SZU-CN

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Platform: Windows 10

Prerequisites: None

SZU-CN: SUMMARY

We use a tracking by detection approach to automatically tracking nuclei through time-lapse videos. The algorithm uses a deep learning network to segment nuclei in each frame, and links the nuclei based on Earth Mover's Distance (EMD).

SZU-CN: PREPROCESSING

To train our deep-learning-based nuclei segmentation network, the frames are extracted from the video and linearly stretched.

SZU-CN: SEGMENTATION

A widely used fully convolutional network, U-Net [1], is adopted in our framework to automatically segment nuclei. The silver truth is used to supervise the training of our network that is implemented using PyTorch and optimized with Adam.

SZU-CN: TRACKING

We link the same nuclei in adjacent frames by calculating the Earth Mover's Distance (EMD). The EMD is used to address the minimum routing problem. In our approach, EMD is used as a metric to measure the similarity of two nuclei. In particular, several features, such as nuclei area, nuclei curvature, nuclei radius and local binary pattern of nuclei, are calculated and form a long feature vector. The length of the constructed feature vector is different according to the datasets. Then, EMD is measured between each pair of nuclei in adjacent frames (*merging*). The nucleus with the highest EMD are linked. For the events such as mitosis, we use the overlapping areas as the clue. Two or more nucleus have the overlapping areas with a nuclei in the previous frame, and the overlapping areas are larger than a pre-set threshold (*overlap*); an event of mitosis is denoted to happen.

SZU-CN: POST-PROCESSING

No post-processing step is performed.

REFERENCES

1. Y Ronneberger O, Fischer P, Brox T. U-net: Convolutional networks for biomedical image segmentation. In *Proceedings of Medical Image Computing and Computer-Assisted Intervention*, 234-241 (2015).