

Automatic prostate segmentation using a two-stage dilated 3D U-Net

Xue Feng (Email: [xfeng@springbokanalytics.com](mailto:xfeng@springbokanalytics.com))

Huitong Pan (Email: [hpan@springbokanalytics.com](mailto:hpan@springbokanalytics.com))

Springbok, Inc., Charlottesville, Virginia, VA

We used a two-stage method with dilated 3D U-Net. In preprocessing, we normalized all images as zero mean and unit variance.

In the first stage, the goal is to find the rough location of prostate on a low-resolution image. Before training the network, all images were resized all images into  $24*168*168$  (d\*w\*h) voxels. The network has 3 encoding blocks and 3 decoding blocks and we apply [1,2,2] as dilation factors on each encoding layer. The network is trained with Adam optimization method with a learning rate of 0.0005.

In the second stage, the goal is to find the exact label on a cropped image based on the first stage output. In the training phase, the images were cropped based on ground truth and added random margins on each dimension. In the testing phase, images were cropped based on first stage output with random margins as testing augmentation. After cropping, all images were resized into  $16*120*120$  voxels before feeding into the model.

Both stages were trained with the following image augmentation: rotation, left-right flipping, deformation.

Post-processing basing on uncertainty measures are performed.