



EDITORIAL

## Introduction to the Special Issue on Emerging Artificial Intelligence Technologies and Applications

Wenfeng Zheng<sup>1</sup>, Chao Liu<sup>2</sup> and Lirong Yin<sup>3,\*</sup>

<sup>1</sup>School of Automation, University of Electronic Science and Technology of China, Chengdu, 611731, China

<sup>2</sup>Department of Robotics, LIRMM, University of Montpellier—CNRS, Montpellier, 34095, France

<sup>3</sup>Department of Hydrology and Atmospheric Sciences, University of Arizona, Tucson, AZ 85721, USA

\*Corresponding Author: Lirong Yin. Email: yin.lyra@gmail.com

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Artificial intelligence (AI) has evolved at an unprecedented pace in recent years. This rapid advancement includes algorithmic breakthroughs, cross-disciplinary integration, and diverse applications—driven by growing computational power, massive datasets, and collaborative global research. This special issue of *Emerging Artificial Intelligence Technologies and Applications* was conceived to provide a platform for cutting-edge AI research communication, developing novel methodologies, cross-domain applications, and critical advancements in addressing real-world challenges. Over the past months, we have witnessed a remarkable diversity of submissions, reflecting the global trend of AI innovation. Below, we synthesize the key insights from these works, highlighting their collective contribution to advancing AI's theoretical frontiers and practical applications.

Natural Language Processing remains a cornerstone of AI progress, and this special issue features works that push the boundaries of language understanding. Fati et al. [1] confront the oversimplification of cyberbullying detection, which often reduces the task to binary classification. Their hybrid framework combines TF-IDF, Word2Vec, and BERT to identify nuanced categories like passive-aggressive remarks. Testing on 47,000 annotated social media posts, this framework advances efforts to combat online harm with greater precision. Mahdi et al. [2] extend this focus to Arabic, a language underrepresented in NLP research despite its global reach. They adapt BERT to recognize the unique nuances of Arabic social media communication, including dialects and informal language, and achieve robust performance on a diverse dataset of tweets. Kim et al. [3] turn to the urgent issue of online grooming, particularly targeting children on social networks. Their approach combines NLP and OCR to analyze both text and images, overcoming limitations of English-centric models by accounting for Korean SNS linguistic features.

Efficiency is a recurring challenge in NLP, especially for large models like BERT. Rahman et al. [4] tackle this by testing 20 combinations of knowledge distillation, pruning, and quantization to compress BERT for Bengali emotion classification. Their findings—showing that compressed models retain acceptable accuracy while reducing size by up to 4x—make advanced NLP accessible for Bengali, the sixth most spoken language globally. Similarly, Yin et al. [5] introduce DPAL-BERT, a faster and lighter question-answering model that uses knowledge distillation to reduce inference time without sacrificing performance. By training student models on teacher model PAL-BERT, this work addresses the computational burden of large language models, making them feasible for real-time applications. Alomari's comprehensive review [6] examines ChatGPT's usage across NLP tasks—from named entity recognition to sentiment analysis. The review identifies strengths and limitations, offering a roadmap for LLMs' responsibility in research and industry.



Computer vision research in this issue also has innovations in methodologies for a wide range of applications. Akgül [7] introduces a novel pooling method for convolutional neural networks (CNNs) that adapts to dataset-specific features, improving efficiency and accuracy in tasks where standard methods fall short. Hamplová et al. [8] demonstrate AI's role in cultural heritage preservation with instance segmentation of characters in ancient Palmyrene Aramaic inscriptions. Using YOLOv8 and Roboflow 3.0, they aid in the digitization and interpretation of fragile historical texts, demonstrating the potential of deep learning in archaeology.

A core application of AI is its role in revolutionizing healthcare. Ye et al. [9] address a critical challenge in image-guided surgery: the radiation risk associated with computed tomography (CT) and X-ray imaging. Their work introduces an Extended Kalman filter-based model to track puncture needles using ultrasound, eliminating radiation exposure while maintaining precision. Complementing this, Hong et al. [10] tackle the limitations of 3D medical image reconstruction, which traditionally relies on densely sampled projection data. They propose AdapFusionNet, a model that uses adaptive weight fusion to address spatial inconsistencies in sparse-angle X-ray data. By enabling high-quality reconstruction from limited inputs, this approach enhances diagnostic accuracy. In computational pathology, Rehman et al. [11] focus on breast cancer detection with a densely convolutional BU-NET framework. Their model addresses longstanding challenges in histopathological analysis by optimizing feature extraction and segmentation. This work enhances the reliability of automated cancer diagnosis, supporting pathologists in making faster, more accurate decisions. Beyond technical innovations, Kumar et al. [12] provide a critical review of AI's role in advancing Saudi Arabia's public healthcare system. Their systematic analysis of AI deployment in disease management, epidemiology, and policy-making emphasizes the need for culturally sensitive and ethically grounded solutions. This review highlights how AI can bridge healthcare disparities, particularly in regions striving for universal access.

Several papers focus on enhancing AI's ability to make robust, efficient decisions. Khan et al. [13] address the "Algorithm Selection Problem" (ASP) in automated machine learning (AutoML) with a meta-learning approach using Multivariate Sparse Group Lasso. Their method models sparsity in meta-features to improve algorithm recommendations, reducing the resource burden of trial-and-error approaches and making AutoML more accessible. Pan et al. [14] explore LLMs' capacity for contextual learning in hate speech detection, finding that fine-tuning yields the highest accuracy, but zero-shot and few-shot strategies remain viable when labeled data is scarce. Zhong et al. [15] apply AI to energy systems with a model that detects anomalies in Li-ion batteries by analyzing time-series data.

The papers in this special issue together show clearly that AI is a versatile tool. It improves accuracy in healthcare, promotes communication across different languages, protects cultural heritage, and enhances the functionality of key infrastructure. Looking ahead, these studies provide a foundation for future research. This includes developing multi-modal AI further, improving language models for low-resource languages, and integrating AI more closely into sustainable systems.

We extend our gratitude to all authors for their rigorous contributions, to the reviewers for their insightful feedback, and to the editorial team of *Computer Modeling in Engineering & Sciences* for supporting this initiative. We hope that this special issue will inspire continued innovation, driving AI toward a more inclusive, efficient, and impactful future.

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