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INTRODUCTION

Editorial: Special Issue on Advanced Artificial Intelligence Technologies for Multimedia Big Data Quality

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Editorial: Special Issue on Advanced Artificial Intelligence Technologies for Multimedia Big Data Quality

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This editorial summarizes the content of the Special Issue on Advanced Artificial Intelligence Technologies for Multimedia Big Data Quality of the Journal of Data and Information Quality (JDIQ).

CCS Concepts: • **Information systems → Data management systems;**

Additional Key Words and Phrases: Multimedia big data, internet of multimedia things, data quality

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1 Introduction

In recent years, the convergence of smart devices, high-speed networks, and AI has produced an unprecedented surge in multimedia big data. This trend is especially evident in the rise of the **Internet of Multimedia Things** (**IoMT**), an ecosystem of interconnected devices (e.g., cameras, sensors, and wearables) that continuously generate rich streams of visual, auditory, and sensor data used across domains such as education, smart cities, healthcare, and remote sensing [5]. Such multimedia data pose unique challenges beyond traditional structured or textual datasets. Key quality concerns include semantic ambiguity, temporal misalignment, incomplete contextual representation, and elevated privacy risks, which are often exacerbated by the heterogeneity and scale of data. Ensuring the fitness-for-use of data in such environments is essential for reliable downstream AI applications [2]. Recent literature underscores the necessity of AI-driven frameworks for managing big data quality in such multimedia-rich environments. Techniques such as attention-based architectures, automated anomaly detection, and metadata-driven correction pipelines have emerged to address issues of veracity, variability, and vulnerability in data streams [6]. Despite advances, there are still gaps in interpretable, domain-aware, and privacy-preserving AI solutions that handle multimedia

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big data quality in diverse real-world applications. Traditional data quality dimensions remain insufficient, especially as stakeholders increasingly demand robust, trustworthy, and explainable AI systems deployed on multimedia input.

This special issue of the ACM **Journal of Data and Information Quality** (**JDIQ**) addresses precisely these needs by bringing together state-of-the-art research on advanced AI technologies, including CNNs, attention models, ensemble learning, prompting frameworks, and privacy-preserving mechanisms, to tackle multimedia big data quality challenges. The selected articles span applications in education, mobility, security, NLP, remote sensing, and beyond. They also present novel metrics, evaluation methodologies, and architectures that set new benchmarks for performance, interpretability, and trust in multimedia analytics. Through this curated collection, we aim to inspire future research that not only improves predictive accuracy and system robustness, but also ensures ethical and reliable deployment amid the complexities of real-world multimedia data.

We sincerely thank all reviewers for their valuable expertise, critical insights, and dedicated efforts that greatly enhanced the quality and rigor of this special issue.

2 Articles Included in the Special Issue

Overall, this Special Issue received a strong response from the scientific community, with a total of 14 submissions. After a rigorous peer-review process, we accepted 57.1% of the manuscripts, reflecting our commitment to maintaining high-quality standards and relevance.

The articles included in this issue cover a broad spectrum of research contributions, from foundational methodologies to practical applications, offering original solutions and insights into multimedia data quality problems in various domains.

The article "Student Academic Success Prediction Using Learning Management Multimedia Data with Convoluted Features and Ensemble Model" by Umer, Al-Ameri, Al-Shammari, Castiglione, Nappi, and Pero [1] contributes to the field of educational data quality analytics by demonstrating how rich, heterogeneous multimedia data from LMS platforms can be transformed into accurate academic success predictions. The authors employ CNNs for automated feature extraction and combine them with ensemble learning techniques, achieving impressive predictive performance. This work aligns strongly with the Special Issue's goals by showing how deep learning architectures can enhance the modeling quality and predictive power of multimodal educational datasets, a key area in applied multimedia AI.

The article "How to Protect Reader Preference Privacy in Mobile Book Information Services: A Technical Method" by Wu, Lin, Liu, Xie, Xu, Chen, and Li [9] addresses a critical issue in privacy and trust in multimedia data processing. Their method generates false requests to obscure true user preferences in mobile library services, leveraging entropy-based models to quantify and preserve privacy. The work directly supports the SI's focus on privacy-preserving multimedia applications, especially in untrusted network contexts typical of IoMT systems, and demonstrates a practical solution that maintains data utility while protecting user identity and intent.

The article "ELF: Educational LLM Framework of Improving and Evaluating AI Generated Content for Classroom Teaching" by Tan, Yao, Pang, and Song [7] proposes a framework to integrate **large language models** (**LLMs**) into teaching processes, enhancing classroom interaction and instructional design with minimal data requirements. This approach supports two AI-generated content tasks: dialogue completion and pedagogical transfer learning. The contribution is aligned with the SI's emphasis on semantic enrichment, content quality evaluation, and LLM-based architectures for generating and validating educational multimedia content.

The article "Overheard: Audio-based Integral Event Inference" by Xu, Cai, Ma, Li, Seo, and Li [10], tackles the novel problem of inferring complex human events from polyphonic audio data using the ALTER family of models. With advanced attention mechanisms and multi-label inference strategies,

their work advances the field of audio-based semantic inference, pushing the boundaries of real-time, high-fidelity event understanding from noisy multimedia data. This study exemplifies the Special Issue's call for novel architectures and representations for multimedia data interpretation, especially in unstructured audio streams.

The article "DUTNG: Employing Dynamically Updating Traffic Network Graph for Short-Term Traffic Flow Prediction" by Lou, Wu, Zhao, Shen, and Yang [4] proposes a real-time, graph-based architecture that dynamically models traffic conditions. The approach captures spatiotemporal correlations more effectively than static models, enabling superior forecasting on real-world datasets. This work responds directly to the SI's focus on modeling and representation of high-volume visual-spatial data, as well as the integration of AI with urban mobility and sensor-driven infrastructures.

The article "AED: A Novel Approach for Intrusion Detection without Abnormal Samples in a Big Data Environment" by Wang, Qi, Wei, Zhu, Jiang, and Guan [8], addresses one of the most pressing concerns in multimedia data environments: cybersecurity in the absence of labeled anomalies. Their method uses a deep autoencoder combined with differential comparison to detect intrusions based solely on normal traffic data, making it particularly useful in dynamic real-time IoMT contexts. The article fits tightly within the SI theme by demonstrating how unsupervised deep learning models can ensure data quality and robustness in multimedia networks without prior assumptions about threats.

The article "Learning Attribute Attention and Retrospect Location for Instance Object Navigation" by Li, Zheng, Li, Zhang, Zou, and Yu [11] proposes a cascade model for instance-level object navigation in embodied environments. Their approach includes an **Object-Attribute Attention Graph** (**OAAG**) and a retrospective memory module, enhancing object discrimination and memory in navigation tasks. This work aligns with the SI by contributing a multimodal, attention-enhanced framework capable of navigating visual scenes through structured semantic cues-a prime example of deep semantic modeling in multimedia AI.

The article "A Remote Sensing Image Classification Method Based on Detail Attention Sampling and Teacher-Student Network" by Liu, Wu, and Wu [3] addresses quality improvement in remote sensing imagery. Their DATS framework integrates attention-based feature refinement with knowledge distillation across teacher-student networks to enhance both fine-grained detail and global structure recognition. This article exemplifies the Special Issue's goals by offering a robust AI pipeline for high-resolution multimedia classification, applicable to real-world challenges in geospatial monitoring and environmental data analytics.

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