HD-Don-GE

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Platform: Linux

Prerequisites: Python 3

HD-Don-GE: SUMMARY

We use a U-Net like network that constructs three representations comprising a foreground mask, a cell contour mask, and a signed Euclidean distance map. These representations are combined to determine seeds for cells. Finally, a watershed algorithm is used to generate cell instance masks.

HD-Don-GE: PREPROCESSING

We perform image standardization by normalizing the image intensities to have zero mean and unit variance.

HD-Don-GE: SEGMENTATION

We use a U-Net [1] like network with a SE-ResNet module [2] that is trained to learn three representations comprising a foreground mask, a cell contour mask, and a signed Euclidean distance map as in U3D-BCD [3] given cell instance masks. The foreground mask consists of all pixels with a non-zero label. The cell contour mask is obtained by applying Sobel filters on the instance mask. The signed Euclidean distance map represents the signed Euclidean distance between the foreground or background. The output of our neural network has three channels corresponding to the three representations. The first two channels use a sigmoid activation function and are interpreted as the probability of being a cell or cell contour, respectively. The third channel employs a tanh activation function and represents the signed Euclidean distance. As loss function, we use a combination of a weighted binary cross-entropy loss and a Dice loss [4] for the foreground and cell contour masks, and we use a mean squared error loss for the signed Euclidean distance map.Our neural network is trained to predict all three representations. From the training dataset, patches of size 512 × 512 are sampled. We use data augmentation comprising rotation, flipping, and elastic deformations. The test images are divided into patches of size 512 × 512 which are used as input for the neural network. Seeds for cells are generated via thresholding the three representations. Finally, the seeds are used for a watershed algorithm to generate cell instance masks.

HD-Don-GE: POST-PROCESSING

No post-processing is performed after segmentation.

REFERENCES

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