Enhancing Deep Learning Robustness in Microscopy Images

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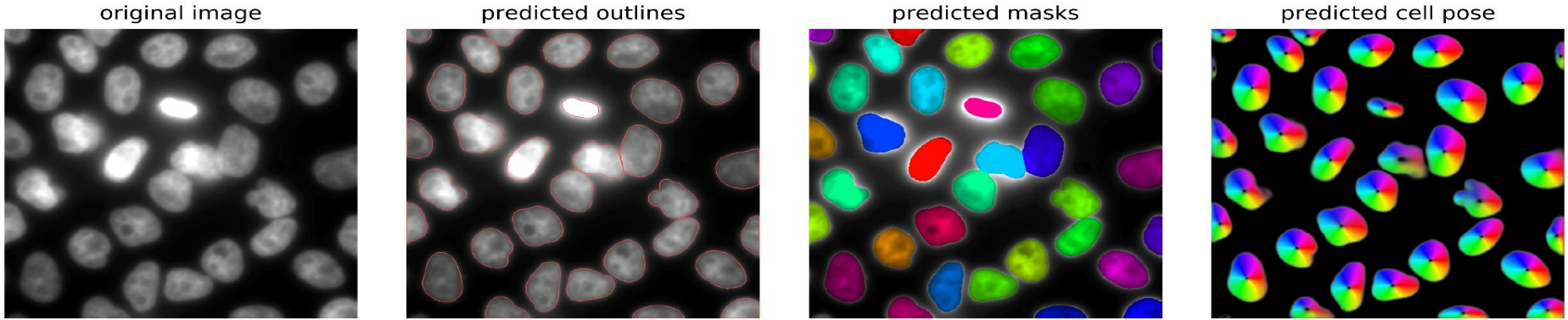
1. Introduction

- **Image cell segmentation:** identifying and delineating individual cells within microscopy images.

- **Obstacles:** The presence of noise and artifacts hinders the accuracy

- **Solution:** Advanced algorithms that can differentiate (e.g. SVM, Random Forest, U-NET etc.)

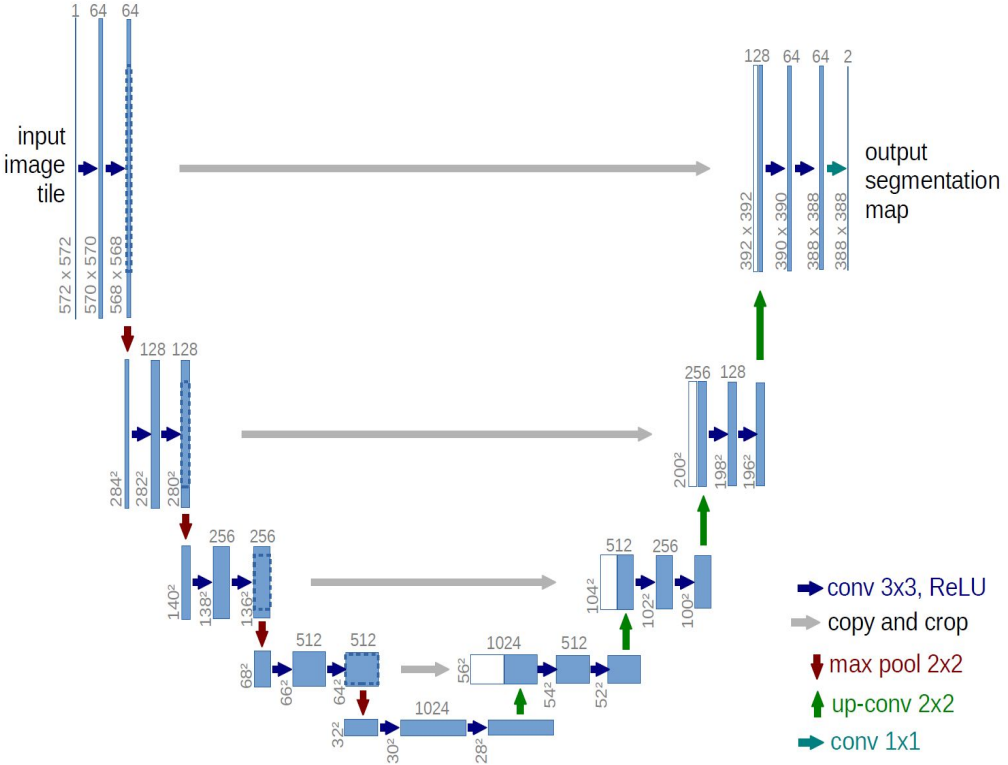


2. **Research Question**

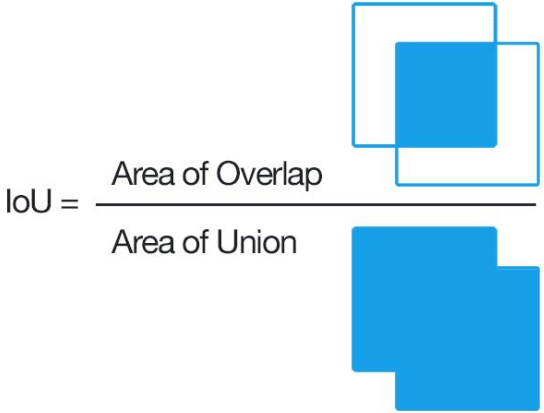
How can deep learning models be more robust to noise and artifacts in microscopy images to make the prediction better?

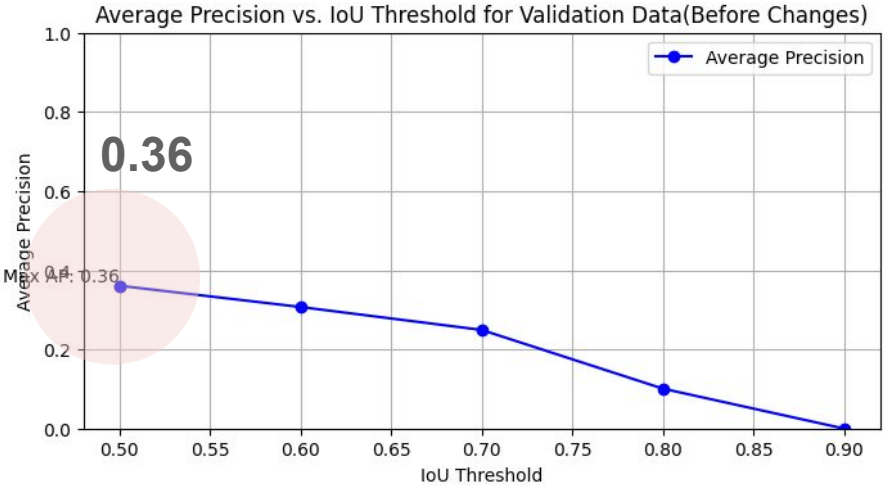
3. Methods

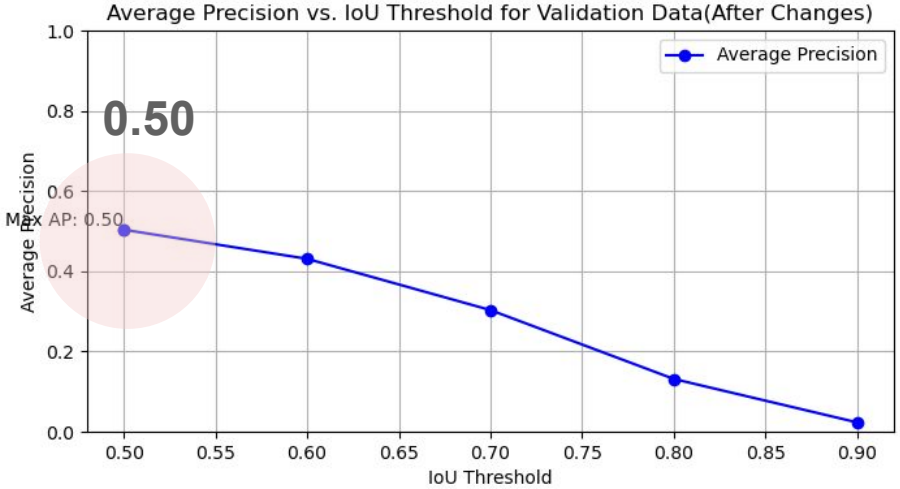
- **Dataset: NMA dataset template**
  - Cell images and their masks
- **Model: U-Net**
  - A CNN network with encoder-decoder structure with skip connections
- **Optimizer: Adamax**
- **Data augmentation:**
  - Rotations, resizing, cropping and translations, and horizontal flipping
- **Noise: Speckle noise**



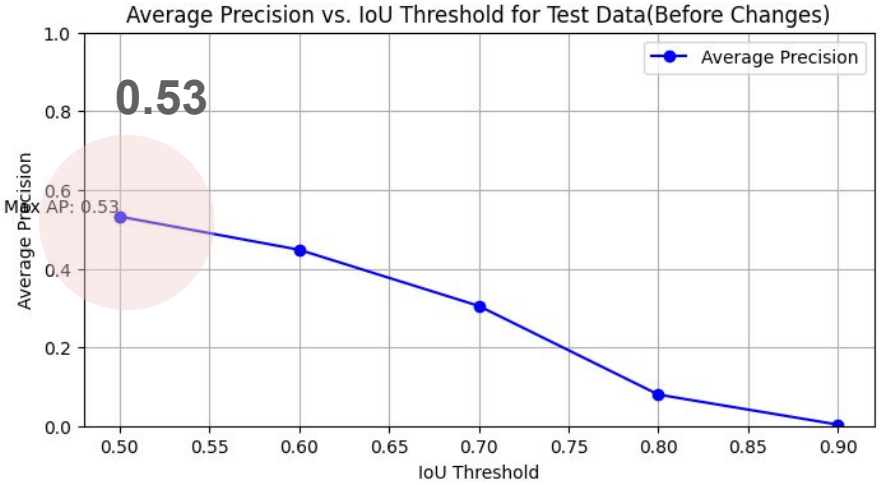
4.Validation Dataset

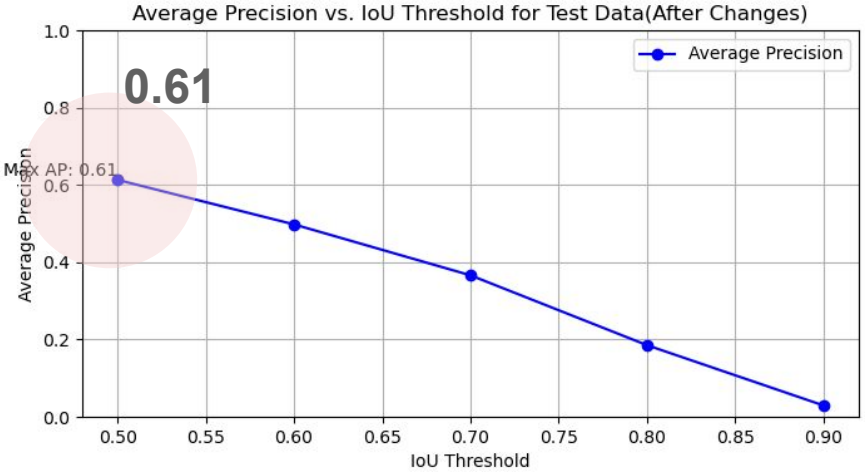






5. Test Dataset

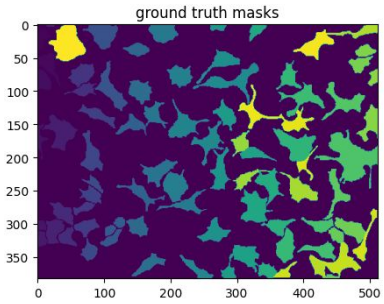


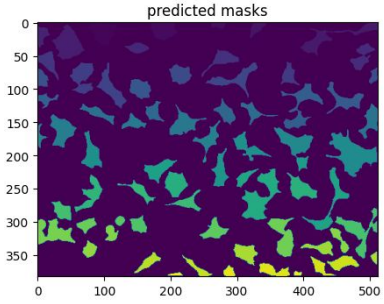


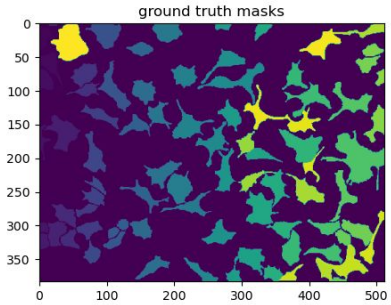
6. Result 3

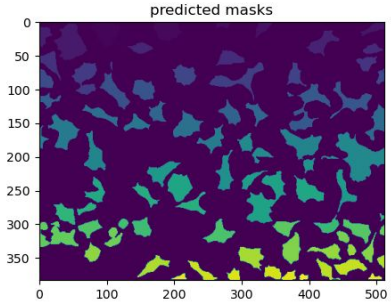
- Comparing true and predicted masks

Default model









Adding noise
Data augmentation
Changing the Optimizer

7. Conclusion

- Summary results
  - With data augmentation, adding noise, and hyper parameter tuning, our model showed more robust segmentation performance.
- Implication of our research
  - We tested out the performance of U-Net on images with speckle noise
- Future direction
  - Find the best hyperparameters for U-Net
  - Apply U-Net to other biomedical images (e.g. real tissue images)
  - Multi-Scale Feature Extraction
  - 3D Image Segmentation

Thank you!