

MSc project “Non-rigid image registration of volumetric models”

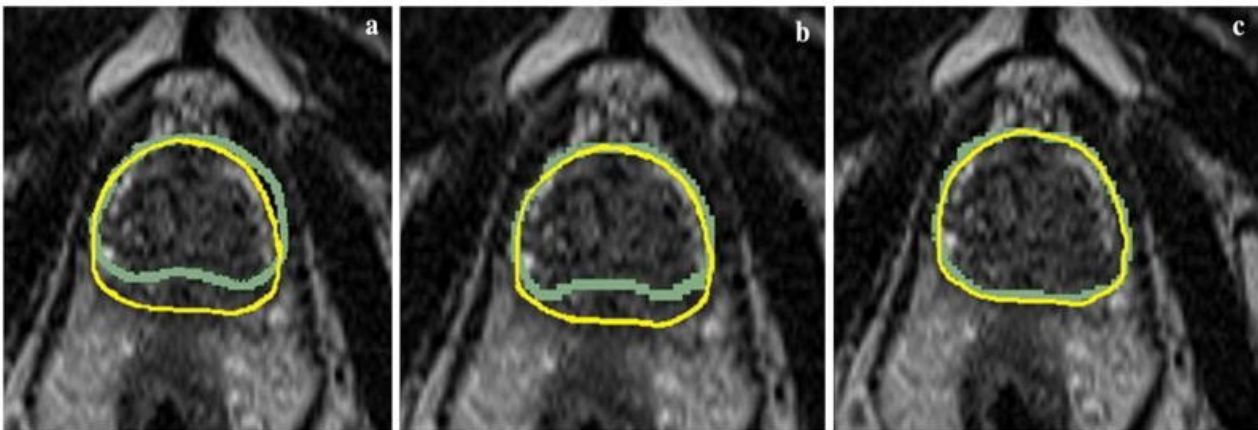
Background

For image guided interventions (e.g. oncology), the diagnostic scan is typically taken at a different point in time, often different patient position and even other imaging modality as the interventional scan. This means the shape of the organ between the scans is different and so-called image-registration is required to “deform” one shape to the other, e.g. to estimate the position of the tumor in the interventional scan where the tumor is not directly visible.

Currently, the image registration algorithms are typically based on deforming surface meshes (segmentation based) or directly on grey-values. However, they not incorporate the mechanical tissue behavior constraints (physical properties).

In attempt to advance the accuracy of registration algorithms, idea is to develop registration algorithms based on volumetric meshes (models) which incorporate constitutive behavior of the tissue as constraints.

In broader sense, these algorithms can also be used for image-driven biophysics modelling as they enable registering a volumetric calculation mesh to the image geometry.



Example: Contour based Image registration .

Overall goal of the project

The overall goal of the project is to investigate methods for non-rigid image registration based on volumetric meshes (models) and incorporate biomechanical constraints (e.g. tissue incompressibility).

Research scope

The MSc research will consist of:

- Inventory of the state-of-the-art of image registration algorithms.
- Define use case(s). E.g. prostate, liver, cardiac.
- Development and implementation in software of the most promising methods.
- Evaluation of the selected methods.
- Reporting of the evaluation outcome: MSc thesis, final presentation, potentially a conference or journal publication.

Expected outcome

Ample insight into the applicability of non-rigid image registration based on volumetric meshes incorporating biomechanical constraints, consolidated in a prototype algorithm and reported in an MSc thesis, presented in a 30 min final presentation, and potentially a paper submission to a scientific conference or journal.

Required expertise and capabilities

- Knowledge of biomechanics, FE modelling.
- Knowledge of state-of-the-art in image analysis algorithms.
- Experience in programming (MatLab/Python, preferably also basics of C, C++ or C#).
- Fluent English speaking and writing.
- Good communication skills.
- And: highly motivated, independent, analytical, systematic, good planner.

Hosting group & supervision

Philips Research Eindhoven (PRE)
Multiphysics & Optics
Eindhoven, The Netherlands

Supervisors: Prof. Dr. Marcel Breeuwer (TU/e), Dr. Kevin Lau (PRE) and Dr. Marco Baragona (PRE)

Start date & duration

Start date: after summer 2018

Duration: minimally 9 months full-time

Contact

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