MIDI 2024 Conference

Towards Effective Immersive Technologies in Medicine: Potential and Future Applications based on VR, AR, XR and AI solutions

Abstract

Mixed Reality (MR) technologies like Virtual and Augmented Reality (VR, AR) are well established in medical practice, enhancing diagnostics, treatment, and education. However, there are still some limitations and challenges that may be overcome thanks to the latest generations of equipment, software and frameworks based on eXtended Reality (XR) by enabling immersive systems that support safer, more controlled environments for training and patient care.

Our review highlights recent VR and AR applications in key areas of medicine. In medical education, these technologies provide realistic clinical simulations, improving skills and knowledge retention. In surgery, immersive tools enhance procedural precision with detailed anatomical visualizations. VR-based rehabilitation has shown effectiveness in restoring motor functions and balance, particularly for neurological patients. In mental health, VR has been successful in treating conditions like PTSD and phobias.

Although VR and AR solutions are well established, there are still some important limitations, including high costs and limited tactile feedback, which may be overcome with implementing new technologies that may improve the effectiveness of immersive medical applications such as XR, psychophysiological feedback or integration of artificial intelligence (AI) for real time data analysis and personalized healthcare and training.