MRI SmarT: A Novel Multi-Modal Approach to Tumor Detection and Surgical Planning

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Recent advancements in extended reality (XR), encompassing augmented reality (AR), virtual reality (VR), and mixed reality (MR), have demonstrated significant potential in transforming the medical field, particularly in surgical applications. This diverse system, MRI SmarT, is a novel XR-based preoperative planning tool designed specifically for neurosurgical procedures, emphasizing brain tumor removal. Leveraging MRI imaging, deep learning (DL), and artificial intelligence (AI), our research aims to create an interactive 3D brain model that enables surgeons to visualize and simulate surgical scenarios using the Meta Quest 2 headset. Integrated DL models provide real-time feedback on surgical strategies, highlighting potential risks and improving decision-making. Our approach builds upon prior work by incorporating advanced DL models, such as convolutional neural networks (CNNs) and Long-Short Term Memory (LSTM) networks, to analyze and provide actionable insights during simulation. Unlike existing tools, which are often limited to basic visualization or simulation, our system evaluates and advises on surgical strategies, helping mitigate errors arising from inadequate planning. This innovation addresses critical challenges in neurosurgery, where errors remain a significant concern, contributing to approximately 98,000 preventable deaths annually in the U.S. and imposing substantial economic costs. By streamlining the preoperative planning process and enhancing the surgeon's ability to visualize and simulate complex scenarios, this tool can significantly reduce surgical errors, improve patient outcomes, and advance the state of precision medicine in neurosurgery.

Awards Won: