

Statistical Shape Modeling of Cardiac Anatomy

Project Management and Software Development
for Medical Applications

General Info



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Project Abstract

This project aims at developing a software module to perform Statistical Shape Modeling (SSM) of the cardiac anatomy to represent the anatomical variability of a whole population group, using the state-of-the-art statistical shape modeling methods.

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 medical devices. SSM is one of the key features of our offering.

Our choice of the shape modeling method is based on the simple and versatile mathematical approach using the theory of Gaussian processes.

We focus on Aorta SSM in this assignment.

Student's Tasks Description

- Following Scalismo tutorials to understand core concepts of statistical shape modeling and how to use Scalismo
- Rigid alignment using Iterative Closest Point
- Modeling shape deformations calculations using Gaussian processes
- Build a visualization concept
- Complete SSM building and prepare an end-to-end pipeline

By the end of the project, the student shall have the following outcome: a visualization concept and an end-to-end aortic SSM pipeline.

The student will learn the core concept of statistical shape modeling and how to apply it to a real-life problem. Virtonomy provides supervision with industrial medical image analysis and software development experience

Technical Prerequisites

Medical imaging and computer science background. Feel comfortable to learn a new concept and work on a new framework.

Why you should choose us

- Opportunity to work in a vibrant environment with many other start-ups (Werk1) or from home
- Participation in the exciting development and growth of a start-up
- Work in a lean startup R&D process and understand a SaaS building
- Contributing to an exciting real-life medical data solution with a huge impact: Two previous PSMD assignees continue working with us after their assignments and are on their way to integrate their work into a web-based software platform.
- Opportunity to demo your work to a real customer.

References

- Virtonomy's references for 3D anatomical models:
<https://virtonomy.io/services/references>
- Probabilistic Morphable Models:
<https://gravis.dmi.unibas.ch/PMM/>
- Scalismo - Scalable Image Analysis and Shape Modelling: <https://scalismo.org/>
- Statistical Shape Analysis, Dryden, Mardia etc. 2016

Please send the completed proposal to javier.esteban@tum.de, ardit.ramadani@tum.de, mf.azampour@tum.de and zl.jiang@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.