

2025 4th International Conference on Embedded Systems and Artificial Intelligence (ESAI 2025)

Fez, Morocco

18-19 December 2025

IEEE Catalog Number:
ISBN:

CFP25CP4-POD
979-8-3315-5140-7



Copyright © 2025, IEEE

All Rights Reserved

Copyright and Reprint Permissions:

Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

*** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.

IEEE Catalog Number:	CFP25CP4-POD
ISBN (Print-On-Demand):	979-8-3315-5140-7
ISBN (Online):	979-8-3315-5139-1

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA

Phone:	(845) 758-0400
Fax:	(845) 758-2633
E-mail:	curran@proceedings.com
Web:	www.proceedings.com

TABLE OF CONTENTS

Enhancing Arabic Industrial Voice Command Recognition Using CNNs with Dilated Temporal Convolutions	1
<i>Naouar Laaidi, Abderrahim Ezzine, Meryam Telmem, Hassan Satori</i>	
End-to-End WiFi CSI Sensing Framework for Accurate and Privacy-Preserving Activity Recognition	8
<i>Hicham Boudlal</i>	
A Comparative Study of Classical Machine Learning Models for Facial Emotion Recognition with Handcrafted Features	15
<i>Fatima-Zahra Naciri, Insaf Bellamine, Abdelhak Boulaalam</i>	
Intelligent SOC Estimation Method for CC-CV Wireless Electric Vehicle Charger	21
<i>M. El Ancary, H. El Fadil, A. Lassoui, M. Chiheb, Y. El Asri, A. Hasni, H. Abbade</i>	
Real-Time Localization of Short-Circuit Faults in Power Systems Based on the Triangulation Principle for Protection Relays	27
<i>Mbakob Ndagoua Polster Kader, Fouad Slaoui Hasnaoui, Semaan Georges</i>	
Design of a Compact and Highly Selective Coplanar Bandpass Filter for ISM Band Applications	33
<i>Soufiane El Maimouni, Fouad Aytouna, Jamal Zbitou, Stephane Ginestar, Mohammed El Gibari</i>	
Artificial Intelligence -Augmented Urban Theory: Modelling Divergence in Rank-Size Systems	38
<i>Rokia Bendaoud, M'Hamed El Mouloudi</i>	
Optimizing HVAC Systems through Temperature Prediction, A Regression Model Approach for Energy Efficiency in Buildings	44
<i>Douniya Sbabou, Wiam Ayrir, Ahmed Ait Errouhi, Driss Benhaddou</i>	
Fuzzy C-Means Segmentation Enhanced by the Improved Sine Cosine Algorithm: Experiments on Medical Images	53
<i>Oussama El Haouari, Mourad Hana, Lahbib Khrissi, Nabil El Akkad</i>	
Self-Supervised Heterogeneous Graph Matching for CV-Job Recommendation with Cross-Encoder Reranking	59
<i>Ibtihal Khelif, Abdelmounaim Kerkri, Mohammed Aissaoui</i>	
Using Chatbots to Develop Students' Communication and Mediation Skills: Experience of Integrating Ready-Made AI Solutions into Academic Courses	67
<i>Olena Akilina, Liudmyla Ilich, Victor Zvonar</i>	
Improved Super-Twisting for Robotic Manipulators: Toward Reduced Chattering and Enhanced Tracking Performance	81
<i>Yassine Kali, Maarouf Saad</i>	
Soil quality classification using deep learning	87
<i>Khaldi Ouadjih, Fouad Slaoui Hasnaoui, Semaan Georges</i>	
Quantum optimization for the Physician Scheduling Problem	93
<i>Baha Mlaouhi, Chahid Ahabchane, Iyed Benslimen</i>	
Towards Intelligent Security: Embedded AI and Multi-Sensor Data Fusion for Threat Detection	101
<i>Zineb Lazrak, Anas Bouayad, Marwa Boumaiz</i>	

Intrusion Detection System To Secure AI-powered E-Learning Platforms Against Various Cyberattacks	109
<i>Abdisamad Ayoubi, Loubna Laaouina, Adil Jeghal, Hamid Tairi</i>	
Clustering Student Profiles with K-Means and HAC for Future Adaptive Virtual Learning Agents	119
<i>Ghalia Mdaghri-Alaoui, Ilhame Khabbachi, Abdelhamid Zouhair, El Mokhtar En-Naimi</i>	
Comparative performance analysis of PID and SMC controllers in a model-in-the-loop framework for quadrotor UAVs	125
<i>Meryem Lahboub, Anass Mansouri, Hamid Hassani, Ali Ahaitouf</i>	
Efficient and Precise Cheat Detection with Deep Learning	132
<i>Ilhame Khabbachi, Ghalia Mdaghri-Alaoui, Abdelhamid Zouhair</i>	
Real-Time Railway Maintenance Inspection on Embedded Devices	138
<i>Fatih Selim Erdeniz, Ayhan Küçükmanisa</i>	
Management of an agricultural greenhouse by integrating the Internet of Things (IoT)	144
<i>Abderrazak Kaida, Abderrahman Aitdada, Youssef El Afou, Abdelouahad Ait Msaad, Omar Ouabouch</i>	
Advanced Deep Learning Algorithms: Architectures, Mathematics, Applications and Open Challenges	150
<i>Lobna El Harrouchi, Hanae Moussaoui, Mounir Karmoudi, Nabil El Akkad</i>	
Architectural Analysis of a Lightweight Autonomous Vehicle Simulator: A Case Study of gym-donkeycar's Modularity, Flexibility, and Adaptability for Aerial Robotics	176
<i>Leila Kelmoua, Zakaria Haja, Rahmoune Mohammed, Jamal Berrich, Toumi Bouchentouf</i>	
Multi-Agent Reinforcement Learning for Collaborative Airport Stand Allocation: Systematic Review with Generative AI Integration	185
<i>Doha Banoui, Abdelmajid Bousseham, Mohammed Mestari, Abdelkrim Saouabe, Khalid Tizra</i>	
Comparative Review of Hybrid AI Approaches for Traffic Signal Systems	192
<i>Khalid Tizra, Brahim Raouyane, Abdelkrim Saouabe, Doha Banoui</i>	
A Modular Framework for Transcription, Diarization, and Language-Adaptive Summarization of Multi-Party Conversations	199
<i>Hasna El Maizi, Rachid Fateh, Mathieu Pouliquen, Kaoutar Ahed, Yasmine Lamari, Miloud Frikel Said Safi</i>	
Artificial Intelligence in Public Sector Governance: A Cross-Sectoral Approach to Enhancing Commercial Justice, Business Experience, and Health System Performance in Morocco	203
<i>Arab Younes, Loubna El Ouadoudi, Akdim Mohammed, Waleed Joud, Abid Mustapha, Rouchdy Mohamed</i>	
Hybrid LSTM-GAT Model with k-Nearest Neighbors for Accurate Multi-Agent Vehicle Trajectory Prediction	209
<i>Chaymae Rami, Mohammed Ammar, Youness Bouhout, Ibrahim Ouahbi, Khalid El Makkaoui</i>	
Embedded System Controlled and Supervised Using LabVIEW	214
<i>Khalidi Ouadjih, Fouad Slaoui Hasnaoui, Semaan Georges</i>	
A blind watermarking Scheme for Medical Images Based on DWT, SVD, and Arnold Transform to Strengthen E-Health Security	220
<i>Reda Alout, Habib Ayad</i>	
Visual Question Answering Challenges: A Review	232
<i>Aya Nuseir, Marc Ebner</i>	

Unsupervised Adaptive Asphalt Pavement Damage Recognition Algorithm Based on Fuzzy C-Means Clustering	240
<i>Youssef Aouni, Omar El Ogri, Souad El Moudni El Alami, Jaouad El-Mekkaoui, Mohamed Qachar Ahmed Chigr</i>	
Optimizing Brain Tumor Diagnosis: Adaptive weights Selection via Lasso Regularization	247
<i>Otmame Mallouk, Nour-Eddine Joudar, Mohamed Ettaouil</i>	
A Unified Security Framework for Smart City AI-Systems: Cross-Domain Vulnerability Analysis and Mitigation Strategies	254
<i>Rachid Sakassa, Oussama Aziz, Khawla Tadist, El Bachir Tazi</i>	
Neuroeducation and Artificial Intelligence: A Systematic Review of Innovative Approaches for Personalized E-learning	263
<i>Ridouane Oubagine, Loubna Laaouina, Adil Jeghal, Hamid Tairi</i>	
Hybrid CNN-GOG Model for Robust Person Re-Identification and Trajectory Tracking	271
<i>Mohammad Nirou Jazi, Mohammed Ayoub Alaoui Mhamdi, Madjid Allili</i>	
Grey wolf Optimization-Based nonsingular fast fixed time sliding mode Control with Fixed-Time Observer for Quadrotor system subject to external perturbations	276
<i>Mouna Lhayani, Ahmed Abbou, Yassine El Houm</i>	
Fast and Efficient Hardware-Accelerated Lightweight CNN for Lung Disease Detection Using ARM Compute Library	283
<i>Emna Aridhi, Kaouther Laabidi, Abdelkader Mami</i>	
TinyML: Accelerometer-Based Processing for Seismic Detection in Buildings	289
<i>Marwane Rezzouki, Kaoutar El Hina, Guillaume Terrasson</i>	
A Focused Review on AI-Powered Intrusion Detection in IoT	293
<i>Mourad Hana, Oussama El Haouari, Ghizlane Khaissidi, Mostafa Mrabti</i>	
Federated Learning and Blockchain for Vibrational Signature-Based Authentication of Handicrafts	300
<i>Youssef Aounzou, Abdelhak Boulaalam, Fahd Kalloubi</i>	
Interactive Tools and Digital Twins for Training in Industry 5.0: A Review	312
<i>Majda Arab, Loubna Laaouina, Adil Jeghal</i>	
Embedded Vision System Using YOLOv8 on Jetson Orin NX	317
<i>Ahlem Maghzaoui, Emna Aridhi, Sadok Ben Yahia, Abdel Kader Mami</i>	
A Lightweight LSTM-Based Model for Sequential Movie Recommendation	323
<i>Aya Lyousfi, Khadija Salih Alj, Kenza Bouqdir, El Habib Nfaoui</i>	
Recommender Systems in E-Commerce: Algorithmic Taxonomy, Comparative Evaluation, and a Framework for Next-Generation Personalization	328
<i>Houda El Bachri, Hayat Sahlaoui, El Arbi Abdellaoui Alaoui, Abdelaaziz Hessane, Said Agoujil</i>	
Machine Learning Approaches for Early Warning of Stock Market Crashes	336
<i>Wafae Saifi, Said Nouh, Said Bahassine, Imrane Chemseddine Idrissi</i>	
Human Factors In Cyber Incident Response: Mitigating Biases, Enhancing Communication, And Optimizing Tool Usability	342
<i>Harchi Anas, Hicham Toumi, Mohamed Talea</i>	

Efficient Deep Learning: Model Optimization Strategies for Resource-Constrained Devices	353
<i>Mohamed Echchidmi, Anas Bouayad</i>	
Interpreting Bank Term Deposit Prediction Models: A Comprehensive SHAP Approach	360
<i>Meryem Saket, Hayat Sahlaoui, El Arbi Abdellaoui Alaoui, Mostafa Merras</i>	
Optimizing Tomato Object Detection in Smart Agriculture with Attention-Augmented AI Vision Systems	367
<i>Hayat Sahlaoui, El Arbi Abdellaoui Alaoui, Said Agoujl</i>	
Noise Removal from ECG Signals Using Generative Adversarial Networks	375
<i>Mohamed Sraitih, Amir Hajjam El Hassani, Younes Jabrane, Emmanuel Andres</i>	
Seasonal IoT-GNN: A Conceptual Framework for Context-Aware Handicraft Recommendation in Tourism Environments	382
<i>Khadija Kassabi, Fahd Kalloubi, Abdelhak Boulaalam</i>	
Genetic Algorithm-Driven Hyperparameter Optimization for FedProx in Federated Learning	386
<i>Abdelkhalek Haddany, Taoufyq Elansari, Brahim Aksasse, Mohammed Ouanan</i>	
Innovative MIMO Antenna with Frequency reconfigurability for 5G mm-Wave Systems	400
<i>Abdelhafid Oumarbeh, Mohammed El Ghzaoui, Yousra Ghazaoui, Badre Bossoufi, Rachid Elalami</i>	
Comparative Evaluation Of Analytical Parameter Extraction Approaches And Their Robustness In The Single-Diode Photovoltaic Model	406
<i>Ayoub Lahboub, Mustapha Elyaqouti, El Hanafi Arjdal, El Mehdi Mellouli, Abdelhafid El Farnane, Fatima Ezzahrae Souaidi, Dris Ben Hmamou, Souad Lidaighbi, Abdelfattah Elhammoudy</i>	
Study of traditional and modern methods for diagnosing mycetoma: the case of grain culture - A systematic review	413
<i>Mor Diagne, Kpetchehoue Merveille Santi Zinsou, Idy Diop, Mass Gning</i>	
A Data-Driven Machine Learning Approach to Assessing Professors' Digital Maturity in Moroccan Higher Education	421
<i>Abdelkarim Taam, Amine Amar, Adil El Makrani</i>	
An Enhanced bio-inspired SLAM model Implemented on heterogeneous architecture	427
<i>Amraoui Mounir, Latif Rachid, Abdelhafid El Ouardi</i>	
Optimizing Cloud Data Warehousing Costs Through Redundancy Elimination and Storage-Aware Automation	434
<i>Junaith Meeran Haja Mohideen</i>	
Dynamic Portfolio Management Using Dual-Model Proximal Policy Optimization	443
<i>Chaimae Khaled, Badr Hirchoua, Hain Mustapha</i>	
A Comparative Study of Automatic Migration from Monolith App to Microservices	449
<i>Jalal Zairi, Adil Kenzi</i>	
Deep Reinforcement Learning-Based MPC for Lateral Maneuver of Autonomous Vehicles	455
<i>Souhail Bentayek, Yassine Kali, Jean-Pierre Kenné, Khalid Benjelloun, Ahmed Chebak</i>	
Artificial intelligence Enhanced Chaotic Encryption vs Blockchain Frameworks for Embedded Medical Imaging Security	463
<i>Imane Arioua, Houssam Bouardi, Said Hraoui, Hakim Fadili</i>	

Efficient Deep Neural Networks for Fast Semantic Segmentation in Self-Driving Cars	485
<i>Lahbib Khrissi, Mohammed Es-Sabry, Nabil El Akkad, Hassan Satori</i>	
An Empirical Comparison of Federated Learning Algorithms: No One-Size-Fits-All	491
<i>Mohammed Nechba, Bessam Abdulrazak, Abdellatif El Afia</i>	
VMD combined with correlation-based feature selection technique and Extra-trees classifier for EEG epilepsy detection	504
<i>Omar Bamaarouf, Said Agounad, Anas Mazid, Said Charfi</i>	
CountTree: A Dataset for Tree Counting using Vision Transformers	509
<i>Yassin Ladham, Omar Elharrouss, Yasir Mahmood, Elarbi Badidi</i>	
Benchmarking Attention-Based Enhancement of CNN-Based Moroccan Arabic Darija ASR Systems	516
<i>El Manaa Khaoula, Satori Hassan</i>	
Mathematical Optimization and Statistical Analysis of Hybrid GWO-SMA Algorithm for PID Control of DC Motors	525
<i>Mounime El Anaya, Omar El Ogri, Amal Hjouji, Jaouad El-Mekkaoui</i>	
GNN-Ensemble Framework for Misinformation Detection on Social Media	533
<i>Alson Prasai, Mohammed Ayoub Alaoui Mhamdi, Madjid Allili</i>	
Triptych AI - Innovation - Cybersecurity: Challenges and Opportunities for Financial Services: The Case of Moroccan Banks	538
<i>Hammani Safae, El Bayane Adnane, El Mouaffaq Fadoua</i>	
FPGA Implementation of Chaos-Enhanced Bat Algorithm for Real-Time Constrained Engineering Optimization	546
<i>Rabab Ouchker, Ismail Mchichou, Mohamed Amine Tahiri, Hicham Amakdoug</i>	
Fine-Tuning Segment Anything Model (SAM) for Brain Tumor Image Segmentation	553
<i>Zahra Faska, Lahbib Khrissi, Imadeddine Mountasser, Khalid Haddouch</i>	
Minimizing Overfitting and Enhancing Computational Efficiency by Reducing Redundant Features	558
<i>Nourddine El Gamouz, Amine Sallah, El Arbi Abdellaoui Alaoui, Abdelaaziz Hessane, Said Agoujl</i>	
Advanced Trilingual RAG Framework: Progressive Architectures for Robust Educational Question Answering	564
<i>Ayman Sbai, Imane Guessous, El Habib Nfaoui</i>	
A Transformer-based Time Series Model for State of Charge Forecasting for Electric Vehicles	570
<i>Hajar El Miri, Mehdi Najib, Moh Amed Bakhouya, Ahmed Nait Sidi Moh</i>	
Sentiment Analysis and Opinion Segmentation of Tourist Feedback in the Moroccan Tourism Sector Using Machine Learning and Deep Learning Approach	576
<i>Rachid Larhmouch, Hanae Moussaoui, Nabil El Akkad</i>	
AI-Driven Behavior Prediction in Autonomous Vehicles: A Short Review	584
<i>Khaoula El Akrou, Abdellatif Ezzouhairi</i>	
Integrating Fraud Detection into Insurance Risk Prediction via Machine Learning	590
<i>Hamza Errahibi, Fatima Zahra Abbou, El Mehdi Lghaouch, Chemlal Yman, Mohamed Azzouazi</i>	

Overview of Extended actor-critic frameworks for multi-intersection Traffic-Signal Control	598
<i>Meryem Mesbah, Imad Lamouik, My Abdelouahed Sabri, Ali Yahyaouy</i>	
Energy-Aware Torque Allocation Strategies for Multi-Motor Electric Vehicles: Simulation-Based Benchmarking	604
<i>Primela Fanou, Khalida Zazi, Marouane Rayyam</i>	
Artificial Intelligence for Predicting Pregnancy Risk Factors: A Literature Review	611
<i>Karima Lakhdadi, Kanza Boujraine, Hassan Satori</i>	
Data Collection, Datasets and Sensors for Pregnancy Risk Factors Prediction: A Literature Review	620
<i>Karima Lakhdadi, Abderrahim Ezzine, Kanza Boujraine, Hassan Satori</i>	
MFCC, PLP, and AI Approaches for Laryngeal Lesion Diagnosis	630
<i>Kanza Boujraine, Karima Lakhdadi, Hassan Satori</i>	
Non-Invasive Computational Diagnostics for Laryngeal Pathology: Voice-Based and Multimodal Learning Perspectives	640
<i>Kanza Boujraine, Karima Lakhdadi, Hassan Satori</i>	
Responsible Artificial Intelligence In Project Management	648
<i>Sara Kacimi, Fatima Bennouna</i>	
Generative AI and the Psychological Experience of Employees: Creative Opportunities and Risks of Cognitive Dependence	653
<i>Meriem Rachid, Sanae El Maliki, Zouheir Boussouf, Mouna Zerhouni Khal</i>	
AI at the Service of Moroccan University Decision-Makers: Between Technological Innovation and Institutional Constraints	660
<i>Sanae El Maliki, Meriem Rachid, Zouheir Boussouf, Mouna Zerhouni Khal</i>	