先端科学技術研究科　修士論文要旨

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要旨

Prediction of clinical information from skeletal structures is essential for forensic and health science applications. Shape analysis has been widely used, as the shape entails specific information related to the subject's sex, age, and disease progression status. In this study, we aim to investigate the potential of geometric deep neural networks (DNN) in shape analysis for the prediction of such information. For this, we propose a fully automated pipeline consisting of two steps: 1) automatic segmentation of the target structure from medical images, 2) prediction of clinical information from the segmented structure based on shape analysis. At the image segmentation step, we used Bayesian U-Net, which has shown promising performance in image segmentation tasks. In addition to the segmented labels of the target structures, it yields the prediction uncertainty, which demonstrated a high correlation with the segmentation accuracy. This helps in automatically selecting valid segmentation results in the absence of ground-truth labels, for example, in large databases. At the second step, two recent representative geometric deep learning methods, i.e. edge-based mesh convolutional neural network (MeshCNN), and point-based dynamic graph CNN (DGCNN) were investigated. The pipeline was tested on two tasks: 1) gender estimation from pelvic shapes, and 2) age prediction from the pelvic shape in CT images. In each task, the experimental data consisted of ~4000 gender-balanced pelvic shapes, and ~33,000 pelvic shapes, respectively. Results in our experiments show the remarkable ability of geometric DNNs in the prediction of clinical information from automatically segmented shapes.