

SurfaceSeg (llasionzhou@gmail.com)

Abstract

This document briefly describes methods we used in segmentation of the prostate in transversal T2-weighted MR images for the PROMISE12 challenge. 3D convolution and fully connected layers are utilized to solve the problem in regression fashion. Details of each step are described next in each section.

Data processing

Each volume is normalized to range $[-1.0, 1.0]$ and resampled to 1.0 mm. Users pick a center of the prostate and then using this center, a sphere with radius being 15 mm is treated as the presegmentation. The surface of the sphere is parameterized as quad mesh, which includes 6 sub strict quads (each sub quad mesh has size 33x33).

For each grid point on the quad mesh, we do a sampling in the normal direction with length 80 as the feature or column structure. And the surface position truth (regression value) is computed for each grid. Then a 3D patch is generated by placing all 33x33 columns together, where the 33x33 2D structure is saved. Rotation and simple translation are used to do the augmentation for training.

Network Structure

The network pipeline consists of 3D Unet, Soft Argmax Layer, and fully connected layer (FC). The 3D Unet is used for surface detection; the Soft Argmax Layer computes the initial surface position estimate; and then FC smooths the prediction.

Loss metric

The loss contains two parts: the binary cross-entropy (BCE) from the Unet and Mean squared error of the final surface regression values. The weights of the two are 0.1 and 1.0, respectively.