

# Morphological Classification of Drosophila Neurons by a Cnn Autoencoder

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**Abstract :** From the perspective of biological evolution, there are always some important, basic cells that will be retained. If we specialize in the classification of all neuronal cell-types in Drosophila, we may get insights about the possible relation between cell-types and their corresponding functions. At present, the FlyCircuit database in the Brain Research Center of National Tsing Hua University provides tens of thousands of single neuron images of Drosophila brain. With such a large amount of image data, new automatic tools are needed to characterize the morphological features of the neurons. Based on Convolutional Autoencoder (CAE), an unsupervised deep learning technology, we developed an algorithm named UFEIC (Unsupervised Feature Extraction Image Classifier) to classify the neuronal cell types according to their morphology. UFEIC including feature extraction algorithm and algorithm for calculating distance in subspace of high-dimensional space. Due to the limitation of hardware, 2D three-view projections of the neurons were analyzed instead of the original 3D images. As a demonstration, we have trained 1,200 neurons, including 200 neurons with known types (ALLN-L, ALLN-S, PN, KC, and FB) and 1,000 randomly selected neurons. The results show that the 200 test neurons can be automatically clustering by UFEIC with accuracy is 98%.

**Keywords:** Neuroinformatics, UFEIC, Neuron similarity, cell type, clustering

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