International Workshop on Digital Twins for Smart Health

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FOREWORD

First defined by NASA in 2010, a digital twin is a synchronized digital replica of a physical system used to monitor, model, and fine-tune the system's performance throughout its lifetime. Digital twins have been widely used in aerospace engineering, manufacturing, construction, urban planning, and automotive. In healthcare, a digital twin can be used to monitor a person's health conditions, evaluate potential preventive or therapeutic plans, design personalized treatment, and interventions, prevent potential health issues, and facilitate virtual clinical trials. In principle, the idea of digital twins for health is poised to revolutionize modern healthcare with the help of artificial intelligence (AI) and machine learning (ML). However, there is still a long way to go before its potential can be fully realized for the benefit of personal health and well-being. One of the main challenges is that the human body is a complex multiscale dynamic system where many biological processes and underlying mechanisms are still unknown. In addition, the multimodal heterogeneous data is scattered and disconnected across various systems and domains, not amenable to AI/ML analysis at scale. Finally, there are concerns about the ethics, fairness, robustness, and explainability of AI algorithms, as well as data privacy and security, which may contribute to health inequities, social harms, and structural injustices in the applications of AI-empowered digital twins for healthcare.

With the recent development in data curation, multiscale modeling, and high-performance computing, there have been increasing and promising applications of AI, ML, and deep learning algorithms in digital twins. In this workshop, we aim to address the timely topics of digital twins for health aided by AI solutions. Specifically, the invited speakers will cover such topics as imaging-based digital twins for oncology, Virtual You: building digital twins of the human body, event labeling for digital twins in health, building the biomedical digital twin ecosystem, physiological modeling for human digital twins, and the socio-ethical implications of digital twins in health. In the end, the technological implementations and some use cases of digital twins will be explored and debated during the panel discussion.

The proposed workshop will bring together researchers, practitioners, and industrial partners from AI, statistics, computer science, mathematics, engineering, healthcare, medicine, social, behavioral, cognitive, and legal sciences to discuss innovative and impactful approaches to enabling digital twins for personal health and well-being. With the involvement of all the major stakeholders, this workshop is expected to attract interested groups from the AI communities and beyond in bringing out the power of AI for better health outcomes for individuals and the public.

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