Fully Automated Segmentation of Mitochondria Based on Morphological Feature Learning

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Characteristics of Mitochondria
- Dynamic organelles
- Fusion and fission processes
- Diverse morphological structures
- Correlated with important biological functions

Challenges
- Inhomogeneity in background intensity, signal-to-background ratio, and SNR
- Diversity of morphological structures

Proposed 2-stage Approach for Mitochondria Segmentation

- Pre-Processing
  - Image to non-overlapped patches

- Step 1. Input Data Grouping
  - R: Local Variance of Patch

- Step 2 & 3
  - Data grouping

- Step 4. Otsu’s Method

- Step 5. Connection of Break-outs
  - Predicted data
  - Hough Transform
  - de-Hough Transform

- Stage 1: Learning-based Segmentation
  - Pre-processing
  - Data grouping
  - Feature extraction
  - Logistic regression
  - Binarization

- Stage 2: Centerline Extraction
  - Combine results in Step 4 and Step 5

Conclusion
- 2-stage Approach for Mitochondria Segmentation
- Regression-based Mitochondrial Objectiveness Estimation
- Optimal-algorithm Based Centerline Extraction
- Automatic segmentations
- Reduce morphological errors