

Automated Brain Region Segmentation for Fruit Fly Fluorescent Images

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Identifying the innervated brain regions of each neuron is crucial for constructing the connectome. In previous studies, several approaches have been developed and applied in the brain image of fruit fly (*Drosophila melanogaster*), such as establishing a standard brain and registering every image into it. In this approach, we only need a brain region atlas for the standard brain. However, image registration involves shifting and warping, and may cause substantial dislocation of a neuron from its true location. In order to address this issue, we developed a method for automated brain image segmentation and used this method to segment a large number of brain images. In the proposed method, U-net, a machine learning algorithm, was used to train the images and perform crude brain-region segmentation. Next, several convex hull algorithms (Andrew's Monotone Chain Convex Hull, Convex Layer Onions, and Chan's Algorithm) were implemented to refine the segmentation. We tested the proposed method in segmenting glomeruli in antennal lobes of fruit flies and will generalize the method to all neuropils and their subregions.

Keywords: segmentation, convex hull, fluorescent images, U-net, machine learning

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