The Digital Transformation by Artificial Intelligence for Medical Education and Clinical Applications

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ABSTRACT

Medical signals and images play an essential role in modern healthcare, aiding in the early detection and accurate diagnosis of various diseases. With advances in artificial intelligence (AI), the techniques of vital signals (including ECG, EEG and others), computed tomography (CT), magnetic resonance imaging (MRI) and other modalities have undergone a paradigm shift in precision screening and diagnostic strategies. For example, AI algorithms have demonstrated remarkable capabilities in improving the detection of obstructive coronary artery disease (CAD) and identifying atrial fibrillation (AF) in sinus rhythm in cardiological studies based on ECG analysis. In addition, AI is extending its transformative impact to cardiac image analysis, particularly with CT and MRI modalities. Deep learning techniques enable automated extraction of vital cardiac parameters from CT images, facilitating accurate classification of left ventricular hypertrophy and prediction of patients with AF. Similarly, AI-driven MRI analysis helps to differentiate between different cardiomyopathies, providing invaluable insights into disease pathology. The Generative AI (GAI) techniques of large language models (LLM) and generative pre-trained transformers (GPT) can be further incorporated for comprehensive medical diagnosis. Future research results will include the integration of multimodalities with genomic data and clinical factors by the GAI methods. Through the synergy between AI and medical data, precision medicine is developing to improve patient care and clinical outcomes. These developments of AI and GAI will enable the digital transformation for medical education and clinical applications.

Keywords: artificial intelligence (AI); precision medicine; multimodalities; Generative AI (GAI); generative pre-trained transformers (GPT); large language model (LLM).