Type of Document: Student Project
Author: Bram de Beer

Eindhoven Medical Robotics

Segmentation of structures on CT images

Background Assignment

Superhuman precision can help advance delicate medical procedures, facilitating the surgeon to improve outcome or even develop novel treatments. Medical robotics allow for such superhuman precision, due to their advance mechanical design and processing power. Example procedures where a robot will assist the surgeon in the near future are bone drilling and milling operations. Vital structures such as the facial nerve are embedded in the bone structure and as such should not be accidentally hit, while there are classes of tumors that typically occur near these areas (and hence, should be removed). At time of writing the standard practice is for a surgeon to manually drill away a piece of the skull very close to the facial nerve, a skill only experienced surgeon master. A typical procedure includes hours of manual drilling.

The figure on the right depicts RoboSculpt, a robotic bone sculpting robot that is able to accurately mill and drill bone in the skull area. By using medical images taken before the operation, the robot has access to detailed knowledge on the anatomy of the patient. The latter allows the robot to optimize drilling trajectories and as such allow for faster surgeries with reduced complication risks for the patient.

The robot will be able to autonomously carry out instructed tasks, but can also be operated manually using a haptic device. This haptic device allows the surgeon to be in full control of the movement of the robot while getting force feedback. Tremors and other unintended inputs are filtered.

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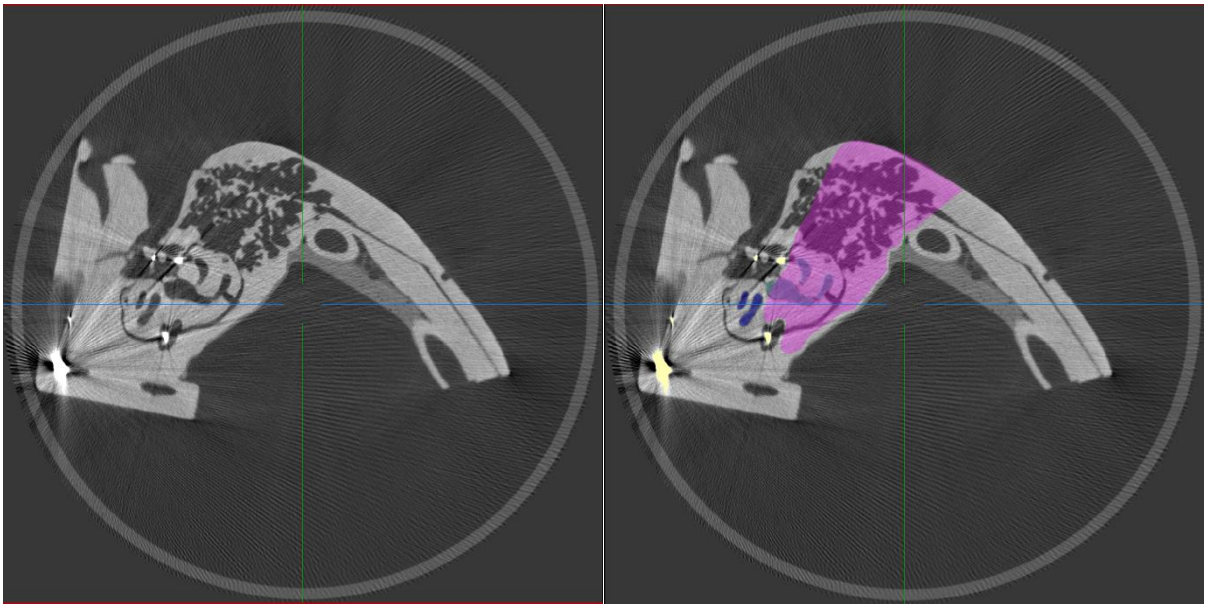
Assignment

Since the creation of the segmentation and user interface are still incomplete, the necessary information from the CT images needs to be extracted manually. This manual segmentation task is the subject of this assignment.



On the CT image, several structures must be identified and coloured.

For now, these structures are:

1. Nervus facialis
2. Chorda tympani
3. Semi-circular canals
4. Cochlea
5. Translab volume

The task will take around 20 hours per sample. Currently, 3 samples need to be segmented. In the future, the segmentation of further samples may be necessary, if the automatic segmentation software hasn't been completed yet.

No prior medical or anatomical knowledge is required for this assignment.

Further details on the assignment will be discussed to interested parties.