A three stage segmentation method of kidney and kidney tumor

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Abstract. The morphometry of a kidney tumor revealed by contrastenhanced Computed Tomography (CT) imaging is an important factor in clinical decision making surrounding the lesion's diagnosis and treatment. I Use 3D Unet to segment kidney and kidney tumor respectively.

1   First Stage

The purpose of first stage is to segment kidney roughly

1.1   Preprocessing

For the preprocessing in the First stage, I adjust all the CT Value to [-200,300] to remove irrelevant information, and resample all the data to 3mm*3mm*3mm, padding all the data to 256*192*192 so that all the data can be put into the model, than all the data was normalized instancely

1.2   Architecture

3D Unet was used for the first stage

1.3   Training details

The learning rate was initialized as 3e-4, and multiplied by 0.3 after every 50 epoches. I use Adam optimizer. For loss function, bce+dice loss was used. Total epoch was set to 150, It takes about 14 hours to train a model

1.4   Post processing

For the first stage, I do not use any post processing

2   Second Stage

The purpose of the second stage is to segment the kidney accurately

2.1 Preprocessing

For the preprocessing in the second stage, I adjust all the CT Value to [-200,300] to remove irrelevant information, then random cropping, contrast augmentation, brightness augmentation, random flipping by w axis, gamma augmentation, random rorate the image were implemented to all the training data, and resample all the data to 1.5mm*0.8mm*0.8mm, then padding them to 144*224*432 so that all the data can be put into the model, than all the data was normalized instancely.

2.2 Architecture

3D Unet was implemented for the second stage

2.3 Training details

The learning rate was initialized as 3e-4, and multiplied by 0.3 after every 50 epoches. I use Adam optimizer. For loss function, bce+dice loss was used. The total epoch was set to 150, It takes about 14 hours to train a model

2.4 Post processing

For the post processing, I get the maximum connected component of the output of trained model, then, all the connected whose voxels more than 0.1* voxels of maximum connected component are kept, and all the connected component whose voxels less than 0.1* voxels of maximum connected component are dropped.

3 Third Stage

The purpose of the third stage is to segment the kidney tumor accurately. The Pre-processing, architecture, training details and post processing is as same as that in the second stage.