The Informatics

Volumetric Tumor Segmentation on Multimodal Medical Images using Deep Learning

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Motivation

The automatic segmentation of tumors supports medical experts patient in diagnosis and treatment.

Multimodal imaging is widely used in cancer

Challenge

Depending on the imaging modality and the clinical indication, the tumor segmentation may look different:

Contribution

We propose a convolutional neural network for tumor co-segmentation on volumetric multimodal data. The network architecture is designed to learn complex multimodal features to predict modality-specific tumor segmentations for PET and MRI scans.

therapy, because the combination of different medical imaging modalities (MRI, CT, PET,...) valuable complementary provides information.

The aim is to develop a segmentation model, which uses the multimodal context to improve the tumor segmentation.



The network is trained with a **soft tissue** sarcoma dataset, which contains PET/CT and MRI (T1-weighted, T2-weighted) data for each patient. Tumor annotations are available for the PET and the MRI-T2 scan.

Method: Convolutional Neural Network for Tumor Segmentation

an 1R

MRI branch: example of learned features per layer



Experiments & Results

Our experiments investigate how different network architectures, multimodal fusion strategies, and input modality types affect the segmentation result.

The results show that

- our multimodal co-segmentation model provides better modality-specific tumor segmentations (DSC T2: 72%, DSC PET: 71%) than single-modal models using only the PET scan or the MRI-T2 scan as input (DSC T2: 56%, DSC PET: 57%).
- modality-specific encoders and normalization layers improves the network's ability to learn complex multimodal features from the different statistical distributions of MRI and PET.

Sample result MRI-T2 scan PET scan



ground truth multimodal segmentation single-modal segmentation



Abbrevations | MRI: Magnetic Resonance Imaging | CT: Computed Tomography | PET: Positron Emission Tomography | DSC: Dice Similarity Score

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