Enhancing Diagnostic and Surgical Planning: The Role of AI and XR Technologies in Modern Medicine

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INTRODUCTION

Advancements in artificial intelligence (AI) and extended reality (XR) are revolutionizing medical diagnostics and surgical planning. AI allows for automated segmentation of medical images, while XR provides immersive 3D visualization of patient-specific anatomy. Deep learning methods, shown in Figure 1., are effective in segmenting complex anatomical structures from MRI and CT scans, such as placental tissue or neurovascular pathways. These segmentations are used to generate 3D models within XR platforms. XR headsets allow real-time visualization of these models during ultrasound or preoperative sessions, enhancing spatial orientation and precision.

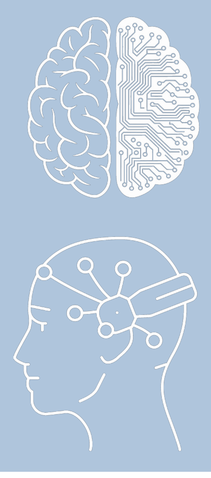
APPLICATION

Placenta Accreta Diagnosis

Placenta accreta is a high-risk condition requiring precise diagnosis. AI and XR enable 3D visualization by fusing MRI and live ultrasound, helping clinicians see placental invasion in real time, improving diagnostic clarity and surgical planning through intuitive AR guidance.

Neurovascular Simulation and Planning

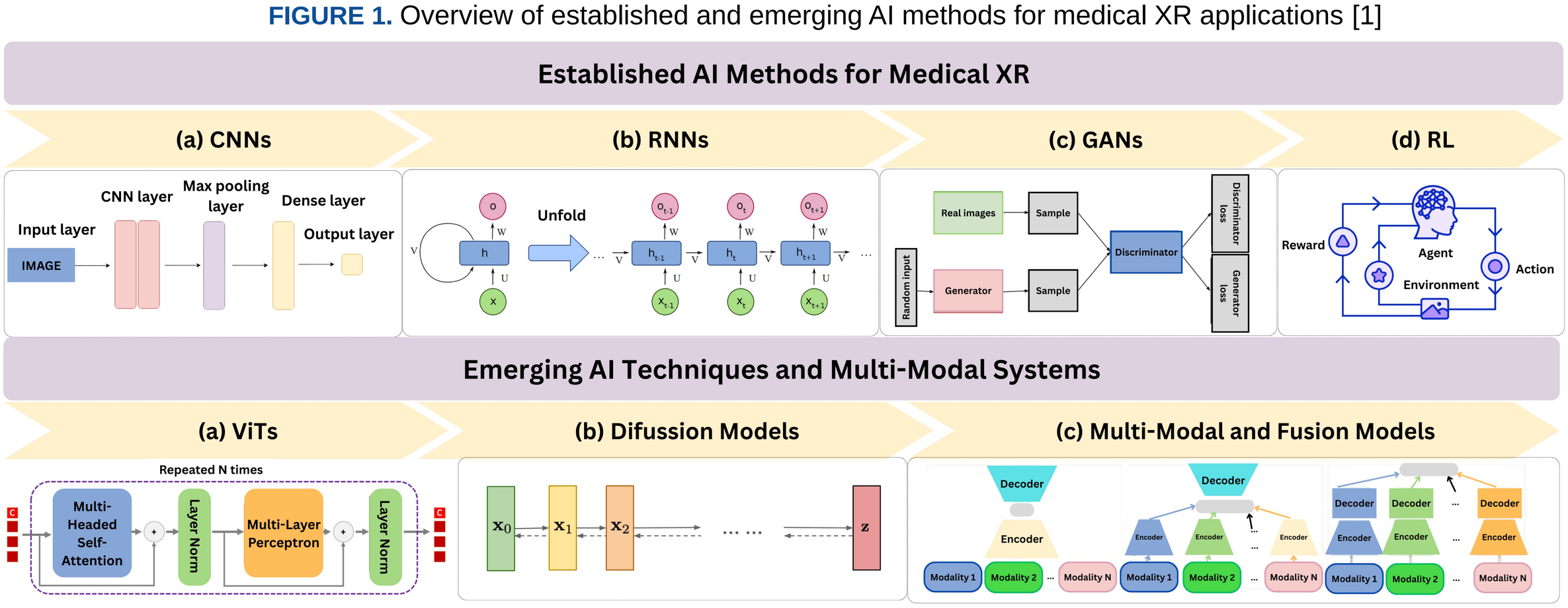
XR and AI enhance neurovascular surgery by enabling 3D visualization, simulation, and training. AI segments vessels from scans to create virtual models for VR practice, while AR aids intraoperative guidance. Together, they improve planning, skill development, and procedural safety.



CONCLUSION

AI and XR technologies enhance diagnostics and surgical planning through improved visualization and spatial insight, leading to faster decisions and better outcomes. They support clinical tasks like assessing placental invasion and planning neurovascular procedures. Benefits include higher accuracy and reduced preparation time. Nevertheless, challenges, including the need for annotated data, the high cost of XR equipment, and the need for training for healthcare professionals, must be addressed to ensure broader adoption [1].

FIGURE 1. Overview of established and emerging AI methods for medical XR applications [1]



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