A CASCADE OF CNN AND LSTM NETWORK WITH 3D ANCHORS FOR MITOTIC CELL DETECTION IN 4D MICROSCOPIC IMAGE

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BACKGROUND & CONTRIBUTION

Background & Problems

• Mitotic can be used to understand cell behaviors, analyze diseases, and in many biomedical applications.
• Detection methods are done on 2D image and problem occur on those methods
  - The mitosis event not occur only on x-y plane
  - Mitotic cell may move from outside of the capture screen

Contribution

• Propose 3D anchors for 4D mitotic detection
  - Reduce false negative results
  - Able to detect oriented mitotic cells
• Combine CLSTM to include temporal information
  - Significantly reduce false positive results

METHODOLOGY

Two Main Parts of Our Network

2.5D Method for Feature Extraction
- Each slice (s) generated feature map (fs).
- Considering the temporal information by using bidirectional CLSTM.

3D Anchors for Mitotic Cell Prediction
- Merging spatial information from nearby slices (fs−1, fs, fs+1)
- Generate prediction result by using 3D anchors for slice (s)

RESULT

DATASET

Dataset information
- From TC-IAIPA-IA2017
- 16 set of 4D data
- 80 temporal frames
- Size: 480x480x37

Data augmentation
- 1-3 mitotic cell(s)
  - Rotated 15°
  - Scale 0.8–1.2

POST PROCESSING

Refine our network results
- Remove erroneously identified
- Adding missing mitotic cells
- Using both spatial and temporal information

CONCLUSION

- We proposed a 2.5D cascaded CNN and LSTM network with 3D anchors for mitotic cell detection in 4D microscopic images.
- Our experimental results show that the proposed method can perform better than the state-of-the-art methods such as Faster RCNN, Single Shot Multi-Box Detector (SSD), Hierarchical Convolution Neural Network (HCNN), Two-Stream Bidirectional Long Short-Term Memory (TS-BLSTM), and the winner of the TC-IAIPA-IA2017 contest.