

Book Abstract of

The 9th Global Symposium
on Smart Computing
and Systems

G3S'25



Chairs of G3S'25 :

- ◆ Mohamed BASLAM
- ◆ Hicham ZOUGAGH
- ◆ Muhammad SARFRAZ



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G3S'25

In 2025, we had the great opportunity to organize the 9th Global Symposium on Smart Computing and Systems (G3S 2025). The conference has grown to be a reputable event for the scientific and business communities. This book of proceedings collects papers accepted for presentation at G3S 2025.

G3S 2025 was organized by the Faculty of Sciences and Techniques (FST) and the laboratory of Information Processing and Decision Support (TIAD) at Sultan Moulay Slimane University along with the Association of Business Intelligence (AMID), and held during November 27 - 29, 2025 (G3S'25), Beni Mellal, Morocco.

For this edition, we received 81 submissions, which were reviewed by a Program Committee of 98 international experts in various fields related to business intelligence and decision support. Out of these submissions, the Program Committee decided to accept 30 regular papers, yielding an acceptance rate of 37%. The contributions are organized in topical sections: Intelligent Models and Smart Decision Systems; Connected Intelligence and Distributed Architectures; and Secure, Trusted, and Data-Driven Ecosystems.

As program chairs of G3S 2025 and editors of these proceedings, we would like to thank the President of Sultan Moulay Slimane University and the Dean of the Faculty of Sciences and Techniques for their support to the conference. In addition, we want to warmly thank again all the authors for their highquality contributions and all the Program Committee members for their invaluable hard work. We also sincerely thank our keynote speakers for sharing their precious insights and expertise. Finally, our special thanks go to the Organizing Committee and to all the local arrangements coordinators. We cordially invite you to visit the G3S website at <https://g3symposium.com/> and to join us at future G3S conferences.

Organizing committee

Mohamed BASLAM Hicham ZOUGAGH Muhammad SARFRAZ

Timetable

KL : Keynote Lecture

CT : Contributed Talk

 All times in the program are given in GMT+1

Thursday, 27 of November

09:00		Registration and Reception 📍 Conference room hall
10:00		Opening & Welcome from discussion Panel members 📍 Conference room
11:00	KL	Plenary session 01: Chair : Said Hamdioui 📍 Conference room <i>Title:</i> IoT, Blockchain, Big Data Technologies and Predictive Analytics to Enable the Development of Cyber-Physical Smart Cities 🎤 Keynote Speaker: Aawatif Hayar
11:45		Morning Coffee Break 📍 Conference room hall
12:15	KL	Plenary session 02: Chair : Ismail Khalil 📍 Conference room <i>Title:</i> Silicon Nations: How AI and Chips Are Rewriting Global Power 🎤 Keynote Speaker: Said Hamdioui
13:00		Lunch Break
15:00	KL	Plenary session 03: Chair : Aawatif Hayar 📍 Conference room <i>Title:</i> AI Agents: Building Autonomy That Thinks, Acts, and Collaborates 🎤 Keynote Speaker: Ismail Khalil
15:45	CT	Session 01: Chair : Youssef EL MOURABIT 📍 Conference room <i>Title:</i> Applied AI & Domain-Specific Solutions
15:45	CT	Session 02: Chair : Mohamed BINIZ 📍 Room 1 Bloc C <i>Title:</i> Cybersecurity & Trustworthy AI Ecosystems
17:45		Afternoon Coffee Break 📍 Conference room hall

Friday, 28 of November

09:00		Registration and Reception 📍 Conference room hall	
09:30	KL	Plenary session 04: Chair : Mohamed BAKHOUYA 📍 Conference room	<i>Title:</i> IoSat, revolution of AI via Satellites 🎤 Keynote Speaker: Mohamed Kayyali
10:15	KL	Plenary session 05: Chair : Moulay Driss EL OUADGHIRI 📍 Conference room	<i>Title:</i> Empowering Socio-Technical communities using IoT and Blockchain, Technologies 🎤 Keynote Speaker: Mohamed BAKHOUYA
11:00		Morning Coffee Break 📍 Conference room hall	
11:30	CT	Session 03: Chair : Driss AIT OMAR 📍 Conference room	<i>Title:</i> Distributed Computing & Edge Intelligence
14:30		Lunch Break	
16:30	CT	Session 04: Chair : Abderrazak Farchane 📍 Conference room	<i>Title:</i> Computer Vision & Autonomous Perception
16:30	CT	Session 05: Chair : Lekbir Afraites 📍 Room 1 Bloc C	<i>Title:</i> Intelligent Decision Systems & Recommender Models
16:30	CT	Session 06: Chair : Imane Chakour 📍 Online Session https://meet.google.com/tci-yefb-kgo	<i>Title:</i> Theoretical Foundations & Advanced Models
18:30		Afternoon Coffee Break 📍 Conference room hall	

Saturday, 29 of November

09:00 –12:00	Social Event, Excursion		
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Keynote Lecture 01:

IoT, Blockchain, Big Data Technologies and Predictive Analytics to Enable the Development of Cyber-Physical Smart Cities

KL

Aawatif Hayar

📍 University Hassan II, Morocco

Biography - Pr. Aawatif HAYAR is Expert in social policies and Artificial Intelligence driven inclusive sustainable smart cities and territories. Strategic Advisor at Presidency of University Mohammed VI Polytechnic on Artificial Intelligence driven Smart Cities in charge of Smart Campus project. Former Minister of Solidarity, Social Inclusion and Family 2021-2024. She received, with honors, as the First Moroccan, the degree of "Agrégation" in Electrical Engineering from Ecole Normale Supérieure de Cachan in 1992. She received the "Diplôme d'Etudes Approfondies" in Signal processing Image and Communications and the degree of Engineer in Telecommunications Systems and Networks from ENSEEIHT de Toulouse in 1997. She received with honors the Ph.D. degree in Signal Processing and Telecommunications from Institut National Polytechnique in Toulouse in 2001.

She was research and teaching associate at EURECOM's Mobile Communication Department from 2001 to 2010 in Sophia Antipolis-France. Aawatif Hayar has an HDR (Habilitation à Diriger la Recherche) from University Sud Toulon Var from France on Cognitive Wideband Wireless Systems on 2010 and an HDR on Green Télécommunication from University Hassan II Casablanca on 2013. From 2011 till June 2019, Aawatif Hayar had Professor position at the engineering school ENSEM of University Hassan II Casablanca. From June 2019 till October 2021, Pr. Aawatif Hayar was appointed President of the University Hassan II of Casablanca-Morocco and is the second female in the history of Morocco to occupy this position. She is also member of Casablanca "Avant-garde" City think-tank. Her research interests includes fields such as cognitive green communications systems, UWB systems, smart grids, smart sustainable social development, e-governance, open data for citizens, frugal social smart cities, social policies, ICT4good, Artificial Intelligence driven smart cities and communities.

Pr. Aawatif Hayar is also IEEE DLT Chair for EMEA region on 2014 and the designer of Frugal Social Sustainable Smart City concept for Casablanca and emerging countries which was selected by IEEE Smart City initiative as one of the most innovative projects in the world in 2015. Pr. Aawatif Hayar is currently Chair of Casablanca IEEE Core Smart City project. She was also selected by the prestigious African Innovation Foundation as one of the top ten innovative African women in 2015. Aawatif Hayar has developed "Frugal Social Collaborative Sustainable Smart City Casablanca", a new concept for smart city transformation which was distinguished by IEEE Smart city initiative in 2015 as an innovative cost effective inclusive smart city concept. She is the Scientific Advisor, at the City level, of Smart City Expo Casablanca and General Co-Chair of IEEE international Conference on Smart Cities (IEEE ISC2 -2019). Pr Hayar was elected in September 2021 member of the AUF (Agence Universitaire de la Francophonie) Council at the international level. Pr. Aawatif Hayar is currently leading or involved in a couple of R&D/Innovation projects with the City of Casablanca, the region Casablanca Settat, CNRST, INDH, GIZ and Heinrich Böll Stiftung such as End to End Energy Efficiency Living Lab, Virtual Museum of Casablanca, e-douar "Smart Inclusive Ecological village" and Solar Decathlon Africa E-Co Dar and Benguerir Smart City ASToN AFD projects.

Keynote Lecture 02:

Silicon Nations: How AI and Chips Are Rewriting Global Power

KL

Said Hamdioui

📍 Delft University of Technology, Netherlands

Biography - Said Hamdioui (ce.ewi.tudelft.nl/hamdioui) is Chair Professor of Dependable and Emerging Computer Technologies and Head of the Computer Engineering Laboratory at Delft University of Technology (TU Delft), Netherlands. He is also the founder and CEO of a startup focused on manufacturing test solutions for emerging technologies. His research bridges emerging paradigms—such as in-memory and brain-inspired computing—with hardware dependability, including testability, reliability, and security. Before entering academia, he held various roles at Intel (USA), Philips Semiconductors R&D (France), and NXP (Netherlands), gaining extensive industrial experience. He holds four patents, authored one book, co-authored two others, and has published over 330 peer-reviewed papers.

Prof. Hamdioui has provided consulting and training to leading semiconductor companies, including Intel, NXP, STMicroelectronics, Renesas, and Huawei. He has collaborated with top academic and industrial partners such as IBM, IMEC, Cadence, ESA, ETH Zurich, and Politecnico di Torino—contributing to advancements in chip design, semiconductors, and electronic design automation (EDA). A frequent keynote speaker and invited lecturer, he has served on editorial boards including IEEE Design & Test, ACM JETC, and IEEE Transactions on VLSI Systems. His accolades include the EDAA Outstanding Dissertation Award, European Commission Innovation Award, multiple HiPEAC Tech Transfer Awards, and more than 20 Best Paper recognitions. He was recognized for the Best Tech Idea of the Netherlands (2021), and awarded the prestigious European Innovation Council Transition Grant in 2025.

Prof. Hamdioui is a Senior Member of IEEE, a Distinguished Lecturer of the IEEE Circuits and Systems Society, and a Fellow of the Netherlands Academy of Engineering. Ranked among the World's Top 2% Scientists (Stanford & Elsevier, 2024), he also serves on strategic advisory boards including AENEAS Scientific Committee (Association for European NanoElectronics Activities), Khalifa University (UAE), and the Advantest–University of Stuttgart graduate program on test and reliability.

Abstract - Artificial Intelligence has become the core infrastructure of modern power, reshaping economies, geopolitics, and society. Yet its rapid rise exposes a critical truth: compute defines capability. Nations that control advanced chips will lead the AI era; those that don't will depend on others for their digital future.

This talk reveals the hidden challenges fueling this global race: explosive growth in computational demand, unsustainable energy use, carbon impact, and deep vulnerabilities tied to foreign infrastructure and semiconductor supply chains. At the same time, AI is unlocking massive new markets in industry, healthcare, and edge systems; these opportunities are accessible only by countries that combine AI adoption with sovereign semiconductor capacity. We outline a forward-looking roadmap: energy-efficient computing, new architectures, and the urgent need to build national semiconductor ecosystems. In a world where AI is infrastructure, the next "Silicon Nations" will be those that unite AI innovation with sovereign compute.

Keynote Lecture 03:

AI Agents: Building Autonomy That Thinks, Acts, and Collaborates

KL

Ismail Khalil

📍 University Linz, Austria

Biography - Ismail Khalil is Deputy Head of the Institute of Telecooperation at Johannes Kepler University (JKU) Linz, Austria, where he has shaped research directions since 2002. He concurrently holds adjunct professorships at Indonesia's leading institutions: the Faculty of Science and Technology (FST) at Syarif Hidayatullah State University Jakarta and Institut Teknologi Indonesia. A computer engineering graduate with habilitation in applied computer science (2008), Dr. Khalil bridges European and Southeast Asian academia through his pioneering work in intelligent systems. As President of the International Organization for Information Integration and Web-based Applications & Services (@WAS), he coordinates global research in emerging technologies. His expertise spans mobile multimedia, cloud architectures, autonomous agents, and semantic web solutions, with 150+ peer-reviewed publications advancing these fields.

Dr. Khalil's research on agent-based ubiquitous environments has particularly influenced smart systems development. Before his current leadership at JKU Linz, he contributed to Utrecht University's Intelligent Systems Group (2001-2002) and directed the AgenCom project at Austria's Software Competence Center Hagenberg (2000-2001). His scholarly impact extends through editorial leadership as Editor-in-Chief of five Q1-ranked journals and mentorship of 25+ PhD candidates. Recognized for interdisciplinary innovation, he actively collaborates with industry partners on IoT and edge computing implementations. His current projects examine ethical AI frameworks and sustainable cloud infrastructures, reflecting his commitment to socially responsible technology. This dual focus on academic excellence and practical application positions him as a thought leader in intelligent web systems and their global implementation.

Keynote Lecture 04:

IoSat, revolution of AI via Satellites

KL

Mohamed Kayyali

📍 International Federation of Global & Green ICT (IFGICT), USA

Biography - Dr. Mohamed Kayyali Certified in Innovation Management from Harvard Business School (HBS), holds a PhD from WCU and was a visiting researcher at the University of California, Santa Barbara (UCSB) within the Image Processing Laboratories under U.S. Defense-funded R&D projects. He serves as an IEEE Industrial Officer and is a Chartered Fellow and ELITE member of the British Computer Society (BCS). In 2013, he was awarded the title of Chartered Scientist by Queen Elizabeth II, and his biography is featured in Who's Who in Science and Engineering. Dr. Kayyali is the author of five indexed books in computer science, IoT, and healthcare, all registered in the Library of Congress (USA), and he has developed a patented theory in image processing alongside numerous journal and conference publications.

A prominent international keynote speaker for the United Nations, IEEE, and the European Union, he has also advised multiple organizations across the USA, the Gulf Cooperation Council (GCC), Latin America, and the Arab League, as well as serving as an invited adviser to ministries of investment and defense in various regions. Currently, he is the CEO and co-founder of 4D Business Consulting, a multinational advisory firm operating in the USA, Spain, Jordan, and Morocco; President of the International Federation of Global ICT (IFGICT), a U.S.-based organization partnering with ITU, IEEE, and the UN; Founder of KSF Space, a non-profit U.S. space foundation; Founder of Time Business News and DNBC.TV, both media ventures based in the USA; and Co-founder of IUEE University.

Keynote Lecture 05:

Empowering Socio-Technical communities using IoT and Blockchain, Technologies

KL

Mohamed BAKHOUYA

📍 International University of Rabat, Morocco

Biography - Mohamed Bakhouya is a professor of computer science at the International University of Rabat. He obtained his HDR from UHA-France in 2013 and his PhD from UTBM-France in 2005. He has more than ten years experiences in participating, coordinating and working in sponsored ICT projects. He was a reviewer of research projects for Agence Nationale de la Recherche, (France, 2011), Ministero dell' Istruzione, dell' Università e della Ricerca (Italy, 2012, 2013, 2016, 2017), Qatar National Research Fund (2019, 2020), European Commission-FP7 (2013-2015), CHIST-ERA (2021-2022) and for CNRST (2022-2024). He was EiC of IJARAS journal and also serves as a guest editor of a number of international journals, e.g., ACM Trans. on Autonomous and Adaptive Systems, Product Development Journal, Concurrency and Computation: Practice and Experience, FGCS, and MICRO. He has published several papers in international journals, books, and conferences. His research interests include various aspects related to the design, validation, and implementation of distributed and adaptive systems, architectures, and protocols.

Abstract - Big data, WSN, and IoT technologies have been proposed for timely gathering and analysing information (i.e., data, events) streams. Similarly, Blockchain technologies can help to build trust, reduce costs, and accelerate transactions processing. Furthermore, decentralization together with peer-to-peer and smart contracts principles, the main core of Blockchain technology, can eliminate single points of failure while increasing the autonomy in handling IoT applications. In this talk, we shed more light on the potential of these technologies for continuous and real-time data monitoring and processing in different real-case applications (e.g, Healthcare and water/energy sharing).

Session 01: Applied AI & Domain-Specific Solutions

Boosted Machine Learning for Fast CU Split Decision in 3D-HEVC Depth Map Inter-coding

CT

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Abstract - The 3D extension of High Efficiency Video Coding (3D-HEVC) compresses both texture sequences and associated depth information. To optimize the coding efficiency of depth data, the standard integrates advanced inter-prediction schemes and a quadtree-based Coding Unit (CU) partitioning mechanism, denoted as depth levels. However, these enhancements considerably increase the encoder's computational burden. This paper proposes a fast depth-level selection strategy that exploits CU homogeneity to accelerate inter-coding. At each level, we derive Average Local Variance (ALV) features and employ them in a binary machine learning model, which establishes adaptive thresholds for partitioning. The derived decision rules enable early CU termination, thereby reducing encoding complexity. Experimental evaluation confirms that the proposed algorithm significantly decreases execution time while preserving rate-distortion performance with negligible degradation.

keywords: 3D-HEVC, Depth Maps, Machine Learning, Inter Prediction

A Novel AI Based Embedded System for Intelligent Solar Tracking to Enhance Renewable Energy Utilization

CT

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⁵ Public Administration and Information Sciences, School of Business, Long Island University, New York, USA.

Abstract - In a world that becomes ever more reliant on the latest technologies, intelligent automation is rapidly reshaping various sectors, with the field of renewable energy leading the automation revolution. This research proposes the design and implementation of an intelligent online solar tracker system based on artificial intelligence (AI), which automatically controls the orientation of solar cells in an embedded system. The proposed work uses machine learning (ML), which is a subset of AI. Three models of machine learning (ML), including Linear Re-

gression, Decision Tree, and XGBoost models, were designed, implemented, and analyzed. The experimental out-come showed that the XGBoost model performed best, recording an accuracy of an incredible 99% with a mean absolute error of 0.646 and a root mean square error of 1.08. The hardware design combines an ESP32 microcontroller board with an Ar-duino Uno board that allows sensor actuations. Data synchronization among all the modules is done by using the real-time database in the Firebase application. The system also uses a corresponding smartphone application developed by using the Flutter application framework. The combination of intelligent embedded systems with machine learning models enables this research work to showcase a cost-effective, portable, and fully automated solution that can increase the efficacy of solar energy installations. The proposed framework attempts to reveal the ever-increasing use of automation by AI models in improving sustainable energy resources.

keywords: Intelligent solar tracking, Energy optimization, Photovoltaic, Machine learning, Embedded system

Adaptive Deep Learning-Based Energy Control for Autonomous Vehicles under Variable Passenger Loads and Dynamic Adhesion Conditions

CT

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Abstract - This paper presents an intelligent braking and energy recovery control strategy for autonomous electric vehicles using deep recurrent neural architectures. Vehicle dynamics, adhesion feedback, and regenerative power prediction of braking are merged for optimizing deceleration stability and efficiency. It was evaluated with real-world driving conditions, including front/rear wheel velocity responses, changing passenger load conditions (100–900 kg), and adhesion command–execution tracking. For the first case, it demonstrates steady deceleration from 80 km/h to rest in 5 s with a low front–rear slip, whereas for the second, it exhibits dynamical oscillations picked up by RNN-based estimations with fast braking events. Generated power varies non-linearly with increased vehicle weight, maximum output approximately 1.2 kW for 900 kg, affirming increased load increases recovery potential. Adhesion control loop exhibits rapid convergence ($\simeq 1.4$ s) between executed and commanded displacements, affirming proposed controller responsiveness. Overall, deep learning architecture achieves a good compromise between brake stability as well as regeneration efficiency, but a reasonable starting point for real-time energy maximization for further autonomous vehicles.

keywords: Autonomous Electric Vehicles, Artificial Intelligence, Deep Learning, Energy Harvesting, Smart Energy Management, Hybrid Energy Systems, Predictive Control.

Casablanca: Morocco's smart city prototype

CT

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Abstract - Rapid urbanisation poses a significant challenge for cities around the world, and Casablanca, Morocco's economic capital, is no exception to this trend. Faced with demographic pressure, environmental issues, and the growing needs for infrastructure and public services, the concept of a Smart City emerges as a strategic solution to improve the quality of life and urban

sustainability. This article examines the process of transforming Casablanca into a smart city by analysing the projects and initiatives implemented in the fields of transport, energy, digital infrastructure, and public services. It also highlights the main challenges encountered, such as traffic congestion, driver stress and drowsiness, outdated infrastructure, and the need to reduce social inequalities. The study emphasises that the success of this transition depends not only on the adoption of innovative technologies but also on effective governance, sustainable urban planning, and active citizen involvement.

keywords: Smart City, Casablanca, Urbanization, Urban Mobility

Ethical Challenges of AI in Public Recruitment in Morocco

CT

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² Mohammed V University in Rabat Faculty of Sciences Rabat (FSR), Morocco

Abstract - This article presents ethical considerations in the use of Artificial Intelligence (AI) in Moroccan government recruitment. The deployment of AI in this context raises significant issues. We survey these challenges, including algorithmic bias, lack of transparency, privacy of information, fairness, responsibility, and potential for augmenting existing inequalities. We cite recent work and statistics to describe Morocco's distinctive case, marked by its accelerating use of AI in various sectors and the government's effort to digitize employment. The primary objective of this study is to explain the main ethical issues mentioned and suggest ways to utilize AI responsibly in the recruitment sector, making sure that efficiency does not come at the cost of fairness and merit, which is important because Morocco is working to modernize governance services and use more AI-based solutions as part of its digital development.

keywords: Artificial Intelligence, Morocco, Public Recruitment, AI Ethics, Algorithmic Bias, Transparency, Data Privacy.

Session 02: Cybersecurity & Trustworthy AI Ecosystems

An Optimized Deep Neural Network for SMS Phishing Detection: A Reliable and Efficient Approach to Mobile Threat Mitigation

CT

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Abstract - Short Message Service (SMS), commonly known as text messaging, is a globally adopted communication medium used by over 5 billion people. However, its simplicity and lack of built-in security have made it a prime target for phishing attacks—known as smishing—which threaten user privacy and financial security. This study presents an optimized Deep Neural Network (DNN) for detecting SMS-based phishing attempts with high reliability and efficiency. The model incorporates TF-IDF for feature extraction, SMOTE to address class imbalance, and regularization techniques including dropout and L2 penalty to enhance generalization. Evaluated on the UCI SMS Spam Collection dataset, the proposed framework achieves 99.43% accuracy and an AUC-ROC of 99.86%, outperforming more complex transformer-based and hybrid deep learning models. With only 186K parameters and a 0.18 ms inference time, the model is lightweight, fast, and well-suited for real-time mobile deployment, offering a practical and scalable solution for modern SMS phishing mitigation.

keywords: SMS Spam Detection, Deep Neural Network, SMOTE, Cybersecurity

An Advanced Denoising Stacked Autoencoder Model for Securing 5G Networks Against Viruses

CT

Mohamed Amine Meddaoui¹ and Mohammed Erritali¹

¹ Data4Earth Laboratory, Sultan Moulay Slimane University, Beni Mellal, Morocco

Abstract - The integration of Artificial Intelligence (AI), the Internet of Things (IoT), and fifth-generation (5G) networks is fueling digital transformation within industries and societies. However, unprecedented connectivity increases the attack surface of modern communication infrastructures, putting 5G networks at risk of advanced cyberattacks and malware. 5G networks consist of dynamic, large-scale, and heterogeneous traffic, thus, the high dependency of traditional intrusion detection systems on signature baselines will not be effective. The present study addresses the issue of designing an SDAE-based framework for intrusion detection capable understanding and adapting to complex, high-dimensional traffic patterns and adapting traffic patterns within the 5G network. Most prior works concentrating on the IoT showed the 5G network's core capabilities that remain central, including network slicing and virtualization. Testing the proposed framework has produced positive results for 5G traffic simulated in the NSL-KDD dataset, achieving an average precision of 95.5%, a recall of 94.4%, and an F1-measure of 94.9%. These results point to the effectiveness of the framework in detecting and classifying anomalous activities in complex 5G network environments and show the framework's robustness and ability to generalize.

keywords: Internet of Things, 5G, Artificial Intelligence, Cybersecurity, Deep Learning, Autoencoders, Intrusion Detection, Network Slicing.

Lightweight PUF-Based Authentication Protocol for IoT

CT

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Abstract - In the Internet of Things (IoT) domain, it is vital to achieve secure and lightweight authentication because of the limited availability of computational, storage, and energy resources on smart devices. In this paper, a new PUF-based authentication protocol specifically tailored to tackle such constraints is proposed. Leveraging the native randomness and individuality of PUFs, the protocol enables safe authentication and identity verification among servers and IoT devices without relying on computationally expensive cryptographic operations. To find its robustness, the new protocol is analytically verified using the AVISPA verification tool and is certified immune to the most common security attacks such as replay, man-in-the-middle, and impersonation attacks. Additional performance analysis offers an end-to-end performance comparison and confirms that the protocol indeed optimizes communication and computation overhead along with offering strong security assurance. These results confirm that the provided solution is best suited for its implementation in real IoT networks where efficiency as well as security is a requirement.

keywords: Internet of Things, Lightweight authentication, PUF, Security protocol, Formal verification, AVISPA, Secure IoT

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Abstract - System logs are a valuable resource for monitoring the health, reliability, and security of large-scale pieces of software. The volume and complexity of contemporary logs have made manual inspection impossible. Therefore, the development of automated anomaly detection methods became necessary. In recent years, deep learning-based methods have gained traction with the introduction of models like DeepLog, LogAnomaly, and LogBERT as three generations of advancement in this field. The purpose of this paper is to improve and compare these three techniques via two commonly existing benchmarks HDFS and BGL. The DeepLog model does sequential modeling of logs through Long Short-Term Memory (LSTM) models. The LogAnomaly model uses semantic representations and then quantitative representations to detect unsupervised anomalies. The LogBERT model leverages transformer-based architectures with self-supervised learning to capture contextual dependencies. We measure their performances based on some metrics like Matthews Correlation Coefficient. The experimental results show that LogAnomaly achieves a strong balance of accuracy and robustness, DeepLog is solid at sequentially detecting anomalies, but is less performant for quantitative phenomena, and LogBERT offers state-of-the-art detection but is more computationally expensive. Overall, the results demonstrate the balance between the accuracy, generalizability, and efficiency of these models, helping researchers choose models that best reflect the practical use case of log anomaly detection.

keywords: Anomaly detection, System logs, Deep learning, LogBERT, LogAnomaly, DeepLog

Federated Learning for Credit Card Fraud Detection: A Comparative Study of Logistic Regression, Random Forest, and XGBoost

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Abstract - Credit card fraud detection relies on machine learning models trained on large and diverse datasets. However, stringent privacy regulations such as GDPR and PSD2 restrict centralized data collection, limiting the applicability of traditional approaches. Federated Learning (FL) provides a de-centralized solution that allows institutions to collaboratively train models without exposing their raw data. In this work, we propose a novel FL framework for fraud detection and conduct a comparative evaluation of Logistic Regression (LR), Random Forest (RF), and Extreme Gradient Boosting (XGBoost) under conditions of severe class imbalance. Our experiments reveal that Federated XGBoost consistently delivers state-of-the-art performance, achieving an AUROC of 0.998 and an AUPRC of 0.918, representing a 176-fold improvement over a random classifier. It also achieves the highest F1-score (0.845), striking a balance between precision (91.4%) and recall (78.5%). By contrast, Federated RF demonstrates competitive but slightly weaker results (AUROC: 0.985), while Federated LR proves insufficient for this task (AUPRC: 0.182). Notably, Federated XGBoost approaches the accuracy of centralized

benchmarks, demonstrating that FL can preserve near-parity in predictive power without requiring data pooling. However, this superior performance comes at a cost: significantly higher computational complexity and communication overhead. Training XGBoost across distributed clients requires substantially more time and bandwidth than lightweight models such as LR. These findings offer clear implications for financial institutions. While simpler models offer efficiency and scalability, ensemble-based approaches, particularly XGBoost, provide the predictive strength necessary for robust fraud detection. Federated Learning thus emerges as a promising paradigm that balances privacy, efficiency, and accuracy, enabling collaborative intelligence in a privacy-preserving manner.

keywords: Federated Learning (FL), Credit Card Fraud Detection, XGBoost (Extreme Gradient Boosting), Random Forest (RF), Logistic Regression (LR), Computational and Communication Costs, Privacy-Preserving Machine Learning, Data Privacy, Imbalanced Datasets.

Session 03: Distributed Computing & Edge Intelligence

Hybrid Clustering Approach Using K-Means, SOM, and DDC for User Mobility Management in Fog Environments

CT

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Abstract - The rapid proliferation of the Internet of Things (IoT) has introduced significant challenges in managing user mobility and allocating resources efficiently within distributed computing environments. Traditional cloud infrastructures are often constrained by latency and bandwidth limitations, making them less suitable for real-time data processing in dynamic mobile contexts. To address these limitations, this study investigates a machine learning-based approach for optimizing user mobility management in mobile fog computing environments. Specifically, we evaluate and compare three clustering algorithms—K-means, Self-Organizing Maps (SOM), and Dynamic Distributed Clustering (DDC). These techniques are employed to improve the classification of mobile users, reduce energy consumption, and enhance resource utilization at the network edge. By leveraging the proximity of fog nodes to end users, the proposed approach alleviates the computational burden on traditional cloud systems and improves system responsiveness. Experimental results indicate that SOM consistently outperforms K-means, especially when resource management strategies are integrated. Both SOM and K-means, when combined with resource management, significantly outperform DDC without resource control. These findings highlight the potential of machine learning-driven solutions to effectively tackle mobility and resource allocation challenges in mobile fog networks, offering scalable and adaptive mechanisms suited for highly dynamic environments.

keywords: Fog, SOM, DDC, K-means, IOT, mobility.

Machine Learning Based Task Offloading for Energy and Execution Time Efficient IoT Devices in MEC Environments

CT

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Abstract - Energy- and service-time-intensive IoT applications create major challenges in computation, communication, and resource management. Although traditional cloud systems offer scalability, they often lead to high energy usage and long service delays, making them impractical for tasks that are both delay-sensitive and energy-restricted. Multi-access Edge Computing (MEC) helps reduce these problems by moving computation closer to IoT devices, yet effective task offloading still faces difficulties due to diverse system architectures and dynamic workloads. This paper introduces a Q-Learning-based offloading framework that adaptively allocates computational tasks across mist, edge, and cloud layers while considering system states, task features, and available resources. Simulation outcomes reveal that the proposed method notably decreases energy consumption and service time, while ensuring balanced CPU utilization and outperforming static offloading methods. The findings underline the capability of reinforcement learning to achieve energy-efficient and low-latency IoT services within emerging MEC environments.

keywords: IoT, MEC, Energy Consumption, Service Time, Machine learnign, Q-Learning

Multi-Agent Reinforcement Learning Approaches for Resource Allocation and Task Offloading ill Mobile Edge Computing Systems

CT

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Abstract - Mobile Edge Computing (MEC) brings computation closer to end users to reduce latency and energy consumption for compute intensive mobile applications. We study joint task offloading and resource allocation in multi-user MEC systems and propose a decentralized control framework based on Multi-Agent Reinforcement Learning (MARL). Each user to base station link acts as an agent that decides whether to execute locally or offload and how much edge compute to request. We implement three learners Q-Learning, Deep Q-Network (DQN), and Double DQN (DDQN) under a centralized training, decentralized-execution paradigm and stabilize training with experience replay, target networks, and soft updates. In a configurable MEC simulator, DDQN consistently achieves lower total cost (latency energy trade-off) than full-local, full-offload, and heuristic baselines, and outperforms Q-Learning and DQN in convergence speed and stability. We also discuss deployment aspects (compute overhead, coordination, and policy updates) and provide a complexity analysis that clarifies when deep RL is preferable to tabular or heuristic methods. Results indicate that lightweight, decentralized MARL is a practical option for dynamic MEC environments and scales with user population and server capacity.

keywords: Mobile Edge Computing, Resource Allocation, Task Offloading, Multi-Agent Reinforcement Learning, Reinforcement Learning, Markov Decision Processus

UAV-CacheTrace v1.0: A 140-Million-Row Synthetic Mobility-Content Trace for Aerial Edge-Caching and Trajectory Planning Research

CT

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Abstract - We present UAV-CacheTrace v1.0, a 140-million-row synthetic mobility-content trace that fuses a 70-day, 100 k-device urban trajectory corpus with time-varying video popularity derived from multi-regional trending statistics. Each record encodes a user identifier, 30-min time slot, 500 m × 500 m geo-cell, requested content ID, category, and file size, yielding a reproducible benchmark for cooperative caching, trajectory planning, and multi-agent reinforcement learning (MARL) in next-generation aerial edge networks. To mimic real workloads, content popularity follows a Zipf-like decay calibrated on viral bursts, while a density-aware spatial partition preserves hotspot heterogeneity. Validation confirms that the trace reproduces circadian and weekly cycles ($r_{24h} = 0.978$) and attains a Zipf exponent $\alpha \approx 0.8$ —values consistent with field measurements. The full CSV (≈ 5 GB), generation scripts, random seeds, and baseline MARL policies are released under CC-BY 4.0, enabling transparent comparison across algorithms and laboratories. By bridging realistic human mobility with non-stationary multimedia demand, UAV-CacheTrace lowers the simulation-to-deployment gap for studies on edge caching, mobility prediction, federated learning, and energy-aware UAV swarms.

keywords: Data papers, Synthetic datasets, Human mobility, Edge caching, UAV swarms, Reinforcement learning

Accelerating Influenza Antiviral Discovery with BOINC Computing

CT

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Abstract - Seasonal influenza continues to represent a major health challenge worldwide, increasingly complicated by the virus's evolving resistance to available treatments. To help address this issue, the Influenza Antiviral Drug Search initiative, conducted by the University of Texas Medical Branch and supported by the World Community Grid via BOINC, relies on the combined computing power of thousands of volunteers around the globe. This distributed framework enables large-scale virtual screening of potential antiviral molecules directed at essential influenza proteins, including neuraminidase, hemagglutinin, and NS1. Through the integration of bioinformatics and molecular modeling, the project demonstrates how collective computing can accelerate the early discovery of antiviral candidates and pave the way toward smarter, AI-assisted drug design in the future. The results illustrate the growing relevance of open, collaborative computing infrastructures in the next generation of biomedical research.

keywords: Influenza, Antiviral, Drug Discovery, BOINC, Distributed Computing, Virtual Screening, Bioinformatics

Session 04: Computer Vision & Autonomous Perception

Detection and Segmentation of Date Fruit Bunch Stalk Using YOLOv8 and SAM Algorithms

CT

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Abstract - The core functionality of any agricultural harvesting robot is its automated fruit detection system. Nevertheless, fruit detection is complicated by arduous environmental conditions, including illumination variance, occlusion from foliage, and the clustering of production. In fact, harvesting date fruit involves many risks, such as worker falls, due to the height of the palm trees. The main challenge in automating this process is accurately identifying the date fruit bunch stalk, as the fruit cluster is attached to this stalk on the palm tree. This paper proposes a method to detect and segment the bunch stalk from images using YOLOv8 model and SAM algorithm, achieving an accuracy of 91.2% and a mean Average Precision (mAP50) of 95.6%. This technique can predict the bounding boxes coordinate of bunch stalk in image, and the SAM algorithm gives the mask of bunch stalk, that can be used to analyze color, size and texture of bunch stalk. We conclude that the YOLOv8 model can be effectively utilized to develop advanced computer vision systems that assist engineers in designing and deploying robotic or drone-based solutions for date palm fruit harvesting.

keywords: Machine Learning, Deep Learning, Date Fruit Harvesting, Robot-ic, Bunch stalk

Semantic Segmentation of Post-flood Images Using SegFormer

CT

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Abstract - Unmanned aerial vehicles (UAVs) have become a crucial tool in daily life, especially when it comes to managing damage caused by natural disasters such as earthquakes and floods. The optimal choice of UAVs in natural disasters due to its effective role in identifying the affected areas for fast damage management. Semantic segmentation of UAVs images is a significant challenge in the computer vision field; to overcome this issue many deep learning models were involved in the study, in particular models based on convolutional neural network (CNN). Recently transformer-based techniques demonstrated its effectiveness in semantic segmentation tasks. In this work, we aimed to use semantic segmentation for post-disaster images taken by unmanned aerial vehicles (UAVs) and evaluated the performance of vision transformers models designed for semantic segmentation on the FloodNet dataset, which contains high-resolution images taken from low altitudes for flooded and non-flooded areas and compare their performance to Unet, DeeplabV3+ and FCN. for this purpose, we used SegFormer series models (SegFormer-B1, SegFormer-B2 and SegFormer-B3) with transfer learning technique for better performance. Effectively reducing the impact of flooding, our study can be used to develop disaster response systems.

keywords: Vision transformer, Semantic Segmentation, Post-disaster Images, Floodnet dataset, SegFormer, UAVs.

Facial Expression Recognition Using 3D Triangular Meshes and Graph Convolutional Networks

CT

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Abstract - Facial expression recognition is a crucial aspect of human-computer interaction, enabling systems to interpret and respond to human emotions effectively. This paper presents a novel 3D approach that leverages 3D triangular meshes combined with Graph Convolutional Networks (GCNs) to enhance the accuracy of facial emotion recognition. Our proposed method involves the extraction of 3D mesh data from facial images sourced from the Real-world Affective Faces Database (RAF-DB), which contains 15939 facial images tagged with various expressions. By representing facial geometry as a graph structure, we capture nuanced details that facilitate a deeper understanding of expressions. The processed data is then analyzed GCNs to learn discriminative features essential for characterizing different emotions. Extensive experiments validate the efficacy of our approach, achieving an impressive recognition accuracy of 94.91%. This work not only advances the state of the art in facial expression recognition but also underscores the potential of integrating geometric representations with deep learning techniques for improved performance in emotion detection tasks. Additionally, we discuss the implications of our findings and outline future research directions in the integration of 3D techniques and GCNs for further advancements in this field.

keywords: GCN, 3D triangular meshes, RAF-DB, Facial Emotion recognition, feature extraction

Radial Basis Function Neural Networks for Collision Learning and Mask Detection in Image Inpainting

CT

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Abstract - We propose a lightweight image inpainting framework that couples a Radial Basis Function Neural Network (RBFNN) with a D2Q9 Lattice Boltzmann Method (LBM). The model learns a mass-conserving collision update Ω inside holes and a mask probability per pixel, while a strict variant guarantees no change outside the mask. On grayscale Caltech101 with diverse masks, our method yields coherent, edge-preserving reconstructions and outperforms a non-LBM RBF patch regressor on medium and large holes. We report PSNR, SSIM and hole-only PSNR, with ablations on RBF centers, relaxation, and post-processing.

keywords: RBF neural networks, LBM simulation, Image restoration, Damage detection

Secure an Autonomous Driving System Using Deep Reinforcement Learning: A Simulation-Based Study in CARLA

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Abstract - This paper presents a simulation-based study on securing an autonomous driving system using deep reinforcement learning (DRL) techniques, particularly Deep Q-Network (DQN) and Double Deep Q-Network (DDQN). The goal is to design an intelligent and safe driving agent capable of maintaining optimal speed, avoiding collisions, and ensuring stability in dynamic environments. The CARLA simulator is used as the testbed, with a convolutional neural network (CNN) employed for state representation and policy learning. Safety is integrated at multiple levels: reward shaping penalizes risky behavior, lane detection is enhanced through the Canny edge detection algorithm, and vehicle parking is supported by geometric calculations to minimize collisions. Experimental results show that DQN achieves a smoothed accuracy of 0.80 with a peak of 0.81, while DDQN demonstrates better consistency with a smoothed accuracy of 0.92 and the same peak performance. These findings confirm the potential of DRL approaches in developing secure and efficient autonomous driving systems suitable for real-world deployment.

keywords: Deep Q-Network, Double Deep Q-Network, Deep Reinforcement Learning, Autonomous Vehicles, Secure Driving, CARLA Simulator.

Session 05: Intelligent Decision Systems & Recommender Models

User Rationality Impact In Competitive CP Environment

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Abstract - User behavior plays a significant role in understanding the decisions that shape the network communication market. However, the influence of users rationality on the competition between Content Providers (CPs) has been widely overlooked in the literature. In this paper, we investigate a non-cooperative game model where multiple CPs compete over pricing and content credibility strategies in the presence of users with bounded rationality. We formulate the utility functions of CPs by incorporating a rationality parameter to model the cognitive limitation of users. The existence and uniqueness of the Nash equilibrium for each game is mathematically proven. Furthermore, we use the Best Response algorithm to simulate the interaction and validate our results. Numerical simulations confirm the equilibrium of the market and reveal how CPs exploit user irrationality to maximize their profit at the expense of user welfare.

keywords: Non-cooperative Game, Bounded Rationality, Game theory, Nash Equilibrium, Content Providers, Network Communication.

Neural-Heuristic Tree of Thoughts for Augmented Sequential Reasoning in Large Language Models

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Abstract - User behavior plays a significant role in understanding the decisions that shape the network communication market. However, the influence of users rationality on the competition between Content Providers (CPs) has been widely overlooked in the literature. In this paper, we investigate a non-cooperative game model where multiple CPs compete over pricing and content credibility strategies in the presence of users with bounded rationality. We formulate the utility functions of CPs by incorporating a rationality parameter to model the cognitive limitation of users. The existence and uniqueness of the Nash equilibrium for each game is mathematically proven. Furthermore, we use the Best Response algorithm to simulate the interaction and validate our results. Numerical simulations confirm the equilibrium of the market and reveal how CPs exploit user irrationality to maximize their profit at the expense of user welfare.

keywords: Non-cooperative Game, Bounded Rationality, Game theory, Nash Equilibrium, Content Providers, Network Communication.

CryptoGpt: An LLM-Driven Transfer Learning Approach to Cryptocurrencies Time Series Forecasting

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Abstract - The accurate prediction of financial time series is critical in efficient portfolio management as well as development of trading strategies. This paper proposes CryptoGpt, a complete framework, which combines reversible instance normalization (RevIn), patch embedding, and a pretrained GPT-2 backbone for cryptocurrency daily prices prediction. Reversible instance normalization addresses the instability of a nonstationary data, and patch embedding captures local patterns and reduces sequence length. By fine-tuning only a small prediction head, CryptoGpt takes advantage of the rich contextual representations made available by a large language model without having to re-train it. Our proposed model competes with state-of-the-art transformer baselines, achieving lower MAPE, MAE, RMSE and higher R^2 on several major cryptocurrencies, while maintaining competitive performance on the remaining ones. These results highlight the consideration of cross-domain pretraining in contrast to a feasible and correct method of univariate financial forecasting.

keywords: Cryptocurrency, Time series, LLM, Forecasting, Transfer Learning

LLMs in Video Generation Pipelines: A Literature Review of Applications and Challenges

CT

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Abstract - Automated video generation from user text prompts has recently achieved remarkable progress in both the quality and duration of generated content. Text-to-video generation models transform minimal textual instructions into animated videos with rich scenes, dynamic actions, and coherent narratives. This transformation is driven by evolving methodological approaches, with large language models (LLMs) playing a central role due to their exceptional ability to perform reasoning and generate structured text. LLMs effectively convert simple textual instructions into detailed scenario descriptions and visual sequences, making them a core component of contemporary video generation pipelines. This literature review examines recent advances in leveraging LLMs within video generation pipelines, focusing on how they are integrated to guide content synthesis and on the technical challenges encountered. Key findings indicate that LLMs enhance semantic coherence, narrative richness, and content diversity in generated videos, while significant challenges remain, including high computational costs, hallucinations, and maintaining spatiotemporal consistency.

keywords: Large Language Models, Text-to-Video Generation, Generative Models

A Neural Recommender for Diverse Course Suggestions in Online Learning

CT

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Abstract - In online education, recommender systems are essential for guiding students toward courses aligned with their strengths. However, many systems amplify popularity bias, over-recommending dominant domains while neglecting underrepresented ones. This study introduces a neural network-based recommender system to predict student success and deliver equitable course recommendations. Our approach combines a deep learning model leveraging student behavioral data and course attributes to predict success with high accuracy, outperforming standard baselines, and a domain-adaptive re-ranking layer that balances relevance with diversity by boosting recommendations for underrepresented education domains. Ablation studies confirm the critical role of VLE clicks and assessment scores in performance. By embedding fairness through diverse recommendations, this scalable framework shifts from purely accuracy-driven models to inclusive, personalized learning, fostering broader student development in online education platforms. Evaluated on the OULAD dataset, the system achieves an F1-score of 85.91%, AUC of 87.45%, and Precision@5 of 1.0 for sample users, ensuring accurate predictions and relevant recommendations.

keywords: Educational recommender systems, neural networks, fairness, personalized learning.

Session 06 (Online): Theoretical Foundations & Advanced Models

Empirical Study of Knowledge Graph Definitions

CT

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Abstract - Knowledge graphs (KGs) have become a central component of artificial intelligence and the semantic web, yet continues to be vaguely de-fined and distributed. In the literature, such views can be found in various definitions differing between ontological and logical formalization to a more practical, data-driven approach. This study collects and analyzes a corpus of definitions published between 2012 and 2025 to highlight their convergences and divergences. The results reveal three structuring dimensions: formal representation through triples, semantics supported by ontologies and their role as cognitive devices. An integrative definition is proposed, aiming to stabilize the concept and provide a shared theoretical foundation for future research.

keywords: Knowledge Graphs, Ontology, Semantic, Reasoning

A Comparative Analysis of State-of-the-Art Multilingual Processing Systems

CT

Imane KHATTABI¹, Amine BATSI¹, Samir BOUKIL¹ and Rachid EL AYACHI¹

¹ Department of Informatics, Faculty of Sciences and Technics, Sultan Moulay Slimane University, Beni Mellal, Morocco

Abstract - With over 7,000 languages spoken worldwide and the exponential growth of multilingual digital content, automatically processing multilingual documents has become a crucial challenge. This article presents a comparative study of the state of the art of multilingual text processing systems, describing their architecture, methodology, performance and then their limitations. We systematically evaluate large transformer-based models like mBERT, XLM-RoBERTa, mT5, EuroBERT, and KaLM-Embedding sophisticated transformer architectures and conventional Unicode-based segmentation approaches. Results show that mT5 achieves 99.61% accuracy on complex classification tasks, XLM-RoBERTa outperforms in cross-language transfer (+14.6% on XNLI) and low-resource languages (+15.7% in Swahili), EuroBERT leads in long context processing (8,192 tokens), and KaLM-Embedding maximizes efficiency in resource-constrained environments

keywords: Transformer architectures, comparative analysis, large language models, multilingual document processing, and cross-lingual learning.

Weam FAKIR¹ and Youssef FAKIR¹

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Abstract - Modern medical research depends on Genomic Data (GD) analysis to study genetic elements which cause diseases. The development of sequencing technologies has generated enormous datasets which create substantial obstacles for conventional bioinformatics analysis methods. Artificial Intelligence (AI) provides effective solutions to manage complex high-dimensional genomic data. The research implements Support Vector Machines (SVM), Random Forest (RF) and Deep Neural Networks (DNNs) as AI methods to forecast disease results from genomic data. The research assesses how these algorithms perform for disease prediction while addressing two main obstacles which include model interpretability and data privacy. The experimental results show that Deep Neural Networks achieve superior accuracy and prediction power than other methods but their high computational requirements and unclear interpretation make them less suitable.

keywords: Genomic Data (GD), Bioinformatics analysis, Artificial Intelligence (AI), Support Vector Machines (SVM), Random Forest (RF), Deep Neural Networks (DNNs), Disease Prediction.

Enhanced Logistic-Rational Map Chaotic for Cryptographic Applications

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Abstract -

Background: One-dimensional chaotic maps present attractive properties for cryptographic applications but are limited by restricted chaotic parameter ranges, insufficient entropy generation, and numerical instability in finite-precision implementations.

Methods: We introduce the Logistic-Rational Map (LRM), a novel chaotic system that integrates a logistic component with a bounded rational term under modular arithmetic. The dynamical characteristics are rigorously evaluated through bifurcation analysis, Lyapunov exponent computation, sensitivity to initial conditions assessment, Shannon entropy measurement, and correlation analysis.

Results: The proposed LRM exhibits significantly extended chaotic behavior across parameter space, near-optimal statistical distribution (Shannon entropy approaching 10), minimal correlation coefficients, and improved numerical robustness achieved through elimination of singularities within the operational domain (0,1).

Conclusions: The demonstrated properties of strong mixing, minimal predictability, and enhanced numerical stability establish the LRM as a promising foundation for cryptographically secure pseudorandom number generation systems.

keywords: Chaotic maps, Cryptography, Logistic-Rational Map

Trajectory Planning based on RL Swarm Approach Applied to the Palm Harvesting System

CT

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Abstract - This research provides a unique multi-objective optimization (MOO) and reinforcement learning (RL) swarm trajectory planning method for autonomous agents [1]. The approach is based mainly on decentralized communication and adaptive attraction toward the goal following the rule of obstacle avoidance, the agent enables cooperation to optimize trajectory and resources [2]. The study aims to apply this new approach to the Palm harvesting System to optimize critical factors in the field like the dates amount, the timing, and security of the process on agriculture domaine. Instead of delegating the harvesting task to one and only one robot, the idea gives the possibility to collaborate between multiple agents to define the paths, exchange information about already explored area on the field and non-secure trajectories. In addition, adding the learning aspect is a huge plus as it ensures trajectory refining, exploring and real-time adaptation to the new environment. Assuming that in real world the obstacles are not static and palm are not the only objects on the field and harvesting time is crucial in this case.

keywords: Trajectory Planning, Artificial Intelligence, Swarm, Harvesting System, Algorithm

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Beyond Bag-of-Words: Transformers for Robust Cyberbullying Detection on Twitter

CT

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Abstract - The internet and social media (SM) have facilitated connectivity and communications between individuals; contrariwise it have also raised the hazard of being a victim of cyberbullying. Cyberbullying is a hurtful phenomenon associated with deep psychological consequences going to suicide intention. To address this growing matter our study inquires Bidirectional Encoder Representations from Transformers (BERT) for identifying cyberbullying in twitter data; then evaluating its efficacy against traditional machine learning approaches. We systematically evaluate various BERT training configurations including fine-tuning pre-trained models and hyper-parameters optimization to identify the optimal setup; the objective is capturing the nuanced character of online harassment. To establish performance baselines, we benchmarked our model against a strong classifier that uses Term Frequency-Inverse Document Frequency (TF-IDF) features. Our empirical results provide detailed performance comparisons using standard metrics such as accuracy, precision, recall and F1 score. With an accuracy of 0.985 and a precision of 0.960, BERT outperforms TF-IDF significantly. The findings highlight BERT's advanced capability to understand nuanced language patterns and implicit threats that elude keyword-based methods. This research exposes practical insights for implementing transformer-based solutions in real-world content moderation systems.

keywords: Twitter, Cyberbullying, Transformers

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Organizers



