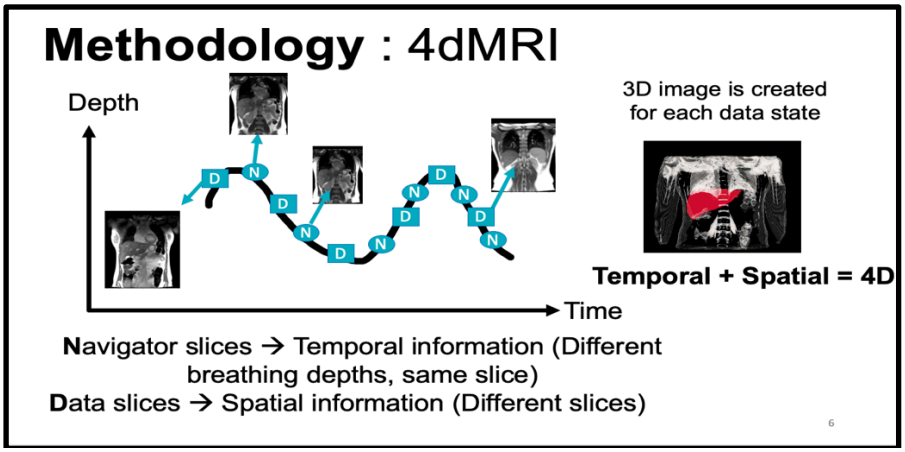
University of Basel
Department of
Biomedical Engineering

University of Basel, Department of Biomedical Engineering, Hegenheimermattweg 167c, 4123 Allschwil

Master of Science – Biomedical Engineering
Thesis Proposal

Automated segmentation of the Liver in 4DMRI



Liver fibrosis is a significant global health concern wherein healthy liver tissue is replaced with scar tissue, leading to structural changes in the liver. Early identification of the cause can help partially reverse the condition, making it crucial to assess the fibrosis stage. To address the limitations of current diagnostic methods, our goal is to develop a new method using dynamic MR measurements that can quantify changes in the liver's mechanical properties to determine the stage of fibrosis. This in-house developed method, called 4DMRI, involves constructing 3D images from 2D abdominal slices for different breathing cycles, segmenting the liver from these images, and determining the deformation field to assess the stage of fibrosis. However, manual segmentation is time-consuming, and segmenting all the images for the whole breathing cycle is not feasible. Therefore, we propose developing a deep-learning model to automatically segment the liver. We plan to train the model using publicly available abdominal databases and test it on a 4DMRI database acquired at the University Hospital in Basel. Ultimately, our goal is to evaluate the volume change and compare the results for patients and healthy volunteers to determine if it can be used as a biomarker for liver fibrosis. This master's thesis aims to accomplish the following objectives: build a deep-learning model for segmenting the liver, test the model on a specific 4DMRI database, test the model for different breathing depths, and evaluate the volume change to compare the results for patients and healthy volunteers.

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Nature of the Thesis
Experimental: 0%
Programming: 90%
Documentation: 10%

Specific Requirements

Proficiency in Python, particularly in the context of deep learning utilizing frameworks such as PyTorch or TensorFlow, would be advantageous for the successful completion of this master project.

Group Leader / Supervisor
Prof. Dr. Philippe Cattin, University of Basel, Center for medical Image Analysis and Navigation CIAN
https://dbe.unibas.ch/en/research/imaging-modelling-diagnosis/center-for-medical-image-analysis-navigation/

Collaborators
This project is in collaboration with:
Division of Radiological Physics, Department of Radiology, University Hospital Basel
Gastroenterology and Hepatology, Basel University Medical Clinic, Liestal, Switzerland

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