ONE-SHOT TRANSFER LEARNING OF REGION SEGMENTATION OF MOUSE BRAIN

Pei-Jie Wang[1], Shen-Ju Chou[2], Jung-Chi Liao[1]
[1]Institute of Atomic and Molecular Sciences, Academia Sinica
No. 1, Sec. 4, Roosevelt Rd., Taipei City 10617, Taiwan
[2]Institute of Cellular and Organismic Biology, Academia Sinica
No. 128, Sec. 2, Academia Rd., Taipei City 11529, Taiwan
Email : jcliao@iams.sinica.edu.tw

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The brain is a highly structured organ with geometrically organized regions. Detailed annotations of the large number of regions in stereotaxic coordinates are expensive and rare, making region-specific studies such as proteomics or transcriptomics difficult. That is, there is a need in using the one or very few available annotated brain images to segment brain images obtained in the lab. Here, using transfer learning from parameters obtained with U-Net deep convolutional network learning of specific regions such as hippocampus or stratum oriens together with image data augmentation, we are able to perform semantic segmentation of several other mouse brain regions of the lateral sagittal section in high precision with one-shot learning (Figure 1). We found that one can achieve better segmentation performance when using the pre-trained result of a morphologically similar region. Together, we found that when the morphology of a specific region is similar to the rod-like shape, the performance is better when using the hippocampus region, a thick rod-like shape for transfer learning (Table 1, Figure 2). The average IOU is above 85%, where using the hippocampus region for transfer learning is better. On the other hand, the IOU is above 80% when using the stratum oriens region for transfer learning, where the IOU is better than 80%. Thus, the use of transfer learning depends on the similarity between the training set and the testing set.

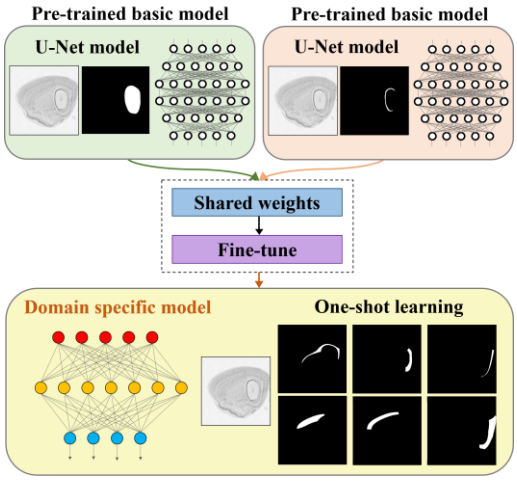

Figure1: Two-stage framework for proposed method of multi-regions one-shot transfer learning followed by image segmentation.

Table. 1. IOU (%) of the one-shot segmentation

	HR	CR
	88.5	66.8
	89.9	78.7
	86.2	76.6
	86.8	83.8
	64.5	**81.5**
	76.8	**80.1**

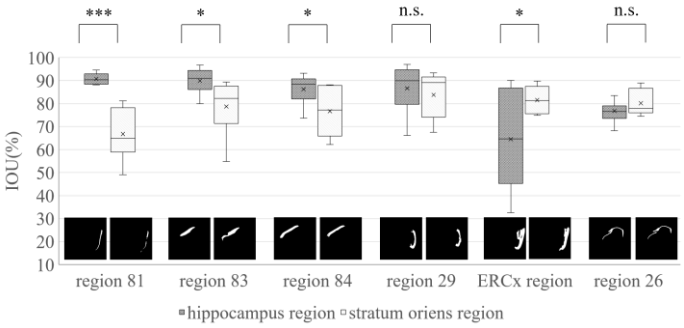

Figure 2: The distributions of IOU and their corresponding predicted masks of different regions.