

## Master Thesis - Job Description- Imaging Algorithm and validation

### Algorithm design and image-based validation of patient-specific pre-operative models using an optical imaging camera

This project is part of a larger ongoing project, collaborating with the ARTORG IGT Group University Bern and SurgeonsLab AG. The project aims to develop accurate pre-operative patient brain pathologies to aid neurosurgeons and neuro-interventionists in accurately planning therapies. The group had developed a dedicated 3D printing and modeling technology that precisely and realistically replicates the patient pathologies. The virtual and physical models are integrated into the existing commercially available neurosurgical simulator for training surgeons.

The proposed thesis will focus on creating an image-based algorithm on a depth optical camera for quantifying closeness to patient geometry in terms of coordinates, position, and spatial distance to neighboring microanatomical structures.

#### Thesis goals:

- Prepare a high-resolution UI based on the requirements and build the image acquisition setup using 3D printing
- Integration of camera and implementation of image detection, classification, and recognition algorithms based on the requirements
- Build a network model based on the references for distinguishing sub-millimeter objects precisely for a cluster of the patient dataset
- implement a quantifiable method for recording the deviation between the reference and models
- Test and conduct experiments using the developed methodologies for a small group of the patient dataset

#### Skillssets:

- Basic knowledge of Qt C++ and/or other programming skills
- Analytical and logical thinking, Fundamental knowledge of how 3D modeling works, Problem-solving, statistics, analyzing and synthesizing requirements, hands on experience with Image processing and computer vision
- Fundamental knowledge in Artificial Intelligence and deep learning

#### Minimum Requirements to Apply:

- Field of Study: Electrical, Biomedical, Computer, Mechanical Engineering, or other related
- Past experiences in robotics, optical imaging, design, and validation of precision tools are a plus

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1. Letter of Motivation (1-page, font size 10) [Format- About me, Past and Motivation, How I fit for this thesis, and what interests me?]
2. CV (Academic Track Record, Professional Experience)

**Start Period:** At the earliest possible

Learn More about the simulator: <https://www.surgeonslab.com/product-surgtrain/>

Research Group Page: <https://www.artorg.unibe.ch/research/igt>