MASTER OF SCIENCES – BIOMEDICAL ENGINEERING

MASTER THESIS PROPOSAL

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UNIVERSITÄT
BERN

Berner Fachhochschule BFH

Abdominal aortic aneurysms – Characterizing geometry and texture

Abdominal aortic aneurysm (AAA) is a vascular disease which can cause life-threatening rupture events. For an effective personalized follow-up and adequate planning of surgical repair, it is crucial to assess reliably the rate of progression of AAAs and their risk of rupture. In current clinical practice, this is achieved on the basis of the AAA's maximal diameter. However, this criterion is not sufficient.[1] Therefore we are conducting research on computer-aided analyses of CT angiography images along with individual clinical history data. This process involves the segmentation of the different anatomical structures of the infrarenal aorta (lumen, wall, etc.), and the extraction of a series of geometrical [4] and textural features [2]. The extracted features will provide input to a classifier to undercover criteria which may improve the prognosis of progression and rupture risk. [4] The use of feature selection methods will be investigated.
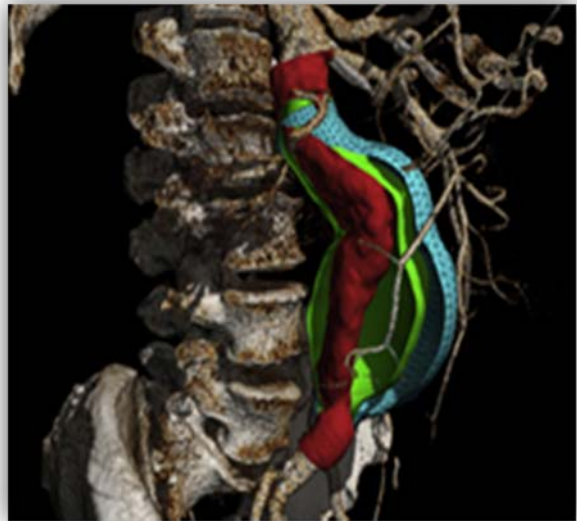
Within the framework of the proposed MSc thesis project, the student will develop algorithms for extracting geometry and texture features from the AAA segmentations, applying them to a dataset of annotated CTA images. The candidate will be working in a multidisciplinary team of clinicians and engineers. The project will be conducted at the ARTORG Center for Biomedical Engineering Research of the University of Bern, in close collaboration with the Department of Diagnostic, Interventional and Pediatric Radiology of the Bern University Hospital "Inselspital".

Requirements:
- Good programming skills in MATLAB and/or Python
- Medical image processing/computer vision/machine learning background
- Excellent English (written, spoken)

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References
[1] Moll FL, Powell JT, Fraedrich G, et al. Management of abdominal aortic aneurysms: Clinical practice guidelines of the European Society for Vascular Surgery. Eur J Vasc Endovasc Surg. 2011;41:S1-S58.
[2] Martufi G, Di Martino ES, Amon CH, et al. Three-dimensional geometrical characterization of abdominal aortic aneurysms: Image-based wall thickness distribution. J Biomech Eng. 2009;131(6):061015.
[3] García G, Tapia A, De Blas M. Computer-supported diagnosis for endotension cases in endovascular aortic aneurysm repair evolution. Comput Methods Programs Biomed. 2014;115(1):11-19.
[4] Tang A, Kauffmann C, Tremblay-Paquet S, et al. Morphologic evaluation of ruptured and symptomatic abdominal aortic aneurysm by three-dimensional modeling. J Vasc Surg. 2014;59(4):894-902.e3.