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Editorial

Editorial for Special Issue on AI for Healthcare

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Artificial intelligence (AI) is rapidly revolutionizing the healthcare industry, enhancing efficiency, precision, and personalization of care. The abundance of medical data from sources like electronic health records, wearables, and medical imaging presents an opportunity for AI algorithms to uncover valuable insights that were previously challenging or impossible to discern. AI finds applications in various healthcare domains, such as medical diagnosis, drug discovery, and personalized patient care. In medical diagnosis, AI and machine learning algorithms can analyze patient data, identifying patterns indicative of specific diseases or conditions. In drug discovery, AI-powered tools analyze vast amounts of molecular, genomic, and drug interaction data, streamlining the identification of potential drug candidates. Personalizing care and improving the patient experience is achieved through AI and machine learning algorithms, which predict high-risk patients, enabling healthcare providers to intervene proactively. AI-powered chatbots and virtual assistants offer patients personalized support and guidance, reducing the workload of healthcare providers, and enhancing the overall patient experience. Though AI in healthcare is still in its early stages, its potential to transform the entire healthcare ecosystem is immense.

This special issue focuses on all aspects of artificial intelligence, machine learning, and deep learning for various healthcare applications. It has collected

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five excellent articles that have been reviewed and highly recommended by the editors and reviewers.

The first paper, titled "Challenges and Opportunities in Medical Artificial Intelligence," authored by Chieh-Mei Tsai, Chieh-Ju Chao, Yung-Chun Chang, Chung-Chieh Jay Kuo, Albert Hsiao, and Alexander Shieh, is a forum paper that extends from an online panel discussion on the 'AI for healthcare' panel that took place in May 2023. The panel featured four panelists with diverse backgrounds, including clinicians and information technologists. The aim of this paper is to provide a comprehensive overview of the current state of the medical AI field, with a specific focus on highlighting its challenges, opportunities, and future directions. Additionally, this paper offers valuable advice to young clinician scientists who aspire to enter the emerging field of medical AI. Despite the rapid advancement of the field, the core principles, challenges, and strategic approaches discussed in this paper are expected to remain relevant and foundational for the next 5-10 years. This information will prove beneficial to those looking to navigate the dynamic landscape of medical AI.

The second paper, titled "ExAD-GNN: Explainable Graph Neural Network for Predicting Alzheimer's Disease State from Single-cell Data," authored by Ziheng Duan, Cheyu Lee, and Jing Zhang, introduces the Explainable Graph Neural Network (ExAD-GNN), a novel machine learning model designed to predict Alzheimer's disease (AD) using single-cell sequencing data. ExAD-GNN constructs graphs based on the gene expression profiles of individual cells and accomplishes two primary objectives: predicting AD status at the cellular level and identifying cell-specific marker genes for AD diagnosis. The paper demonstrates empirically that ExAD-GNN outperforms existing methods in terms of AD prediction accuracy and robustness across various cell types and samples. Moreover, the paper effectively highlights the key AD risk genes, making it a valuable tool for gaining molecular insights into AD pathology from single-cell RNA sequencing data. The software developed in this paper has been publicly released for use by the scientific community.

The third paper, titled "Plantar Space-Gait Cycle Transformer for Early Parkinson's Disease Detection," authored by Xiaoyue Wang, Teng Li, Haoqiang Hua, Lin Shu, and Xiaofen Xing, introduces a novel dual self-attention Transformer model for early Parkinson's disease (PD) detection. This dual self-attention Transformer model explores spatial correlations in plantar pressure and temporal correlations in gait cycles, incorporating a masking mechanism to focus on the affected foot during specific phases of movement. Empirical analysis presented in this paper demonstrates that the proposed transformer model surpasses existing methods in PD classification based on plantar pressure data, highlighting its potential for early PD detection.

The fourth paper, titled "A Comprehensive Overview of Computational Nuclei Segmentation Methods in Digital Pathology" and authored by Vasileios

Magoulianitis, Catherine A. Alexander, and C.-C. Jay Kuo, provides a comprehensive review of the evolution of nuclei segmentation methods. The review spans from traditional image processing techniques to modern Deep Learning approaches. It emphasizes the challenges posed by limited annotated data and discusses the advantages of various models and types of supervision. Additionally, the paper looks forward to future research directions aimed at reducing reliance on labeled data while ensuring transparent and trustworthy outputs for physicians.

The fifth paper, titled "Multi-Scale Self-Attention Network for Denoising Medical Images" and authored by Kyungsu Lee, Haeyun Lee, Moon Hwan Lee, Jin Ho Chang, C.-C. Jay Kuo, Seung-June Oh, Jonghye Woo, and Jae Youn Hwang, introduces the Multi-Scale Self-Attention Network (MSAN). This specialized architecture is designed for denoising fluorescence and ultrasound images. Benchmarking results demonstrate that MSAN outperforms state-of-the-art models such as RIDNet and DnCNN, achieving significant improvements in signal-to-noise ratios across various datasets. This highlights its superior denoising capabilities for fluorescence and ultrasound images.

The papers featured in this special issue encompass a broad spectrum of topics within the field of AI for Healthcare. They not only shed light on the challenges and limitations of this rapidly growing domain but also present innovative solutions for various healthcare predictive applications. These applications range from digital pathology and medical imaging to disease prediction using single-cell data. We anticipate that this special issue will encourage researchers to explore new directions and inspire newcomers to embark on research endeavors related to AI for Healthcare. Lastly, we extend our heartfelt gratitude to all the reviewers for their dedicated collaboration and valuable feedback.

Guest Editors

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