Graduate School of Science and Technology Master's Thesis Abstract

Laboratory name (Supervisor)	Imaging-based Computational Biomedicine (Yoshinobu Sato (Professor))		
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Thesis title	Automated musculoskeletal segmentation and analysis of torso CT images in a large-scale database		

Abstract

This study aims to explore automated segmentation of the entire torso's musculoskeletal (MSK) structures in CT images and investigate the feasibility of the predictive uncertainty for analyzing the segmentation accuracy in unlabeled datasets, as well as, assess torso CT image analysis accuracy on a large database. Previous research has mainly focused on segmenting 2D slices of the abdomen or a limited number of 3D CT structures. Our approach involves using an active learning strategy with Monte Carlo dropout sampling to efficiently prepare data on 20 cases, covering 21 structures consisting of 19 muscles and 2 types of fat. Two types of convolutional neural networks (CNNs) were tested: a 2D Bayesian UNet and a 3D patch-based nnUNet. The segmentation accuracy using a 5-fold cross-validation on 20 labeled CT images was measured and the models were validated on large-scale databases from a different institution containing approximately 1000 unlabeled CTs. Additionally, a muscle and fat volume and density estimation was done, investigating its relationship with age, and sex factors, across the dataset.