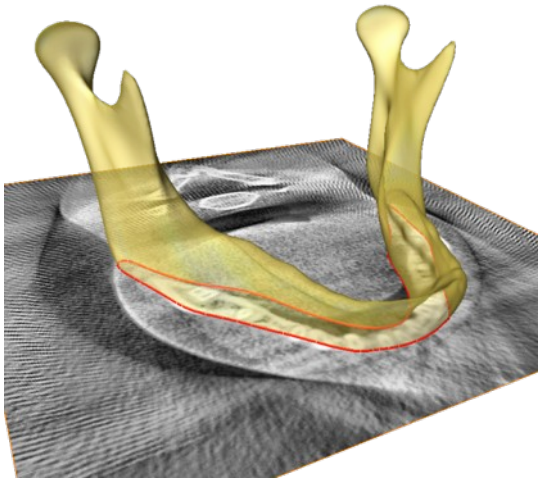
Master Thesis Topic

Mandible Segmentation in CT Images Through Deep Leaning and Statistical Shape Models

Your Profile

You are studying computer science, mathematics or another scientific subject and are interested in medical image analysis. Ideally you already have experience with machine learning / deep learning in Python as well as with C++ programming.



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In a research project together with clinical partners at *Charité Berlin*, we are investigating shape characteristics of the human mandible bone using statistical shape analysis. For that purpose, we have access to a large database of three-dimensional computed tomography scans, from which the bone shape can be extracted semi-automatically via image segmentation. While Convolutional Neural Networks (CNNs) perform well in many medical image segmentation tasks, they often show an accuracy drop when being applied to a broad variety of real-world data. On the other hand, segmentation approaches based on statistical shape models include a strong shape prior and therefore promise reliability, for example generating plausible shapes even in presence of image artifacts. This thesis aims to investigate the performance differences between the two methods based on the given clinical data, as well as to combine their strengths and improve the overall segmentation performance.

In particular, the first step is to establish an annotated dataset in cooperation with our clinical partners by employing an existing segmentation pipeline based on statistical shape models. Using this data, state of the art Deep Learning-based approaches are to be trained and evaluated in comparison to the existing pipeline. Finally, if the time allows and performance differences are observed between the two methods, the next step would be to regularize the CNN-predicted segmentations by statistical shape models. Here, special care must be taken to correct errors in segmentations without inadvertently removing correctly predicted details.

We Are Offering

In the ZIB research group *Computational Diagnosis and Therapy Planning* we work on problems in the medical domain by developing computer-assisted solutions. The focus lies on solutions with practical relevance, while contributing novel methodological developments. The proposed thesis topic allows an exciting introduction into medical image analysis by using and extending existing systems. The thesis is supervised at our institute in a team of researchers. Powerful workstations as well as a working place at ZIB are provided. The master thesis is granted at your university – either in Berlin or any other city.

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