Enhancing UNet-driven T1-weighted Brain Magnetic Resonance Image Segmentation using Post-processing Techniques

MDSC 689.03 Final Project

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Introduction

Brain segmentation is vital for any brain analysis task

Traditional methods

Sensitive to noise
Sensitive to intensity variations
Time consuming

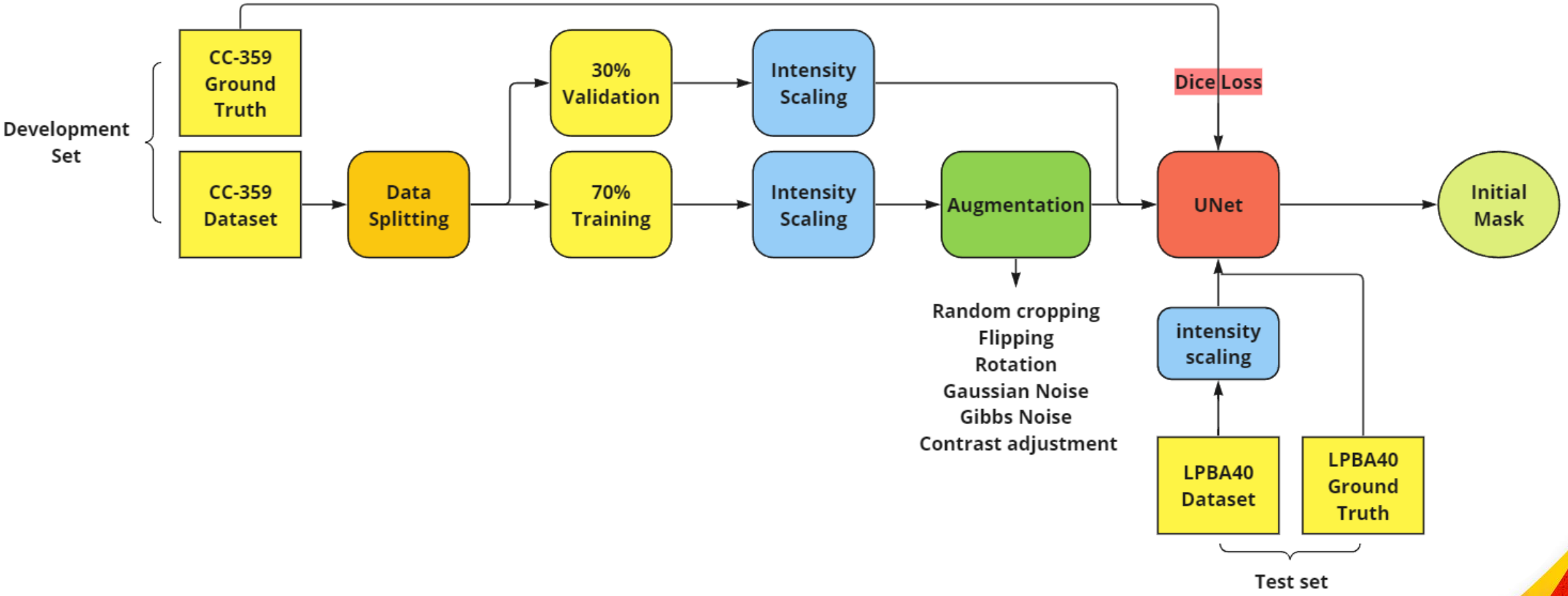
CNNs

Need for large labeled dataset
overfitting
Sensitive to hyperparameter choices

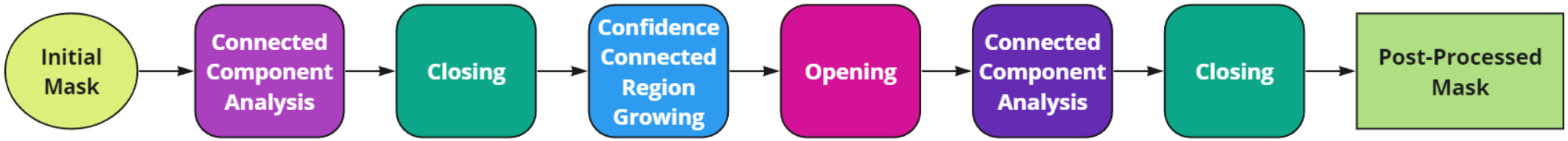
This Project

Combining CNNs, traditional, and post-processing techniques
utilizing benefits, overcoming drawbacks

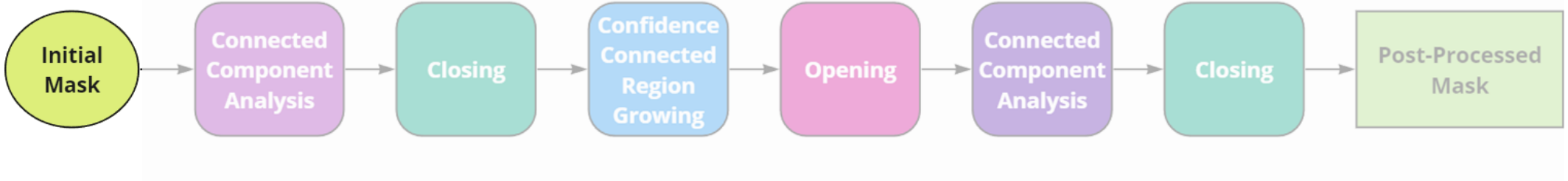
Initial Segmentation: UNet

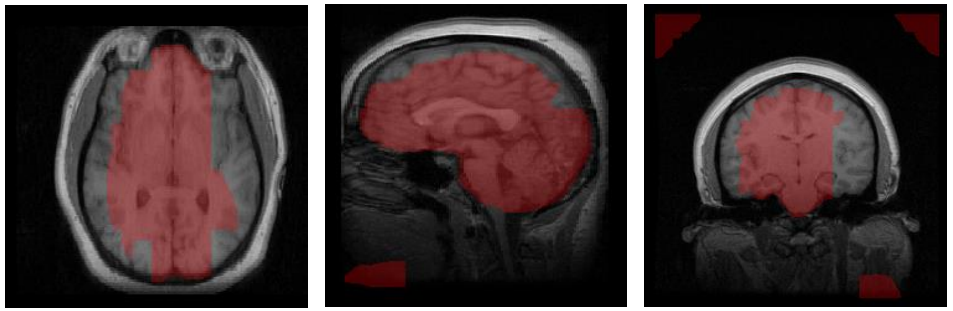


Post-Processing Pipeline



Post-Processing Pipeline





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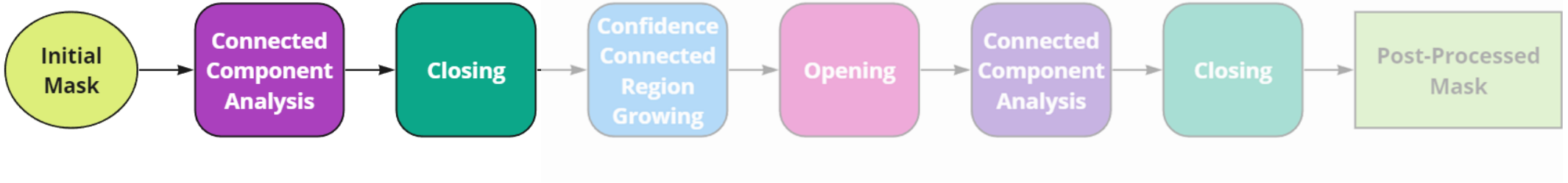

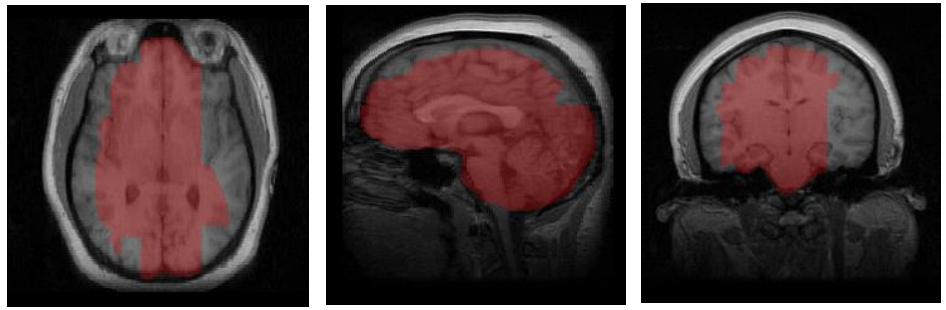

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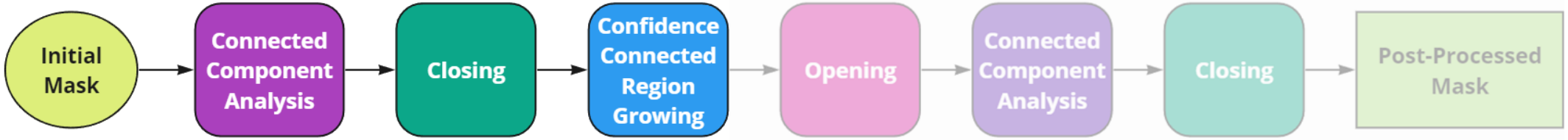

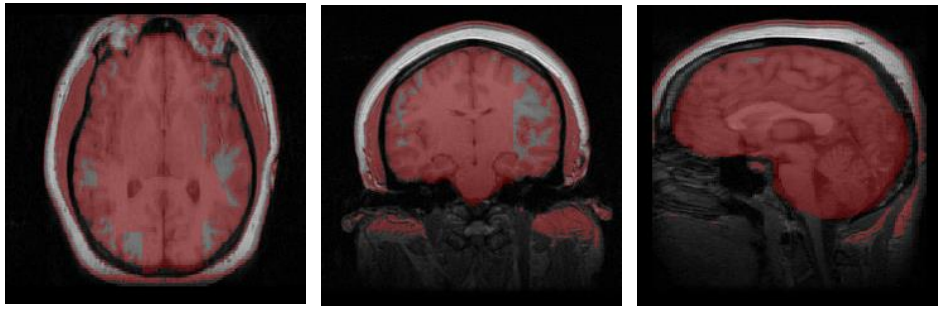

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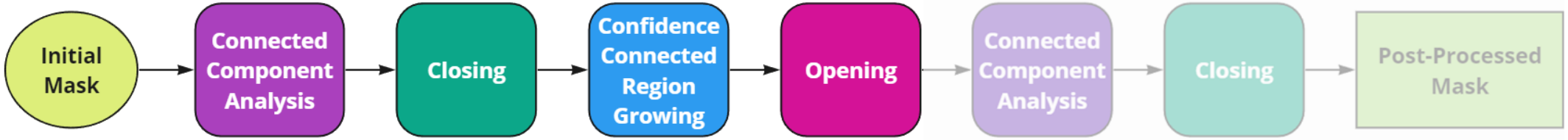

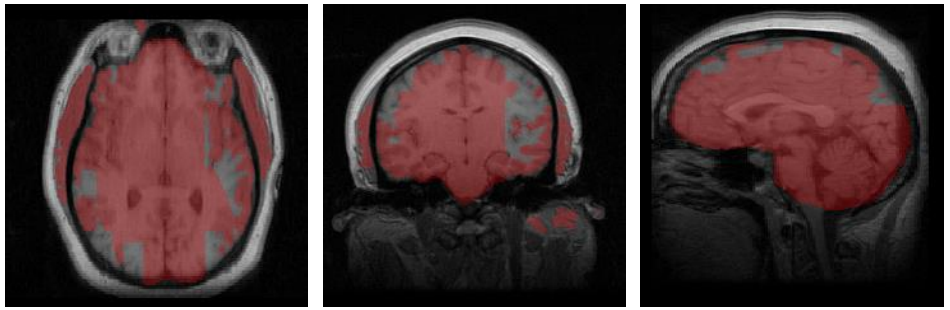

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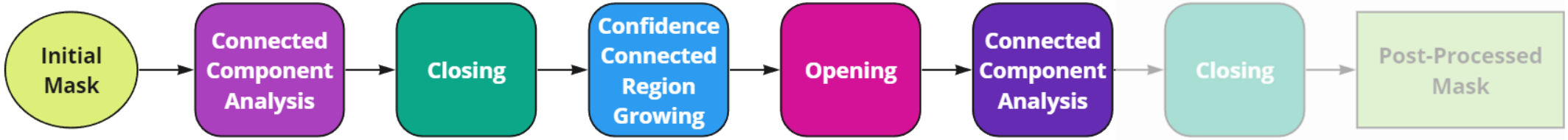
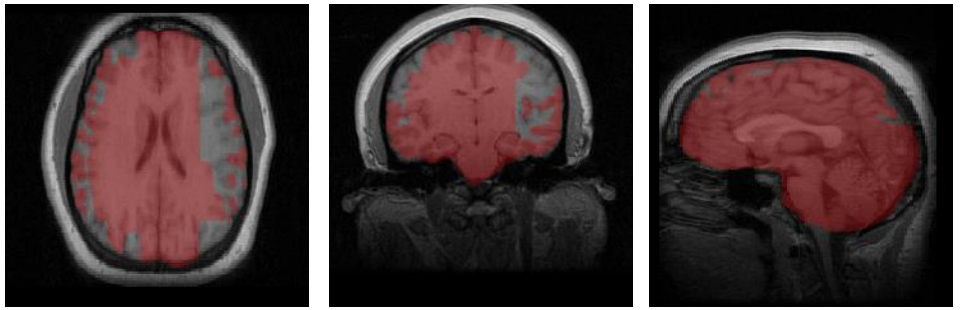
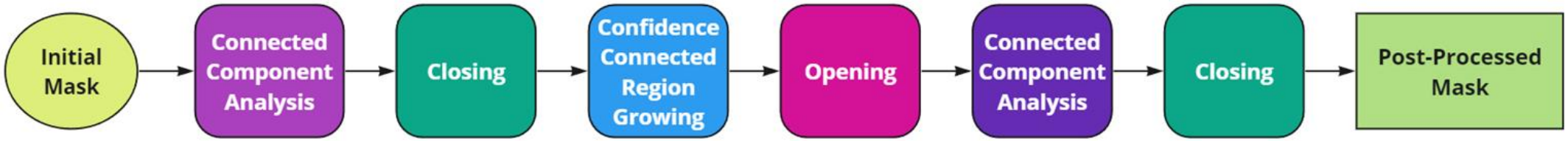
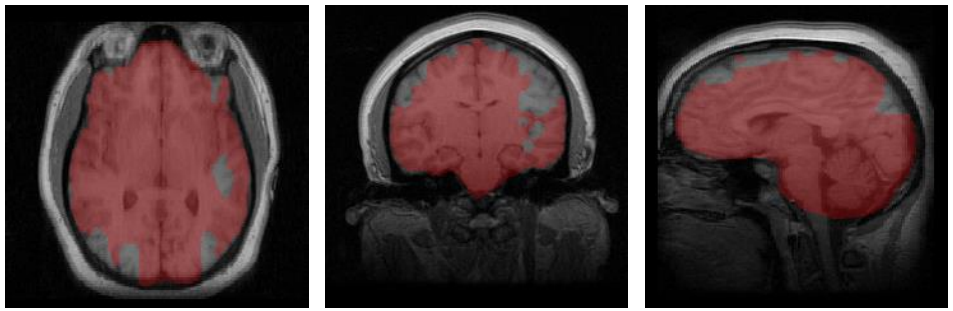


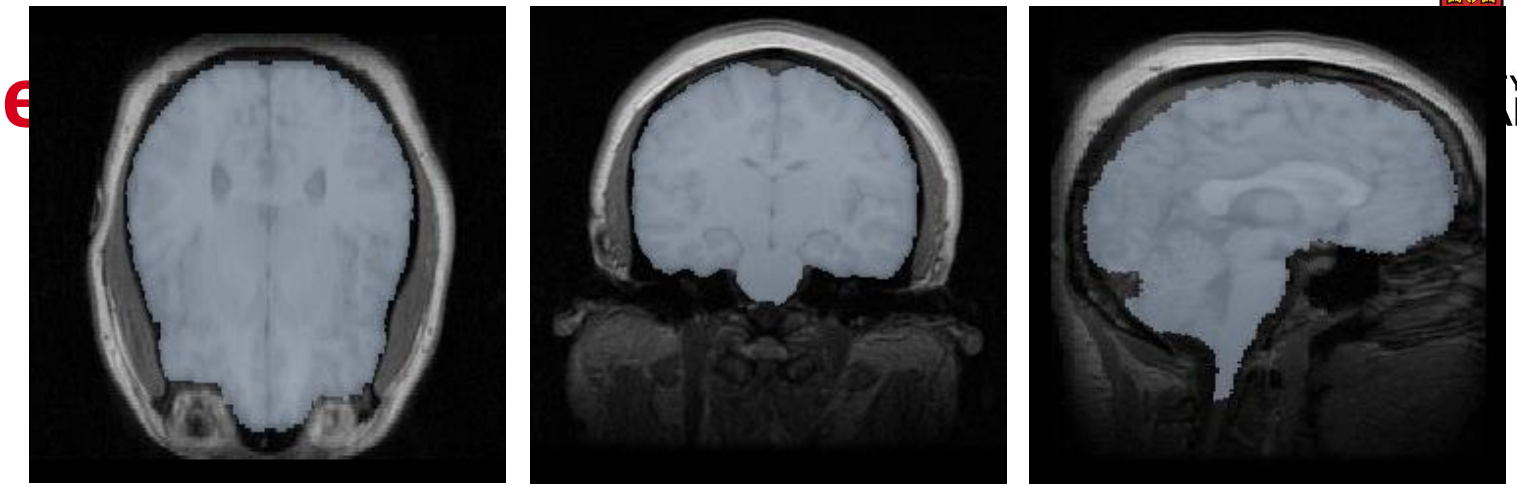


Post-Processing Pipeline

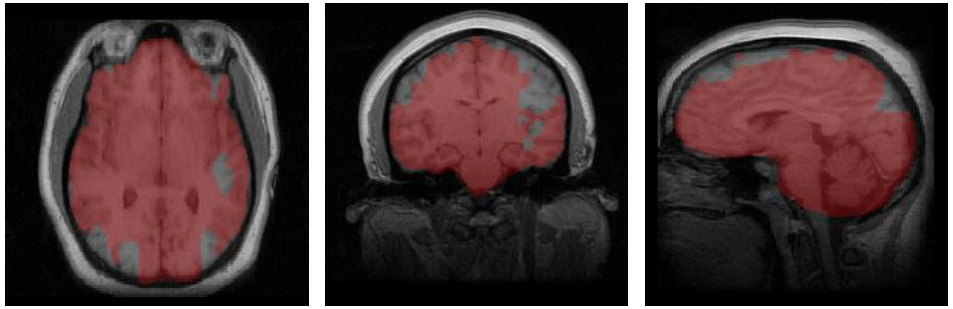




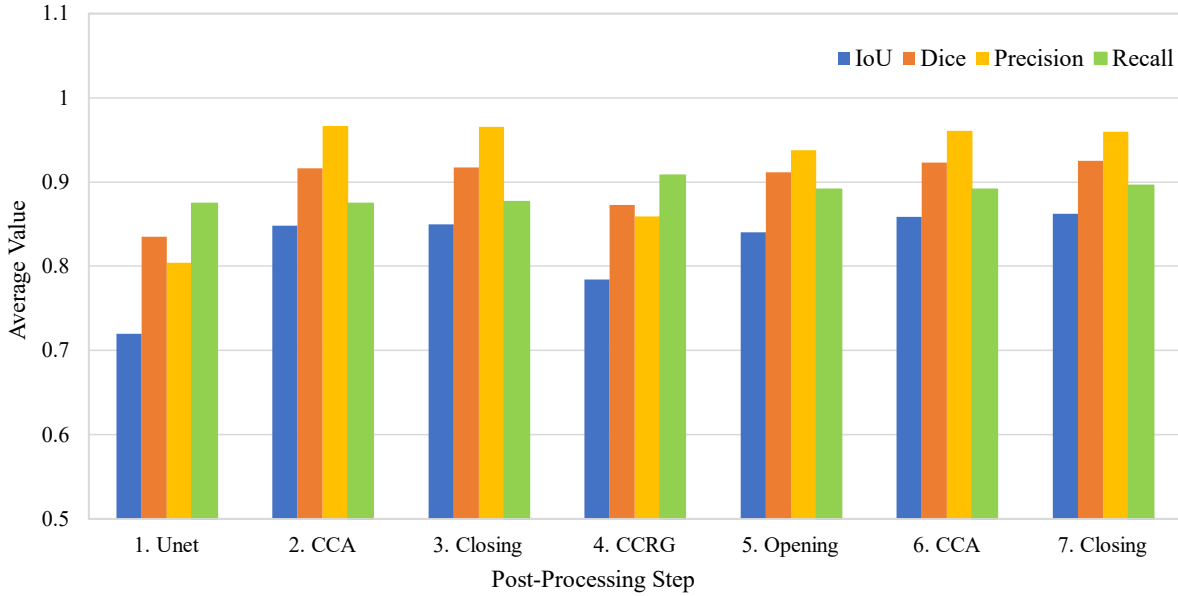
Post-Processing Pipe

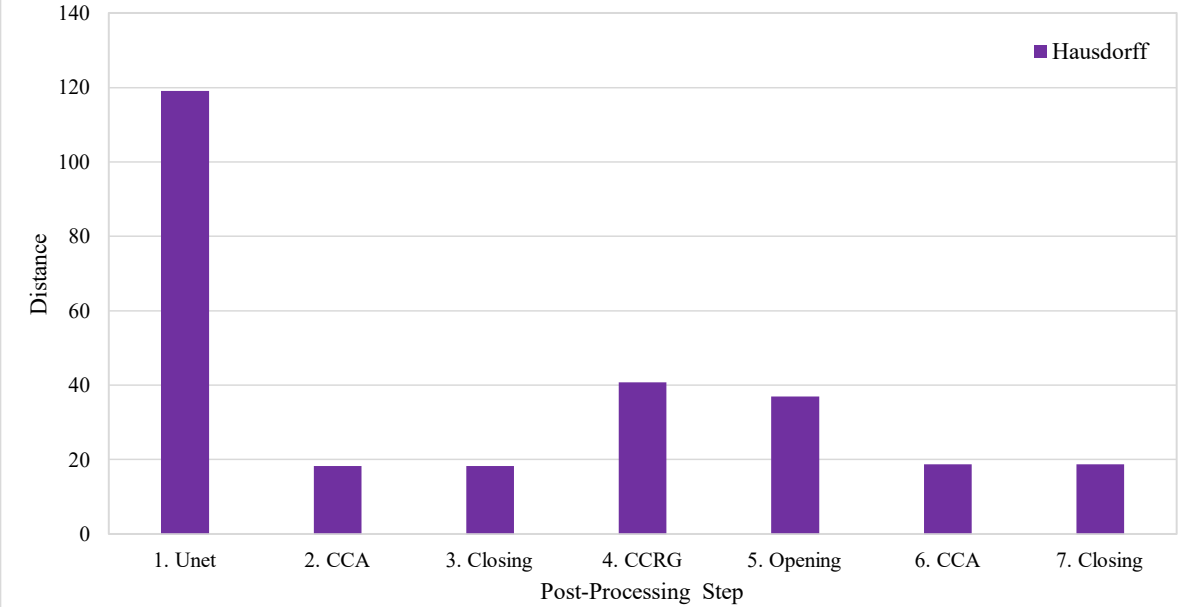


(a) (b) (c)

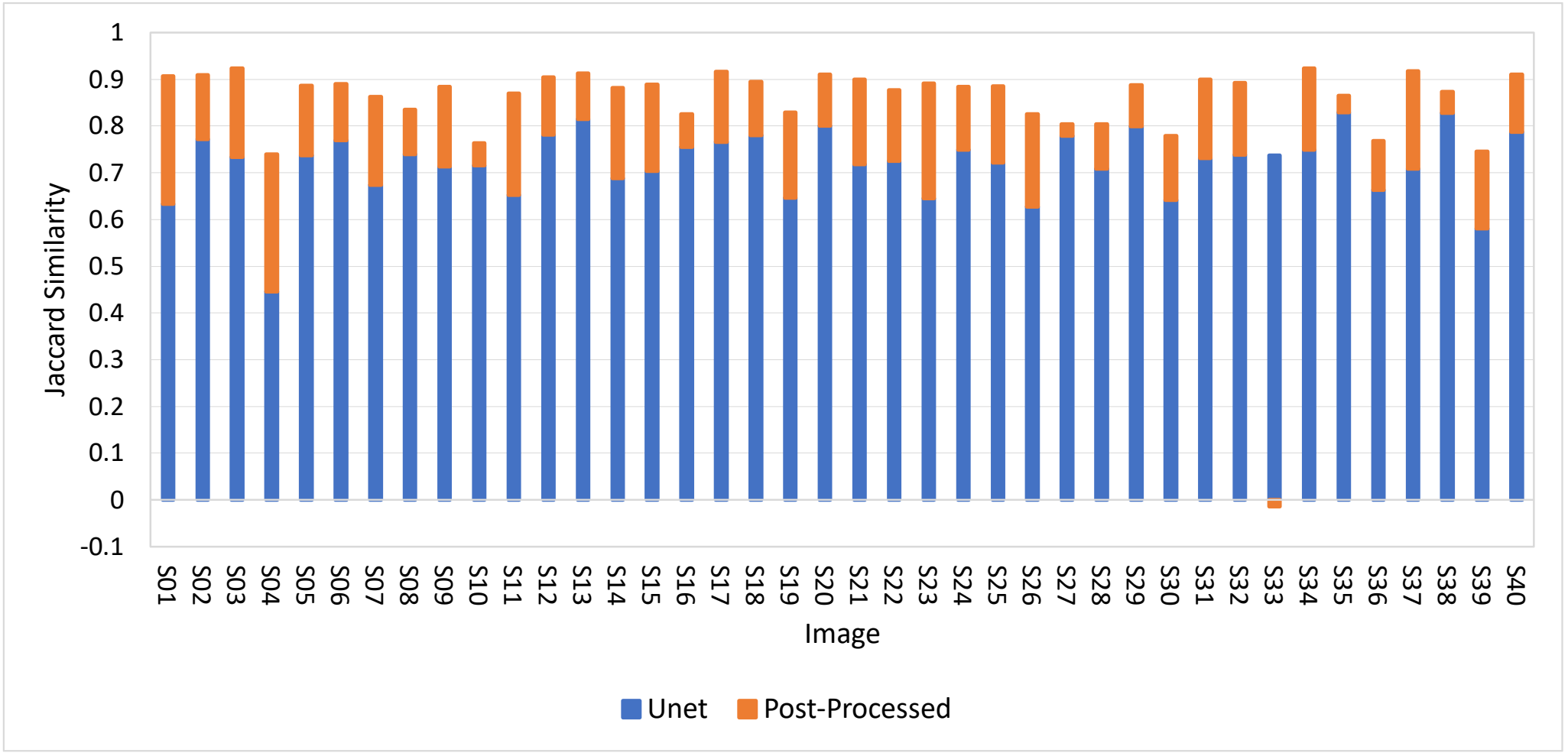


Evaluation Results





Results


1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
Jaccard Similarity
S01 S02 S03 S04 S05 S06 S07 S08 S09 S10 S11 S12 S13 S14 S15 S16 S17 S18 S19 S20 S21 S22 S23 S24 S25 S26 S27 S28 S29 S30 S31 S32 S33 S34 S35 S36 S37 S38 S39 S40
Image
Unet
Post-Processed

Limitation and Future Works

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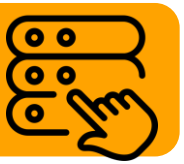
- Post-processing technique selection 
- Dataset limitations 
- Generalizability concerns 
- Combined computational cost 
- Dependence on initial CNN performance 

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Thank you! ☺