Guided Proofreading of Automatic Segmentations for Connectomics

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Connectome = neuron wiring

We take mice.

Extract brain.

Slice it thinly.

Scan with Electron Microscopy.

Acquire large, high-resolution image volumes.

Perform automatic segmentations.

Automatic segmentations are not perfect and need human proofreading!

False labeling.

Errors.

Cell boundaries.

Correct labeling.

Interactive Proofreading

Visual search for errors and interactive corrections are **extremely time-consuming**!

Correcting Split Errors.

Correcting Merge Errors.

Guided Proofreading of Segmentations

We train a 4-layer multi-input CNN to find **split errors** with probability *p*.

Training Data: 2k x 2k x 300 vx, 3 x 3 x 30 nm/vx, 112k correct and 112k error patches (75 x 75 px).

Merge Error.

Dilated.

Watershed Borders.

1 - *p*

Correction.

And re-use the same CNN for **merge errors**.

Our system suggests errors and reduces corrections to **yes/no decisions** with a **single-click user interface.**

Experiments

User study on the **Proofreading Benchmark** (400 x 400 x 40 vx)

Comparison with state-of-the-art **Focused Proofreading** (FP) [Plaza 2016]

2 x 10 Novices, 2 x 2 Experts, 30 minute time limit

Measure Variation of Information (the lower, the better)

Our approach (GP) reduces manual labor for both novices as well as experts and is **7.5x** faster than interactive proofreading and FP.

Failure Examples

All participants correctly chose A, but had problems with B and C.

Conclusions

Guided Proofreading removes bottlenecks for humans in the error correction process and reduces the task to *only* the **critical decision.**

Open Data / Code / Results

http://rhoana.org/guidedproofreading/