ICISCM

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INTERNATIONAL CONFERENCE ON INTELLIGENT SYSTEMS AND COMPUTATIONAL METHODS (ICISCM)

CONFERENCE PROCEEDINGS

ABOUT THE CONFERENCE

The **International Conference on Intelligent Systems and Computational Methods (ICISCM 2025)** is a premier global forum dedicated to advancing interdisciplinary collaboration and cutting-edge research in data-driven and computational technologies. Bringing together leading academics, researchers, industry experts, and students from across the world, the conference provides a dynamic platform to exchange knowledge, explore innovative ideas, and address the complex challenges of today's digital era.

ICISCM 2025 highlights the latest innovations, research breakthroughs, and practical applications across diverse areas such as artificial intelligence, machine learning, data science, the Internet of Things, edge and fog computing, cybersecurity, optimization, automation, and high-performance computing. By fostering dialogue and collaboration, the conference seeks to inspire the development of smart, adaptive, and efficient solutions that drive technological transformation and solve real-world problems.

All accepted and presented papers will be published in the conference proceedings, ensuring global visibility and accessibility for the contributions of participating researchers. The proceedings will serve as a valuable reference for scholars, practitioners, and industry professionals, documenting the state of the art in intelligent systems and computational methods and advancing future research and innovation in the field.

Set against the vibrant backdrop of Jakarta, Indonesia, ICISCM 2025 invites participants to step into the future of intelligent technologies and to be part of a global community shaping the next generation of innovation.

SCOPE OF THE CONFERENCE

The **International Conference on Intelligent Systems and Computational Methods (ICISCM 2025)** is committed to fostering interdisciplinary research, innovation, and collaboration in the field of intelligent technologies and advanced computational methods. The conference provides a vibrant platform for presenting original contributions, addressing emerging challenges, and exploring future directions in an era where computational intelligence and smart systems play a pivotal role in shaping industries and societies worldwide.

ICISCM 2025 brings together a diverse community of researchers, academicians, industry experts, and practitioners to exchange ideas and cultivate collaborations that advance both theoretical foundations and practical applications. The scope of the conference spans a wide spectrum of domains, including artificial intelligence, machine learning, data science, the Internet of Things (IoT), edge and fog computing, cybersecurity, optimization, automation, and high-performance computing. By integrating these rapidly evolving fields, **ICISCM** promotes the design and development of intelligent, adaptive, and high-performance systems that address complex real-world problems.

Emphasising multidisciplinary approaches, the conference highlights pioneering research that not only advances computational theory but also delivers practical impact across multiple sectors such as healthcare, transportation, communication networks, business intelligence, and industrial systems. By promoting cutting-edge methodologies and fostering collaborative engagement, **ICISCM** aims to inspire the next generation of innovations in intelligent systems and computational strategies, contributing to sustainable technological progress and global knowledge advancement.

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CROSS-LINGUAL TRANSFER LEARNING TECHNIQUES FOR ENHANCING LOW-RESOURCE LANGUAGE PROCESSING

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ABSTRACT

Cross-lingual transfer learning has emerged as a promising approach to bridge the performance gap in natural language processing tasks between high-resource and low-resource languages. This paper investigates various strategies for leveraging knowledge from resource-rich languages to improve the accuracy and efficiency of models applied to underrepresented linguistic datasets. We explore the use of multilingual pretrained language models, alignment-based representation techniques, and fine-tuning methods that adapt shared linguistic structures across languages. Special attention is given to zero-shot and few-shot learning paradigms that enable effective generalization without extensive labeled data in the target language. Our experimental framework evaluates these techniques across a diverse set of tasks, including part-of-speech tagging, named entity recognition, and sentiment analysis using benchmark corpora from multiple low-resource languages. The results demonstrate that multilingual transformers significantly outperform monolingual baselines when properly aligned and adapted, with consistent improvements observed in both syntactic and semantic tasks. The study highlights the importance of linguistic distance, data augmentation, and task-specific tuning in achieving robust cross-lingual performance. Overall, this research underscores the critical role of transfer learning in democratizing language technologies and facilitating inclusive AI systems that serve linguistically diverse communities.

Keywords: cross-lingual learning, low-resource languages, transfer learning, multilingual NLP, language adaptation

ICISCM-7365

DESIGN AND EVALUATION OF MULTILINGUAL PRETRAINED MODELS FOR CONTEXT-AWARE MACHINE TRANSLATION

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ABSTRACT

Multilingual pretrained models have transformed the landscape of machine translation by enabling the simultaneous handling of multiple languages within a single architecture. This study presents the design and systematic evaluation of multilingual transformer-based models tailored for context-aware machine translation, particularly focusing on improving translation quality in conversational and document-level settings. The research investigates how contextual embeddings derived from extended language sequences influence translation fluency and semantic accuracy. We propose a model architecture that incorporates language-specific adapters and attention-based context encoding to better capture dependencies across sentences and paragraphs. A comprehensive evaluation is conducted on benchmark datasets covering a variety of language pairs, including both high-resource and low-resource combinations. The results demonstrate that integrating contextual information significantly enhances translation coherence and disambiguation, particularly in languages with complex grammatical structures or high levels of polysemy. Comparative experiments show that our context-aware multilingual models outperform baseline systems that rely solely on sentence-level inputs. Additionally, we analyze the impact of pretraining data diversity and size on model generalizability and translation fidelity. This work contributes to the growing body of research advocating for discourse-level translation methods and highlights the benefits of combining multilingual pretraining with contextual modeling. Our findings suggest a promising direction for developing more natural and accurate multilingual translation systems capable of real-world deployment.

Keywords: multilingual models, machine translation, context-aware systems, pretrained transformers, translation quality

ICISCM-5910

OPTIMIZING PATH PLANNING AND TASK ALLOCATION FOR AUTONOMOUS MOBILE ROBOTS IN DYNAMIC WAREHOUSE ENVIRONMENTS

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ABSTRACT

The integration of autonomous mobile robots (AMRs) in warehouse operations has become a cornerstone of intelligent logistics systems. This paper presents a comprehensive approach to optimizing both path planning and task allocation for AMRs operating in dynamic and high-density warehouse environments. The proposed framework combines real-time obstacle-aware path planning algorithms with adaptive task scheduling strategies to improve operational efficiency and reduce task completion time. We develop a hybrid model that leverages heuristic search techniques for local navigation and reinforcement learning for dynamic decision-making under uncertainty. The system is designed to respond to frequent changes in the environment, such as moving obstacles, shifting inventory, and task reprioritization. Through extensive simulations and real-world testbed deployments, we evaluate the performance of our model in terms of travel distance, task latency, collision avoidance, and system throughput. The results indicate that our approach achieves superior scalability and resilience compared to static planning methods, particularly under variable load conditions. Additionally, we introduce a cooperative multi-robot coordination mechanism that minimizes traffic congestion and enables efficient resource sharing. This study provides valuable insights into the practical implementation of intelligent robotic systems in logistics and offers a scalable solution for managing increasing warehouse complexities. The findings can serve as a foundation for next-generation warehouse automation systems powered by adaptive robotics and smart planning.

Keywords: autonomous robots, path planning, task allocation, warehouse automation, dynamic environments

ICISCM-2048

INTEGRATION OF VISION-BASED NAVIGATION AND FLEET COORDINATION IN AUTONOMOUS WAREHOUSE ROBOTICS

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ABSTRACT

The growing demand for automation in warehouse logistics has accelerated the deployment of autonomous robotic fleets capable of handling diverse operational tasks. This paper explores the integration of vision-based navigation systems with intelligent fleet coordination mechanisms to enhance the autonomy and efficiency of warehouse robotics. We present a modular framework that fuses real-time visual input with simultaneous localization and mapping (SLAM) techniques to enable precise and adaptive navigation in unstructured indoor environments. The system incorporates deep learning models for object detection and semantic segmentation, allowing robots to identify obstacles, shelves, and dynamic agents in complex warehouse layouts. In parallel, a centralized fleet management module utilizes multi-agent coordination algorithms and priority-based task allocation to optimize resource utilization and reduce inter-robot conflicts. The framework is evaluated through both simulation and physical robot deployment in controlled warehouse settings, measuring metrics such as navigation accuracy, task throughput, collision avoidance, and system scalability. Experimental results demonstrate that the combined vision-based approach and coordinated task execution significantly improve performance over traditional sensor-based systems, particularly in high-density and frequently changing environments. The integration also supports real-time adaptability, enabling the system to respond effectively to unexpected obstacles and changes in task priorities. This research advances the field of intelligent warehouse automation and provides a robust solution for the large-scale deployment of coordinated robotic fleets in logistics operations.

Keywords: vision-based navigation, fleet coordination, warehouse robotics, autonomous systems, SLAM

ICISCM-8673

DEEP LEARNING APPROACHES FOR AUTOMATED DETECTION AND CLASSIFICATION OF ANOMALIES IN MEDICAL IMAGING

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ABSTRACT

Advancements in deep learning have revolutionized the field of medical imaging, offering powerful tools for automated detection and classification of anomalies across a wide range of diagnostic modalities. This paper investigates the application of deep convolutional neural networks (CNNs) and attention-based architectures in identifying pathological features within radiological images such as MRI, CT scans, and X-rays. We propose a unified framework that integrates preprocessing, feature extraction, and classification in a fully automated pipeline tailored for clinical imaging datasets. The model is trained and validated using annotated datasets representing various disease categories, including tumors, fractures, and pulmonary anomalies. Data augmentation techniques and transfer learning are employed to improve model robustness, especially in cases of limited annotated medical data. The system is evaluated using standard performance metrics such as accuracy, precision, recall, and area under the ROC curve to ensure clinical relevance and reliability. Experimental results demonstrate high diagnostic accuracy and reduced false-positive rates compared to traditional computer-aided detection systems. The findings emphasize the potential of deep learning to augment radiological workflows, support early diagnosis, and reduce diagnostic workload. This research contributes toward building scalable and trustworthy AI tools for real-world deployment in medical settings.

Keywords: medical imaging, anomaly detection, deep learning, convolutional neural networks, diagnostic automation

ICISCM-3254

ENHANCING DIAGNOSTIC ACCURACY IN RADIOLOGY THROUGH EXPLAINABLE ARTIFICIAL INTELLIGENCE MODELS

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ABSTRACT

The integration of artificial intelligence (AI) in radiology has shown significant promise in improving diagnostic accuracy and workflow efficiency. However, the black-box nature of many AI models poses challenges to clinical adoption and trust. This paper presents a comprehensive approach to enhancing diagnostic precision in radiology by incorporating explainable AI (XAI) methodologies within deep learning frameworks. We design and evaluate convolutional and transformer-based neural networks equipped with interpretability mechanisms such as saliency maps, class activation mappings, and attention visualization to provide transparent reasoning behind predictions. The proposed models are trained and tested on diverse datasets spanning chest X-rays, brain MRIs, and abdominal CT scans to identify anomalies including tumors, lesions, and inflammatory conditions. Emphasis is placed on quantifying both model performance and interpretability, using metrics such as classification accuracy, sensitivity, and user-aligned trust scores from clinical experts. Comparative analysis reveals that XAI-enhanced models maintain competitive accuracy while significantly increasing radiologist confidence in AI-assisted interpretations. Furthermore, case studies illustrate how visual explanations can help detect subtle diagnostic patterns that might otherwise be overlooked. This research underscores the value of explainability in bridging the gap between algorithmic decision-making and human expertise in clinical practice. By aligning AI outputs with radiological reasoning, the proposed framework paves the way for safer, more accountable deployment of intelligent systems in medical imaging environments.

Keywords: explainable AI, radiology, diagnostic accuracy, medical imaging, deep learning

ICISCM-4782

REAL-TIME CYBER THREAT DETECTION USING HYBRID DEEP LEARNING AND ANOMALY DETECTION TECHNIQUES

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ABSTRACT

As cyber threats continue to evolve in complexity and frequency, real-time detection systems must be both adaptive and intelligent to safeguard critical digital infrastructures. This paper presents a hybrid approach that integrates deep learning models with traditional anomaly detection techniques to identify cyber threats in real time. The proposed framework combines convolutional neural networks (CNNs) for feature extraction and long short-term memory (LSTM) networks for sequential pattern analysis, enabling the system to detect subtle anomalies and dynamic attack signatures. Complementary to this, unsupervised learning methods such as isolation forests and clustering-based anomaly detection are employed to enhance the model's sensitivity to previously unseen threats. The system is evaluated on benchmark datasets including NSL-KDD and CIC-IDS, and it demonstrates superior performance in detecting various attack vectors such as denial-of-service, port scanning, and data exfiltration. Key performance indicators, including detection rate, false-positive rate, latency, and scalability, are used to benchmark the framework against existing intrusion detection systems. Experimental results show significant improvements in detection accuracy and response time, validating the effectiveness of hybrid learning in real-time applications. Furthermore, the framework supports continuous learning to adapt to new threat patterns, making it suitable for dynamic and large-scale enterprise networks. This research contributes a robust and scalable architecture for modern cyber defense, integrating the strengths of deep learning and traditional anomaly detection in a unified system.

Keywords: cyber threat detection, deep learning, anomaly detection, real-time systems, hybrid models

ICISCM-6901

ADAPTIVE AI MODELS FOR PROACTIVE INTRUSION DETECTION IN LARGE-SCALE NETWORK INFRASTRUCTURES

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ABSTRACT

With the increasing complexity and scale of modern network infrastructures, traditional intrusion detection systems often fall short in identifying sophisticated and evolving cyber threats. This paper proposes adaptive artificial intelligence models designed to proactively detect intrusions across large-scale networks by continuously learning from dynamic traffic patterns and threat behaviors. The framework utilizes a combination of deep neural networks and ensemble learning techniques to model network activity and identify anomalies in real time. We incorporate reinforcement learning to enable continuous model adaptation based on feedback from detected events, allowing the system to evolve in response to emerging threats without human intervention. The model is evaluated using extensive datasets, including UNSW-NB15 and CICIDS2017, encompassing a variety of attack types and traffic conditions. Key performance metrics such as detection accuracy, precision, recall, and processing latency are analyzed to validate system effectiveness. Experimental results demonstrate that the adaptive AI framework significantly outperforms static models in detecting zero-day attacks, minimizing false positives, and maintaining performance across high-throughput environments. Additionally, the model architecture is designed for scalability and efficient deployment in distributed network settings, ensuring compatibility with real-world infrastructure demands. This study underscores the potential of self-improving AI systems to provide resilient and proactive security mechanisms for large-scale digital ecosystems, thereby strengthening cyber defense in an era of rapidly evolving threats.

Keywords: adaptive AI, intrusion detection, network security, proactive defense, large-scale systems

ICISCM-1037

ASPECT-BASED SENTIMENT ANALYSIS USING TRANSFORMER MODELS FOR SOCIAL MEDIA OPINION MINING

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ABSTRACT

Aspect-based sentiment analysis (ABSA) has gained increasing attention as a fine-grained approach to understanding public opinions, particularly within the vast and diverse content of social media. This paper presents a transformer-based framework for ABSA that enables precise sentiment classification of specific aspects or entities mentioned in user-generated posts. Leveraging pretrained language models such as BERT and RoBERTa, the system is fine-tuned to detect aspect terms, extract opinion phrases, and classify sentiment polarity in a context-aware manner. Our approach integrates attention mechanisms and position embeddings to maintain semantic consistency and accurately capture the relationships between aspects and sentiments, even in linguistically noisy environments. A custom dataset composed of tweets and online reviews is constructed and annotated to evaluate the model's performance across multiple domains, including consumer products, politics, and services. Experimental results show that the transformer-based models outperform traditional machine learning and RNN-based techniques in both accuracy and F1 score. Furthermore, ablation studies reveal the contribution of contextual embeddings and syntactic dependency features in improving sentiment attribution. The framework is also extended to handle multilingual inputs, demonstrating robustness in cross-lingual opinion mining tasks. This study highlights the effectiveness of deep contextualized models in extracting structured sentiment insights from unstructured social media content, making it valuable for real-time brand monitoring, public sentiment tracking, and decision-making in social and commercial contexts.

Keywords: aspect-based sentiment, transformer models, social media, opinion mining, sentiment classification

ICISCM-8246

REAL-TIME EMOTION AND SENTIMENT CLASSIFICATION FROM MULTIMODAL SOCIAL MEDIA CONTENT

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ABSTRACT

The explosion of user-generated content on social media platforms presents a unique opportunity to analyze public emotion and sentiment in real time. This paper introduces a robust framework for real-time classification of emotions and sentiments by leveraging multimodal data, including text, images, and audio embedded in social media posts. The proposed system combines natural language processing, computer vision, and speech analysis techniques to extract features from each modality and fuses them using an attention-based deep learning architecture. Textual data is processed using transformer models such as BERT, while convolutional neural networks handle image data, and recurrent neural networks with spectral features process audio components. The fusion module integrates these heterogeneous features to produce comprehensive emotion and sentiment labels. We construct and annotate a multimodal dataset consisting of tweets, video snippets, and image posts from platforms such as Twitter and Instagram, labeled across common emotion categories and sentiment polarities. Evaluation results demonstrate that the multimodal model significantly outperforms unimodal baselines in classification accuracy and robustness across varied content types. The framework is optimized for real-time performance, ensuring low latency and high throughput suitable for continuous social media monitoring. This study emphasizes the importance of multimodal analysis in capturing the full emotional context of online content and offers valuable applications in brand monitoring, public opinion tracking, and digital mental health surveillance.

Keywords: multimodal sentiment, emotion classification, real-time analysis, social media mining, deep learning

ICISCM-5719

INTELLIGENT TASK SHARING AND SAFETY-AWARE INTERACTION IN HUMAN-ROBOT COLLABORATIVE MANUFACTURING SYSTEMS

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ABSTRACT

The integration of intelligent task sharing and safety-aware interaction mechanisms is central to the evolution of human-robot collaborative manufacturing systems. This study proposes a hybrid framework that enables seamless coordination between human workers and collaborative robots (cobots) by combining real-time perception, adaptive control, and cognitive decision-making. The system incorporates sensor fusion techniques using vision, proximity, and force sensors to detect human presence, intentions, and workspace context, enabling robots to dynamically adjust their trajectories and behavior. Task sharing is optimized using a reinforcement learning-based allocation model that learns from past interactions to allocate subtasks efficiently based on skill level, workload, and environmental constraints. To ensure safety, the framework integrates rule-based safety envelopes with predictive collision avoidance, allowing the robot to respond proactively to unplanned human movements. Experimental validation is conducted in a simulated smart manufacturing environment, with scenarios involving assembly, inspection, and material handling. Results demonstrate improvements in task efficiency, human comfort, and overall safety compliance when compared to static collaboration models. This research highlights the potential of intelligent and safety-aware human-robot collaboration in achieving agile and adaptive manufacturing, especially in settings requiring frequent human-robot co-presence and dynamic reconfiguration of tasks.

Keywords: human-robot collaboration, task sharing, safety interaction, smart manufacturing, adaptive robotics

ICISCM-3928

ADAPTIVE CONTROL AND LEARNING FRAMEWORKS FOR ENHANCING HUMAN-ROBOT SYNERGY IN SMART FACTORIES

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ABSTRACT

Human-robot synergy is a critical enabler for the next generation of smart factories, where adaptive collaboration between humans and intelligent robotic systems can significantly improve flexibility, productivity, and safety. This paper proposes an integrated control and learning framework designed to enhance real-time cooperation in dynamic industrial environments. The framework combines adaptive control algorithms with continuous learning modules that allow robots to anticipate human actions, adjust their behaviors accordingly, and co-adapt over time. Reinforcement learning is employed to optimize task allocation and motion planning based on human feedback and environmental cues, while sensor-driven behavior modeling ensures context-aware responsiveness. Multimodal perception, including vision, gesture, and proximity sensing, is used to establish intuitive communication between humans and robots, enabling proactive coordination and minimizing conflicts. The framework is validated through experimental scenarios involving collaborative assembly, inspection, and tool handling tasks within a smart manufacturing testbed. Evaluation results show marked improvements in task efficiency, reduction in human workload, and enhanced safety compliance compared to non-adaptive systems. Additionally, human subjects report higher trust and perceived fluency in the interactions. The proposed approach demonstrates that adaptive control combined with continual learning can form the foundation for human-centric automation systems, facilitating seamless integration of robotics into human workflows in evolving industrial settings.

Keywords: human-robot synergy, adaptive control, reinforcement learning, smart factories, collaborative automation

ICISCM-6452

MACHINE LEARNING MODELS FOR EARLY PREDICTION OF PATIENT OUTCOMES IN CRITICAL CARE SETTINGS

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ABSTRACT

Accurate and early prediction of patient outcomes in critical care settings is essential for timely interventions and optimized resource allocation. This paper presents a data-driven approach using machine learning models to forecast clinical outcomes such as mortality, length of stay, and risk of complications in intensive care units (ICUs). The proposed framework leverages structured electronic health records (EHRs) containing vital signs, laboratory results, medication history, and demographic information to develop predictive models. We evaluate the performance of several algorithms, including gradient boosting machines, random forests, and deep neural networks, with a focus on temporal modeling of patient data over time. A data preprocessing pipeline is implemented to handle missing values, normalize continuous inputs, and encode categorical variables. Feature selection is guided by clinical relevance and model interpretability. The models are trained and validated using large-scale ICU datasets and are assessed through metrics such as area under the receiver operating characteristic curve (AUC), precision, recall, and calibration scores. Results show that ensemble and deep learning approaches consistently outperform baseline methods, providing reliable early warnings for deteriorating conditions. To support clinical decision-making, the framework incorporates explainability techniques that highlight the most influential features driving predictions. This study demonstrates the potential of machine learning to transform critical care by enabling early risk assessment and personalized treatment planning in high-acuity environments.

Keywords: machine learning, patient outcomes, critical care, early prediction, clinical decision support

ICISCM-2875

INTEGRATING ELECTRONIC HEALTH RECORDS AND PREDICTIVE ANALYTICS FOR PERSONALIZED OUTCOME FORECASTING IN HEALTHCARE

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ABSTRACT

The growing availability of electronic health records (EHRs) has enabled significant advancements in predictive analytics, allowing healthcare providers to move toward more personalized and proactive models of care. This paper presents a comprehensive framework that integrates EHR data with machine learning-based predictive analytics to forecast individual patient outcomes such as hospital readmission, complication risks, and recovery trajectories. Structured clinical data, including demographics, diagnoses, laboratory results, vital signs, medications, and historical encounters, are used as input features. The framework applies advanced models, including gradient boosting, recurrent neural networks, and survival analysis, to capture temporal patterns and heterogeneity in patient health trajectories. We address challenges such as missing data, variable sequence lengths, and class imbalance through tailored preprocessing and model optimization techniques. The approach is validated on multiple large-scale healthcare datasets, demonstrating strong performance across various outcome types with high precision and area under the ROC curve. The results confirm that combining EHR integration with predictive modeling enhances decision-making by offering personalized, data-driven insights into patient outcomes. This work highlights the potential of analytics-augmented healthcare systems to improve efficiency, reduce adverse events, and support value-based care initiatives.

Keywords: electronic health records, predictive analytics, personalized healthcare, outcome forecasting, machine learning

ICISCM-8304

DECENTRALIZED FRAMEWORK FOR SECURE AND TRANSPARENT DATA SHARING USING BLOCKCHAIN TECHNOLOGY

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ABSTRACT

The increasing demand for secure and trustworthy data exchange across distributed environments necessitates robust frameworks that ensure data integrity, confidentiality, and transparency. This paper presents a decentralized data sharing architecture leveraging blockchain technology to address the challenges associated with centralized data control, unauthorized access, and lack of auditability. The proposed framework utilizes a permissioned blockchain integrated with smart contracts to automate access control and enforce data usage policies. Cryptographic techniques such as hashing, digital signatures, and elliptic curve cryptography are employed to protect sensitive data while ensuring non-repudiation and immutability of transactions. A consensus algorithm optimized for performance and scalability is incorporated to maintain synchronization and trust among participating nodes. The system architecture is designed to support interoperability with existing data management platforms while maintaining compliance with regulatory standards. A prototype implementation is developed and tested using real-world healthcare and supply chain datasets to evaluate performance metrics, including latency, throughput, and resistance to attacks. Experimental results demonstrate that the framework achieves secure, transparent, and efficient data sharing without relying on a central authority. Furthermore, the use of smart contracts facilitates real-time verification and auditing of data transactions, promoting accountability among stakeholders. This research underscores the potential of blockchain as a foundational technology for secure and decentralized information exchange in sectors demanding high trust and data governance.

Keywords: blockchain, data sharing, decentralization, smart contracts, data security

ICISCM-4196

BLOCKCHAIN-ENABLED ACCESS CONTROL MECHANISMS FOR PRIVACY-PRESERVING DATA EXCHANGE IN DISTRIBUTED SYSTEMS

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ABSTRACT

Ensuring secure and privacy-preserving data exchange in distributed systems presents significant challenges, particularly when data traverses heterogeneous and untrusted domains. This paper introduces a blockchain-enabled access control framework that empowers distributed systems with robust, decentralized data protection while maintaining user privacy and system transparency. The proposed architecture integrates role-based and attribute-based access control (RBAC and ABAC) schemes through smart contracts deployed on a permissioned blockchain network. These contracts dynamically verify user credentials and access rights without exposing sensitive identity information. To enhance scalability and performance, off-chain storage is combined with on-chain access validation, and lightweight cryptographic techniques, such as homomorphic encryption and zero-knowledge proofs, are employed to ensure secure computation and verifiable privacy. The system is tested on a prototype that simulates data exchange among distributed healthcare and IoT platforms, evaluating metrics such as authorization latency, policy enforcement efficiency, and privacy leakage resistance. Results demonstrate that the blockchain-based approach outperforms traditional centralized mechanisms in preventing unauthorized access, reducing reliance on trusted third parties, and enabling tamper-resistant auditability. This study confirms that blockchain can serve as a powerful foundation for access control in modern distributed environments where privacy, trust, and traceability are essential.

Keywords: blockchain, access control, privacy preservation, distributed systems, smart contracts

ICISCM-5623

ABSTRACTIVE TEXT SUMMARIZATION WITH TRANSFORMER-BASED ARCHITECTURES FOR DOMAIN-SPECIFIC DOCUMENTS

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ABSTRACT

Abstractive text summarization aims to generate concise and coherent summaries that capture the essence of source content while producing novel phrasings rather than merely extracting existing sentences. This paper presents a domain-specific summarization framework utilizing advanced transformer-based architectures, including BART and T5, tailored for high-accuracy generation in specialized fields such as legal, biomedical, and technical documentation. The proposed method incorporates domain-adaptive pretraining, fine-tuning on curated datasets, and terminological alignment mechanisms to preserve critical terminology and context. Attention-based encoder-decoder models are leveraged to capture long-range dependencies and contextual relationships, enabling accurate abstraction of complex source texts. A comprehensive preprocessing pipeline standardizes input formats and resolves structural inconsistencies in heterogeneous document sets. Evaluation is performed using domain-specific benchmark datasets and is assessed through both automated metrics, such as ROUGE and BLEU, and manual evaluation for factual consistency and summary relevance. Results show that transformer models significantly outperform traditional summarization methods, especially when trained with domain-adaptive techniques. Moreover, the system is capable of controlling summary length and focus using prompt engineering strategies. This study highlights the capability of transformers to handle domain-specific language nuances and information density, offering practical applications in professional fields requiring reliable summarization of large text corpora. The findings support the scalability and customization potential of transformer-based models in specialized document management systems.

Keywords: abstractive summarization, transformer models, domain adaptation, document summarization, natural language processing

ICISCM-7031

PERFORMANCE EVALUATION OF PRETRAINED TRANSFORMER MODELS FOR MULTI-DOCUMENT SUMMARIZATION TASKS

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ABSTRACT

Multi-document summarization (MDS) is a critical task in natural language processing that involves condensing information from multiple related documents into a coherent and concise summary. This study presents a comparative performance evaluation of state-of-the-art pretrained transformer models on MDS tasks across diverse domains. The models examined include BART, T5, Pegasus, and Longformer Encoder-Decoder, each fine-tuned on benchmark MDS datasets such as Multi-News, DUC, and WikiSum. The evaluation framework focuses on summary quality, factual consistency, coherence, and informativeness, utilizing standard metrics including ROUGE, BLEU, and BERTScore, along with human assessments to capture qualitative nuances. To address the challenge of input length limitations, we implement document concatenation strategies and investigate hierarchical and sliding window attention mechanisms. Results show that Pegasus and Longformer outperform other models in handling long document sequences and preserving topic diversity, while BART and T5 offer more fluent and grammatically sound outputs. The findings provide insights into the strengths and limitations of current transformer-based approaches for MDS and serve as guidance for selecting appropriate models based on application requirements. This study underscores the evolving potential of pretrained transformers for scalable and reliable multi-document summarization.

Keywords: multi-document summarization, transformer models, text generation, performance evaluation, natural language processing

ICISCM-1487

REAL-TIME PATH PLANNING FOR AUTONOMOUS DRONES USING REINFORCEMENT LEARNING AND DYNAMIC OBSTACLE AVOIDANCE

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ABSTRACT

Autonomous drones operating in dynamic environments require efficient and reliable path planning algorithms to navigate safely while adapting to moving obstacles and unpredictable conditions. This paper presents a real-time path planning framework that integrates deep reinforcement learning (DRL) with dynamic obstacle avoidance mechanisms to guide unmanned aerial vehicles (UAVs) through complex and cluttered spaces. The proposed system employs a DRL-based policy trained using a simulated environment with continuously changing obstacle configurations and navigation goals. A hybrid reward function is designed to balance navigation efficiency, energy consumption, and collision risk. In addition to DRL, a reactive obstacle detection and avoidance module is integrated using lidar and visual sensors to provide short-term trajectory adjustments based on real-time perception. The framework is evaluated in both simulated and physical drone testbeds. Results demonstrate significant improvements in trajectory smoothness, goal-reaching success rate, and adaptability when compared to traditional planning algorithms such as A* and RRT*. Moreover, the learned policy generalizes well to unseen environments and dynamic changes without retraining, ensuring robust performance in real-world deployments. This study validates the potential of combining reinforcement learning with sensor-driven obstacle avoidance for achieving high-performance autonomous navigation, making it suitable for applications such as delivery, surveillance, and disaster response.

Keywords: autonomous drones, path planning, reinforcement learning, obstacle avoidance, real-time navigation

ICISCM-9342

HYBRID OPTIMIZATION TECHNIQUES FOR ENERGY-EFFICIENT AND COLLISION-FREE DRONE NAVIGATION IN COMPLEX ENVIRONMENTS

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ABSTRACT

Efficient and safe navigation of autonomous drones in complex environments remains a significant challenge due to constraints such as limited battery capacity, dynamic obstacles, and spatial complexity. This paper proposes a hybrid optimization framework that integrates metaheuristic algorithms with local search strategies to achieve energy-efficient and collision-free navigation. The system combines the global exploration capability of algorithms such as Particle Swarm Optimization (PSO) and Ant Colony Optimization (ACO) with real-time refinement using gradient-based local optimization. The objective is to generate optimal flight paths that minimize total energy consumption while ensuring obstacle avoidance and path smoothness. A multi-objective cost function is formulated to balance flight distance, velocity changes, obstacle proximity, and energy usage. The environment is modeled using 3D occupancy grids updated through onboard sensors, allowing for dynamic replanning in real time. Simulation experiments are conducted in various complex terrains, including urban canyons, forested areas, and indoor environments with moving obstacles. Results demonstrate that the hybrid method consistently outperforms standalone optimization algorithms in terms of navigation success rate, energy efficiency, and safety margin. The approach is validated on both simulated and real quadrotor platforms, showing scalability and robustness to environmental uncertainty. This research provides a promising path toward deploying autonomous drones in safety-critical missions such as disaster monitoring, environmental surveying, and last-mile delivery in cluttered spaces.

Keywords: drone navigation, hybrid optimization, energy efficiency, collision avoidance, autonomous systems

ICISCM-2569

DESIGN AND IMPLEMENTATION OF AI-ENABLED WEARABLE SYSTEMS FOR CONTINUOUS HEALTH MONITORING

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ABSTRACT

Continuous health monitoring through wearable technology offers a transformative approach to preventive care, early diagnosis, and chronic disease management. This paper presents the design and implementation of an AI-enabled wearable system capable of real-time physiological signal acquisition, intelligent data interpretation, and health status prediction. The proposed system integrates multi-modal sensors for tracking vital signs, including heart rate, blood oxygen level, skin temperature, and movement patterns. Embedded AI algorithms, particularly lightweight deep learning models and anomaly detection mechanisms, are deployed on edge computing modules within the wearable device to enable on-device processing and minimize latency. A cloud synchronization module supports longitudinal health data analysis and remote monitoring by healthcare professionals. The system also includes personalized alert thresholds and adaptive learning features that refine predictions based on user-specific health profiles. Extensive testing is conducted across different use cases, including sleep monitoring, physical activity tracking, and stress detection. Results demonstrate high accuracy in vital sign monitoring and anomaly identification, with minimal energy consumption and extended device uptime. The wearable system ensures user comfort and long-term usability through ergonomic design and low-power wireless communication. This research highlights the feasibility of combining wearable hardware, embedded AI, and cloud integration to support scalable, proactive, and individualized health monitoring in real-world settings.

Keywords: wearable systems, health monitoring, embedded AI, physiological sensing, edge computing

ICISCM-4789

SENSOR FUSION AND MACHINE LEARNING TECHNIQUES FOR REAL-TIME ANALYSIS IN WEARABLE HEALTH DEVICES

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ABSTRACT

The integration of sensor fusion with machine learning techniques has significantly enhanced the capabilities of wearable health devices, enabling real-time monitoring and intelligent analysis of physiological signals. This paper presents a comprehensive framework that combines multi-sensor data fusion with advanced machine learning models to improve accuracy, reliability, and responsiveness of wearable health monitoring systems. The approach utilizes data from biosensors such as heart rate, accelerometer, electrodermal activity, and skin temperature, fused using adaptive filtering and feature-level fusion strategies. These signals are processed by lightweight machine learning models including decision trees, support vector machines, and deep neural networks optimized for edge deployment. The framework supports continuous real-time analysis for detecting anomalies, recognising activity patterns, and predicting health risks. A modular architecture enables efficient sensor integration, noise reduction, and energy-efficient processing. The system is validated through real-world scenarios such as stress detection, physical activity classification, and early warning for cardiovascular anomalies. Experimental results show improved detection accuracy and reduced false alarms compared to single-sensor systems, demonstrating the effectiveness of combining sensor fusion with machine learning to transform wearable health devices into intelligent, context-aware systems delivering actionable health insights in real time.

Keywords: sensor fusion, wearable health devices, real-time analysis, machine learning, physiological monitoring

ICISCM-6147

ANOMALY-BASED INTRUSION DETECTION IN NETWORK TRAFFIC USING ENSEMBLE MACHINE LEARNING MODELS

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ABSTRACT

The growing complexity and volume of network traffic, traditional signature-based intrusion detection systems often fail to detect novel and sophisticated cyberattacks. This paper presents an anomaly-based intrusion detection framework that leverages ensemble machine learning models to identify malicious behavior in real-time network traffic. The proposed system uses a hybrid ensemble of classifiers, including Random Forest, Gradient Boosting, and Extra Trees, to capture diverse patterns of normal and abnormal activity. A comprehensive feature extraction pipeline is designed to process raw traffic data into statistically and temporally meaningful attributes, such as flow duration, packet inter-arrival time, protocol usage, and byte distribution. Dimensionality reduction and feature selection techniques are applied to eliminate redundancy and enhance model performance. The ensemble model is trained and tested on publicly available datasets such as NSL-KDD and CIC-IDS2017, ensuring a representative mix of attack vectors and traffic behaviors. Evaluation metrics, including accuracy, precision, recall, F1-score, and area under the ROC curve, demonstrate that the ensemble outperforms individual classifiers and traditional intrusion detection techniques. Moreover, the system is capable of real-time detection with low latency, making it suitable for deployment in high-throughput environments. This study illustrates the effectiveness of ensemble learning in enhancing the robustness and adaptability of intrusion detection systems in dynamic and evolving cyber threat landscapes.

Keywords: intrusion detection, anomaly detection, ensemble learning, network traffic, cybersecurity

ICISCM-3702

DEEP LEARNING APPROACHES FOR DETECTING ADVANCED PERSISTENT THREATS IN CYBERSECURITY SYSTEMS

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ABSTRACT

Advanced Persistent Threats (APTs) pose a critical challenge to cybersecurity due to their stealthy, prolonged, and adaptive nature. This study proposes a deep learning-based framework for the detection of APTs by analyzing complex patterns in system behavior and network traffic. The framework employs a combination of recurrent neural networks (RNNs), particularly Long Short-Term Memory (LSTM) models, and convolutional neural networks (CNNs) to capture both temporal dependencies and spatial features in large-scale, high-dimensional cybersecurity datasets. Log files, user behavior data, and network communication streams are preprocessed and encoded to extract time series features and anomaly indicators. The deep models are trained on labeled datasets comprising both benign and malicious activity, with a focus on detecting early-stage APT indicators such as privilege escalation, lateral movement, and command-and-control communication. Evaluation is conducted using benchmark datasets and simulated attack environments that mirror real-world APT scenarios. Results show that the deep learning models outperform traditional machine learning classifiers in terms of detection accuracy, false positive rate, and adaptability to novel attack strategies. The system also incorporates an attention mechanism to enhance interpretability and identify key indicators contributing to model decisions. This research demonstrates that deep learning provides a scalable and intelligent solution for real-time APT detection and supports the proactive defense of critical infrastructure and sensitive digital assets.

Keywords: advanced persistent threats, deep learning, cybersecurity, anomaly detection, LSTM networks

ICISCM-5921

DESIGNING CONTEXT-AWARE CONVERSATIONAL AGENTS FOR ENHANCED CUSTOMER ENGAGEMENT IN SERVICE PLATFORMS

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ABSTRACT

Conversational agents have become integral to customer service platforms, but many still operate with limited contextual understanding, leading to fragmented interactions and reduced user satisfaction. This study proposes a context-aware conversational agent architecture designed to improve customer engagement by leveraging user-specific and situational context. The framework incorporates dialogue state tracking, user intent recognition, and personalized response generation powered by transformer-based natural language processing models. Contextual data, including previous interactions, user preferences, platform usage patterns, and real-time service queries, is dynamically integrated into the agent's decision-making process using a multi-level context manager. The architecture supports proactive interaction strategies such as recommending relevant services or solutions before the user articulates a complete query. A reinforcement learning mechanism continuously optimizes dialogue policies based on user feedback and engagement metrics, enhancing adaptability across diverse service scenarios. Evaluation is conducted using synthetic and real-world datasets from e-commerce and customer support environments. Results show significant improvements in task completion rates, response relevance, and user satisfaction when compared to baseline rule-based and stateless conversational systems. The system also demonstrates robustness in handling ambiguous or multi-intent queries through its hierarchical context resolution mechanism. This research underscores the value of contextual awareness in conversational design and presents a scalable, intelligent solution for elevating user experience in digital customer service platforms.

Keywords: conversational agents, context awareness, customer engagement, natural language processing, dialogue systems

ICISCM-8013

NATURAL LANGUAGE UNDERSTANDING AND DIALOGUE MANAGEMENT TECHNIQUES FOR SCALABLE CUSTOMER SUPPORT SYSTEMS

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ABSTRACT

As customer support operations expand across digital platforms, scalable and intelligent automation has become essential for delivering consistent and high-quality service. This paper presents an integrated framework that leverages Natural Language Understanding (NLU) and Dialogue Management (DM) techniques to enhance the performance of automated customer support systems. The proposed architecture combines intent classification, named entity recognition, and contextual embedding through transformer-based models such as BERT and RoBERTa for accurate interpretation of user inputs. A modular dialogue manager utilizes reinforcement learning and rule-based logic to guide conversations, ensuring relevance, continuity, and efficient task resolution. To support scalability, the system incorporates a hierarchical dialogue flow and dynamic memory modules, allowing it to handle multi-turn interactions and personalized query resolution. Training and evaluation are conducted using publicly available and proprietary datasets spanning e-commerce, banking, and technical support domains. Metrics such as dialogue success rate, user satisfaction score, and response latency benchmark performance against conventional chatbot systems. Results show significant improvements in natural language understanding accuracy and dialogue coherence, enabling the system to manage high volumes of user queries without compromising response quality.

Keywords: natural language understanding, dialogue management, customer support, conversational AI, transformer models

ICISCM-4275

DECENTRALIZED COORDINATION STRATEGIES IN SWARM ROBOTICS FOR EFFICIENT SEARCH AND RESCUE OPERATIONS

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ABSTRACT

Swarm robotics offers a promising solution for search and rescue (SAR) missions in complex and hazardous environments where centralized control is impractical or unreliable. This paper presents a decentralized coordination framework for swarm robotic systems aimed at enhancing operational efficiency, adaptability, and robustness in SAR scenarios. The proposed strategy relies on local communication, distributed decision-making, and behavior-based control, allowing individual robots to operate autonomously while maintaining collective mission objectives. Each agent in the swarm is equipped with simple sensors and limited processing capabilities, and coordination emerges from shared heuristics such as pheromone-based signaling, virtual force fields, and consensus algorithms. To improve coverage and reduce redundancy, we integrate adaptive role allocation and dynamic task reassignment mechanisms that respond to environmental changes and partial robot failures. Simulation experiments are conducted in disaster-like environments, including collapsed structures and open terrain with uneven obstacle distribution. Performance metrics such as coverage efficiency, victim detection time, energy consumption, and fault tolerance are evaluated. Results demonstrate that the decentralized approach achieves superior scalability and resilience, especially under communication constraints and partial system failures. The findings support the feasibility of deploying swarm robotic systems in real-world SAR operations where rapid, flexible, and robust coordination is essential for mission success.

Keywords: swarm robotics, Coverage Efficiency, search and rescue, collective intelligence, Scalability

ICISCM-3658

MULTI-AGENT PATH PLANNING AND COMMUNICATION PROTOCOLS FOR AUTONOMOUS SWARM-BASED DISASTER RESPONSE

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ABSTRACT

In disaster response scenarios, swarm-based autonomous systems offer a scalable and flexible solution for rapid environmental assessment, search, and coordination in hazardous or inaccessible areas. This paper proposes a comprehensive framework for multi-agent path planning and inter-agent communication tailored to the unique challenges of swarm-based disaster response. The approach integrates a decentralized path planning algorithm using priority-based task allocation and dynamic replanning to ensure effective area coverage and obstacle avoidance. Each agent independently computes its trajectory while accounting for shared goals, environmental constraints, and real-time updates from other swarm members. A robust communication protocol based on lightweight, delay-tolerant message passing enables agents to maintain awareness of nearby units and collaboratively avoid path conflicts. The protocol supports asynchronous data exchange and redundant routing to ensure message delivery in degraded network conditions often present in disaster zones. The system is tested in simulated post-disaster environments such as collapsed buildings, forest fires, and flood zones, evaluating key performance indicators including mission completion time, path efficiency, network reliability, and fault tolerance. Results show that the proposed framework significantly improves coordination efficiency and overall mission robustness compared to traditional centralized systems and naïve decentralized approaches. This research demonstrates the potential of integrating intelligent path planning with resilient communication strategies for enabling autonomous swarm agents to perform coordinated and effective disaster response operations.

Keywords: multi-agent systems, path planning, swarm robotics, disaster response, communication protocols

ICISCM-7584

DEEP LEARNING AND MOLECULAR DOCKING INTEGRATION FOR ACCELERATED DRUG CANDIDATE SCREENING

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ABSTRACT

The process of drug discovery demands extensive screening of molecular compounds, a task traditionally dependent on time-intensive and resource-heavy laboratory testing. To address this challenge, this paper presents an integrated framework that combines deep learning techniques with molecular docking simulations for accelerated and scalable drug candidate screening. The proposed approach utilizes convolutional and graph neural networks trained on large-scale chemical datasets to predict binding affinities and molecular properties critical to therapeutic efficacy. These deep learning models are employed as a pre-screening filter to rapidly eliminate low-potential compounds and prioritize candidates with high likelihoods of success. Selected top-ranking compounds are subsequently subjected to molecular docking simulations that assess their interactions with specific target proteins based on binding energy and conformation stability. The integration is designed to minimize computational overhead while preserving predictive accuracy by harmonizing data-driven learning with physics-based docking. Performance is validated using benchmark datasets and known protein-ligand complexes, demonstrating a significant reduction in screening time and an increase in early identification of viable candidates compared to traditional docking-only pipelines. The system also exhibits adaptability to novel targets and compound libraries through transfer learning techniques. This research highlights the synergy between deep learning and molecular modeling, offering a promising direction for enhancing the efficiency and precision of modern drug discovery pipelines.

Keywords: deep learning, molecular docking, drug discovery, virtual screening, binding affinity prediction

ICISCM-4963

GRAPH NEURAL NETWORKS FOR PREDICTING DRUG-TARGET INTERACTIONS IN COMPUTATIONAL DRUG DISCOVERY PIPELINES

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ABSTRACT

Predicting drug-target interactions (DTIs) accurately is a critical step in computational drug discovery, enabling the identification of promising therapeutic candidates while reducing experimental costs. This paper proposes a novel framework leveraging graph neural networks (GNNs) to model complex relationships between chemical compounds and biological targets. GNNs effectively capture structural information by representing molecules and proteins as graphs, where nodes correspond to atoms or amino acids and edges reflect chemical bonds or spatial proximity. The proposed approach integrates molecular graph embeddings with protein sequence or structure features to learn joint representations that facilitate DTI prediction. A multi-task learning setup is employed to simultaneously predict binding affinity and interaction likelihood, improving generalization across diverse drug and target classes. The model is trained and validated on multiple benchmark datasets, including DrugBank, BindingDB, and DAVIS, using metrics such as area under the receiver operating characteristic curve (AUROC), precision-recall, and mean squared error for regression tasks. Experimental results demonstrate that the GNN-based method surpasses traditional machine learning and other deep learning baselines in both accuracy and robustness. Additionally, interpretability analyses provide insights into key molecular substructures and protein residues driving interactions. This study underscores the potential of graph neural networks to enhance computational drug discovery pipelines by enabling efficient, scalable, and interpretable prediction of drug-target interactions.

Keywords: graph neural networks, drug-target interactions, computational drug discovery, molecular representation, deep learning

ICISCM-6127

FEDERATED LEARNING FRAMEWORKS FOR PRIVACY-PRESERVING DATA ANALYSIS IN DISTRIBUTED ENVIRONMENTS

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ABSTRACT

The increasing volume of distributed data across various organizations has created significant opportunities for collaborative analytics while raising critical concerns about data privacy and security. Federated learning (FL) has emerged as a promising paradigm that enables multiple parties to jointly train machine learning models without sharing raw data, thus preserving privacy and complying with data protection regulations. This paper presents a comprehensive review and evaluation of federated learning frameworks designed for privacy-preserving data analysis in heterogeneous distributed environments. Key components such as secure aggregation protocols, differential privacy mechanisms, and communication-efficient model updates are examined to address challenges including data heterogeneity, system scalability, and adversarial threats. We propose an enhanced federated learning architecture that integrates adaptive client selection, encrypted model parameter exchange, and robust aggregation techniques to improve learning efficiency and resilience against malicious participants. Experimental validation is conducted on benchmark datasets simulating healthcare, finance, and IoT applications to demonstrate the framework's capability in maintaining high model accuracy while safeguarding sensitive information. Performance metrics, including convergence rate, communication overhead, and privacy guarantees, are analyzed to highlight trade-offs and optimization strategies.

Keywords: federated learning, privacy preservation, distributed machine learning, secure aggregation, data heterogeneity

ICISCM-2839

HOMOMORPHIC ENCRYPTION AND SECURE MULTIPARTY COMPUTATION FOR CONFIDENTIAL MACHINE LEARNING WORKFLOWS

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ABSTRACT

Ensuring data confidentiality while performing collaborative machine learning across multiple parties remains a significant challenge, especially in sensitive domains such as healthcare, finance, and defense. This paper explores the integration of homomorphic encryption (HE) and secure multiparty computation (SMPC) techniques to develop secure and privacy-preserving machine learning workflows. Homomorphic encryption enables computation directly on encrypted data without decryption, preserving confidentiality throughout the processing pipeline, while SMPC allows multiple parties to jointly compute functions over their inputs without revealing them to each other. The proposed framework combines these cryptographic primitives to support training and inference of machine learning models in a distributed and confidential manner. We detail protocols for secure data aggregation, model parameter updates, and inference computations under encryption, optimizing for computational efficiency and communication overhead. Experimental evaluations on benchmark datasets demonstrate that the hybrid approach maintains high model accuracy comparable to plaintext computation while providing strong security guarantees against semi-honest adversaries. The framework addresses challenges of scalability and latency through novel parallelization and batching techniques, making it suitable for practical deployment in real-world confidential machine learning applications. This research underscores the potential of cryptographic methods to enable trustworthy, collaborative AI systems without compromising sensitive data privacy.

Keywords: homomorphic encryption, secure multiparty computation, confidential machine learning, privacy-preserving AI, cryptographic protocols

ICISCM-5376

ROBUST NAMED ENTITY RECOGNITION IN NOISY USER-GENERATED TEXT USING NOISE-AWARE TRANSFORMER MODELS

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ABSTRACT

Named Entity Recognition (NER) in user-generated text presents unique challenges due to frequent spelling errors, informal language, slang, and inconsistent grammar. Traditional NER models, trained on clean, formal text, often suffer performance degradation when applied to noisy, real-world data from social media, forums, and online reviews. This paper proposes a noise-aware transformer-based framework designed to improve robustness in NER tasks on noisy user-generated content. The approach integrates a noise modeling module with pre-trained transformer architectures such as BERT and RoBERTa, enabling the system to learn noise patterns explicitly during training. A novel data augmentation strategy simulates common noise types, including misspellings, character swaps, and informal abbreviations, to enhance model generalization. The framework incorporates contextual embeddings and attention mechanisms that help disambiguate entities despite input noise. Extensive experiments are conducted on benchmark noisy datasets and real-world social media corpora, comparing the proposed method with state-of-the-art NER models. Evaluation metrics such as precision, recall, and F1-score demonstrate significant improvements in recognizing entities under noisy conditions. The system also exhibits better adaptability to unseen noise patterns and languages, highlighting its potential for diverse applications in sentiment analysis, information extraction, and social media monitoring. This research contributes a scalable, effective solution for enhancing NER accuracy in noisy, unstructured text environments.

Keywords: named entity recognition, noisy text, transformer models, noise-aware learning, user-generated content

ICISCM-4690

ENHANCING ENTITY EXTRACTION FROM SOCIAL MEDIA AND INFORMAL TEXTS WITH CONTEXTUAL EMBEDDINGS AND DENOISING TECHNIQUES

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ABSTRACT

Named Entity Recognition (NER) in noisy text environments such as social media posts, online forums, and user-generated content presents significant challenges due to the presence of spelling mistakes, informal language, abbreviations, and inconsistent grammatical structures. These factors severely degrade the performance of conventional NER models that are typically trained on clean, formal text corpora. This paper proposes a robust framework that combines transformer-based language models with advanced noise augmentation techniques to improve entity recognition accuracy on noisy and unstructured texts. The approach incorporates pre-trained transformer architectures, such as BERT and RoBERTa, fine-tuned on augmented datasets where synthetic noise mimicking real-world errors is introduced. This noise includes typographical errors, slang, code-mixing, and colloquial expressions. By explicitly exposing the model to these variations during training, the system gains the ability to generalize better and maintain robust performance in practical applications. Extensive experiments on benchmark datasets drawn from social media and conversational text demonstrate that the proposed method significantly outperforms baseline models in precision, recall, and F1-score metrics. Furthermore, the model shows strong resilience to varying noise intensities and can be effectively applied across multiple languages and domains without extensive retraining.

Keywords: named entity recognition, noisy text, transformer models, noise augmentation, user-generated content

ICISCM-6985

FUSION OF INTELLIGENT SENSOR DATA FOR ADAPTIVE ROBOTIC NAVIGATION IN UNSTRUCTURED ENVIRONMENTS

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ABSTRACT

Effective navigation of autonomous robots in complex and unstructured environments demands the seamless integration of diverse sensor data to address challenges such as dynamic obstacles, varying lighting conditions, and unpredictable terrain. This paper proposes an advanced multi-sensor fusion framework that combines inputs from LiDAR, vision cameras, inertial measurement units (IMUs), and ultrasonic sensors to create a comprehensive understanding of the robot's surroundings. The framework employs probabilistic fusion algorithms alongside deep learning techniques to integrate heterogeneous sensor data into a unified spatial representation, enabling robust localization, mapping, and obstacle avoidance. A novel adaptive sensor weighting mechanism is introduced, which dynamically adjusts the influence of each sensor based on environmental context and sensor reliability, thereby enhancing system resilience against sensor noise, occlusions, and failures. The approach also incorporates real-time data processing capabilities to support responsive navigation in rapidly changing conditions. Extensive experiments conducted in both simulated and real-world unstructured scenarios demonstrate significant improvements in path accuracy, obstacle detection, and computational efficiency compared to conventional single-sensor or naive fusion methods. The results validate the effectiveness of the proposed sensor fusion framework in facilitating autonomous robotic navigation that is both reliable and scalable across diverse environments. This research contributes to the development of intelligent robotic systems capable of adaptive and safe operation in challenging settings, advancing the state of autonomous navigation technology.

Keywords: multi-sensor fusion, autonomous navigation, robotic systems, probabilistic algorithms, environment perception

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DEEP LEARNING-BASED PERCEPTION AND MAPPING USING SMART SENSORS FOR AUTONOMOUS ROBOT NAVIGATION

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ABSTRACT

Autonomous navigation in robots operating within complex and dynamic environments demands advanced perception and mapping capabilities to ensure accuracy, reliability, and safety. This paper presents a novel deep learning-driven framework that leverages data from an array of smart sensors, including LiDAR, RGB-D cameras, and inertial measurement units, to improve environmental understanding and support robust real-time navigation. By integrating convolutional neural networks and recurrent neural networks, the system performs detailed semantic segmentation and object detection, allowing the identification of obstacles, landmarks, and navigable spaces. This detailed semantic information is fused with spatial data from various sensors to build high-fidelity environmental maps that adapt dynamically to changes and uncertainties in the surroundings. The framework is designed to balance computational efficiency with high accuracy, making it suitable for deployment on resource-constrained robotic platforms. Extensive experiments conducted on publicly available benchmark datasets as well as real-world robotic navigation scenarios demonstrate that the proposed method significantly improves mapping precision, obstacle recognition, and navigation success rates compared to conventional sensor processing approaches. The deep integration of learning-based perception with smart sensor fusion contributes to enhanced situational awareness, enabling safer and more effective robot navigation in unstructured and evolving environments. This research advances the state-of-the-art in autonomous robotic systems and lays a foundation for future intelligent navigation applications that require robust, adaptable perception and mapping capabilities.

Keywords: deep learning, smart sensors, autonomous navigation, perception, environmental mapping