Web-Based Collaborative Neuronal Reconstruction with CATMAID

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Abstract

CATMAID, the Collaborative Annotation Toolkit for Massive Amounts of Image Data (www.catmaid.org), is a web-based platform suitable for the annotation of very large 3D data sets, such as those produced by serial section transmission electron microscopy. Manual and automated methods are required to segment and extract meaningful information from these images. Automated methods for segmentation are certainly improving, but much annotation and segmentation still needs to be done by human operators. A fast and proven way to extract neural circuits is by by skeletonizing neurons and their synaptic connectivity. We implemented in CATMAID such an annotation and tracing interface, and means to semantically group and tag neurons in a hierarchical manner. Every new or changed annotation is immediately reflected in a remote centralized database. The utilization of a client-server architecture enables crowd-sourcing approaches to neural circuit reconstruction with hundreds of annotators or researchers within a lab, no duplication of large image datasets, automatic incremental backup, client-side browser caching, and making data available via web services.

We also have added to CATMAID WebGL-based 3D visualization of neural morphologies, text tagging of skeleton nodes and connectors, statistics of the tracing progress, a review system and a logging system.

Future plans aim at integrating segmentation workflows on the server through standardized protocols that supports the manual segmentation task and enables dense neural circuit reconstruction in a collaborative, interactive and incremental manner.

Keywords

Collaborative tool, large image, segmentation, annotation, web-based