FROM MEDICAL IMAGING TO AUGMENTED REALITY FOR SURGICAL APPLICATIONS

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Hosting:

- City: Nantes (France)
- Type of institution : University Campus / Research Laboratory
- Name of hosting institution : Ecole Centrale de Nantes

Keywords:

Augmented Reality, Artificial Intelligence, Medical Imagery, 3D Reconstruction, Surgical Assistance.

Context of the internship:

Augmented Reality (AR) and Virtual Reality (VR) are transforming the practice of medicine by providing new, innovative, and effective methods developed from the interaction of digital medical data such as medical images. AR and VR play an essential role in the current and future training of health professionals such as surgeons and different actors in the medical world, including medical students. AR and VR in surgical education have enhanced teaching and learning experiences and provided opportunities for distance teaching, participation, and collaboration between different surgical teams worldwide.

Information from medical imaging, such as computed tomography (CT), magnetic resonance angiography, and magnetic resonance imaging (MRI), is crucial for applying AR and VR in a medical, surgical context. Indeed, thanks to AR/VR capabilities for real-time in-situ visualizations, these technologies could be used not only for preoperative planning, surgical training, and education, but also during real surgery.

In this project, our goal is to use AR to guide the user during a surgical procedure in order to enforce safety and efficacy of such procedures. The information provided to the surgeon can be of different sort: anatomical delineation, display of invisible (e.g., tumorous) tissues, virtual cutting guides, etc.

Like any new procedure, it presents difficulties and challenges. A significant challenge to work on and solve in AR is image tracking and anatomical repositioning to guide the surgical procedure. Indeed, this is of crucial importance to avoid injuring the patient during the surgical procedure.

Our team is composed of experts (Pr. HASCOET, Dr. VIDAL) in medical procedures as well as in medical images processing to create digital counterparts or physical models of organs or anatomical tissues. Thus, thanks to our digital chain strategy (Fig. 1) we are able to create 3D models of organs or tissues from real medical images.

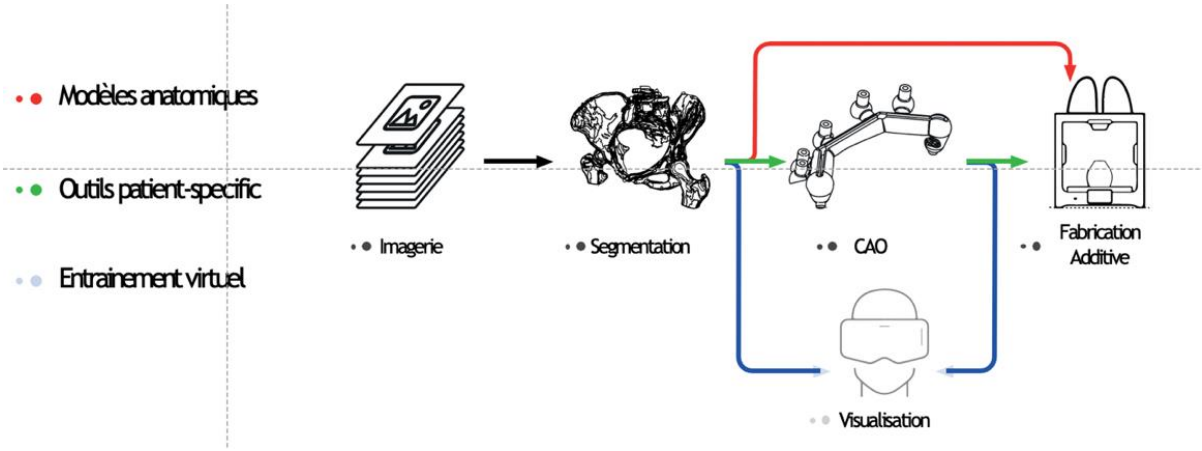

Figure 1. Semi-Automated Digital Chain from medical.

Second, our team integrates experts (Dr. NORMAND and Dr. FRIBOURG) in AR/VR in order to develop interaction and visualization techniques to display such 3D models collocated with real organs/tissues during a surgical procedure.

During this internship, we will first use 3D printings of organs/tissues to develop our AR techniques that we mimic a real surgical procedure. The intern will have to display 3D organs/tissues and develop interaction techniques to allow a surgeon to manipulate them in real-time. To do so, we aim at using a Microsoft HoloLens 2 (see Fig. 2) that we already bought on our own research funds.

Figure 2. Interaction with a 3D model though an AR device (Microsoft HoloLens 2).

Duration: 6 months, start from January 2023.

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