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**Promoting Technology and Collaboration**

# The Potential Utility of 3D Modeling as a Novel Pre-surgical Imaging Technique for Liver Surgery

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**Background:** In liver cancer surgery, spatial awareness of the tumor is essential for successful outcomes. The degree of this awareness directly impacts operative and postoperative outcomes. Complex liver cancer cases demand a thorough spatial mapping of liver anatomy in relationship to the tumor. However, a difficult tumor location, altered anatomy due to underlying liver disease, or tumor characteristics such as adhesions, infiltration, and increased vascularity can make safe surgery challenging. Surgeons currently rely on 2D imaging to create a mental model of the patient's anatomy. Unfortunately, this process creates uncertainty and is heavily dependent on the surgeon's experience, making it difficult to objectively share with the entire medical team. The introduction of 3D modeling offers a solution by providing more accurate and objective spatial awareness, potentially leading to improved postoperative outcomes.

**Technology Overview:** OSF's Advanced Imaging and Modeling lab, in collaboration with the University of Illinois Urbana Champaign, developed the ability to convert medical axial images into immersive 3D models for pre-surgical planning. Using high-resolution 3D MRI images, convolutional neural networks, and segmentation algorithms, the lab automatically detects, isolates, and segments anatomy and pathology.

**Potential Application in Surgical Simulation and Education:** A new workflow which integrates clinical cases to generate 3D models in virtual reality significantly enhances surgical planning and understanding of patient-specific anatomy and pathology. This technology creates a higher degree of spatial awareness. Furthermore, additional potential lies in enabling treatment team members to share the same immersive models as objective images, broadening the range of treatment options and facilitating decision-making for complex liver cancer cases. This 3D visualization system is expected to foster collaboration which improves treatment outcomes.

**Potential Opportunities to Collaborate:** Incorporation of novel techniques like magnetic resonance fingerprinting and elastography are being developed for this application to provide further detailed insights into tumor and tissue characteristics.