

Prostate MR Image Segmentation Method Using 3D U-net with skip connection

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Abstract

This document briefly describes techniques we used in automatic segmentation of the prostate in transversal T2 MRI for the PROMISE12 challenge. We tackled this problem using U-net enhanced by designed dense block.

1. Data Preprocessing

Uniform size. To unify the image sizes, we resized and cropped the 3D MRI images to be of size 256×256 .

Gaussian normalization. Gaussian normalization was then applied to rescale the voxel intensities to has a zero mean and a unit variance.

Data augmentation. Training set has about 143 3D images with corresponding masks. Therefore, data was augmented to 1200 by random rotations , shifts, zooms, flips and elastic deformations.

2. Network architecture

Our network is trained with U-net [1],and skip connection inspired by [2].

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The U-net consists of a down-convolutional part (left side) and up-convolutional part (right side). The left side aims at extracting features for classifying each voxel into one or zero. The dense block connects each layer and its subsequent layer in a feed-forward fashion.

3. Implementation Details

The proposed method was implemented in Python language, using Keras with Tensorflow backend. All experiments were conducted on a Linux machine running Ubuntu 16.04 with 32 GB RAM memory. The U-net training was carried out on a single GTX 1080 Ti with 11 GB RAM memory.

References

- [1] O. Ronneberger, P. Fischer, T. Brox, U-net: Convolutional networks for biomedical image segmentation, in: International Conference on Medical image computing and computer-assisted intervention, Springer, 2015, pp. 234–241.
- [2] M. Drozdal, E. Vorontsov, G. Chartrand, S. Kadoury, C. Pal, The importance of skip connections in biomedical image segmentation, in: Deep Learning and Data Labeling for Medical Applications, Springer, 2016, pp. 179–187.