Propagating anatomical measurements over point cloud meshes registration

Project Management and Software Development for Medical Applications

General Info

Virtonomy.io

Contacts: Diogo Ferreira de Almeida, Ching-En Lin, Moritz Jung

Contact Email: almeida@virtonomy.io; lin@virtonomy.io; jung@virtonomy.io

Project Abstract

It is important to have insight on population-based data of target groups in the development process of medical devices. For such, it is required that anatomical measurements are performed on a significant number of patient datasets to ensure population coverage. Performing these measurements manually is a tedious, time-consuming and error prone process. The purpose of the current project is to propagate measurements over data samples by registering point cloud data to a template. However, in the cardiac domain, heart chambers present a high shape variability that can present a challenge to the deformable registration. Successful outcome of the project will be deployed to Virtonomy's SaaS web platform.

Background and Motivation

Virtonomy GmbH is developing the first web platform for conducting fully data driven clinical trials of medical devices with the use of virtual patients. Our system is based on clinical scans (CT, MRI), pathology data and data about the medical devices. Anatomical measurements of a cohort of patient data can help implant developers optimize their manufacture cycle by improving sizing estimation and reducing clinical trials. An efficient landmark propagation will enhance robustness and automation to the process. In conclusion, virtual testing can include population coverage and provide high value to implant developers.

Student's Tasks Description

- Understand deformable point cloud mesh registration;
- Improve template meshes for the heart chambers and connecting vessels;
- Understand and optimize how pre-defined landmarks propagate through the registration;
- Post-registration optimization of the landmark estimation ;
- Document and present findings.

At the end of the project, the student should present a report of the registration performance and commit source code in a GIT repo. The student will learn how to handle 3D point cloud models, automate anatomical measurements while improving his coding skills. Virtonomy will provide supervision in the computer vision and deep learning methods and software development experience.

Technical Prerequisites

- Solid mathematical background
- Experience with point cloud meshes
- Point cloud registration is a plus
- Python for data analysis or algorithm design
- Basic understanding of Git.

Why you should choose us

- Opportunity to work in an international start-up environment or remotely
- Participation in the exciting development and growth of a start-up
- Contributing to an exciting real-life medical data solution with impact

References

https://siavashk.github.io/pycpd/

Mansilla, L., Milone, D.H. and Ferrante, E., 2020. Learning deformable registration of medical images with anatomical constraints. Neural Networks, 124, pp.269-279.

Please send the completed proposal to ardit.ramadani@tum.de , lennart.bastian@tum.de and tianyu.song@tum.de
Please note that this proposal will be evaluated by the BMC coordinators and will be assigned to a student only in case of acceptance.