

## Master thesis - *Masterarbeit*

Thesis received: XX.XX.20XX

Workload: 720 h (24 CP)

Submission of thesis until: XX.XX.20XX

Duration: 6 months

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Second examiner: Prof. Dr.-Ing. U. Nackenhorst

### Multiscale image segmentation for medical images

Robust and autonomous segmentation of organs such as liver, kidneys, lungs, and skeleton system from the whole-body CT scan supports the integration of patient-specific images to predictive simulation modules in existing medical infrastructure. In prior work, we developed a two-stage variational approach for segmenting 3D bone CT data that performs robustly with respect to thin cartilage interfaces. We demonstrated the success of our methodology for the fully autonomous segmentation of 3D femur and vertebra bones.

Building on this framework, the objective of this M.Sc. thesis project is to formulate a multiscale strategy that enables us to segment multiple important objects in CT data. The basic idea is to leverage the relative variance in the intensity of different objects in the CT data. In the first step, a strategy needs to be formulated that can perform robustly on standard 2D test images for multi-object segmentation. In a second step, the resulting methods need to be tested on 3D whole-body CT data. In the final step, further challenges and future possibilities related to this idea should be evaluated.

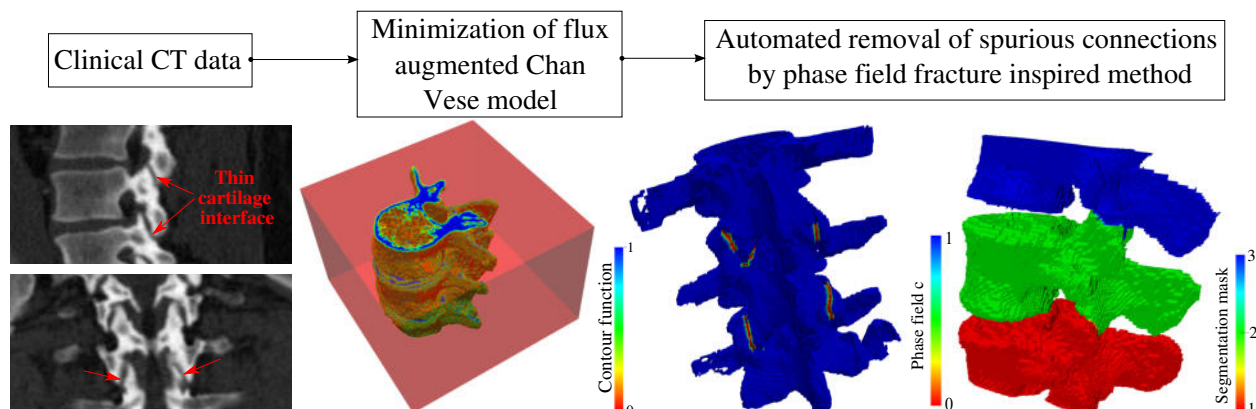


figure 1: Robust variational segmentation of 3D bone CT data with thin cartilage interfaces.

**Required knowledge: ...**

A background in finite element analysis is required. This thesis can be supervised/written in the English language only.

**Literature:**

- [1] Gangwar, T., Calder, J., Takahashi, T., Bechtold, J. E., & Schillinger, D. (2018). Robust variational segmentation of 3D bone CT data with thin cartilage interfaces. *Medical Image Analysis*, 47, 95-110.
- [2] Jeon, M., Alexander, M., Pedrycz, W., & Pizzi, N. (2005). Unsupervised hierarchical image segmentation with level set and additive operator splitting. *Pattern Recognition Letters*, 26(10), 1461-1469.