Prostate MR Image Segmentation Method Using Dense Unet

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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 trackled this problem using U-net enhanced by designed dense block.

1. Data Preprocessing

Uniform size. To unify the image sizes, we resized the 2D MRI slices of each image 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 1200 images with corresponding masks. Therefore, data was augmented to 5000 by random rotations , shifts. zooms, flips and elastic deformations.

2. Network architecture

Our network is trained with U-net [1],and designed dense block 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] G. Huang, Z. Liu, K. Q. Weinberger, L. van der Maaten, Densely connected convolutional networks, in: Proceedings of the IEEE conference on computer vision and pattern recognition, Vol. 1, 2017, p. 3.