MASTER OF SCIENCES - BIOMEDICAL ENGINEERING

MASTER THESIS PROPOSAL

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UNIVERSITÄT
BERN

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Lung bronchovascular tree segmentation

The term bronchovascular tree refers to the networks of airways and the pulmonary blood vessels. The segmentation of these structures is a preprocessing step that plays a crucial role for the accurate lung CT image analysis in computer-aided diagnosis systems [1]. Although both airway and vascular tree segmentation has been studied extensively the past decades and produced adequate results [2] for cases with limited or focal pathologies, there are not many works addressing the problem in cases with interstitial lung diseases (ILD). ILDs are chronic lung disorders characterized by scarring and/or inflammation of the lung tissue, which often increases its density and are generally manifested as texture alterations of the lung parenchyma [3]. The presence of bronchovascular structures in the CT slices can often obstruct the detection and recognition of ILD findings because the representation of the vessels and airway walls in HU is higher than the surroundings and really close to high attenuation pathologies such as ILD introducing a challenging problem that need to be tackled.
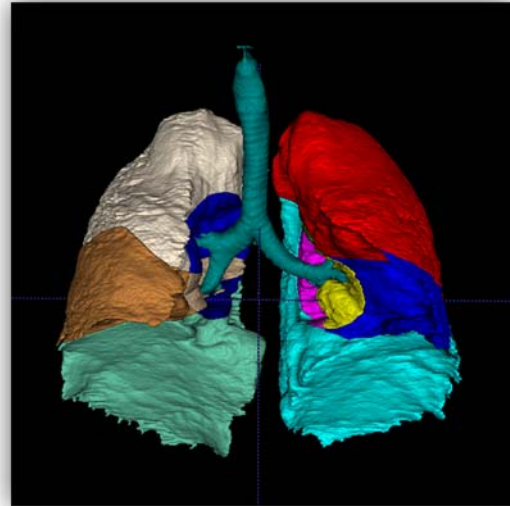
Within the framework of the proposed MSc Thesis project, algorithms for bronchovascular tree segmentation will be developed and evaluated on CT scans with ILDs. Two publibly available datasets will be used for the purposes of the project, one is provided by the Lung Tissue Research Consortium (https://www.ltrcpublic.com/) while the other by the VESSEL 12 grand challenge (https://grand-challenge.org/site/vessel12/). 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
- Image processing background
- Excellent English (written, spoken)

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References
[1] Anthimopoulos, M., S. Christodoulidis, A. Christe, and S. Mougiakakou. "Computer-aided diagnosis of interstitial lung diseases based on computed tomography image analysis." Computational Optical Biomedical Spectroscopy and Imaging (2015): 175-200.
[2] E. M. Van Rikxoort and B. Van Ginneken, "Automated segmentation of pulmonary structures in thoracic computed tomography scans: a review," Phys. Med. Biol., vol. 58, pp. R187–220, 2013.
[3] W. D. Travis et al., "An official American Thoracic Society/European Respiratory Society statement: Update of the international multidisciplinary classification of the idiopathic interstitial pneumonias," Am. J. Respir. Crit. Care Med., vol. 188, no. 6, pp. 733–748, 2013.