High Precision Automated Reconstruction of Neurons with Flood-filling Networks

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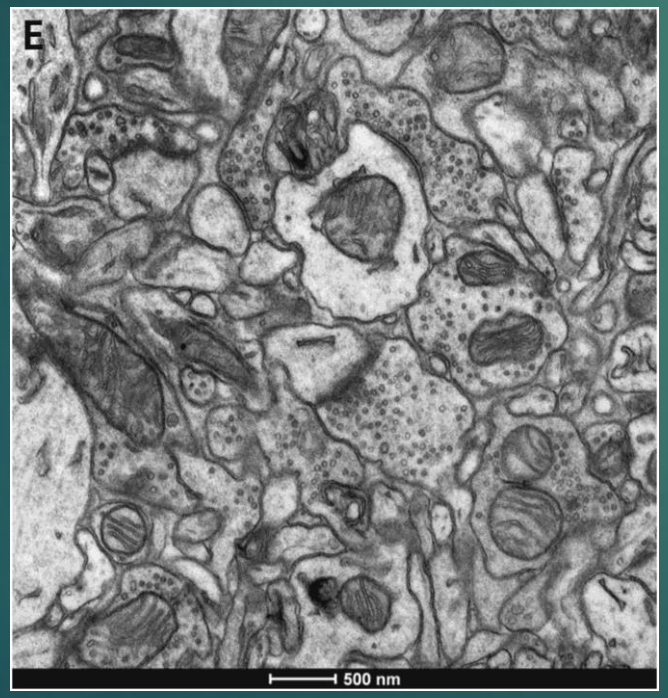
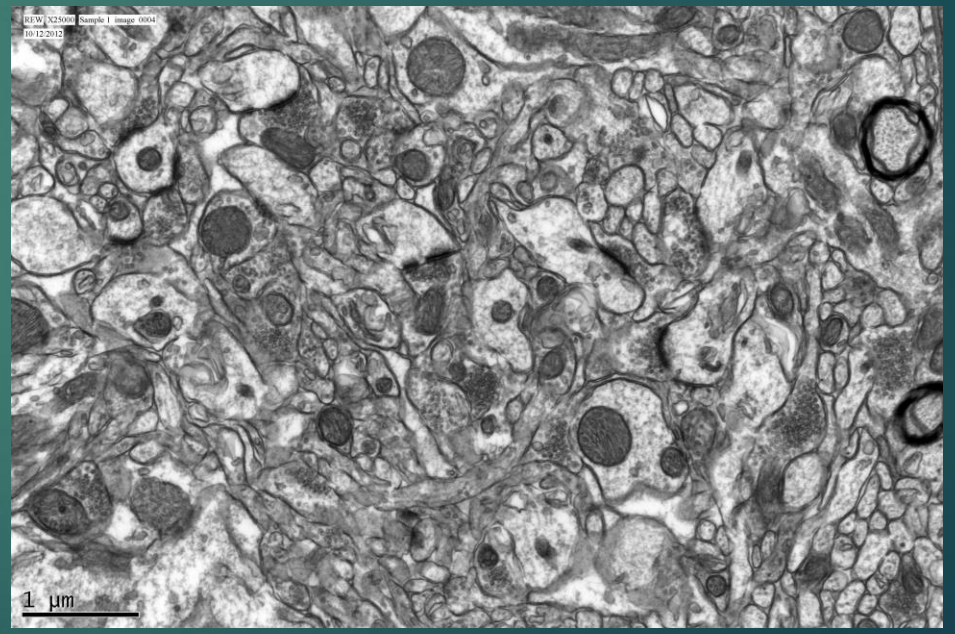
INTRODUCTION TO CONNECTOMICS

Opportunity

We have extremely high resolution images of the brain from EM





Challenge

- We do not have the technology to process these images
- There is a tradeoff between accuracy and time
  - Humans take too much time
  - Algorithms have too much error

With even the most streamlined workflow, it would take a human

100,000

hours to annotate an volume

of 0.1 mm^3

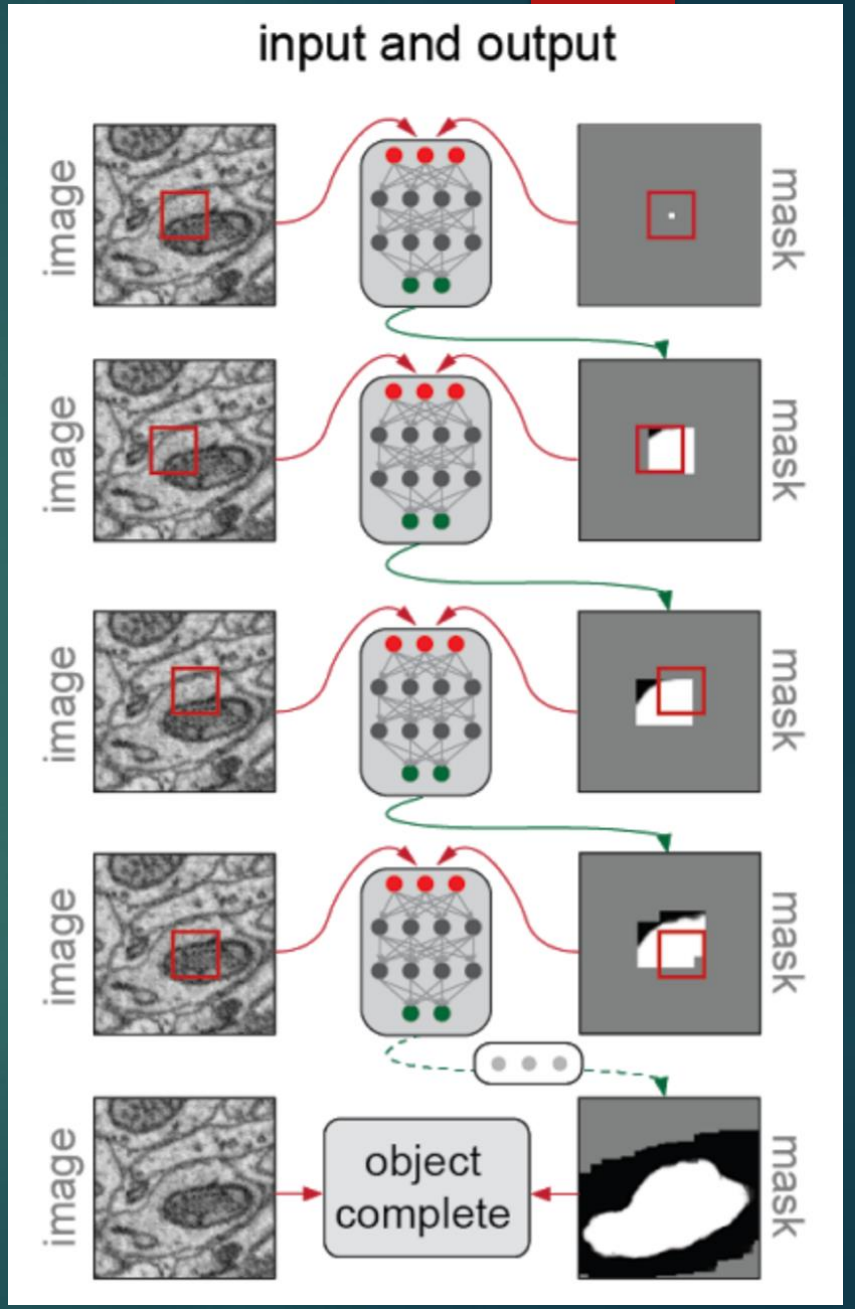
Action

Convolutional Neural Network

- First, find likelihood of boundary existing at each location
- Then, with separate algorithm segment using boundary information.

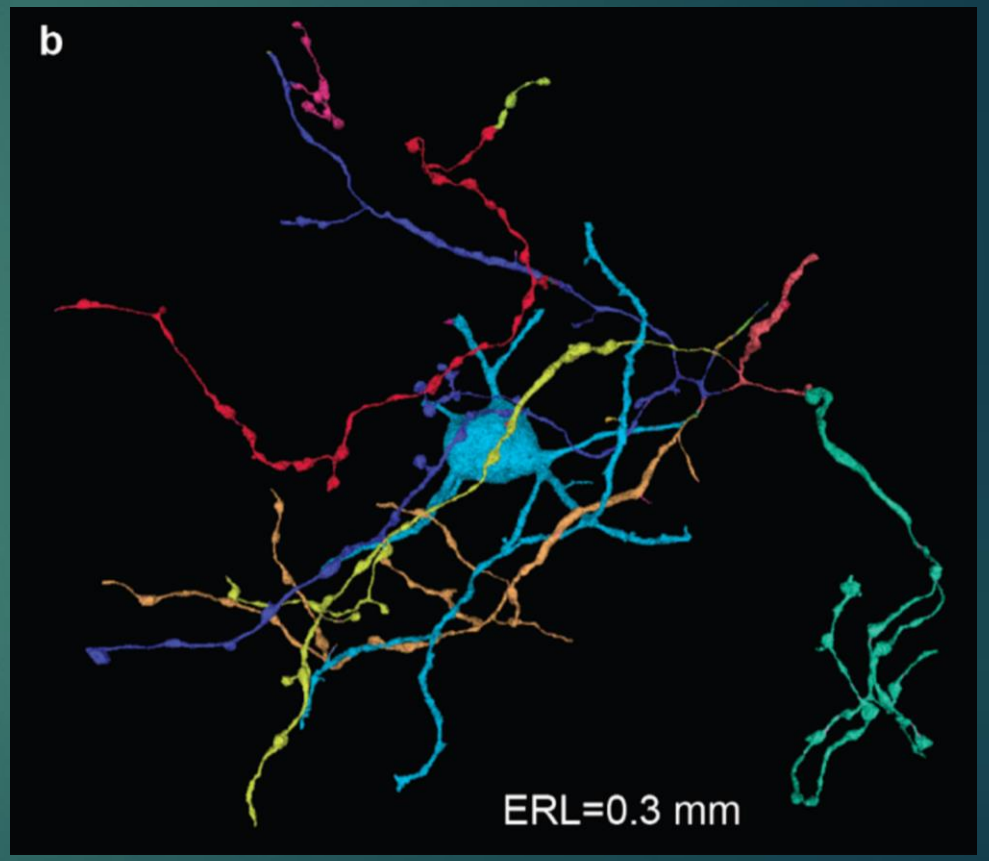
Flood Filling Network

- Uses a CNN as its base algorithm
- Combines the steps of conventional algorithms.
  - Besides using only the 3D image data, also uses previous results
  - This makes it iterative and less error prone
- Uses results from "easy" areas to help compute "hard" areas.



Results

- Manually traced "skeleton" neurons and compared to those.
- Looked for "splits" and "mergers"
- Achieved an order of magnitude less of merge errors and significantly less split errors.
- Also achieved high "Expected Run Length" or sections without errors.
- Costly computationally, almost 74x more than base CNN.



Feedback

This paper…

- Does a good job of framing the question, explaining methodology clearly etc.
- Has encouraging results

But…

- Doesn't follow through on explaining the potential impact of its good results.
- Instead spouts figures that take effort to see are encouraging. (See Abstract)