container, a GPS for live tracking, a temperature and humidity sensor for monitoring the inside environment of the container, a vibration sensor for Accident detection, and a gas sensor for detecting gas leakage in the container. The prototype model implemented using ESP32 controller with enabled IoT connection. This project introduces a secure, scalable, and interoperable cloud-based logistics framework. It ensures data integrity, enables real-time tracking, and enhances. The system aims to reduce costs, optimize delivery efficiency, and provide a seamless experience for stakeholders.

Keywords: Delivery efficiency optimization, Cloud-based solutions, Gas leakage detection, Temperature and humidity sensor, Cost reduction

Sensor-Free Human Activity Recognition Using CNN-LSTM Deep Learning Architecture

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Abstract

In recent years, video-based surveillance systems have garnered significant attention in the field of computer vision, with Human Activity Recognition (HAR) playing a crucial role. However, accurately identifying human actions from real-world video data remains a complex challenge due to high computational demands and dynamic motion patterns. This research proposes a sensor-free approach to HAR using a hybrid deep learning model that integrates Convolutional Neural Networks (CNNs) for spatial feature extraction and Long Short-Term Memory (LSTM) networks for capturing temporal relationships in motion sequences. The model is trained on the UCF-50 dataset, which includes 50 distinct activity classes. By leveraging only video inputs—without relying on physical sensors—the proposed system demonstrates potential for application in areas such as surveillance, healthcare monitoring, and security analytics. The framework is implemented using advanced deep learning libraries and aims to provide a robust solution for real-time human action recognition.

Keywords: Convolutional Neural Networks, Long Short-Term Memory, Sequential Data, Temporal Dependencies, Deep Learning Frameworks, Human Activity Recognition

A Hybrid Deep Learning Model with Feature Selection for Intrusion Detection in Software-Defined Networks

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Abstract

Software-Defined Networking (SDN) offers a flexible and centralized approach to managing modern network infrastructures. However, the centralized nature of SDN also introduces new vulnerabilities, including Distributed Denial-of-Service (DDoS), web-based attacks, and User to Root (U2R) intrusions. These threats can compromise the SDN controller, leading to severe network disruptions and potential system failure. To mitigate such risks, Network Intrusion Detection Systems (NIDS) are essential. In this work, we propose a hybrid deep learning model that combines Convolutional Neural Networks (CNN) and Bidirectional Long Short-Term Memory (BiLSTM) networks to enhance intrusion detection accuracy and performance in SDN environments. The CNN layers are employed for automated feature extraction, while the BiLSTM layers capture complex sequential attack patterns. Additionally, a hybrid feature selection method is used to eliminate redundant and irrelevant features, thereby optimizing input quality and reducing training time. The model is evaluated on UNSW-NB15, NSL-KDD, and InSDN datasets for both binary and multi-class classification tasks. Experimental results demonstrate improved accuracy, generalization capability, and detection efficiency. The proposed approach strengthens SDN security by providing a robust and scalable intrusion detection framework.

Keywords: Network Intrusion Detection System (NIDS), Software-Defined Networking (SDN), CNN-BiLSTM, Deep Learning, Feature Selection, Cyber security

Real-Time End-to-End Target-Speaker ASR with Integrated Activity Detection in Multi-Speaker Environments

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Abstract

Recognizing speech from a specific speaker amidst overlapping conversations presents a persistent challenge in automatic speech recognition (ASR). Conventional systems often rely on separate modules for target speech extraction and recognition, which increases latency and system complexity. This study introduces a streaming, end-to-end Target-Speaker ASR framework based on a neural transducer architecture, designed for real-time and edge-device deployment. The proposed system utilizes speaker embeddings to condition the recognition model on a predefined speaker's voice, allowing it to isolate and transcribe only the target speaker while suppressing interfering voices. Additionally, a built-in target-speaker activity detection (TSAD) module ensures the system remains silent during non-speaking intervals of the target speaker, reducing unnecessary transcriptions. This unified approach not only streamlines the ASR pipeline but also improves accuracy, efficiency, and responsiveness in multi-speaker, real-world scenarios.

Keywords: Automatic Speech Recognition (ASR), Target-Speaker Detection, Neural Transducer, Deep Learning, Real-Time Processing, Multi-Speaker Environment, Speech Embeddings, Activity Detection, Signal Processing, Streaming ASR

CLIP-Guided Image Captioning Using a Lightweight Prefix Mapping for Generative Vision-Language Models

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Abstract

Image captioning, a core task in vision-language understanding, aims to generate informative textual descriptions for given input images. In this work, we introduce a lightweight and efficient approach that leverages the rich semantic representations of the pre-trained CLIP model. Our method uses CLIP image embeddings as a prefix to guide caption generation via a simple trainable mapping network, followed by a pre-trained language model (GPT-2) for text generation. Notably, our architecture requires minimal fine-tuning; only the mapping network is trained, while CLIP and GPT-2 remain frozen. This design significantly reduces computational overhead and model complexity. Despite its simplicity, the proposed method demonstrates competitive performance on the Conceptual Captions dataset, achieving results comparable to state-of-the-art models. Our findings highlight the effectiveness of combining vision and language models through prefix tuning, enabling efficient captioning without additional annotation or extensive training.

Keywords: CLIP, Image Captioning, Vision-Language Models, GPT-2, Mapping Network, Pre-trained Models, Lightweight Architecture, Conceptual Captions

Predicting At-Risk Students in Virtual Learning Environments Using a Hybrid Deep Learning Model

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Abstract

With the rise of digital education platforms, virtual learning environments (VLEs) have become increasingly popular, offering flexible access to educational content. Despite their advantages, VLEs often suffer from issues such as low engagement, high dropout rates, and a lack of self-regulated learning among students. Early prediction of high-risk students in these environments is essential for enabling timely interventions and enhancing learning outcomes. This study presents a Hybrid Deep Learning (HDL) framework that utilizes an Enhanced Convolutional Neural Network (ECNN) integrated with a ResNet-based classification model to predict student performance in VLEs. The proposed model is evaluated using the Open University Learning Analytics Dataset (OULAD), which provides a robust benchmark for academic performance prediction. Our HDL approach outperforms traditional models, achieving a prediction accuracy of 95.67%, compared to 93.9% for Deep Feedforward Neural Networks (DFFNN) and 71.41% for Multi-Layer Perceptrons (MLP). These results demonstrate the model's effectiveness in identifying at-risk students and supporting data-driven pedagogical decision-making.

Keywords: Academic Performance Prediction, Virtual Learning Environments (VLE), Hybrid Deep Learning, Enhanced Convolutional Neural Network (ECNN), ResNet, Min-Max Normalization, Butterfly Optimization, Learning Analytics

Attention-Based Neural Question Generation for Enhanced Reading Comprehension

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Abstract

This study addresses the task of Automatic Question Generation (AQG) for reading comprehension by proposing a fully trainable, end-to-end neural architecture based on attention-driven sequence-to-sequence learning. In contrast to conventional AQG approaches that rely on rule-based systems or complex natural language processing (NLP) pipelines, our model offers a streamlined and flexible solution that eliminates the need for handcrafted features. We examine the influence of input granularity—comparing sentence-level versus paragraph-level encoding—on the quality and complexity of generated questions. Experimental results show that our model outperforms state-of-the-art rule-based systems across automatic evaluation metrics, producing questions with superior lexical diversity and syntactic structure. Furthermore, human evaluations confirm that the generated questions are more grammatically natural, fluently phrased, and cognitively demanding, often requiring deeper reasoning beyond surface-level information. These findings highlight the effectiveness of our attention-based model in generating contextually rich and educationally valuable questions for reading comprehension tasks.

Keywords: Automatic Question Generation (AQG), Reading Comprehension, Attention-Based Sequence Learning, Sequence-to-Sequence Learning, Natural Language Processing (NLP), Deep Learning, Text Understanding

A Context-Aware Sentiment Analysis Framework Using Decision-Based Recurrent Neural Networks

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Abstract

Sentiment analysis, a key area within opinion mining, focuses on extracting subjective information from textual data such as reviews, social media posts, and user comments. This project introduces Deep-Sentiment, a robust deep learning framework that integrates multiple components to enhance sentiment classification accuracy. The proposed system combines the pre-trained BERT-large-cased (BLC) model with Stochastic Gradient Descent (SGD) optimization to improve contextual understanding and convergence efficiency. Additionally, the model incorporates Aspect-Based and Priority-Based Sentiment Analysis to capture nuanced sentiment signals related to specific features and their importance. A Decision-Based Recurrent Neural Network (D-RNN) is employed for final sentiment classification, enabling the model to make informed decisions based on contextual cues and sentiment priority. The framework is evaluated on benchmark datasets including Twitter sentiment data, restaurant reviews, and laptop review datasets. Results, supported by confusion matrix analysis, demonstrate that Deep-Sentiment outperforms conventional models in terms of accuracy and contextual relevance. The model is implemented using Python libraries such as Keras and Pandas, offering a scalable and effective solution for real-world sentiment analysis applications.

Keywords: Sentiment Analysis, Opinion Mining, BERT-Large-Cased (BLC), Stochastic Gradient Descent (SGD), Aspect-Based Sentiment Analysis, Priority-Based Sentiment Analysis, Decision-Based Recurrent Neural Network (D-RNN), Feature Extraction, Bag-of-Words (BoW),Word2vec, Confusion Matrix, Keras, Pandas, Python

A Vision Transformer Framework for Finger Vein Recognition with Regularized MLP Head

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Abstract

Vision Transformers (ViTs) have emerged as a powerful alternative to convolutional architectures for various computer vision tasks. However, their application to finger vein recognition—a highly secure biometric modality—remains underexplored, primarily due to the limited size of available datasets. This project introduces FV-ViT, a novel ViT-based model specifically optimized for finger vein recognition tasks. Rather than modifying the ViT backbone, we propose regMLP, a regularization strategy applied within the MLP head of the transformer architecture, aimed at enhancing performance in low-data scenarios. Experimental results show that FV-ViT achieves a remarkably low Equal Error Rate (EER) of 0.042% on the FV-USM dataset and 1.033% on the SDUMLA-HMT dataset, outperforming state-of-the-art approaches. We further compare pretrained and non-pretrained versions of the model, demonstrating that ViTs can be effectively trained from scratch, yielding competitive results. These findings highlight the viability of Vision Transformers in biometric systems and suggest future directions in architectural tuning and data augmentation for improved performance in constrained biometric applications.

Keywords: Vision Transformer (ViT), Finger Vein Recognition, Biometric Authentication, FV-ViT, Regularization (regMLP), Equal Error Rate (EER), FV-USM Dataset, SDUMLA-HMT Dataset, Deep Learning, Pretrained vs. Non-Pretrained Models, Optimization, Data Augmentation

Signature Verification Using Siamese Networks with One-Shot Learning for Offline Biometric Authentication

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Abstract

With the rapid advancement of digitalization across industries, the demand for secure and efficient biometric authentication methods has grown significantly. Among various biometric modalities, signature verification remains critical in sectors such as banking, legal documentation, and forensics. This study focuses on offline signature verification, which is inherently more challenging than its online counterpart, as it relies solely on static, scanned images without capturing the dynamic motion of the signing process. To address this complexity, we propose a Siamese Neural Network architecture trained using One-Shot Learning, which enables effective verification with minimal labeled data. Unlike conventional deep learning models that require large datasets for classification, this approach leverages similarity learning to distinguish between genuine and forged signatures using just a few samples. Our method is evaluated on multiple benchmark datasets, including 4NSigComp2012, SigComp2011, 4NSigComp2010, and BHsig260, achieving impressive accuracy rates of 93.23%, 90.11%, 89.99%, and 92.35%, respectively. The results demonstrate the effectiveness of the proposed model in low-data scenarios, making it a practical and scalable solution for offline signature verification in real-world applications.

Keywords: Offline Signature Verification, Siamese Neural Network, One-Shot Learning, Biometric Authentication, Deep Learning, Machine Learning, Forgery Detection

A Hybrid Data Fusion Approach for Customer Churn Prediction in the Banking Sector Using Hard and Soft Data

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Abstract

Customer churn poses a growing challenge for the banking industry, where retaining customers is vital for sustained growth and profitability. To better predict churn, it is essential to integrate both hard data—structured, system-generated records such as banking transactions, call detail records (CDRs), and smart device logs—and soft data, which includes subjective insights derived from customer perceptions and preferences. This study presents a hybrid model that fuses hard and soft data to improve the accuracy of churn prediction. A supervised Decision Tree (DT) algorithm, complemented by change mining techniques, is applied to analyze hard data. In parallel, K-means clustering, an unsupervised learning method, is used in conjunction with preprocessing strategies to uncover hidden patterns. For soft data modeling, the Dempster-Shafer theory is utilized to manage uncertainty and aggregate evidence from various sources. The fusion of these methodologies allows for a comprehensive analysis of customer behavior, resulting in more precise churn identification. Empirical evaluation using banking datasets shows that this integrated approach significantly enhances the effectiveness of Customer Relationship Management (CRM) systems by enabling proactive retention strategies and dynamic customer engagement.

Keywords: Customer Churn, Hard Data & Soft Data, Decision Tree (DT), Change Mining, K-Means Clustering, Data Preprocessing, Dempster-Shafer Theory, Customer Relationship Management (CRM)

Trend Detection-Driven Auto-Scaling for Containerized Applications in High-Concurrency Cloud Environments

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Abstract

Efficient resource management in cloud-native environments is essential for maintaining performance and service availability, particularly during periods of high user concurrency. Traditional auto-scaling mechanisms—such as Kubernetes' Horizontal Pod Autoscaler (HPA)—often fall short in adapting to sudden or irregular workload spikes, resulting in resource under utilization or service degradation. This study proposes an enhanced auto-scaling method that incorporates a trend detection module into a proactive scaling framework. The module identifies short-term workload trends and mitigates inconsistencies in resource demand predictions, allowing the system to anticipate and react to changes more accurately and responsively. The proposed method is implemented and evaluated within a Kubernetes environment using both real-time and simulated peak traffic scenarios. Experimental results demonstrate that the trend-based auto-scaler outperforms conventional scaling strategies by improving application performance, maintaining high availability, and reducing resource wastage. This approach offers a practical and scalable solution for dynamic resource allocation in high-concurrency scenarios.

Keywords: Trend Detection, Auto-Scaling, Kubernetes, Containers, Horizontal Pod Autoscaler (HPA), Cloud Computing, Resource Optimization

Fusion-Based Sentiment Analysis for Evaluating E-Commerce Product Experience

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Abstract

As e-commerce continues to expand, customer-generated reviews have become a rich source of insight into product satisfaction and user experience. This study proposes a Fusion Sentiment Analysis Method that integrates natural language processing techniques with machine learning to effectively analyze product experiences from online customer reviews. The approach comprises three core stages: (1) sentiment feature extraction using an extended sentiment dictionary, (2) classification of review polarity (positive, negative, or neutral) using a Support Vector Machine (SVM) algorithm, and (3) topic modeling with Latent Dirichlet Allocation (LDA) to uncover dominant themes in customer feedback. To enhance sentiment detection accuracy, the sentiment dictionary is expanded using semantic similarity measures, and a custom weighting mechanism is introduced to quantify the impact of emotionally significant words—an aspect often overlooked in prior research. The proposed model is applied to customer reviews from a major e-commerce platform to assess its effectiveness in capturing sentiment trends and identifying key factors influencing customer satisfaction. The findings aim to support e-commerce businesses in refining product quality and tailoring marketing strategies based on data-driven insights.

Key Words: E-Commerce, Sentiment Analysis, Customer Reviews, Machine Learning, Support Vector Machine (SVM), Latent Dirichlet Allocation (LDA), Sentiment Dictionary, Semantic Similarity, Product Experience, Marketing Strategies

Neural Network-Based Prediction of Short-Term Cloud Data Transfer Throughput in Distributed Systems

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Abstract

Accurately forecasting cloud data transfer throughput is essential for optimizing performance, reducing latency, and ensuring efficient resource utilization in distributed computing environments. This research presents a neural network-based predictive model trained on a novel dataset derived from real-world file transfers across Amazon Web Services (AWS) regions. The dataset captures multivariate features, including disk I/O bandwidth, CPU utilization, and network performance metrics, enabling comprehensive modeling of short-term throughput variations. Experimental results show that the proposed multivariate neural network model achieves low error rates—3.7% for network throughput and 6.1% for disk throughput—significantly outperforming traditional univariate and ARIMA-based models. The approach effectively learns complex interdependencies among cloud resources, leading to more accurate predictions and robust adaptability under varying workloads. Improved throughput forecasting supports dynamic resource management tasks such as auto-scaling, replica selection, and load balancing, contributing to cost-efficient operations and enhanced data transfer reliability. This work advances intelligent cloud infrastructure by enabling proactive workload adaptation and smarter decision-making in large-scale cloud environments.

Keywords: Cloud Computing, Data Transfer Throughput, Neural Networks, AWS Performance Prediction, Disk I/O Bandwidth, CPU Utilization, Network Performance, Multivariate Time Series Forecasting, Auto-Scaling, Load Balancing, Replica Selection, Resource Optimization

A Graph Neural Network Framework with Temporal Attention for Urban Air Quality Prediction

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Abstract

Accurate air quality prediction is critical for public health, environmental management, and urban planning. However, traditional forecasting models often fall short in capturing the complex, non-linear relationships among pollution sources, meteorological factors, and traffic dynamics—particularly in large, data-sparse urban environments. This study proposes a novel deep learning framework that integrates Graph Convolutional Networks (GCNs), Gated Recurrent Units (GRUs), and an Attention Mechanism to jointly model spatial and temporal dependencies in air quality data. While conventional approaches such as regression analysis, time series models, and decision trees rely primarily on historical pollutant and weather data, our model leverages graph-based representations to encode the topological relationships between monitoring stations and pollution sources. The GRU component captures temporal patterns, while attention layers emphasize critical features for improved prediction accuracy. Experimental results demonstrate that this approach outperforms traditional methods in terms of both efficiency and forecasting reliability. The proposed framework offers a powerful tool for real-time air quality monitoring and pollution mitigation in smart city infrastructures.

Keywords: Air Quality Prediction, Graph Convolutional Network (GCN), Gated Recurrent Unit (GRU), Attention Mechanism, Deep Learning, Pollution Forecasting, Urban Air Quality, Traffic Patterns, Meteorological Factors, Environmental Monitoring

A Language-Agnostic Automated System for Discovering State-of-the-Art Research Topics Using Topic Modeling, BERT, and Entity Linking

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Abstract

Advancements in research rely on the timely discovery and synthesis of emerging knowledge across disciplines. However, traditional methods for tracking state-of-the-art developments are often limited by language dependency and manual intervention, making them inefficient and prone to bias. This project presents an automated, language-independent system for identifying and visualizing cutting-edge research topics across multiple domains. The system collects research articles from various academic databases and applies a standardized preprocessing pipeline that includes tokenization, case normalization, stopword removal, and lemmatization. A numerical document-phrase matrix is constructed and analyzed using a combination of Latent Dirichlet Allocation (LDA) and Bidirectional Encoder Representations from Transformers (BERT) to perform automated topic modeling and classification. A novel topic refinement mechanism is introduced, incorporating entity linking and knowledge-driven filtering to enhance the relevance and coherence of extracted topics. Visualization is achieved through nested bubble and line charts, offering interactive insights into topic evolution, emerging trends, and research gaps over time. Evaluation results confirm that the system effectively extracts meaningful and domain-relevant topics, providing researchers with a high-precision tool for preliminary literature analysis and strategic exploration of the research landscape.

Keywords: Tokenization, Case Normalization, Token Filtering, Lemmatization, Document-Phrase Matrix, Latent Dirichlet Allocation (LDA), Bidirectional Encoder Representations from Transformers (BERT), Topic Classification, Topic Refinement, Entity Linking, Knowledge-Driven Filtering, Research Trend Analysis

Weather-Enhanced Deep Learning for Demand Forecasting in Retail Supply Chains: A Case Study on Rossmann Stores

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Abstract

Accurate demand forecasting is critical for effective supply chain management, especially in the retail sector where fluctuations in consumer behavior can significantly impact inventory and financial planning. This study aims to improve sales demand forecasting for 1,115 Rossmann stores across Europe by incorporating external variables often overlooked in traditional models. While prior research has primarily relied on historical sales data in a univariate context, our approach treats the problem as a multivariate forecasting task, integrating influential factors such as weather conditions, promotions, store location, and holidays. We propose a deep learning-based model, Sales Demand Forecasting using Weather Data (SDFW), which leverages a Gated Recurrent Unit (GRU) architecture optimized through Grid Search. Comparative analysis shows that SDFW outperforms the widely used Long Short-Term Memory (LSTM) model in terms of forecasting accuracy. The incorporation of weather-related features enables more precise prediction of demand trends, ultimately supporting better inventory management and operational efficiency for Rossmann stores.

Keywords: Demand Forecasting, Sales Prediction, Supply Chain Management, Rossmann Stores, Deep Learning, Gated Recurrent Unit (GRU), Grid Search, Long Short-Term Memory (LSTM), Weather Data, Multivariate Forecasting, Inventory Management

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