**Open Surgery Training Simulator
Using Haptics and Augmented Reality Technologies**

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This thesis focuses on the research and development of a novel Haptics-based Augmented Reality system that is able to realistically simulate open surgical procedures, called *ImmersiveTouch*®.

As a proof of concept, a neurosurgical procedure called ventriculostomy is simulated. This surgical procedure consists of the insertion of a catheter in the brain ventricles for draining excess spinal fluid and reducing intracranial pressure. While performing the surgery, neurosurgeons must rely on their fine eye-hand coordination and sense of touch to properly orient and introduce the catheter, as a subtle puncturing sensation is felt when the catheter cannulates the ventricles.

The new high-fidelity simulator can help trainees to develop both tactile and psychomotor skills required to perform a ventriculostomy. As an interdisciplinary project between the Department of Mechanical and Industrial Engineering and the Department of Neurosurgery at UIC, the ultimate goal of this doctoral dissertation is to provide an interactive educational instrument to better train medical residents, allowing them to become proficient prior to working with real patients, unrestricted by time and patient safety constraints.