

Internship/Bachelor Thesis/Master Thesis in the Field of Medical Image Post-Processing: Customizable Anatomical Landmark Detection in 3D CT

Function/Department: R&D, CT Concepts, Image Analytics

Sector/Division/Business Unit: Healthcare GmbH, Diagnostic Imaging, Computed Tomography

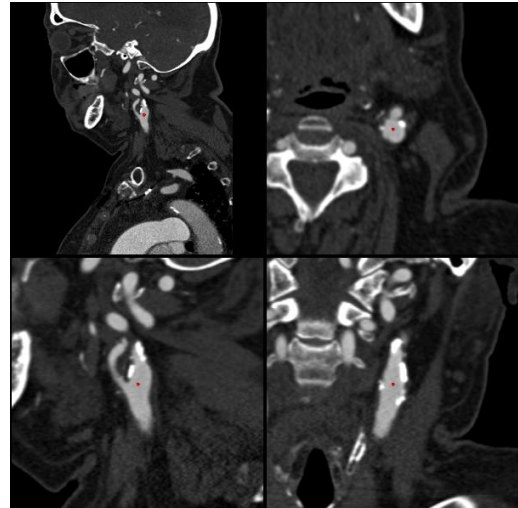
Site: Forchheim

Mode of Employment: Mandatory internship or bachelor/master thesis position

The R&D department of Siemens Healthcare GmbH, Diagnostic Imaging, Computed Tomography develops and actively researches in the field of advanced medical image analytics systems. In order to drive Siemens' competitive power and to ensure its market position, R&D focuses on cutting edge technology and highest quality standards regarding the systems' outcomes.

Reading volumetric medical imaging data can be considerably accelerated when navigation, further analysis and secondary visualization can be done relative to morphologically well-defined anatomical landmarks. [1] With the emergence and wide-spread availability of open source deep learning libraries (Theano, TensorFlow, and Caffe) it is becoming conceivable that learning landmark detection models may have lost its technological burden. This means landmark detection systems for specific anatomical entities could be assembled by a system of off-the-shelf software components. Furthermore, these systems could be designed in a way that even end-users can train their own customized landmark detection models on-site. [3]

The goal of this internship/thesis is therefore the initial development of an easy-to-use landmark detection framework that can be adapted to several landmark detection tasks through appropriate training data. Anatomical landmark detection however is a challenging endeavor due to the heavy computational burden associated with exhaustive search strategies [1] and with the generalization of convolutional neural networks to three dimensions [3]. Appropriate solutions may thus include (implicit) multi-scale [1] and/or 2.5D approaches [2]. The final system shall exemplarily be applied to, at least two, different anatomical landmark detection tasks with appropriate quantitative evaluation according to usual scientific practice.



One of the carotid bifurcations in multiple MPR views of a computed tomography angiography scan.

The thesis involves the following tasks:

- Description of the state of the art based on scientific literature and patents
- Design and formalization of the software system to be developed
- System development (algorithmic system, clinical prototype, and evaluation framework)
- Where possible, existing software shall be re-used, e.g., (general and in-house) MeVisLab modules (www.mevislab.de) or software from other publicly available libraries.
- Integration of the final system into the department library for future re-use
- Quantitative evaluation of the developed method on real-world data in at least two scenarios

Profile:

- Very good programming skills in C++ and Python, familiarity with MeVisLab is a plus
- Expertise in Medical Image Post-Processing, Machine Learning, and Pattern Recognition
- Good communication skills (English)

We are looking forward to your application (CV, certificates, etc.).

Contact: michael.wels@siemens-healthineers.com

References

- [1] Ghesu et al. Robust Multi-scale Anatomical Landmark Detection in Incomplete 3D-CT Data. MICCAI 2017, Part I, LNCS 10433, pp. 194–202, 2017.
- [2] Peasoon et al. Deep feature learning for knee cartilage segmentation using a triplanar convolutional neural network. MICCAI 2013, Part II, LNCS 8150, pp. 246–253, 2013.
- [3] Wels et al. Method and System for On-Site Learning of Landmark Detection Models for End User-Specific Diagnostic Medical Image Reading. Patent US 20140219548, 2014.
- [4] Zheng et al. 3D Deep Learning for Efficient and Robust Landmark Detection in Volumetric Data. MICCAI 2015, Part I, LNCS 9349, pp. 194–202, 2015.