



Master's Thesis Proposal

General Information

Master's Thesis Title: **Optimal alignment of medical images sequences**

Publication Date: 10/11/2010

Expiry Date:

Modality: technological project
 research work

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Observations:

Student's Name:
(if already known)

M.Sc. Thesis Description

Brief Description: (a 4-5 lines long paragraph)

The aim of the project is the analysis of the heart contraction in patient affected by cardiac diseases. In this project the student will analyze sequences of magnetic resonance imaging (MRI) using existing algorithms of image registration and alignment. The candidate, after identifying the optimal parameters will compare the performance of the different methods. The project counts with very advanced image acquisition technology with promising results and great interest from the clinical community. The project is being developed in a narrow collaboration with a major Hospital in Barcelona.

Detailed Description: (a half-page or one-page description, may include a brief task planning)

General content

Today, analyzing medical images is a must in diagnosis of most of diseases. In clinical practice medical imaging (like Computed Tomography, Magnetic Resonance Imaging, Angiography, Ultrasound, etc.), provides different kinds of information to physicians. Moreover, medical image data acquired during diagnosis is often used to aid in operations and intraoperative images are revised for follow-up.

One of the goals of medical image registration is to *align* image sequences in order to improve visual judgment for treatment or diagnosis. Depending on which specific anatomy is imaged, or which device has been used for it respectively, registration methods differ in their applicability. Furthermore, if a real patient is to be aligned with preoperative data, one has to evaluate how to acquire data from the real patient that can be registered with the image data.

Objective

Non-rigid registration method consist in finding the local deformation of the images enabling an optimal correspondence between biological structures [1-3].

The aim of the project is to use non-rigid registration approaches in order to compensate for heart beat or patient breathing, or to be able to compare images of different modality.

In this work the student will analyze sequences of magnetic resonance imaging (MRI) using existing algorithms of image registration and alignment. The candidate, after identifying the optimal parameters will compare the performance of the different methods.

The project counts with very advanced image acquisition technology with promising results and great interest from the clinical community. The project is being developed in a narrow collaboration with a major Hospital in Barcelona.

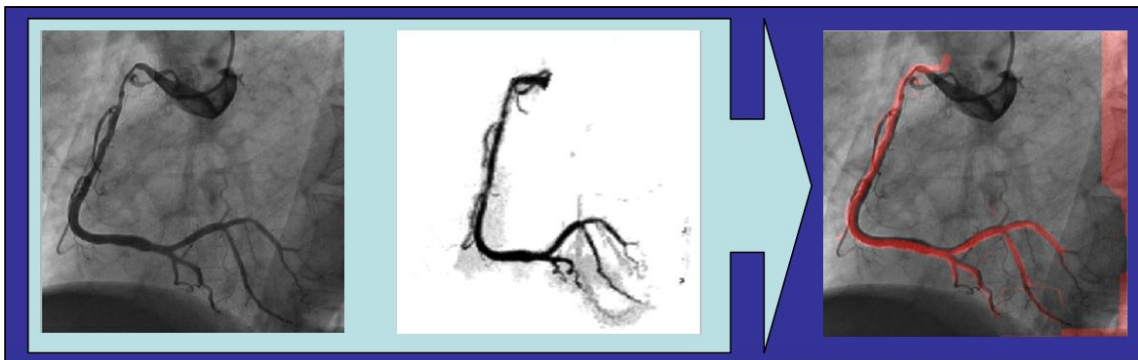


Figure 1 Example of multimodal image registration. An X-ray image (left) is aligned to a vessel extracted from a CT image (middle). The resulting image is illustrated on the right.

References: (bibliographical references, relevant web links, etc.)

- [1] D. Forsyth, P. Torr, A. Zisserman *et al.*, "SIFT Flow: Dense Correspondence across Different Scenes," *Computer Vision – ECCV 2008*, Lecture Notes in Computer Science, pp. 28-42: Springer Berlin / Heidelberg, 2008.
- [2] D. Rueckert, L. I. Sonoda, C. Hayes *et al.*, "Non-rigid registration using free-form deformations: Application to breast MR images.," *IEEE Trans Med Imag*, vol. 18, no. 8, pp. 712-721, 1999.
- [3] A. Ruiz, M. Ujaldon, L. Cooper *et al.*, "Non-rigid Registration for Large Sets of Microscopic Images on Graphics Processors," *J. Signal Process. Syst.*, vol. 55, no. 1-3, pp. 229-250, 2009.

Minimal Requirements & Previous Knowledge: (optional)

The research profile of the candidates should cover as much as possible:

- Programming experience in C++ and Matlab are compulsory.
- Written and verbal communication skills in English.

Additional comments: (optional)

Location and Date: Barcelona,

To the Academic Commission of the Master in Artificial Intelligence (CAIMIA)