UNIVERSITY OF GENOA
DEPARTMENT OF INFORMATICS, BIOENGINEERING, ROBOTICS AND SYSTEMS ENGINEERING
MASTER'S PROGRAM IN BIOENGINEERING

Thesis Project Form

Title (tentative): Visuo-haptic simulator for surgical training

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Description

Motivation and application domain

Before starting clinical practice, surgeons need to learn how rely on different haptic feedback. In particular, they must recognize between different biological tissues, perform dexterous tasks in limited space, learn an optimal hand-eye coordination, and use surgical instruments which limits, misses or distorts haptic information, resulting in a higher risk for tissue damaging.
In this context, medical simulation can support surgical learning in a riskless environment. Surgical training, especially at the beginning of residency, is exploited through synthetic materials and box-trainers, (i.e., devices for laparoscopic training including a camera and different objects to create preparatory activities), either physical or virtual. However, one of the greatest limitations of surgical simulation is the haptic feedback which is usually unrealistic or totally missing.

General objectives and main activities

The work of the thesis will be focused on the implementation of an educational tool for surgical training and research. The project starts from two previous thesis works aimed at creating a visuo-haptic model of the skin and implement surgical tasks such as incision and suturing by using a Geomagic Touch haptic device and the open source SOFA framework.
The student will collaborate with a team of surgeons, to define the further steps to be taken to create a tool which can be used by residents and physicians who need to be trained on different surgical abilities, as well as by researchers to investigate surgical learning. This includes: (i) improve the existing visuo-haptic models and exercises; (ii) add new exercises (both mono a bimanual); (iii) define with the surgeons the proper scoring system; (iv) integrate the system with biological data acquisition system; (v) test the simulator

Training Objectives (technical/analytical tools, experimental methodologies)

1. Analysis of the existing models and tools
2. Identification of the changes to be implemented (collaboration with Surgeons)
3. Software implementation using a visuo-haptic modelling software (e.g. SOFA, iMSTK, or others)
4. Running experiments with surgeons and/or people without surgical background
5. Testing phase and data analysis (Matlab/Python/SPSS)

Place(s) where the thesis work will be carried out: Joint lab for emerging technologies in simulation at SimAv

Additional information

Maximum number of students: 1