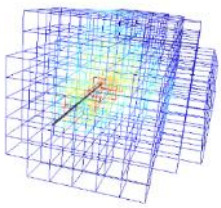
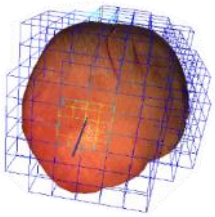
Specular – Simulation of PErCutaneoUs Liver tumor Ablation in virtual Reality

Laboratory: MLMS ICube – CNRS.
Topic: Medical Simulation / Virtual Reality
Duration: 2 years
Site: Strasbourg

We are excited to post a job opening (05/2023) for the position of Research Engineer with expertise in Simulation and Modeling to join our research team in Strasbourg. The objective of this project is to create an immersive virtual reality training simulation for medical procedures involving the use of needles.

Context: Needle-based interventions provide a minimally invasive surgical approach to access deep internal structures in organs without damaging surrounding tissues. Percutaneous image-guided interventions, such as biopsy, vertebroplasty, and radiofrequency ablation (RFA), have become the gold standard for many medical procedures. However, due to the complexity of accessing internal structures, medical practitioners require more than a decade of training to master these procedures. There is a growing need for quick, affordable, and reusable training solutions to address these concerns. Computer-based simulators have become increasingly popular in academia and industry since they can reproduce realistic conditions for minimally invasive surgery. These simulators feature realistic virtual organs that can be computed in real-time and serve as valuable tools for medical training and education.

Objective: We seek a Research Engineer to design and implement advanced solutions for developing a needle insertion training simulation. The candidate will be responsible for collaborating with our development team to create real-time finite element simulations and integrate them into a VR demo with haptic feedback. The role also involves working alongside medical doctors to evaluate the effectiveness of the training simulation. The ideal candidate for this position should possess a Master's degree in Computer Science or a related field, with expertise in C++. Knowledge of biomechanics would be considered a valuable asset. This is an opportunity to work with a passionate and dynamic team, contributing to developing innovative products that significantly impact society.

Our team is specialized in real-time finite element simulation and robotic control in medical applications. This work will be implemented on the Sofa-Framework and a dedicated hardware platform, consisting of a collaborative robot equipped with a needle manipulation tool. We have a strong will to bring our research results to an experimental prototype that allows for qualitative and quantitative evaluation of our approach.

Your primary responsibilities in this role will include the following:

- **Accurate modeling and interactions:** You will develop accurate physical modeling of deformable structures and interactions while maintaining stability and fast computation time.
- **Computation time optimization:** You will contribute to advanced solutions to produce large-scale simulations of multiple organs, including complex interactions with the liver during breathing motion, while limiting computational time and focusing on the most critical interactions.
- **Realistic haptic feedback:** As haptic feedback is the only cue for assessing needle puncture inside tumors, you will need to develop accurate and fast models of interactions with virtual instruments to reproduce these forces.
- **Immersion:** You will be responsible for ensuring a high level of immersion in the training simulator. This will involve creating realistic visual feedback and ensuring the user's and instruments' physical positioning in the operating room is accurate.

If you are interested in this opportunity, please send your CV and cover letter to hcourtecuisse@unistra.fr. We look forward to hearing from qualified candidates who are excited to join our team and contribute to our goal of creating a startup based on the innovative work developed during this project.

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