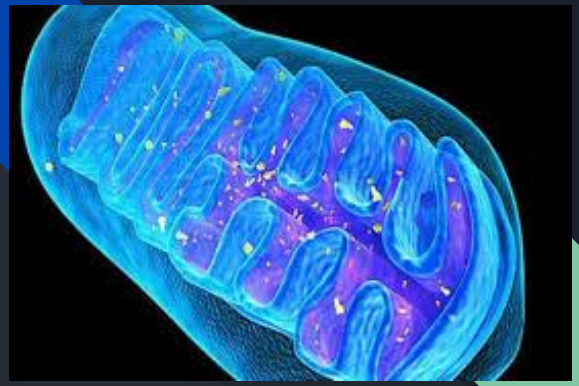


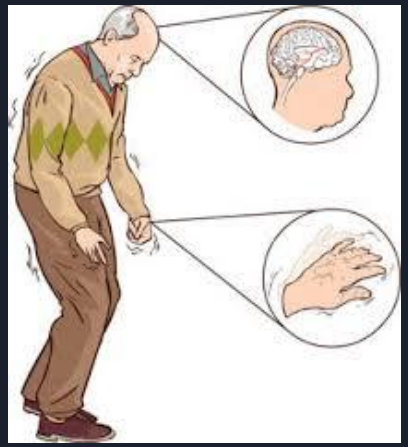
Supervoxel-Based Segmentation of Mitochondria in EM Image Stacks With Learned Shape Features

Aurélien Lucchi, Kevin Smith, Radhakrishna Achanta, Graham Knott, Pascal Fua

Presented by: Kavya Tumkur

Opportunity

- Mitochondria shape maintains cellular physiology
- Important in neural functionality
- Likely strong connection between mitochondrial defects and neurodegenerative diseases
    - Mutations in gene for PINK1 associated with Parkinson’s

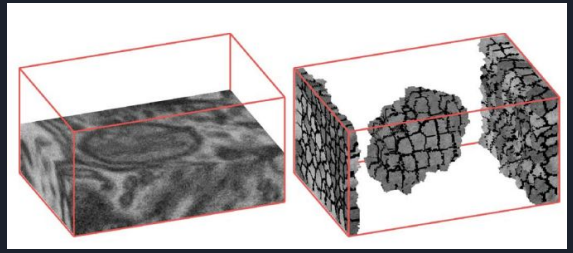


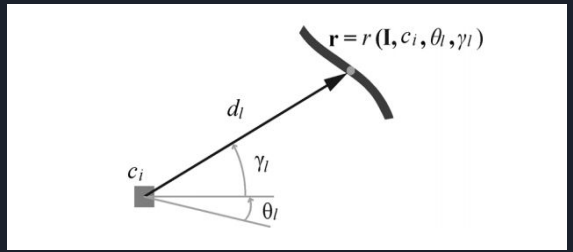
Challenges

- Mitochondria range from 0.5-10 micrometers
- Analyzing EM stack by hand takes too long
- Generic computer vision algorithms are intractable
- Previous EM segmentation algorithms not designed for large 3D volume stacks

Action

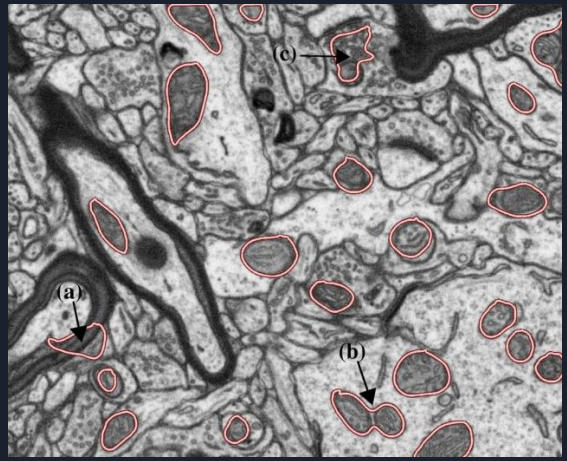
- Data from hippocampus and striatum
- Segment EM stack into supervoxels using SLIC algorithm
- Feature vector extracted for each supervoxel
  - shape and intensity
- Segment mitochondria using graph cuts approach

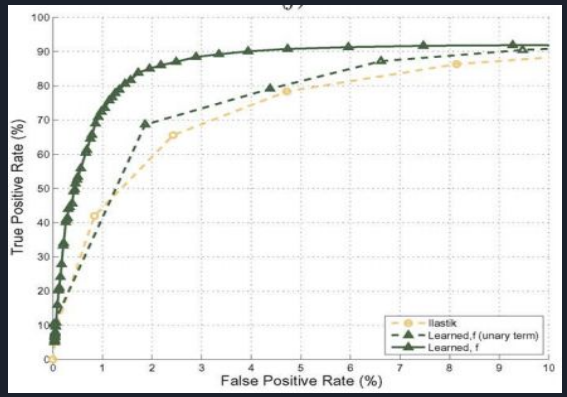




Resolution

- VOC score used to evaluate segmentation quality
- SLIC supervoxel algorithm superior
  - Downsampling reduces VOC by 14-16%
- Important to include shape in feature vector
  - Otherwise VOC drops by 18%
- Much more accurate than prior state-of-the-art approaches
  - VOC 23% and 16% higher
- Room for improvement





Feedback/ Future Work

- Overall paper was well-organized and interesting
- Algorithm well-explained
- Slightly redundant
- Methods a little technical and confusing
- Definitely impactful
    - Can be applied to other cellular structures