

Editor's Note

THE International Journal of Interactive Multimedia and Artificial Intelligence (IJIMAI) provides a diamond open-access forum for researchers and professionals to share recent advances in artificial intelligence (AI) and its wide range of applications.

The present regular issue brings together ten articles that reflect this diversity, ranging from methodological advances in clustering, optimization, and recommender systems to AI applications in healthcare, wearable sensing, IoT, multimedia forensics, and smart education, as well as research on web accessibility and usability. Together, these contributions illustrate both the continued development of AI methods and their increasing application to real-world problems.

The first article, by Chen et al., titled “IKCS: An Effective Intelligent K-Medoids Clustering Scheme Based on Granularity Rough Entropy”, focuses on improving the classical k-Medoids clustering algorithm through the integration of granular computing (GrC). The proposed approach, called IKCS, identifies the most relevant features for clustering and enables a more effective selection of initial cluster centers. To this end, the authors define a granularity roughness entropy to determine feature weights, which are incorporated into the similarity function used by k-Medoids. The method also applies coarse-grained clustering and a maximum-minimum distance strategy to select the initial cluster centers. The approach is evaluated on both artificial datasets and 12 well-known UCI datasets. The experimental results show that IKCS achieves strong performance across different clustering metrics, outperforming several baseline methods in terms of accuracy and Adjusted Rand Index (ARI), while also obtaining lower clustering Sum of Squared Errors (SSE).

Continuing with methodological advances, Feng et al., in the next article titled “An Improved Attraction-Repulsion Optimization Algorithm for Global Optimization and Engineering Design Problems”, propose an enhanced version of the Attraction-Repulsion Optimization Algorithm (AROA), called the Differential Cauchy Tangent Attraction-Repulsion Optimization Algorithm (DCTAROA). The proposed method incorporates a mutation operator based on a tangent flight strategy to strengthen local search, together with a dimension decision mechanism based on the inverse cumulative distribution function of the Cauchy distribution to increase population diversity and enhance exploration efficiency. In addition, Differential Evolution (DE) is integrated as a local search mechanism to further strengthen the optimization capabilities of AROA. Experimental results on 29 CEC2017 benchmark functions across different dimensions show that DCTAROA outperforms several state-of-the-art algorithms in terms of solution accuracy, stability, and convergence speed. Furthermore, its application to three practical engineering design problems demonstrates its ability to effectively explore the search space and obtain competitive solutions, supporting its practical applicability.

Next, González-Prieto et al., in its article titled “Restricted Bernoulli Matrix Factorization: Balancing the Trade-Off Between Prediction Accuracy and Coverage in Classification Based Collaborative Filtering”, propose Restricted Bernoulli Matrix Factorization (ResBeMF), a new algorithm aimed at enhancing the performance of classification-based collaborative filtering. The approach seeks to provide recommendations with an associated degree of reliability, helping to identify predictions in which users can have greater confidence. The proposed model relies on a collection of restricted matrix factorizations that jointly generate, for each user-item pair, a full probability distribution over the possible rating scores. Experimental results show that ResBeMF achieves a good balance among prediction quality, prediction coverage, and recommendation quality compared with other existing approaches in the literature.

Moving to health-related applications of AI, Karayığit and Kalelioğlu, in its article titled “The Role of Advanced Language Models in Medical Diagnostics: A Case Study On Breast Cancer Prediction”, systematically evaluate 12 LLMs with 13 prompting strategies across three public datasets with different clinical characteristics: the Wisconsin Breast Cancer Dataset (WBCD) based on cytological features, the Breast Cancer Coimbra Dataset (BCCD) based on metabolic biomarkers, and the Mammographic Mass Dataset (MMD) based on mammographic attributes. Their findings reveal that LLM performance varies considerably depending on both the dataset and the prompting strategy, with no single model achieving the best results across all tasks. While traditional supervised machine learning (ML) methods still provide superior predictive performance, the gap has narrowed in some settings, highlighting the growing potential of LLMs for structured clinical prediction. The study therefore positions these models as promising complementary tools for exploratory diagnostic support, while emphasizing the need for expert supervision given the clinical relevance of the remaining errors.

Also in the health domain, the article “Captivating Insights Into Sleep Health: Orchestrating Lifestyle Features and Predictive Models Through Computational Intelligence”, by Abu Khurma et al., proposes an interpretable ML framework for predicting sleep disturbances based on lifestyle and health-related features. The methodology includes careful dataset selection and preprocessing, together with comprehensive feature engineering to account for the temporal aspects of sleep patterns. Within this framework, several established supervised and unsupervised ML techniques are considered and evaluated using cross-validation and different performance metrics. An optimized Decision Tree model is selected for its interpretability and predictive performance, achieving an accuracy of approximately 93% and improving upon previous results obtained on the same dataset. In addition, different visualization techniques are used to provide insights into the relationships between lifestyle factors and sleep health outcomes.

Continuing with health-related applications, the study “Wearable Sensors and MET Features: The Importance of Preprocessing and Understanding the Data”, by Bermudez-Edo et al., investigates the impact of different preprocessing techniques and features related to the metabolic equivalent of task (MET) on activity recognition accuracy using wearable devices. The authors conduct several experiments combining different features and ML algorithms to distinguish among physical activities. Their results show that incorporating features such as filtered acceleration (ACCfil), percentage of heart rate reserve (%HRR), and Ratio of Unfiltered to Filtered acceleration (RUF) improves activity recognition accuracy, particularly for more challenging activities. These findings highlight the relevance of preprocessing and feature selection for developing more accurate wearable-based activity recognition models.

Extending the discussion from wearable sensing to broader intelligent IoT environments, the article “XAIoT: A Conceptual Model for XAI Solutions on IoT”, by Parejas-Llanovarcad et al., addresses the need to make the decisions of AI-enabled connected devices more understandable to users. The authors propose XAIoT (eXplainable Artificial Intelligence of Things), a conceptual model that structures the main characteristics, requirements, and relationships involved in applying explainable AI to IoT systems. The framework is intended to guide the selection of suitable XAI solutions for given intelligent IoT applications. It is validated by classifying and characterizing 100

approaches identified through a systematic review of the literature and is further formalized as an ontology to support semantic queries and system design. The analysis also shows that healthcare is the most prominent application domain for XAIoT solutions, followed by industrial applications.

Moving to the field of multimedia security, Saleem et al., in their article titled “AV-DeepFake-Net: Attention-Guided and Uncertainty-Aware Network for Audiovisual DeepFake Detection”, propose an efficient multimodal framework for detecting audio-visual DeepFakes on consumer devices. The approach combines audio and visual encoders with cross-modal attention and uncertainty-aware mechanisms to capture inconsistencies inherent in manipulated content and improve robustness. It also incorporates a temporal boundary module to identify the onset and offset of manipulated segments. Experiments on FaceForensics++ and LAV-DF show strong performance in both clip-level detection and temporal boundary localization, while substantially reducing inference time compared with transformer-based approaches.

Turning to the field of smart education, the article “Real-Time Monitoring of Progress on a Smart Learning Platform” by Real-Fernández et al., explores the use of Khipulearn, an AI-supported platform designed to provide adaptive learning and real-time monitoring of students’ progress. Attention is given to the teacher dashboard, which offers visual analytics of both individual and group performance and competence development to support timely pedagogical decisions. The study shows that these monitoring tools can help identify different learning patterns and students requiring additional support, while also facilitating a more personalized learning experience. The results obtained in two different subjects also reveal a relationship between students’ performance within the platform and their final academic outcomes, highlighting the potential of real-time visual analytics and data-driven tools to support teaching and learning.

Finally, the issue closes with another human-centered application of technology. Alonso Virgós et al., in their article titled “Exploring Web Accessibility and Usability for Users with Attention Deficit Hyperactivity Disorder: Evaluation of Specific Guidelines and Adaptations” examine the applicability of accessibility and usability guidelines through controlled user tests involving adolescents with combined Attention Deficit Hyperactivity Disorder (ADHD). The experiments, adapted from previously validated studies with other neurodiverse users, evaluate different web design elements, including multimedia presentation and sound control. The findings show that certain guidelines can improve user performance, whereas others lead to results that differ from standard Web Content Accessibility Guidelines (WCAG) recommendations. These results suggest that accessibility strategies should consider the cognitive characteristics of users with ADHD rather than relying on broadly generalized recommendations. Based on the empirical findings, the study offers practical guidance for designing web interfaces that better address the needs of this user group.

Taken together, these regular contributions illustrate the breadth of the research covered in this issue, combining methodological developments with studies addressing healthcare, connected environments, multimedia, education, and web accessibility.

In addition to these regular articles, this issue includes a Special Section devoted to Intelligent Data Engineering and Automated Learning, comprising extended and substantially enhanced versions of selected contributions presented at the 25th International Conference on Intelligent Data Engineering and Automated Learning. The Guest Editor introduces the motivation, scope, and contributions of this Special Section below.

I would like to express my sincere appreciation to all the authors who have contributed to this issue, as well as to the reviewers and editors whose careful work and dedication have been essential throughout the evaluation and editorial process. I would also like to thank the Guest Editor for coordinating the Special Section. I hope that the contributions in this issue will be of interest to our readers and stimulate further research across these diverse areas of AI.

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From the Guest Editor

Artificial Intelligence is experiencing an unprecedented expansion, driven by continuous advances in intelligent data engineering, machine learning, and automated learning. The widespread digitalization of society, together with the exponential growth of data generated by connected devices, cyber-physical systems, and digital services, has created new opportunities for extracting knowledge and supporting intelligent decision-making. At the same time, recent progress in computational power and data-driven methodologies has accelerated the development of intelligent systems capable of learning from complex and heterogeneous information. As a result, AI has evolved from a predominantly theoretical discipline into a mature technological paradigm with a profound impact on science, industry, and society. Today, AI is no longer confined to algorithmic development but is becoming a key enabling technology for domains as diverse as healthcare, critical infrastructures, sustainability, human-centered computing, and decision support.

This Special Section of the International Journal of Interactive Multimedia and Artificial Intelligence presents extended and substantially enhanced versions of a selection of papers originally presented at the 25th International Conference on Intelligent Data Engineering and Automated Learning. Following a rigorous review process, five outstanding contributions were selected, illustrating the breadth of current research in artificial intelligence, from semantic interoperability in healthcare and intelligent emergency management to trustworthy machine learning, probabilistic modeling, and intelligent monitoring of critical infrastructures.

The first contribution, “CSSDH: A Unified Ontology for Social Determinants of Health and Seamless Continuity of Care Data Exchange,” addresses one of the major challenges in modern digital healthcare: achieving semantic interoperability across heterogeneous healthcare information systems. The authors propose the Common Semantic Data Model for Social Determinants of Health (CSSDH), an ontology that integrates the ISO 13940 Continuity of Care standard with the World Health Organization framework for Social Determinants of Health. Beyond its formal ontological foundations, the work demonstrates how knowledge graphs and semantic reasoning can facilitate interoperable healthcare data exchange while incorporating social determinants into patient-centered care, thus supporting more comprehensive and explainable healthcare management.

The second paper, “A Grid-Based Reinforcement Learning Approach for Ambulance Dispatching,” focuses on intelligent decision making in emergency medical services. The authors introduce GARD, a reinforcement learning framework that combines geographical grid partitioning with adaptive dispatch policies to optimize ambulance allocation for critical emergencies. Unlike traditional nearest-ambulance strategies, the proposed approach balances immediate response times with future service coverage, demonstrating how

reinforcement learning can improve operational efficiency in resource-constrained and geographically dispersed environments.

The third contribution, “Transformer with Decoupled Self-attention Regularization for Age-unbiased Facial Expression Recognition,” tackles the increasingly important issue of fairness and robustness in artificial intelligence. The paper proposes a novel Transformer-based architecture that explicitly disentangles age-related and emotion-related representations within the self-attention mechanism. By combining adversarial regularization with triplet learning, the proposed method significantly reduces age bias while preserving discriminative emotional features, achieving improved recognition performance across multiple benchmark datasets and contributing to the development of more trustworthy affective computing systems.

In “Mixtures of Polynomial with Tails as Probability Distributions: Theoretical and Experimental Evaluation,” the authors address a fundamental problem in probabilistic modeling and reasoning under uncertainty. They introduce mixtures of polynomials with tails (tMoPs), a flexible representation for continuous probability distributions particularly suited to hybrid Bayesian networks. The paper provides both the theoretical foundations and practical learning algorithms for the proposed model, together with an extensive experimental evaluation showing its effectiveness in approximating a wide range of probability distributions while maintaining computational simplicity and interpretability.

Finally, “Water Distribution System Leakage Detection and Localization Using Water Demand Automated Meter Reading: An Underexplored and Advantageous Technique,” presents an intelligent approach to sustainable water management. Rather than relying primarily on pressure sensors, the authors investigate the use of automated water demand meter readings as the principal information source for leakage detection and localization. Using the LeakG3PD simulated dataset, they demonstrate the feasibility of transparent and computationally efficient algorithms for identifying leakage events, highlighting the potential of intelligent data analysis to improve the monitoring and management of critical urban infrastructures.

Taken together, these contributions illustrate the diversity and vitality of current research in Intelligent Data Engineering and Automated Learning. Although they address different application domains, they share a common objective: exploiting advanced artificial intelligence techniques to transform heterogeneous data into actionable knowledge, supporting more accurate decision making, more reliable intelligent systems, and more effective solutions to complex real-world problems.

We would like to express our sincere appreciation to all the authors who submitted their work to this Special Section for the high quality of their contributions. We are equally grateful to the reviewers for their careful evaluations, constructive comments, and dedication throughout the review process, which have been essential in maintaining the high scientific standards of this issue. Finally, we would like to thank the Editor-in-Chief, the Managing Editor, and the entire editorial team of the International Journal of Interactive Multimedia and Artificial Intelligence for their continuous support and for providing us with the opportunity to edit this Special Section. We hope that the articles collected here will stimulate further research and foster new collaborations within the Intelligent Data Engineering and Automated Learning community.

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