

2024 3rd International Conference on Embedded Systems and Artificial Intelligence (ESAI 2024)

**Fez, Morocco
19-20 December 2024**



**IEEE Catalog Number: CFP24CP4-POD
ISBN: 979-8-3315-2206-3**

**Copyright © 2024 by the Institute of Electrical and Electronics Engineers, Inc.
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:	CFP24CP4-POD
ISBN (Print-On-Demand):	979-8-3315-2206-3
ISBN (Online):	979-8-3315-2205-6

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

CURRAN ASSOCIATES INC.
proceedings
.com

TABLE OF CONTENTS

Moroccan Arabic Darija Automatic Speech Recognition System Using CNN Model for Drone Control Application	1
<i>El Manaa Khaoula, Satori Hassan</i>	
Build an Efficient Amazigh Speech Recognition Using a CNN-CTC Model	8
<i>Meryam Telmem</i>	
Hybrid CNN Model Architecture with Data Augmentation for Intelligent Arabic Handwritten Character Recognition	15
<i>Khalid Chakir, Bendaoud Rokia, Hicham El Moubtahij, Hassane Moustabchir, Nabil El Akkad</i>	
Image Clustering Approach Based on Artificial Bee Colony and Enhanced K-Means Algorithm.....	20
<i>Oussama El Haouari, Lahbib Khrissi, Imadeddine Mountasser, Nabil El Akkad</i>	
Machine Learning for Nonlinear System Identification: Kernels and ANN.....	26
<i>Rachid Fateh, Anouar Darif, Mathieu Pouliquen, Miloud Frikel, Said Safi</i>	
An Algorithm for Image Encryption Combining the Lorenz System, XOR Operation, and Inverted Bit Permutation.....	32
<i>Fatima Koulouh, Safae Amine, Rafik Taouil, Mohammed Es-Sabry, Ferdaous Hdioud, Nabil El Akkad</i>	
Advanced 3D Color Image Encryption Using Lorenz and Rössler Chaotic Systems:A Multi-Layered Approach	38
<i>Safae Amine, Fatima Koulouh, Mohammed Es-Sabry, Rafik Taouil, Ferdaous Hdioud, Nabil El Akkad</i>	
Stock Market Volatility Forecasting: A Supervised Learning Approach with Normal Tempered λ -Stable Distribution.....	45
<i>Sahar Charfi, Farouk Mselmi</i>	
Comparison of Traditional Tool Combination and Deep Learning Methods for Automatic Classification of Steel Surface Defects.....	50
<i>Zoheir Mentouri, Abdelmalek Bouguettaya, Hakim Doghmane, Kaddour Gherfi, Salim Bendjoudi</i>	
A Comprehensive Review of Intelligent Voice Disorder Diagnosis: Techniques, Databases, and Machine Learning Approaches.....	58
<i>Kanza Boujraïne, Naouar Laaidi, Abderrahim Ezzine, Hassan Satori</i>	
Advanced Optimization of Discrete Orthogonal Hahn Moments for Precision Image Reconstruction Via the Firefly Algorithm	66
<i>Abdelati Bourzik, Belaid Bouikhalene, Jaouad El-Mekkaoui, Amal Hjouji</i>	
Integrating Industry 4.0 into Moroccan Supply Chain Management: Technologies, Transformations, and Trends	75
<i>Mohammed Zizi, Mohamed Saad Bajjou, Anas Chafi, Mohammed El Hammoumi</i>	
SDN and NFV Security Approaches for IoT Environments.....	84
<i>Manare Zerifi, Abdellatif Ezzouhairi, Abdelhak Boulaalam</i>	

Towards a Question/Answering System in Moroccan Legal Domain: Investigation of the Impact of Tailored Preprocessing Techniques and Alternative Word Representations on the Question Classification	87
<i>Oussama Tahtah, Yassine Akhiat, Ahmed Zinedine, Khalid Fardousse</i>	
Li-Fi in Medical Applications.....	94
<i>Louiza Hamada, Pascal Lorenz, Aicha Djerouni</i>	
Artificial Intelligence in Quality4.0.....	100
<i>Souad Lahmine, Fatima Bennouna</i>	
Contribution to Predicting Electricity Load Using Random Forest.....	105
<i>Zahira Marzak, Salma Mouatassim, Jamal Benhra, Rajaa Benabbou</i>	
Impact of Digital Resources on Learning Nuclear Physics a Case Study on Isotopes and Atomic Mass in Final Year High School Students	119
<i>Aziz Taoussi, Khalid El Khattabi, Ahmida Chikhaoui, Hassan Yakkou</i>	
Review of 3D Scene Reconstruction: From Traditional Methods to Advanced Deep Learning Models.....	125
<i>Maryem Belkaid, El Arbi Abdellaoui Alaoui, Mostafa Merras, Achraf Berrajaa, Nabil El Akkad</i>	
Strengthening Security in the Internet of Things (IoT): Integrated Approach of Intrusion Detection Systems (IDS) and Edge Computing.....	136
<i>Bouchra Hafid, Abdellatif Ezzouhairi, Khalid Haddouch</i>	
Enhancing Analysis by Integrating Link and Node Metrics Based Fuzzy Logic for IoT System	145
<i>Soukayna Riffi Boualam, Mariyam Ouaisa, Mariya Ouaisa, Abdellatif Ezzouhairi</i>	
New Biometric Recognition System by Multichannel Orthogonal Radial Triangular Pulse Moments.....	151
<i>Yahya Sahmoudi, Omar El Ogri, Amal Hjouji, Jaouad El-Mekkaoui</i>	
Enhancing Microblogging User Recommendations Using BERT-Based Transformer and LDA Topic Models.....	162
<i>Dib Brahim, Kalloubi Fahd, Nfaoui El Habib, Boulaalam Abdelhak</i>	
Design and Implementation of a Low Energy Consumption Data Logger for a Nano-Grid Applied to a Solar Smart Greenhouse	168
<i>Fathallah Rerhrhaye, Yassine Ennaciri, Badr Rerhrhaye, Ilyas Lahlouh, Driss Khouili, Chaymae El Martaoui, Ahmed El Akkary, Nacer Sefiani</i>	
Analysis of Moroccan Arabic Speech Recognition for Integration in Voice Command Systems	174
<i>Abderrahim Ezzine, Naouar Laaidi, Hassan Satori</i>	
Improving the CXR Reports Generation with Multi-Modal Feature Alignment and Self-Refining Strategy.....	180
<i>Fatima Cheddi, Ahmed Habbani, Hammadi Nait-Charif</i>	
Enhanced Approach for Performance Analysis in Vehicular Communications Leveraging Taguchi and ANOVA Methods.....	187
<i>Souad Ajjaj, Mohammed-Alamine El Houssaini, Souad El Houssaini, Mustapha Hain</i>	
Enhanced Hybrid Approach for Real-Time Emotion Recognition Using Canny Edge Detection and Deep Learning on Embedded Systems.....	194
<i>Ismail McHichou, Rabab Ouchker, Mohamed Amine Tahiri, Hicham Amakdouf, Mohammed Ouazzani Jamil, Hassan Qjidaa</i>	

Enhancing News Credibility Detection in Arabic: A Study of Attentional Bidirectional LSTM.....	202
<i>Hanane Elfaik, El Habib Nfaoui</i>	
Enhancing Photovoltaic Maintenance with Real-Time Data Integration: A Sensorless and Scalable Approach Validated by Intelligent Correlation Analysis	206
<i>Karom Mohamed, Chaieb El Bekkaye, Chikri Mounim, Chadli Hajar, Chadli Sara, Salmi Khalid, Derkaoui Abdechafik, Tahani Abdelouahad</i>	
Theoretical Study and Simulation of Two Radiometers for Breast Cancer Detection.....	212
<i>Zahra El Motamassik, Atman Jbari, Larbi Bellarbi</i>	
Elevating Pulse Analysis: Variational and Empirical Mode Decomposition Algorithms for Heart Rate Extraction from Plethysmography Waves*	217
<i>Zakaria El Khadiri, Rachid Latif, Amine Saddik</i>	
Adaptive Genetic Algorithm for 2D Problems with a Dynamic Gene Walk	225
<i>Ismail Naouadir, Jaouad El Mekkaoui, Amal Hjouji, Omar El Ogri, Mohamed Benslimane</i>	
Photovoltaic Hotspot Fault Detection Based on Detectron2 with Faster R-CNN	231
<i>Nouamane Ayadi, Abdelilah Et-Taleby, Yassine Chaibi, Cheikhelwely Elwely Salem, Mohamed Benslimane, Zakaria Chalh</i>	
Evaluation of Perceptual Hashing Algorithms for Digital Image Authenticity	243
<i>Mohamed Ben Aissi, Soulaïman El Hazzat, Majid Ben Yakhlef</i>	
Towards Blockchain Technology for Enhancing Agri-IoT Security.....	250
<i>Ilham Laabab, Abdellatif Ezzouhairi, Muhammad Haris Khan</i>	
Comparative Analysis of Embedded Techniques for Biomedical Sentiment Analysis: Insights into Pandemic Drug-Related Issues on Social Networks.....	255
<i>Hanane Griset, Oumayma Elbiach, El Habib Nfaoui</i>	
The Impact of Artificial Intelligence on Employee Adaptability to Remote Work.....	263
<i>Ahmed El Hammoumi, Nabil Seghyar, A Mohammed El Hammoumi, Adil El Ouali</i>	
Comparison Between 2D Classification and 3D Classification Based on Deep Learning	268
<i>Zouhir El Khalfi, Soulaïman El Hazzat, Majid Ben Yakhlef</i>	
Universal Design of an Embedded Hardware for Educational Robotics Based on Atmega328P.....	274
<i>Mohammed El Miri, Said El Khaldi, Ismael Driouch, Loukmane Elkhaldi</i>	
Crop Yield Prediction in IoT: A Hybrid Feature Selection Approach Using Machine Learning Models.....	280
<i>Soukaina Bouarourou, Chaimae Kanzouai, Abderrahim Zannou, El Habib Nfaoui, Abdelhak Boulaalam</i>	
Addressing Unhappiness in Elderly Care: Challenges in Causal AI and Span Categorization Solutions.....	285
<i>Asmae Elidrissi, My Abdelouahed Sabri</i>	
Development of an Explainable AI (XAI) System for the Interpretation of ViT in the Diagnosis of Medical Images	292
<i>Soufiane Hachi, Abdelouahed Sabri</i>	
Accurate Real-World Co-Ordinate Finding and the Object Classification for the Robot Manipulator	300
<i>Sudeep Sharan, Hung Do Thanh, Peter Nauth, Juan José Domínguez-Jiménez</i>	

Study of Motor Oil Adulteration Employing a Novel Neural Network Approach for Processing Laser-Induced Fluorescence Spectra	307
<i>Youssef Tmimi, Loubna Srata, Sofia Farres, Mounim Chikri, Fouad Fethi</i>	
Digital Advancements in Hypertension Management	313
<i>Sara Ramdani, Nour El Houda Benkaddour, Intissar Haddiya</i>	
Ultra-Low Power DNN-Based TSCH Scheduling at the Edge Using the MAX78000	326
<i>Martina Balbi, Erman Okman, Blaz Korecic, Elsa Lopez Perez, Said Alvarado-Marin, Lance Doherty, Thomas Watteyne</i>	
Transfer Learning for Severity and Stages Detection of Diabetic Retinopathy.....	334
<i>El-Mehdi Chakour, Anass Mansouri, Ali Ahaitouf</i>	
Efficient Implementation of Codebook Algorithm for Background Subtraction.....	340
<i>Tebbaa Brahim, Abdessamad Klilou, Smail Bariko, Assia Arsalane</i>	
An Innovative Federated Learning Paradigm for Safeguarding Privacy in IoT Through a Synergistic SDN-CLOUD Structure.....	345
<i>Harchi Anas, Hicham Toumi, Mohamed Talea</i>	
Artificial Intelligence Techniques for Cardiovascular Disease Classification Using 12-Lead ECG	353
<i>Younes Hadzine, Atman Jbari, Mohamed Najoui, Lhoussain Bahatti</i>	
CSHA-CSI: Towards Contactless Sensing of Human Activities Utilizing WiFi Channel State Information	366
<i>Hicham Boudlal, Mohammed Serrhini, Ahmed Tahiri</i>	
Two-Teacher Net: Dual-Distillation-Based QAT for CNN Compression.....	375
<i>Azzam Alhussain, Mingjie Lin</i>	
Disturbance Management-Based Finite-Time Adaptive Sliding Mode Control for Agriculture Mobile Robot: A Fixed-Time Observer-Based Approach.....	380
<i>Brahim Moudoud, Imad El Adraoui, Abderrahim Bahani, Hicham Aissaoui</i>	
Transformer-Based Arabic Language Lemmatization	387
<i>Soumia Afartass, Fadoua Ataa Allah, Khalid Minaoui</i>	
A Systematic Review and Taxonomy of Ransomware Detection Based on Artificial Intelligence Algorithms.....	394
<i>Chaieb Omar, Kannouf Nabil, Mohammed Benabdellah</i>	
A Rich and Balanced MSA Corpus for HMM-Based Consonant-Vowel Segmentation.....	405
<i>Youssef Boutazart, Abderrahim Ezzine, Hassan Satori</i>	
Optimizing Direct Power Control of Variable Speed Wind Turbine Systems Using Genetic Algorithms and Space Vector Modulation.....	419
<i>Mohammed Es-Salmi, Mohammed Taoussi, Abdelfatah El Ouadiki, Aziz Derouich</i>	
Improved Polar Lights Optimizer Algorithm Using Chaotic Maps for Medical Image Segmentation.....	427
<i>Adil Sayyouri, Ahmed Bencherqui, Mhamed Sayyouri, Abderrahim Bourkane, Abdeljabbar Cherkaoui</i>	
Towards Resource Efficient and Low Latency CNN Accelerator for FPGAs: Review and Evaluation.....	433
<i>Rashed Al Amin, Roman Obermaisser</i>	

Deep Learning Techniques for Enhanced Classification of Gastrointestinal Images	443
<i>Zakariae El-Jabbari, Jaouad Boumhidi</i>	
An Enhanced Diagnostic Framework for Hepatitis C Prediction Using Machine Learning with Advanced Feature Selection Techniques	450
<i>Asif Ur Rahman Adib, Md. Asib Rahman Jahin, Abdullah Al Mahmud Nafiz, Asif Newaz</i>	
Robust Control of Mechanical Systems Applied on Vehicle Active Suspension System	456
<i>Ismail Nasri, Abdelkader Benbouaza, Abdelhafid Messaoudi, Kamal Kassmi, Mohammed Karrouchi</i>	
State of the Art on CAN Protocol Vulnerabilities and Intrusion Detection Systems in Automotive Networks	461
<i>Mohammed Saad Darouiche, El Bachir Tazi, Hassan Satori</i>	
Region-Wise Weather Data-Based Crop Recommendation Using Machine Learning Algorithms	466
<i>Akram Ghilan, Youssef El Afou, Nabil El Akkad</i>	
Enhancing Recruitment Transparency and Efficiency with Explainable AI (XAI)	472
<i>Abdelfattah Jamal, Karima Aissaoui, Sanae Kassal</i>	
Enhancing Encryption of an RGB Image by Combining the Lorenz Chaotic System and Arnold's Cat Map	478
<i>Yousra El Farssia, Fouzia El Azzaby, Khalid Sabour, Nabil El Akkad</i>	
Conception of the C19H2RM-2 Prototype Based on an Embedded Camera Module for Driver State Monitoring.....	483
<i>Hoda El Boussaki, Rachid Latif, Amine Saddik</i>	
Refined Coati Optimizer with Chaotic Systems for Optimization in Image Processing Applications	490
<i>Hanaa Mansouri, Karim El-Khanchouli, Mohamed Amine Tahiri, Nawal El Ghouate, Mhamed Sayyouri, Hassane Moustabchir</i>	
UML Functional Aspects in Business-To-Business: Some Lessons Learned	501
<i>El Mahi Bouziane, Hamza Abdelmalek, Lamy Benaddi, Charaf Ouaddi, Lahbib Naimi, Zakaria Babaalla, Adnane Souha, Abdeslam Jakimi</i>	
Arabic Speech Recognition for Industrial Commands: A Review	507
<i>Naouar Laaidi, Abderrahim Ezzine, Mohamed Lamrini, Hassan Satori</i>	

Author Index