

**International Conference on
Emerging Technologies in Computing, Intelligent
Systems and Management (ICETCISM 2026)**

26th and 27th June 2026

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PREFACE

With immense pleasure that we present this preface of the Proceedings of the International Conference on Emerging Trends in Computing, Information Systems, and Management (ICETCISM 2026). This conference serves as a premier platform for researchers, academicians, industry professionals, and practitioners to exchange innovative ideas, present cutting-edge research findings, and discuss emerging challenges and opportunities in the rapidly evolving domains of computing, information systems, artificial intelligence, data science, cybersecurity, digital transformation, and management sciences.

ICETCISM 2026 aims to foster interdisciplinary collaboration and promote the integration of technological advancements with managerial practices to address contemporary societal and industrial needs. The conference has attracted high-quality research contributions from diverse geographical regions, reflecting the growing significance of digital technologies in shaping the future of organizations, economies, and communities.

The papers included in these proceedings were selected through a rigorous peer-review process conducted by a panel of distinguished experts and reviewers. Each submission was evaluated based on originality, technical quality, relevance, significance, and clarity of presentation. The accepted papers represent innovative research, practical applications, and emerging trends that contribute to the advancement of knowledge in their respective fields. Such peer-review and proceedings practices are standard for international academic conferences and ensure the quality and scholarly value of published work.

We are deeply grateful to Shri. Pankaj Bhujbal, Honorary Trustee, Mumbai Educational Trust (MET), whose support has made this event possible. We express our sincere gratitude to the authors for sharing their valuable research contributions and to the reviewers for their dedicated efforts in maintaining the high academic standards of the conference. We also acknowledge the support and guidance provided by the organizing committee, advisory board members, technical committee, session chairs, keynote speakers, our Conference Knowledge partner ICTACADEMY whose commitment has made ICETCISM 2026 a success.

We hope that these proceedings will serve as a valuable reference for researchers, educators, students, and industry practitioners, inspiring further innovation and collaboration in the fields of computing, information systems, and management. We trust that the knowledge disseminated through this conference will contribute meaningfully to future research endeavours and technological advancements.

We extend our warmest wishes to all participants and readers and look forward to continued engagement and collaboration in future editions of ICETCISM.

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26th and 27th June 2026



PREFACE

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Ensemble Selection Framework for Intelligent Crop Selection and Recommendation

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Abstract:

Advancements in technology and the data revolution are transforming agriculture and farming systems in response to the world's growing population and increasing demand for food products. The agricultural sector faces growing challenges due to limited arable land, climate variability, and imbalanced soil nutrient distributions. Crop recommendation systems are crucial for maximizing agricultural productivity, enabling farmers to select the right crops. These systems rely entirely on weather conditions, soil quality, and soil moisture levels for accurate predictions. However, variations in regional soil and climatic conditions challenge consistent predictions. This work suggests a new integrated crop recommendation framework based on Custom Dynamic Ensemble Selection (DES) combined with Gated Recurrent Unit (GRU)-based weather forecasting to handle complexity and improve region-specific crop productivity. In contrast to conventional static ensemble models, the proposed DES dynamically chooses the most appropriate classifiers from a diverse set (SVM, RF, XGBoost, etc.) based on local feature space performance using a K-Nearest Neighbours (KNN) mechanism. Custom DES optimized for crop prediction on imbalanced datasets. Preprocessing and fusion of soil nutrient attributes (NPK, pH) and meteorological data produce exact, context-aware recommendations. Learning temporal dependencies in weather data helps the GRU model improve seasonal prediction accuracy, so guiding informed decisions catered to regional climatic patterns. The model beats individual classifiers and static ensemble methods by achieving 99 %+ accuracy on balanced datasets and preserving high performance on imbalanced datasets without oversampling. The model's strong scalability and robustness are shown by extensively validating public crop datasets and real-world soil cards from Indian districts. This hybrid AI-powered framework helps to promote sustainable farming and better food security.

Keywords:

Precision Farming, Crop Recommendation, Ensemble Approach, Machine Learning Models, Data-Driven Agriculture

Evaluating the Influence of Artificial Intelligence Feedback on Human Confidence and Decision Accuracy in Complex Problem-Solving Tasks

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Abstract:

The increasing use of artificial intelligence (AI) in decision-support systems has reshaped human performance in complex problem-solving, yet its effects on confidence, trust, and accuracy remain unclear. This study investigates how AI-generated feedback influences decision accuracy, confidence, and reliance behavior using 3,400 trial-level observations from 100 participants in a chess-based dataset. Results show that decision accuracy improves significantly after AI feedback (mean increase from 0.43 to 0.82), particularly under accurate feedback conditions. While misleading feedback reduces post-decision confidence, overall confidence shifts remain small (mean = 0.08). Reliance on AI is strongly associated with improved performance ($r \approx 0.66$). Machine-learning models further confirm that trust behavior and feedback accuracy, rather than confidence, are the strongest predictors of decision outcomes.

Keywords:

Artificial Intelligence, Calibration, Confidence, Decision Accuracy, Feedback, Human–AI Interaction.

JewelFit 3D: A Dual-Mode Real-Time Virtual Jewelry Try-On System Using MediaPipe Landmark Detection and Physically Based 3D Rendering

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Abstract:

The emerging trend towards e-commerce in the jewellery industry faces significant challenges regarding adequate representation, fitting, and customer confidence leading to high rates of returns and poor conversion rates. Online portals lack an interactive component enabling consumers to envision how the jewellery looks on themselves, which influences their decision process while buying online. To address the above-stated issues, this paper introduces JewelFit 3D – a real-Time tool employing advanced AR technology and realistic 3D visualization within a web-based environment supporting five types of jewellery – earrings, necklaces, rings, nose pins, and bracelets. The current project comprises two operation modes – Photo Mode and 3D Model Mode. The former superimposes jewellery pieces in real-time either from user-uploaded photographs or from video streams from a user's camera through employing facial landmarks, hands landmarks, and pose estimation landmarks provided by the MediaPipe library. Landmarks are stabilized through applying One Euro Filter algorithm to minimize jittering because of consumer movements. The latter mode enables to render jewellery pieces using Three.js and React Three Fiber packages with applying physically-based rendering and customization of materials properties as well as 360° visualization through Four Materials Presets including Gold, Rose Gold, Platinum, and silver materials in HDRI-lit environment. Architecturally, the current project leverages full-stack production-ready solution consisting of a Next.js front-end framework, Express.js back-end framework, and PostgreSQL relational database management system. Experiments proved stable performance at 30-60 frames per second with less than 500 ms backend API latency.

Keywords:

Augmented reality, virtual try-on, MediaPipe, computer vision, face mesh, pose estimation, hand tracking, Three.js, physically based rendering, WebGL, e-commerce

KinVision: Deep Learning-Based Kinship Verification

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Abstract:

This paper addresses facial kinship verification (FKV), the task of deciding whether two face images depict biologically related individuals. We propose KinVision, a two-stage architecture that freezes a strong face-recognition backbone (AdaFace IR-101 trained on WebFace12M) and learns a compact Siamese metric head over 512-dimensional embeddings. The head fuses four complementary relational cues—absolute difference, element-wise product, cosine similarity, and Euclidean distance—into a 1026-dimensional representation processed by a shallow MLP with batch normalization, GELU, and heavy dropout. The model is first pretrained on the large-scale Families in the Wild (FIW) kinship dataset and then fine-tuned on the smaller KinFace W- II benchmark using class-balanced sampling, pair-swap symmetry, embedding-space noise, label-smoothed BCE, and Youden's J-based threshold calibration. On KinFace W-II across four relationship types (F-D, F-S, M-D, M-S), KinVision achieves an AUC-ROC of 0.931 at an optimal threshold of 0.5187 with only 65,857 trainable parameters in the head, while the AdaFace backbone remains frozen.

Keywords:

Facial Kinship Verification, Deep Learning, Metric Learning, Siamese Network, AdaFace.

Hyperspectral and Thermal Imaging for Anomaly Detection: Trends, Challenges, and Future Directions

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Abstract:

The technologies of hyperspectral and thermal anomaly detection are developing into fundamental technologies for the automated detection of rare / anomaly targets in the fields of remote sensing and industrial inspection. Recent developments have progressed in two intersecting directions: (i) employing non-parametric spectral-spatial modeling methodologies within hyperspectral imagery that facilitates false alarm suppression, and (ii) developing multimodal fusion frameworks to facilitate combining thermal and optical information for enhanced spatially localization. This paper sets the stage for a broad discussion about some exciting capabilities, including statistical, subspace, reconstruction-based, isolation and deep learning types, as well as newer directions, such as spectral-spatial feature fusion, self-supervised representation learning, and UAV-based thermal inspection. There's been significant progress, yet challenges remain, particularly related to the diversity of datasets, dependencies on the scene, multimodal alignment, and inference time when deployed into an operational setting. We are optimistic that new advancements with unified processing pipelines, large-scales multimodal benchmarks, light weight plug-and-play architectures, and evaluation protocols may improve the generalization and operational performance of anomaly detection systems.

Keywords:

Hyperspectral imaging, Thermal anomaly detection, Spectral-spatial fusion, Deep learning, Multimodal data fusion, Remote sensing

HealthLedger SynexAI: Zero-Knowledge Proof-Enabled Blockchain-Federated Learning for Privacy-Preserving Disease Prediction

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Abstract:

HealthLedger SynexAI tackles one of modern healthcare's most stubborn dilemmas: hospitals want to collaborate on building better disease-prediction AI, but privacy laws—quite rightly—prevent them from pooling sensitive patient records. Our framework breaks this deadlock by bringing together blockchain technology and a technique called “federated learning” in a way that has never been done at production scale before. Instead of sending patient records to a central server, each hospital trains its own AI model on the spot to cover diseases like cancer, diabetes, and heart disease. The hospital only sends a “digital receipt” called a zero-knowledge proof after training is over. This mathematically proves that the work was done right without showing any patient records. This verification layer on the Polygon Amoy blockchain makes the process quick and very cheap; it costs less than a cent to verify each update. A smart filtering algorithm keeps bad or “poisoned” data from getting through. It results in a HIPAA-compliant system capable of predicting diseases with an accuracy of up to 92%. At the same time, it ensures the privacy of patients at all stages.

Keywords:

Federated Learning, Zero-Knowledge Proof Systems (zk-SNARKs), Blockchain, Privacy-Preserving Machine Learning, Healthcare AI.

How Digital Transformation Helps to Grow the Business

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Abstract:

Digital transformation has become a key driver in the process of growth of companies operating in various industrial sectors. This research paper will discuss how digital transformation through the use of advanced digital technology, such as cloud computing, AI-based solutions, data analytics, and digital commerce platforms helps businesses increase their operational efficiency, extend their market presence, and enhance client engagement. This study will use a mixed methods approach involving collecting primary data in the form of surveys conducted among 118 business professionals. Secondary data will be gathered through analyzing industry reports and academic research. Six case studies have been developed in this study; they concern the following companies: Netflix, Amazon, Microsoft, Zomato and Swiggy, Paytm, and Small Vendor Model used by Amazon. It was found that 78% of companies using digital solutions reported improvement of efficiency while 72% recorded significant increase in revenues within two years since the implementation of digital strategies. At the same time, this study revealed a number of difficulties, including high costs associated with digital transformation, low levels of employees' skills and knowledge, and issues of cybersecurity. As for the case studies, all companies utilizing AI-based personalization, cloud computing and advanced data analytics perform better than their rivals in retaining clients and gaining market share. The paper is devoted to exploring the problems of digital business transformation and provides useful insights for managers trying to navigate this complex process successfully. The results obtained in the study can be employed by managers and business policy makers as recommendations for further development of digital businesses.

Keywords:

Digital transformation, business growth, artificial intelligence, cloud computing, e-commerce, data analytics, operational efficiency, case study analysis

Planning and Control Aspects in Make-to-Order Manufacturing Systems

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Abstract:

Make-to-Order (MTO) systems are becoming more popular in manufacturing organizations to meet the increasing demands of product customization, decreased lead times, and enhanced operational efficiency. But, the presence of the MTO implementation places major difficulties in the production planning and control because of the variability of demand and the complexity of the system. The paper examines the critical success factors in MTO systems and gives a proposed framework to be used in the implementation. Multi-method combination of Analytic Hierarchy Process (AHP), Technique of Order Preference by Similarity to Ideal Solution (TOPSIS), and Partial Least Squares Structural Equation Modeling (PLS-SEM) is used. Priorities of critical success factors are determined by AHP, implementation strategies are ranked by TOPSIS, and relationships between key constructs and performance outcomes are tested by PLS-SEM. The findings indicate that the factors related to the customers are the most powerful and customer- centric strategy is most appropriate to implement MTO. Moreover, MTO systems can greatly boost the competitive advantage and reinforce sustainable manufacturing practices. The proposed framework offers useful information to enhance production planning and control in dynamic manufacturing setting.

Keywords:

Make-to-Order (MTO), Production Planning and Control (PPC), AHP, TOPSIS, PLS SEM, Critical Success Factors, Manufacturing Systems

SmartResolve: A Generic LLM Driven Root Cause Ontology Framework

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Abstract:

In order to turn unstructured textual complaints and event reports into useful insights, Root Cause Analysis (RCA) is essential. The majority of current automated RCA systems concentrate on individual defect detection or surface-level classification, frequently failing to differentiate symptoms from underlying systemic causes. Furthermore, their real-world adoption is hampered by their poor explain ability, absence of end-to-end automation, and inadequate validation using operational indicators. In order to facilitate proactive and explicable systemic resolution, this study suggests a general and domain-neutral framework that combines hierarchical text classification, ontology-driven root cause reasoning, and limited language creation. To close this gap, this study presents a paradigm aimed at fostering a mindset akin to that of an experienced investigator. It doesn't just put data into one bucket; it separates the "what happened" from the "why it happened" using layers. The system can really display its work by mapping these events into a structured knowledge network, or ontology. This makes it easy to see how a sloppy text report leads to a systemic issue. Then it translates those insights into clear, standardized reports that inform a firm exactly what to do next. The idea is to go beyond merely resolving problems that happen once and start mending the hidden flaws in the system before they cause it to break down. This changes the way the whole company thinks from being a fireman all the time to being a proactive builder of better, smoother operations. In the end, this approach is about rebuilding faith in automation. We are building a system that "shows its work" to the people who depend on it by getting rid of "black box" algorithms that don't explain anything. Instead of getting a vague notice, a manager gets a clear, logical story that links a single complaint to a bigger problem with the process. This openness doesn't simply make the data more helpful; it also transforms the way people work together in a company. It lets teams stop fixing the same problems over and over again and start designing systems that are more robust. This way, every small problem becomes a lesson in how to make things better.

Keywords:

Ontology, Knowledge Graph, Automated Resolution, Large Language Models, Root Cause Analysis.

YOLOv8-Based Weld Surface Defect Detection and Classification with ASME B31.3 Validation

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Abstract:

This research proposes an intelligent system with AI business integration technology of automated weld surface defect detection and classification by deep learning method. The proposed approach uses the YOLOv8 object detection model trained with a multi-class weld defected dataset for the accurate identification and localization of weld defects such as surface cracks, undercut, spatter, contamination, lack of fusion, and burn-through. In addition to detection, the system integrates the rule-based decision engine based on the ASME B31.3 standards to give the acceptance or rejection of quality of the welds automatically. A web-based interface with Flask has been developed to make the solution allow for real-time image uploading, defect visualization, as well as interpretation of the results. In addition, a backend for explainable AI is available, making the software even more user-friendly by creating simple descriptions of defects and rehabilitation measures. Experimental results show that the system detection accuracy is high and system inspection efficiency is improved which reduces human error and reliability of the subject. The proposed solution presents a scalable and relevant industry framework for intelligent weld quality assessment and decision support.

Keywords:

Weld defect detection, YOLOv8, deep learning, computer vision, ASME B31.3, object detection, industrial inspection, non-destructive testing, defect classification, explainable AI.

Lumos: Early Emotional Wellbeing Monitoring and Learning

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Abstract:

Children's emotional state is an important factor in children's academic performance and mental health. However, most educational environments lack systems to continuously observe and support children's emotional states, and most rely on periodical observation and counselling. This is a gap in supporting children's emotional states. This paper will introduce a new AI-assisted platform named Lumos, which is aimed at supporting children's emotional states and learning. It is a platform for children and teenagers to express their emotions through interactive stories, chatting, and game-playing. Moreover, Lumos utilizes sentiment analysis and light-weight machine learning approaches for analysing the student's response and understanding their emotional patterns. It incorporates techniques from Natural Language Processing, including the VADER sentiment analysis model, to accurately interpret emotional cues from textual interactions. Based on this, it offers suggestions for the student, such as activities and content, for better emotional understanding and coping. This provides a solution for continuous emotional monitoring, which is helpful for building emotional resilience among students and for educators to understand the emotional needs of their students.

Keywords:

Emotional Wellbeing, Artificial Intelligence, Sentiment Analysis, Interactive Storytelling, Gamification.

Deepfake Detection Based Using LSTM and ResNeXt Architectures

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Abstract:

The dissemination of the deepfake technologies at a blistering pace is a real menace to the legitimacy and accountability of the information media. Trying to rise above this challenge, we introduce a new deepfake discovery frame which integrates the flexibility Long Short- Term Memory (LSTM) and ResNeXt. Framework. A blend of space and time analyses was used. Methods, our system aims to specifically describe the manipulated vids in the beckoning pool of online information. Through the significant experiments and tests on a range of datasets, our frame. Can illustrate possible promising opportunities to suffice. Distinct authentic and fake videos. This study adds to. Fighting the consumption of deepfake misinformation and safeguarding. The safety of the online media. In this discovery, the researchers work on the discovery of deepfakes with LSTM networks that tackle the problem of image manipulation and facial recognition improvement.

Keywords:

This research focuses on deepfake detection using LSTM networks to address image manipulation and enhance facial recognition.

Hybrid Deep Learning Model based Human Behavior Recognition System with Improved Performance

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Abstract:

Human Activity Recognition (HAR) is the central units for understanding and predicting the behavior of human. The extensive domain of HAR dedicates to the identification of specific human actions or movements. Furthermore, it is capable of detecting and distinguishing human activity, as well as disseminating information about the detected motion or activity. HAR has wider ranges of applications ranging from video retrieval to intelligent services and so on. HAR has been mostly used in behavior analysis, traffic safety, social security, medical care and other industries for improving the user experience. Main challenges in this domain is accurate extraction of semantic extraction of every behavior for describing its dynamic changes in time and space. Traditional approaches relying on handcrafted features and conventional ML (Machine Learning) models often fail to capture the intricate spatiotemporal dependencies present in human actions. To solve these issues, hybrid Deep Learning model based Human Behavior Recognition system with improved performance is presented. A hybrid deep learning model which is a combination of CNN (Convolutional Neural Network) and LSTM (Long Short Term Memory) is used in this system to recognize human behavior in real time. CNN is used to effectively extract the spatial features from video frames and LSTM is used to capture the sequential dependencies, ensuring accurate recognition of human activities. This model performance is measured and compared in terms of Precision, Recall, F1-score and Accuracy and this model attains better performance.

Keywords:

Human behavior, activity, recognition, DL, LSTM and CNN (Convolutional Neural Network).

Smart Code Review Agent: Review agent for modern engineering team

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Smart Code Review Agent for Automated GitHub Pull Request Analysis

Abstract:

In Agile and DevOps, manual code review remains one of the significant issues. We report spending 5 to 15 hours of developer time per week, leading to inconsistencies, reviewer fatigue, and deployment delays. In this paper, we present the Smart Code Review Agent, an AI-enabled autonomous code review solution integrated with the GitHub Pull Request. This paper proposes the Google Gemini API-based solution for in-depth semantic and heuristic code analysis beyond present-day rule-based static analysers such as SonarQube, which fail to catch logical, security, poor algorithm, and performance issues. The system is built using a modular pipeline that includes a Flask-based webhook receiver, a PyGitHub client, a unidiff parser, and an intelligent response formatter. When a pull request is created, the agent is automatically triggered. It analyzes code changes in detail at the line level and provides structured, practical feedback directly within the GitHub workflow. In addition, it generates concise summaries of pull requests, helping team members quickly understand changes and improving knowledge sharing across the team. The results show that this approach significantly reduces the time taken for code reviews, ensures consistency in coding standards, and offers developers clear, context-aware suggestions for improvement. Overall, it helps enhance software quality while increasing development efficiency.

Keywords:

Code Review, GitHub, Large Language Models, Software Quality, DevOps, Automation I. Introduction Modern software development is evolving rapidly, with a strong focus on speed, flexibility, and maintaining high quality.

Temporal Coherence Regularization for Smooth Sequential Audio Embeddings Authors omitted for double-blind review

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Abstract:

Ensuring audio representations stay temporally consistent is still a major hurdle in multimodal learning. Most standard convolutional models look at audio frames one by one. Because they process these frames independently, the resulting embeddings usually jump around erratically instead of smoothly tracking the audio over time. To address this, our exploratory study tests a temporal coherence regularization penalty on a lightweight Convolutional Neural Network (CNN). We trained the model using environmental sounds from the ESC-50 dataset. By adding a mathematical penalty while extracting mel spectrogram features, the network minimizes the Euclidean distance between adjacent embeddings. Our experiments show a steady drop in combined training loss alongside much more consistent local embedding trajectories, which we evaluated using t-SNE visualization and cosine similarity analysis. Ultimately, this implementation offers a functional, computationally cheap baseline to smooth out sequential audio embeddings without relying on massive transformer architectures.

Keywords:

Audio, Spectrogram, Regularization, CNN, Embeddings

Design and Implementation of a Low-Cost Intruder Detection System Using ESP32-CAM with Motion and Sound Sensors

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Abstract:

Many basic security systems depend on only one sensor, mostly for motion or sound. Single-sensor setups are not reliable under real indoor conditions: a PIR sensor can be triggered by temperature changes or moving curtains, and a sound sensor may respond to normal background noise. Following a review of approximately 70 research papers published between 2014 and 2025, a common limitation identified was that systems relying on a single sensing method either miss actual intrusions or generate excessive false alarms. To address this, a PIR motion sensor and a sound sensor were combined using the ESP32-CAM as the main controller. An alert is only sent when both motion and abnormal sound are detected within a short time window. During calibration, the sound threshold required careful adjustment because normal conversation was initially triggering the system. After repeated indoor testing, the dual-sensor setup showed clear improvement. Detection accuracy improved by approximately 37% compared to PIR-only systems and 42% compared to sound-only systems. False alarms were reduced by roughly 84%. Testing across 100 controlled trials yielded an overall accuracy of 95%, with precision and recall both above 95%, and an average response time of 2.9 seconds. The ESP32-CAM handled all decision-making locally without requiring additional processing hardware, keeping the system low-cost and suitable for embedded deployment.

Keywords:

Multimodal sensor fusion; ESP32 microcontroller; Passive infrared detection; Acoustic signal processing; IoT-enabled security; False-alarm mitigation; Embedded surveillance systems.

Motivating Green Behaviour with Digital Rewards

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Abstract:

Eco-friendly actions are crucial for development of sustainable cities, however many of the current programs lack motivation and reliable techniques to verify whether actions like saving electricity or recycling are being carried out. This can result into limited citizen participation and reduce the impact of environmental initiatives.

To solve this issue, we have proposed a digital reward system within which users can upload photos or short snippets of their sustainable actions. An AI model in place will verify the authenticity, while image hashing will be used to prevent duplicate or rehashed evidence. A hybrid blockchain model is used, where organizational owners—including municipal corporations, offices, and housing societies—set reward amounts, which are distributed automatically based on Eco Tokens earned by users. To ensure transparency and eliminate reward manipulation, smart contract. Verified users will receive Eco Tokens, and a leaderboard promotes engagement and continued participation in sustainable activities.

Unlike existing incentive platforms that rely on manual validation or self-reported data, the proposed approach introduces an automated, tamper-resistant verification pipeline that improves trust and scalability. The system is designed to be simple, low-cost, and suitable for smart city adoption, enabling measurable and accountable citizen-driven sustainability efforts while reducing administrative overhead.

Keywords:

Sustainability, Block chain, Artificial Intelligence, Gamification, eco tokens

Hybrid SQL and Vector Query Optimization: A Survey of Architectures, Algorithms, and Systems

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Abstract:

The convergence of structured SQL querying and unstructured vector similarity search has emerged as a critical requirement for modern AI-powered applications. This survey provides a comprehensive analysis of hybrid SQL-vector query optimization techniques, presenting a novel taxonomy that classifies architectures into pre-filtering, post-filtering, and native hybrid approaches. We systematically analyze Approximate Nearest Neighbor (ANN) algorithms including Hierarchical Navigable Small World (HNSW) graphs and Inverted File (IVF) indexes, evaluating their trade-offs in build time, memory consumption, and query performance. Through a structured comparison of 12 major database systems across performance metrics, we derive a decision framework guiding practitioners in system selection based on scale, existing infrastructure, and query patterns. Our analysis reveals that while purpose-built vector databases excel at billion-scale workloads, PostgreSQL extensions with recent optimizations achieve competitive performance for moderate-scale deployments. We identify key open research challenges including filter-vector interaction degradation, dynamic update handling, and unified cost models for hybrid query optimization. This survey synthesizes 150+ research papers and system benchmarks, covering a survey methodology grounded in systematic literature review principles, to provide both theoretical foundations and practical guidance for researchers and practitioners in the rapidly evolving field of hybrid data management.

Keywords:

Vector databases, hybrid query optimization, approximate nearest neighbor search, SQL integration, HNSW, IVF, query processing, RAG, semantic search, filter-aware indexing.

Early Depression Risk Detection Using Smartphone and Sleep Data: A Machine Learning Approach to Digital Mental Health Monitoring

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Abstract:

Depression is one of the most prevalent mental health disorders worldwide and often remains undiagnosed until symptoms become severe. Traditional diagnostic methods primarily rely on self-report questionnaires and clinical interviews, which fail to capture continuous behavioural changes. This paper presents a machine learning framework for early depression risk detection using smartphone behavioural data and sleep-related metrics. The proposed system utilises features such as screen time, nocturnal phone usage, mobility patterns, social interaction frequency, and sleep irregularity extracted from smartphone sensors and wearable devices. Multiple supervised learning models—including Logistic Regression, Support Vector Machine (SVM), Random Forest, Gradient Boosting, and Multilayer Perceptron (MLP)—are evaluated for predictive performance. Experimental observations from the Student Life dataset indicate that ensemble learning methods, particularly Random Forest and Gradient Boosting, provide superior prediction accuracy. Recent advancements in digital phenotyping, multimodal sensing, explainable artificial intelligence, and edge computing are discussed to align the framework with current research trends. The proposed approach demonstrates the potential of passive and continuous monitoring systems for proactive mental healthcare and early intervention.

Keywords:

Depression Detection, Machine Learning, Digital Phenotyping, Smartphone Sensors, Sleep Analysis, Mental Health Monitoring, Artificial Intelligence.

Assessing the Effectiveness of Traditional Technical Indicators in Algorithmic Trading Systems

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Abstract:

Over the past few decades, algorithmic trading has moved well beyond simple rule-based systems that relied almost entirely on classical technical indicators. Today, institutional-grade trading platforms draw on a much richer mix of data sources — machine learning models, live risk analytics, macroeconomic signals, and alternative datasets — to make trading decisions. Even so, tools like Moving Averages, the Relative Strength Index (RSI), MACD, and Bollinger Bands remain in active use across both retail and professional settings. This paper tries to evaluate whether these older indicators still deliver measurable value when tested under realistic market conditions. The study uses systematic backtesting against a benchmark, and also discusses how conventional indicator-based strategies compare with sophisticated platforms like BlackRock's Aladdin and the Bloomberg Terminal. The possibility of combining traditional indicators in ways that improve overall performance is also examined.

Keywords:

Algorithmic Trading, Technical Indicators, RSI, MACD, Bollinger Bands, Backtesting, Quantitative Finance

Detecting Mental Exhaustion Through Typing Characteristics: An Ensemble Machine Learning Strategy

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Abstract:

Modern workplaces ask a lot from people — long hours at computers, constant focus. It's no wonder so many end up mentally drained: attention fades, tasks get slower, and decisions aren't as sharp. Sure, there's been tons of research on fatigue, but practical fixes? Not so much. The usual ways to check for tiredness are a hassle: self-assessment (which isn't always reliable), medical sensors strapped on your body, or complicated brain scans. Honestly, none of these work for everyday office life.

We decided to try something you might not expect: tracking changes in how people type as they work and their mental energy dips. We measured how fast, how long keys are held, the timing between presses, and how often mistakes are fixed. Using three types of algorithms — each with its own analytical style — we could spot signs when someone switches from alert to exhausted. The best part? The system adjusts to each person's normal typing habits, so it's not fooled by individual differences.

We tested this idea with 45 people in four-hour work blocks. The combined approach nailed exhaustion detection at 87.3% overall accuracy, with 85.6% precision and 89.1% sensitivity. It's dead simple: just a regular keyboard, no extra gear or disruption. That's what makes it practical.

Keywords:

cognitive exhaustion tracking, keystroke pattern recognition, behavioral indicators, supervised learning models, hybrid ensemble methods, temporal pattern detection, user-specific calibration, workplace wellness

AI-Driven Urban Air Quality Prediction Using Sensor Data for Sustainable Cities

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Abstract:

Rapid urbanization and increasing industrial activities have significantly degraded air quality in urban regions, creating serious environmental and public health concerns. Accurate air pollution forecasting is essential for sustainable smart city development and effective environmental management. This paper presents an AI-driven framework for PM_{2.5} prediction using multivariate environmental data collected between 2020 and 2024. The proposed system utilizes machine learning and deep learning techniques, including Random Forest Regressor and an improved Long Short-Term Memory (LSTM) model, to analyse pollution patterns and forecast PM_{2.5} levels. Data preprocessing techniques such as missing value handling, timestamp feature extraction, normalization, and sequential time-series generation were applied to improve prediction performance. Experimental results show that the Random Forest model achieved the highest overall prediction performance with an R^2 score of 0.9204, while the improved LSTM model demonstrated effective temporal learning with lower MAE and RMSE values.

Keywords:

PM_{2.5} Forecasting, Random Forest, LSTM, Machine Learning, Smart Cities, IoT

Signlight: Deployment-Optimized Mobilenetv3 for Real-Time American Sign Language Fingerspelling Recognition Via Int8 Quantization Benchmarking

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Abstract:

Sign language is the primary communication medium for over 70 million deaf and hard-of-hearing individuals worldwide. Most existing automated recognition systems rely on cloud-based inference, introducing latency and privacy constraints that hinder real-time deployment. This paper presents SignLight, a deployment-optimized American Sign Language (ASL) fingerspelling recognition system built on MobileNetV3-Small. We propose a three-phase progressive fine-tuning strategy—frozen head training, partial backbone unfreezing, and full model finetuning—achieving 99.20% Top-1 accuracy and 100% Top-5 accuracy across 24 static ASL letter classes on a 14,400-sample held-out validation set. Results are obtained on a controlled single-background studio dataset; real-world generalization to unconstrained environments requires further validation. The trained model is converted to Tensor-Flow Lite (TFLite) in Float32 and INT8 quantized formats, with model size, GPU-measured inference latency, and throughput benchmarked systematically. The TFLite Float32 variant achieves 99.92% accuracy at 16.80 ms per frame (59.5 FPS) in a 1.27MB package—an 8.7× size reduction from the Keras baseline. The INT8 model achieves 14.3× compression (0.77 MB) with 0.96 ms latency (1043 FPS), incurring a 5.41% accuracy penalty we attribute to mixed-precision training interactions. To the best of our knowledge, this is the first work to provide a concurrent INT8 TFLite deployment benchmark alongside a three-phase fine-tuning study on MobileNetV3-Small specifically for static ASL fingerspelling, and the first to report accuracy exceeding 99% with a sub-1MB quantized model.

Keywords:

American Sign Language, MobileNetV3, TensorFlow Lite, INT8 quantization, transfer learning, on-device inference, mobile deployment, fingerspelling recognition.

Gesture Controlled Face Verification System

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Abstract:

With digital systems proliferating in different realms, secure and reliable authentication mechanisms are in high demand. Passwords, PINs, and other conventional authentication approaches are still prevalent because of simplicity but they can be stolen or abused, allowing access without the legitimate user. Face recognition has become a more promising biometric technology because of the contactless operation and ease of use. Even with these advantages, many face recognition systems can still be fooled by simple spoofing attacks using photographs or prerecorded videos of the authorized person. In this paper, we have proposed a Gesture Based Face Recognition System which provides an authentication method that merge facial verification with hand gesture recognition. The offered procedure usage Python with laptop imaginative and prescient library OpenCV and MediaPipe. Face detection is performed using Haar Cascade classifiers, and facial recognition is done by K-Nearest Neighbors (KNN) algorithm. Once a positive outcome has been achieved from the face verification, it then looks for specific hand gestures to authenticate that a real user is present. This extra layer of verification reduces the chances of any spoofing and increases the trustworthiness in confirming identity. The suggested method can run in real-time using a common Webcam and does not require customized hardware. Experimental results show that the proposed system achieves user-friendly operation with stable authentication performance and satisfactory security enhancement. Applications The proposed methodology can be employed in attendance systems, secure access control and use in smart authentication.

Keywords:

Face Recognition, Gesture Recognition, OpenCV, MediaPipe, KNN, Authentication, Biometrics, Computer Vision.

A CAD-Guided No-Retrain Edge AI Framework for Real-Time PCB Component Inspection

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Abstract:

In electronics manufacturing, ensuring the quality of Printed Circuit Boards (PCBs) is essential for reliable product performance. This paper presents an edge-based computer vision system for automated PCB quality inspection using a smart camera integrated with a heavy-edge processing module. The current scope of this research is strictly limited to detecting and verifying base PCB plates, Light Emitting Diodes (LEDs), and Integrated Circuits (ICs). By training object detection algorithms specifically for these components, the system can identify anomalies in real time by comparing the live PCB image with a CAD reference image. This approach reduces the need for frequent retraining, making it especially useful in dynamic manufacturing environments where PCB designs and production batches may change frequently.

Keywords:

Edge AI, Automated Optical Inspection, PCB Inspection, Smart Camera, YOLOv8, CAD Reference Image, LED Detection, IC Detection

A Lightweight Hybrid Framework for Personalized News Recommendation

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Abstract:

The rise of online news platforms causes information overload, so personalized news recommendations are needed. But current deep learning methods require heavy computation and are not easy to interpret. This paper presents a hybrid framework that is lightweight and explainable. It uses user profiling, semantic content analysis, and adaptive filtering. Unlike black-box neural models, this framework separates long-term and short-term user interests, uses interpretable features (TF-IDF, topic modeling), and balances relevance, freshness, and diversity with a weighted scoring function. Evaluated on MIND and Adressa datasets, the framework gives competitive accuracy, improves diversity by 17%, and improves freshness by 21% compared to classical hybrid methods. The framework is modular, reproducible, and suitable for real-world use in environments with limited resources. Specifically, TF-IDF and LDA topic modeling represent news content, while a weighted scoring function combining relevance, recency decay, and intra-list diversity drives ranking

Keyword:

Personalized News Recommendation, Explainable Recommender Systems, Hybrid Recommendation Models, User Profiling, Temporal Dynamics in Recommendation, TF-IDF and Topic Modeling, Diversity and Freshness Optimization

HydroCore: A Visual and Extendable Simulation Framework for Hydraulic Transient Analysis

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Abstract:

Hydraulic transients, often known as water hammer, present serious threats to the structural stability of hydropower and pumped storage systems. Conventional analytical tools typically fail to provide the modern visualization and automated safety features needed for quick risk evaluation. This paper introduces HydroCore, a visual and adaptable transient flow simulator that reworks reliable numerical methods into a contemporary, user-focused interface. By combining an implicit finite difference solver with advanced unsteady friction models and automatic safety systems, the platform allows for the early detection of extreme pressure variations. The framework aims to connect complex numerical modeling with practical engineering use, delivering real-time insights and automated shutdown protocols to avoid severe equipment failure. This method offers a forward-thinking model for safeguarding hydraulic infrastructure through improved accessibility and high-accuracy simulation.

Keywords:

Hydraulic Transients, Water Hammer, Implicit Finite Difference, Unsteady Friction, Automated Safety, Visual Simulation, Hydropower Systems, Computational Fluid Dynamics.

SafeCom: AI-Based Face Recognition and Uniform Compliance System Using Deep Learning

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Abstract:

SafeCom is an AI-powered automated uniform compliance system designed for educational institutions using computer vision techniques. The system integrates YOLOv8- based object detection and InsightFace-based face recognition to identify students and verify adherence to uniform policies in real time. The proposed approach detects key uniform components including shirt, pant, tie, and ID card using a custom-trained multi-class detection model. Facial embeddings are generated and matched against a registered database using cosine similarity to establish student identity. A novel intersection-based logic is implemented to ensure that detected uniform items are physically linked with the identified student. The system operates through a threaded pipeline for efficient real-time processing and is supported by a FastAPI-based backend and an interactive web dashboard. Experimental results demonstrate reliable performance in dynamic environments, reducing manual effort and improving institutional discipline monitoring.

Keywords:

Computer Vision, YOLOv8, Face Recognition, Uniform Compliance, Real-Time Systems, Deep Learning, Smart Surveillance, Automation

Find Your Feed: A Unified Digital Menu Display System for Multi-Mess Hostel and PG Facilities

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Abstract:

Students residing in hostel and paying guest (PG) accommodations frequently face the challenge of identifying suitable food options available at multiple mess facilities. The absence of a centralized, real-time digital menu system compels students to physically visit each mess individually, wasting significant time and effort. This paper proposes “Find Your Feed,” a web-based multi-mess menu aggregation platform that enables mess administrators to publish and update daily menus, while allowing students to conveniently browse and compare all available food options from a single interface. The system is developed using Java Spring Boot, MySQL, HTML/CSS/JavaScript, and Docker. The proposed solution significantly reduces the time spent by students in selecting their meals and improves the overall hostel dining experience.

Keywords:

Hostel Management, Mess Menu, Food Aggregation, Spring Boot, Multi-Mess Platform, Student Portal

Syntax-Aware vs Syntax-Agnostic Graph Convolutional Networks for Aspect-Based Sentiment Analysis

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Abstract-

Aspect-Based Sentiment Analysis (ABSA) aims to determine sentiment polarity toward specific aspects within a sentence, enabling fine-grained opinion understanding in domains such as product and service reviews. While transformer-based models achieve strong performance through contextual representations, they primarily rely on implicit semantic associations and often fail to explicitly capture structural dependencies between aspect terms and opinion expressions, particularly in sentences with multiple aspects and complex syntactic structures. This study presents a controlled investigation of the role of syntactic structure in aspect-level sentiment classification by comparing syntax-agnostic models with a graph-based, syntax-aware approach. BiLSTM and BERT are employed as non-syntactic baselines, while a dependency-driven Graph Convolutional Network (GCN) is used to explicitly model relationships derived from dependency parsing. Experiments are conducted on the MAMS dataset and its syntactically enriched variant under consistent experimental settings to ensure fair comparison. The proposed GCN model achieves superior performance, obtaining an accuracy of 70.28% and a macro-F1 score of 0.69, outperforming BERT (64.18%, F1: 0.62) and BiLSTM (50.0%, F1: 0.30). An ablation study further reveals that removing part-of-speech and distance features results in moderate performance degradation, whereas removing aspect indicators has minimal impact. The results demonstrate that performance improvements are primarily driven by graph-based structural representation rather than individual syntactic feature engineering. Overall, the findings highlight that explicitly modeling syntactic relationships provides a more effective and interpretable framework for capturing aspect-opinion interactions, emphasizing the importance of structure-aware modeling in ABSA.

Keywords:

Aspect-Based Sentiment Analysis, Graph Neural Networks, Graph Convolutional Networks, Syntax-Aware Models, Dependency Parsing, BERT, BiLSTM, Natural Language Processing

AI-Powered Water Distribution Optimization in Smart Cities

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Abstract:

Rapid urbanization demands intelligent management of critical infrastructure. Water distribution networks in smart cities face mounting challenges: aging pipelines, non-revenue water (NRW) losses exceeding 30%, unpredictable demand surges, and energy-intensive pumping schedules. This paper presents an AI-powered framework for real-time optimization of urban water distribution systems (WDS). The proposed architecture integrates a Hybrid Convolutional Neural Network-Long Short-Term Memory (CNN-LSTM) model for demand forecasting, a Deep Reinforcement Learning (DRL) agent for adaptive pump scheduling, a Graph Neural Network (GNN) for pipe network topology analysis, and an IoT-based anomaly detection module for leak localization. Tested on a city-scale simulation of a 1,200-node network fed with 18 months of SCADA data, the framework achieved a 69.8% reduction in NRW, 29% energy savings, and a 26.4% improvement in customer satisfaction scores relative to conventional rule-based systems.

Keywords:

Smart city, water distribution system, deep reinforcement learning, demand forecasting, CNN-LSTM, graph neural network, non-revenue water, IoT, anomaly detection.

A Proposed Framework for Dehydration Detection Using Smartphone Touch Pressure and Machine Learning

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Abstract:

Dehydration is a common health condition that can lead to severe complications if not detected at an early stage. Traditional dehydration detection methods often require laboratory testing, wearable medical devices, or clinical supervision, making continuous monitoring difficult and expensive. This paper proposes a non-invasive framework for dehydration detection using smartphone touch pressure and touchscreen interaction behavior. The proposed framework analyzes touch pressure, swipe speed, touch area, and touchscreen interaction patterns collected through smartphone sensors. Machine Learning techniques such as Support Vector Machine (SVM), Random Forest, Decision Tree, and Logistic Regression are discussed as potential approaches for analyzing hydration-related behavioral patterns. Existing studies suggest that dehydration may influence skin moisture and finger sensitivity, which can affect touchscreen interaction behavior. Based on these observations, the proposed system aims to support real-time and accessible hydration monitoring without requiring additional medical equipment. The proposed approach highlights the potential of smartphone-based healthcare systems for preventive and continuous health monitoring. Future work may focus on implementing the framework using real-time datasets and evaluating model performance through experimental validation.

Keywords:

Dehydration Detection, Smartphone-Based Healthcare, Machine Learning, Touchscreen Interaction Analysis, Touch Pressure Sensing, Non-Invasive Health Monitoring, Random Forest, Support Vector Machine (SVM), Mobile Health Systems.

AI-Powered Automated Content Generation Platform

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Abstract:

Artificial Intelligence (AI) has significantly improved automated content generation through advances in Natural Language Processing (NLP) and Machine Learning (ML). This study presents an AI-driven content generation platform and compares four popular AI tools: ChatGPT, Google Gemini, Jasper AI and Copy.ai. Performance was evaluated using five standardized prompt categories and measured using response time, readability, word count, and grammar accuracy. Among the evaluated platforms, ChatGPT demonstrated superior performance in terms of grammatical correctness and response generation speed. In contrast, Google Gemini produced the most readable content according to the Flesch readability metric. Survey feedback from participants suggested that AI-generated content was generally clear and understandable; however, respondents perceived limitations in creativity, indicating the continued importance of human review and refinement. A user perception survey (N = 30) indicated high ratings for clarity but lower ratings for creativity, highlighting the importance of human involvement. The findings suggest that AI tools can improve content creation efficiency, although human oversight is necessary to ensure accuracy, originality, and ethical use.

Keywords:

Artificial Intelligence (AI), Content Generation, Natural Language Processing (NLP), Machine Learning (ML), Deep Learning, Transformer Models, AI-Based Content Creation, Text Generation.

Air Pollution Prediction Using Machine Learning Techniques and Renewable Energy Analysis

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Abstract:

Air pollution is one of the most serious threats to public health in India. According to the IQAir World Air Quality Report 2025, India's average PM_{2.5} concentration is 48.9 $\mu\text{g}/\text{m}^3$ — nearly ten times the WHO's recommended safe limit. Simultaneously, India has made significant progress in renewable energy adoption, exceeding 220 GW of installed capacity by 2025. This study proposes an integrated machine learning framework that combines both domains: it forecasts PM_{2.5} and PM₁₀ concentrations across 26 Indian cities using data from 2015 to 2020, and investigates whether increased renewable energy adoption is associated with measurable air quality improvement. Three models were implemented and evaluated — Long Short-Term Memory (LSTM), Random Forest, and XGBoost — and combined into an ensemble. XGBoost achieved the highest individual R² of 0.8917, while the ensemble delivered the lowest RMSE of 29.92. An ablation study confirmed that renewable energy indicators contribute a statistically meaningful improvement across all metrics ($\Delta R^2 = +0.0045$). The proposed framework can support environmental agencies, smart city planners, and policymakers through improved pollution monitoring and early warning systems.

Keywords:

air pollution prediction; PM_{2.5}; PM₁₀; machine learning; LSTM; ensemble learning; renewable energy; AQI; urban air quality; India.

AI Infused Deception and Prevention Model with Unified Threat Analytics and Predictability

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Abstract

The rapid evolution of Artificial Intelligence (AI)-enabled defensive technologies has rendered traditional analytical ability and reactive methodologies, insufficient against adaptive adversaries. While cyber deception technologies such as honeypots and honeynets provide high-fidelity attacker interaction data, their intelligence remains largely deviated from the operational defensive approach. This paper proposes a unified and purposeful methodology to create a wholesome workflow of attack management and prevention through extensive visual accountability integrating a predictive analysis to bring forward likelihood and impact of an attack. This model integrates three core components: (i) an adaptive deception layer orchestrated using Reinforcement Learning (RL) to dynamically modify decoy environments based on adversarial behavior, (ii) a Unified Log Management (ULM) layer that normalizes heterogeneous telemetry into a standardized schema enriched with MITRE ATT&CK mappings, and (iii) a Predictive Analytical Engine employing AI based intelligence to model attack sequences and forecast lateral movement and breach propagation (“blast radius”). By embedding predictive threat intelligence into the XDR’s correlation and orchestration pipeline, the system enables proactive containment actions, including endpoint isolation, credential revocation, and deception reconfiguration. The framework bridges the operational gap between deception telemetry and automated response, reducing detection latency and improving threat prioritization. The proposed model provides a scalable and modular architecture suitable for enterprise environments, offering a structured approach toward predictive, deception-integrated cyber defense against intelligent and stealth adversarial campaigns

Keywords:

Adaptive Cyber Deception; Artificial Intelligence; Extended Detection and Response (XDR); MITRE ATT&CK Framework; Predictive Analysis; Unified Log Management.

Explainable Sentiment Analysis Using BERT and SHAP: Towards Trustworthy AI for Social Media Understanding

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Abstract:

Sentiment analysis of social media has become essential for business intelligence and customer feedback analysis. However, existing systems lack transparency—they provide predictions without explaining the reasoning behind them. This paper addresses this critical gap by proposing an Explainable Sentiment Analysis System that combines BERT-based classification with SHAP (SHapley Additive exPlanations) interpretability methods. Our approach not only achieves state-of-the-art accuracy (94.2%) but also provides human-interpretable explanations for each prediction. The system identifies which words and phrases most influenced the sentiment classification, enabling stakeholders to understand and trust AI decisions. We demonstrate that explainability does not compromise performance and significantly improves model reliability for enterprise deployment. Experimental results on Twitter and product review datasets show 8-12% improvement over baseline methods. The work is particularly relevant for regulated industries (banking, healthcare) where AI transparency is mandatory. Our system is deployable and can be integrated into existing sentiment analysis pipelines with minimal overhead.

Keywords:

Explainable AI (XAI), Sentiment Analysis, BERT, SHAP, Interpretability, Trustworthy AI, NLP

Federated Learning with Homomorphic Encryption and Median-of-Means Aggregation: Balancing Privacy, Robustness, and Efficiency

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Abstract:

Federated Learning is a kind of ML model with a distributed approach to training the machine-learning model and does not require sending raw data to the server for training purposes making it applicable to modelling applications which are privacy sensitive. FL has vulnerabilities where there can be privacy leakages due to a gradient-inversion attack, and adversarial actors can attack the FL server. Adversarial threats can come in the form of poisoning attacks and Byzantine attacks. Homomorphic Encryption (HE) is another method that secures the machine-learning model and its data by permitting for computation on the encrypted data without first decrypting it; however, the use of HE can create a large amount of overhead on computation resources. Federated Averaging (FedAvg) requires the use of traditional aggregation methods which are not robust against maliciously updated gradients. To mitigate privacy breach attacks, MAAP proposes a hybrid framework that combines CKKS-based HE with a Median-of-Means (MoM) aggregation strategy to provide a solution for secure aggregation and robustness to adversarial attacks. This framework provides a balanced solution to ensure privacy, robustness and efficiency for FL and to show the robustness of the proposed solution, it shows that through the results of experiments conducted, the proposed hybrid framework has improved resilience against attacks, reduced information leakage and provides comparable accuracy with a manageable level of computational overhead.

Keywords:

Federated Learning, Homomorphic Encryption, Median-of-Means, Privacy Preservation, Byzantine Robustness, Secure Aggregation

Iterative Health: A Framework for Applying Agile Software Development Principles to Personal Fitness.

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Abstract:

Most people begin their fitness journey with enthusiasm, yet nearly 90% fail to sustain it. This pattern mirrors the challenges of projects executed using the Waterfall model—rigid, long-term plans that struggle to adapt to changing circumstances, human variability, lifestyle disruptions, and psychological burnout. This study explores the application of Agile software development principles to personal health and fitness. By viewing the human body as a product under continuous development, it proposes a framework built around Agile practices such as Sprints, Retrospectives, and Backlog Grooming. Instead of pursuing fixed, long-term goals, individuals focus on short, iterative cycles, regularly assess progress, identify obstacles, and adjust their approach based on real-world feedback. The framework emphasises adaptability, continuous improvement, and sustainable habit formation rather than perfection. The central hypothesis is that an iterative and flexible fitness methodology can deliver better long-term adherence, sustainable weight loss, and improved health outcomes compared to traditional linear approaches that often fail when confronted with the realities of daily life. Through this lens, fitness becomes less about following a rigid plan and more about continuously evolving toward better health.

Keywords:

Agile Fitness, Scrum Framework, Habit Formation, Fitness Adherence, Sustainable Weight Loss, Behavioral Change, Continuous Improvement, Personal Health Management.

Vectorshield: Preserving Semantic Utility in Privacy-Aware AI Retrieval Systems

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Abstract:

Retrieval-Augmented Generation (RAG) systems routinely store Personally Identifiable Information (PII) in plaintext alongside semantic embeddings in vector databases, creating persistent privacy exposure that violates GDPR and HIPAA data minimization requirements. Existing countermeasures offer incomplete solutions: pre ingestion redaction degrades retrieval accuracy by up to 22%, encryption-based approaches impose prohibitive latency overhead, and output-stage guardrails act after sensitive data has already entered persistent storage. This paper proposes VectorShield, a stateless middleware architecture that enforces PII sanitization structurally at the ingestion boundary. A dual-path processing model generates high-fidelity embeddings from original text while concurrently sanitizing content before storage, decoupling semantic utility from privacy enforcement without cryptographic overhead. Evaluated on a 400-chunk annotated corpus of 789 ground-truth PII spans across six domain clusters, VectorShield achieves a PII detection F1 of 0.825, eliminates 78.9% of sensitive spans from persistent storage, and matches or exceeds the unprotected baseline in retrieval quality (nDCG@5: 0.309 vs. 0.301; MRR: 0.484 vs. 0.476). Median ingestion latency (p50 = 64.5 ms) undercuts the pre-redaction alternative by 16.9 ms. These results confirm that the privacy-utility trade-off in RAG ingestion is an architectural artifact of existing designs, not an inherent constraint.

Keywords:

Data Privacy, PII Detection, Privacy-Preserving AI, Retrieval-Augmented Generation, Vector Databases.

Forensic Readiness Principles for Cloud-Native Applications

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Abstract:

Cloud-native architectures — built on containers, serverless functions, and dynamically orchestrated infrastructure— have fundamentally challenged traditional digital forensic practices. Conventional forensic methods rely on assumptions that no longer hold in these environments: persistent disk storage, predictable system lifespans, and centralized logging. Containers and serverless functions can be created and destroyed within seconds, often leaving little to no trace once an incident has occurred, while evidence is scattered across distributed, provider-specific logging systems with inconsistent retention policies. This paper examines the concept of forensic readiness — designing systems proactively to preserve usable evidence before an incident occurs, rather than relying on reactive post-incident investigation — as applied to cloud-native environments. It reviews existing technical approaches, including container snapshot mechanisms, proactive logging frameworks, and API-based evidence acquisition, and identifies persistent gaps between these proposals and practical, provider-agnostic implementation. Drawing on this synthesis, the paper proposes a practical set of forensic readiness design principles intended to guide organizations in building cloud-native systems that remain forensically sound by design. The discussion aims to bridge the gap between fragmented technical research and actionable guidance for practitioners building modern cloud infrastructure.

Keywords:

digital forensics, forensic readiness, cloud-native applications, container forensics, evidence acquisition

Agentic Ai for Talent Acquisition: A Conceptual Framework for Autonomous Recruitment Systems

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Abstract:

Artificial Intelligence (AI) has become a key enabler in transforming the process of talent acquisition, which makes the job of the human resource more accurate and quicker. However, current AI-driven recruitment tools primarily operate as assistive systems rather than autonomous decision-makers using machine learning. This paper introduces the concept of *Agentic AI* in talent acquisition—intelligent, goal-oriented agents capable of reasoning, learning, and acting independently to optimize talent acquisition processes. The study presents a conceptual framework that integrates Agentic AI with existing HR processes to enable adaptive, context-aware, and ethically aligned hiring practices. Drawing on theories of autonomous systems, machine learning, and human–AI collaboration, the paper explores how Agentic AI can autonomously find candidates, assess their, conduct initial interactions, map them to the job requirement and support final hiring decisions while maintaining fairness and transparency. The proposed framework emphasizes accountability, data ethics, and human oversight as essential components for trustworthy implementation. This research contributes to the growth of future smart and intelligent HR ecosystems by positioning Agentic AI as a transformative paradigm that acts as a bridge between automation and cognitive autonomy in recruitment. This paper proposes a conceptual framework for integrating Agentic AI into talent acquisition processes. The framework combines multi-agent architectures, Natural Language Processing (NLP), machine learning-based decision support, and governance mechanisms to create an intelligent and adaptive recruitment ecosystem. A literature review was conducted to examine the current state of research in AI-enabled recruitment, Generative AI applications in human resources, and autonomous agent systems. The review identifies significant research gaps related to autonomous workflow execution, human-AI collaboration, fairness, explainability, and governance. Based on these findings, a comprehensive framework is proposed that positions Agentic AI as the next evolutionary stage of recruitment technology. The paper provides a foundation for future empirical research on autonomous recruitment platforms.

Keyword:

Agentive AI, Talent Acquisition, Autonomous Recruitment, Human–AI Collaboration, Ethical AI, Artificial Intelligence in HR, Intelligent Agents, AI-driven Hiring

An AI-Based Decision Support System for SIP Using Hybrid Machine Learning Models

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Abstract:

Financial markets have experienced rapid growth, so more investors are looking for smart systems to help them make informed financial decisions. Most research so far has focused on using machine learning and deep learning to predict mutual fund Net Asset Value (NAV), but does not provide investors with practical and actionable advice. This paper introduces a hybrid setup that pairs mutual fund performance forecasting with personalized Systematic Investment Plan (SIP) suggestions. The prediction layer uses time-series models like Long Short-Term Memory (LSTM) networks and XGBoost, while a recommendation engine is driven by rules and risk-awareness,

offering SIP strategies that actually fit each investor's profile. Tests show this combined system not only predicts returns better but also offers meaningful investment guidance. It tackles the long standing gap between financial forecasting research and the real-world needs of people making investment decisions.

Keyword:

Systematic Investment Plan (SIP), Decision Support Systems, Hybrid Machine Learning Models, Financial Forecasting, Net Asset Value (NAV) Prediction, Portfolio Optimization, Long Short-Term Memory (LSTM), Gradient Boosting (XGBoost)

Enhancing Graduate Employability Through Industry–Academia Collaboration: Evidence from Higher Education Institutions in India

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Abstract:

India generates millions of graduates each year; nonetheless, a major gap exists between the performance of learners at academic levels and the expectations of industry in terms of competence. This disparity impacts graduate employability, productivity, and overall economic performance. Industry–Academia Partnerships (IAPs) have been found to be effective tools that address this disparity through the harmonization of the curriculum, practical training, internship opportunities, industrial projects, and skill development. This paper seeks to examine the role of industry-academia partnership on employability of graduates in India. The research used a survey-based methodology involving students, academics, and professionals from Indian higher educational institutions. Analysis of statistical data generated from surveys was done to measure the connection between partnership programs and employability factors including technical skills, interpersonal skills, internship programs, employment statistics, and general job preparedness. The results indicate that there is a significant difference in employability measures between institutions with high partnerships and those with low partnerships.

Keywords:

Industry–Academia Partnership, Employability, Skill Gap, Higher Education, Internship Programs, Workforce Development, India.

The TRUST Framework: Bridging Cybersecurity Awareness and Real-Time Decision Making - A Comparative Analysis with Existing Models

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Abstract:

As generative AI enables increasingly sophisticated threats such as deepfake voice cloning and urgent Unified Payments Interface (UPI) fraud, traditional knowledge-based cybersecurity awareness programs are proving insufficient for everyday users. This paper introduces the TRUST Framework (Tone, Reality, Urgency, Source, Transfer), a simple, memorable cognitive heuristic designed to bridge the gap between cybersecurity awareness and real-time threat evaluation. The framework operationalizes threat detection into a five-step mental checklist that non-technical users- including students and general consumers—can apply instantly to emails, messages, calls, and financial requests. Drawing on Endsley’s Situation Awareness Theory, this study maps the TRUST dimensions onto the three core stages of perception, comprehension, and projection, thereby establishing its theoretical foundation. A comparative architectural analysis against prominent existing awareness models reveals that the TRUST Framework offers distinct advantages: high memorability through its acronym structure, complete independence from software or institutional infrastructure, and strong emphasis on behavioral guidance during high-pressure digital interactions. Unlike many current approaches that remain theoretical or tool-dependent, TRUST provides an immediately deployable mental model for countering social engineering and AI-enabled deception. Future work will empirically validate the framework through randomized controlled simulations. The TRUST Framework represents a practical step toward empowering individuals with actionable cognitive tools in an evolving digital threat landscape.

Keywords:

cybersecurity awareness, TRUST Framework, situation awareness, social engineering, phishing, decision-making heuristic, UPI fraud, cognitive security

Impact of CI/CD on Manual and Automation Testing

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Abstract:

Continuous Integration and Continuous Delivery (CI/CD) have transformed modern software development by enabling faster and more reliable software releases. The adoption of CI/CD has significantly influenced software testing practices, particularly the shift from traditional manual testing to automation testing. This review paper analyses fifteen research studies to examine the impact of CI/CD on software testing practices. The selected studies were categorized into seven thematic areas, including CI/CD foundations, test automation adoption, regression testing, software quality, release efficiency, manual versus automation testing, and emerging AI-driven testing trends. The findings indicate that automation testing plays a vital role in supporting CI/CD pipelines by enabling continuous testing, rapid feedback, efficient regression testing, and improved software quality. While automation testing offers advantages in terms of speed, consistency, and scalability, manual testing remains important for exploratory and usability testing activities. The review concludes that a balanced combination of manual and automation testing is essential for maintaining software quality in CI/CD environments. Furthermore, emerging technologies such as Artificial Intelligence and Machine Learning are expected to enhance future software testing practices and improve testing efficiency.

Keywords:

Continuous Integration, Continuous Delivery, DevOps, Manual Testing, Automation Testing, Continuous Testing, Software Quality.

Multi-Criteria Priority Scoring Framework for Electric Vehicle Charging Infrastructure Deployment: A Data-Driven Analysis of Maharashtra Districts

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Abstract:

India's transition to electric mobility requires strategic deployment of charging infrastructure, yet no systematic framework exists for prioritizing regions within states based on multi-criteria assessment. This paper presents a data-driven multi-criteria decision-making (MCDM) framework using the Analytic Hierarchy Process (AHP) to prioritize all 35 districts of Maharashtra, India's second-most populous state, for EV charging infrastructure deployment. We integrate three heterogeneous data sources: 295,332 EV registrations aggregated from 58 Regional Transport Offices (VAHAN/Parivahan 2026), Census 2011 demographic data for 35 districts, and 2,486 public charging station locations extracted from PlugShare with point-in-polygon geo-validation against district boundaries. Five weighted criteria, EV demand per capita (0.35), charging infrastructure gap (0.30), EV penetration rate (0.15), vehicle registration volume (0.10), and population density (0.10), are normalized and combined into composite priority scores. Our analysis reveals a 14:1 disparity in priority scores across districts, with Pune (0.775), Nagpur (0.745), and Kolhapur (0.670) identified as highest-priority districts due to high EV demand coupled with insufficient charging infrastructure. We find that charger deployment is heavily concentrated in western Maharashtra (Pune and Thane account for 31.3% of all chargers), while eastern districts like Gadchiroli (1 charger for 719 EVs) face critical infrastructure gaps. An accompanying open-source interactive dashboard provides a choropleth visualization and supports dynamic weight adjustment for policy scenario analysis. The framework is generalizable to other Indian states and developing country contexts.

Keywords:

electric vehicles, charging infrastructure, AHP, multi-criteria decision making, Maharashtra, spatial analysis, priority scoring

Creating a Maharashtra Prakrit NLP Dataset from Sanskrit Using Vararuchi's Morphological Rules

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Abstract:

Maharashtri Prakrit is a classical Middle Indo-Aryan language spoken from approximately 500 BCE to 875 CE, serving as the official literary language of the Satavahana dynasty. Despite its historical and linguistic significance, Maharashtri Prakrit remains a critically under-resourced language with no existing digital corpus or NLP tools. This paper presents the first rule-based morphological dataset generation framework for Maharashtri Prakrit, implementing 19 phonological transformation rules derived from Vararuchi's Prakrit Prakasha, the oldest known grammar of Prakrit. The framework is applied to a curated Sanskrit lexicon of 163 words sourced from the Cologne Digital Sanskrit Lexicon (CDSL), producing a structured dataset of Sanskrit-Maharashtri word pairs annotated with part-of-speech tags, word type classification, and transformation rules applied. The resulting seed corpus establishes a foundational resource enabling future NLP research including neural machine translation, morphological analysis, and language modeling for this historically significant but computationally neglected language.

Keywords:

Maharashtri Prakrit, Sanskrit NLP, Low-resource language, Morphological transformation, Vararuchi

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