NeuroBlocks - Visual Tracking of Segmentation and Proofreading for Large Connectomics Projects

Presented by Ben Bougher
Connectomics?

- A perfectly cromulent field of research
Connectronix

Connectometry
Connectometry
Slice up the brain

Electron microscope imaging

~ nm resolution!

Form images into volumetric data

~100 TB!
Segment the key neuron components in the image

ie dendrites, axons,

Manually segment (~100 TB!)

Grad students, “interns”, large spread of experience

Automatically segment

Algorithms always require baby sitting
Students are bad, automated algorithms worse

The segmented volumes need to be verified by domain experts (~100 TB!)
Segmented volumes are analyzed and synapses can be traced out based on connected segments.
Bottleneck

*Most time intensive*
Why?
NeuroBlocks Goals

Interactive visualization-driven framework for managing the state and progress of a individual segmentation projects.

Requirements:

- see the current segmentation
- track its evolution
- manage users and their individual progress
- create tasks and track their project
- integrate with 3rd party tools
Tasks

Overview and detailed views of current segmentation (explore)

Track changes (provenance)

Manage segmentation tasks (task manager)

Audit users and segmentations (user manager)

Switch seamlessly between 3rd party tools (integration)
Video

- http://vcg.seas.harvard.edu/files/pfister/files/vis15_neuroblocks.mp4?m=1440702700
Pixel view

Abstracts a segment into a pixel

Uses colour to encode activity

Aggregates large datasets by combining pixels into a “super pixel”

Filters segments based on attributes, encourages auditing

Timeline viz via sliders and brushes
Detail view

Segment Info

Bobbys Dendrite (Red)_DE [814]

- id: 814
- status: active
- type: Dendrite: Bobbys Dendrite (Red)_DE
- color: red
- voxels: 278752288
- created by: johanna
- created on: 18-02-2014
- last update by: segmenter3
- last update on: 03-03-2014

Connectivity

Related Tasks

- To be Approved
- Completed

History

- merge by segmenter3 on 03-03-14 @ 10:23
- merge by segmenter3 on 03-03-14 @ 10:23
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Connectivity view

Some *abstraction* in the connectivity plot.

The middle “node” is an object, which is a group of “segments”, and the coloured squares encode what segments are in the object.

The outer nodes are connected nodes, however the spatial channel encodes no information.
Task view

yep, they have one
Integration

API’s so 3rd party tools can “plug in”

Demonstrated this with their own 3D rendering plugins
Validation?

Covered their tasks and met their domain goals

NeuroBlocks was used in 2 case studies

General management of a project

Proof reading automated segments
Qualitative Feedback

Interoperability had the biggest impact

All tools in one place, common formats, all activities write to the same database
Questions?