Universitätsklinikum Hamburg-Eppendorf

Master-Project/Thesis Medical Image Processing

Learning Standardized Landmark Locations for Automated Analysis of Aortic Pulsatile Deformation

Background: Detailed patient-specific as well as population-based understanding of pulsatile aortic deformation would enable more accurate and individualized endovascular aortic stenting. This, in turn, would improve treatment of, e.g., patients with thoracic aortic aneurysm.
Respective studies require detection of standardized landmarks (see Fig. 1) and subsequent landmark- and aorta segmentation-based analysis of aortic dynamics in temporally-resolved image data. Landmark detection and aorta segmentation are currently performed (semi-)manually – which is time-consuming and prone to intra- and inter-rater variability.

Project/Thesis Topic: The aim of the current project is to investigate feasibility of adapting recent machine learning-based landmark detection approaches [2] to the task at hand and to develop strategies for landmark-based but segmentation-free analysis of aortic deformation in systolic/diastolic CT data pairs. The project will be performed in close collaboration with the Department of Diagnostic and Interventional Radiology of the UKE.

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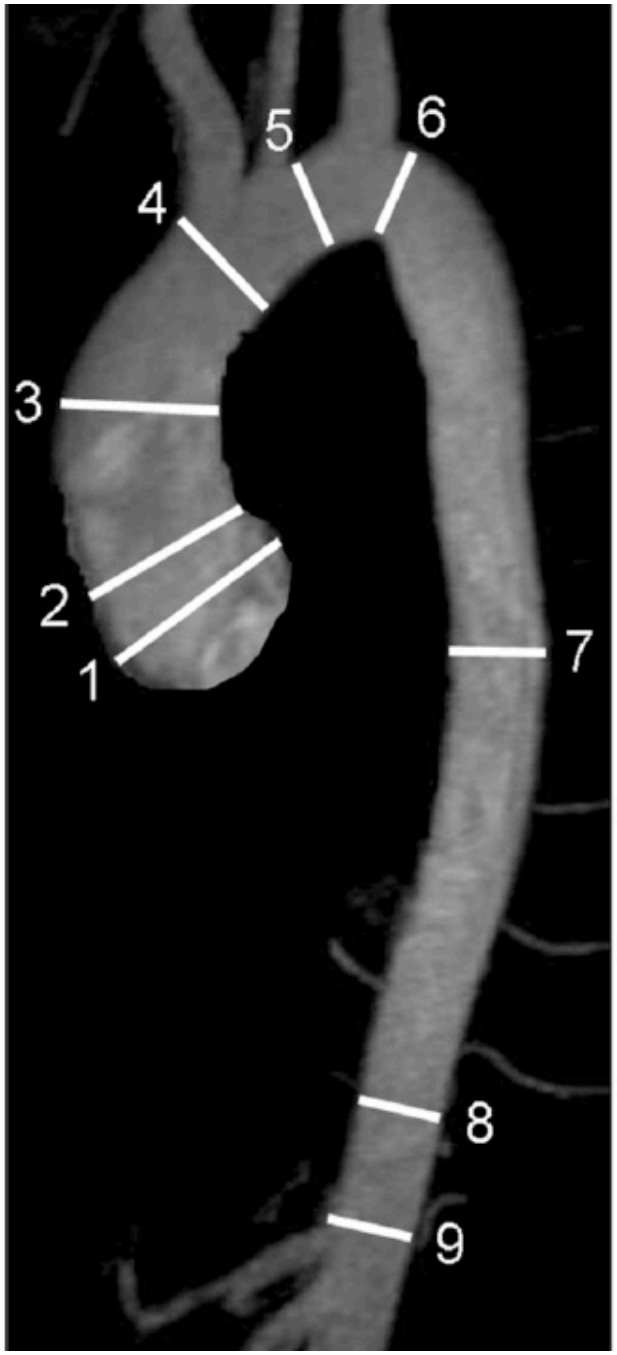

Fig. 1: Anatomic landmarks for standardized reporting of diameters of the aorta at the level of sinuses of valsalva (1), sinotubular junction (2), mid-ascending aorta (3), proximal to brachiocephalic trunk (4), between left common carotid and left subclavian arteries (5), distal to left subclavian artery (6), mid-descending aorta (7), diaphragm (8), abdominal aorta above coeliac trunk (9). Image from [1].

[1] Schulze-Menger J, et al. Standardized image interpretation and post processing in cardiovascular magnetic resonance *J Cardiov Magn Reson* **15**: 35, 2013.
[2] Oktay O, et al. Stratified Decision Forests for Accurate Anatomical Landmark Localization. *IEEE Trans Med Imag* 2016.