Siamese Content Loss Networks for Highly Imbalanced Medical Image Segmentation

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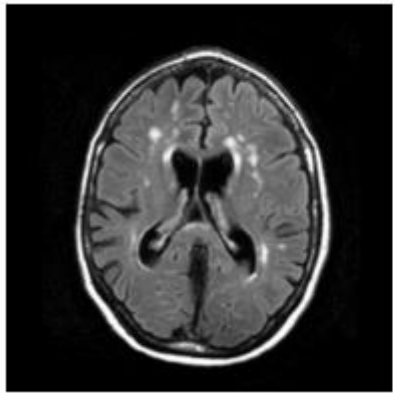
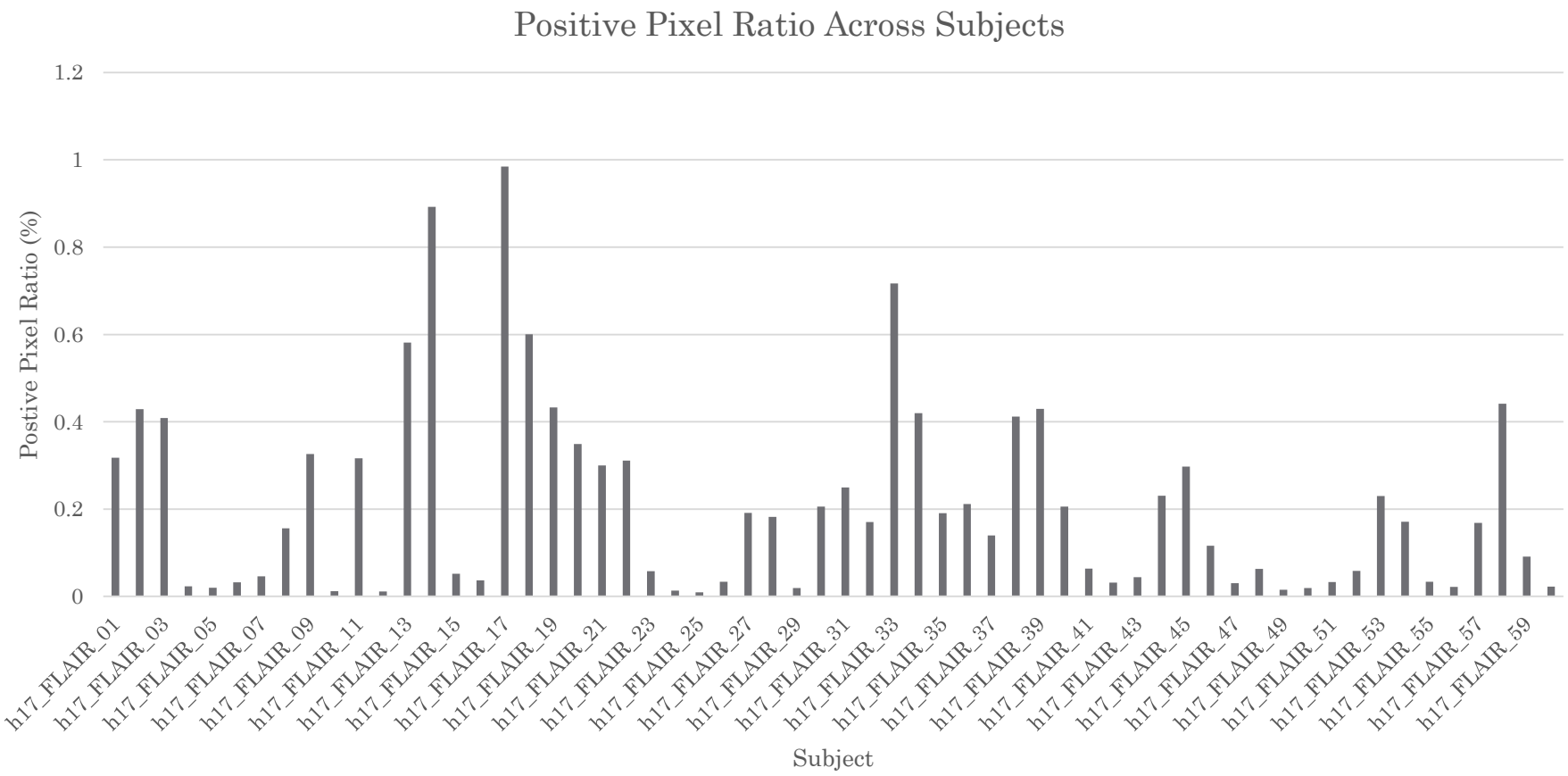
IAMLAB IMAGE ANALYSIS IN MEDICINE LAB

Clinical Problem

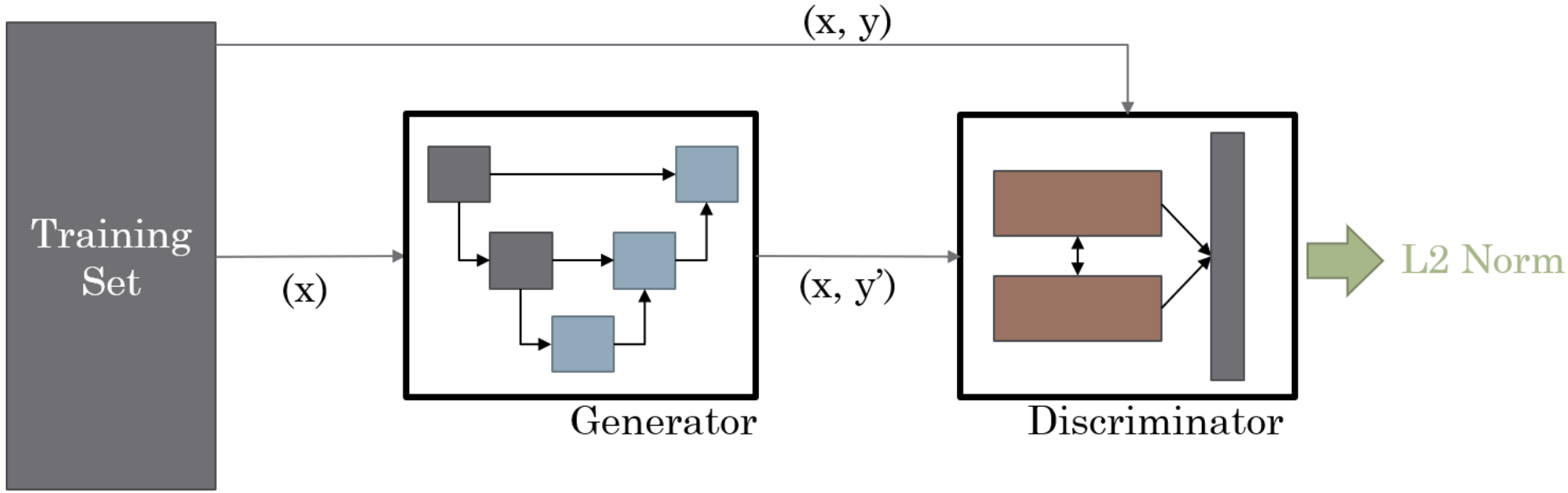
- White Matter Hyperintensities [1]
  - Local macroscopic tissue structure erosion
  - Increased water content due to inflammation
- Key Biomarker
  - Linked with stroke and dementia
- Typical analysis is manual
  - Time consuming and expensive
  - High inter- and intra- rater variability
  - Reported DSC of 0.66 [2] – 0.83 [3] between radiologists
- Our Method
  - Trained on: MICCAI 2017 WMH Grand Challenge Data (60 Volumes)
  - Validated on: Canadian Atherosclerosis Imaging Network (50 Volumes)



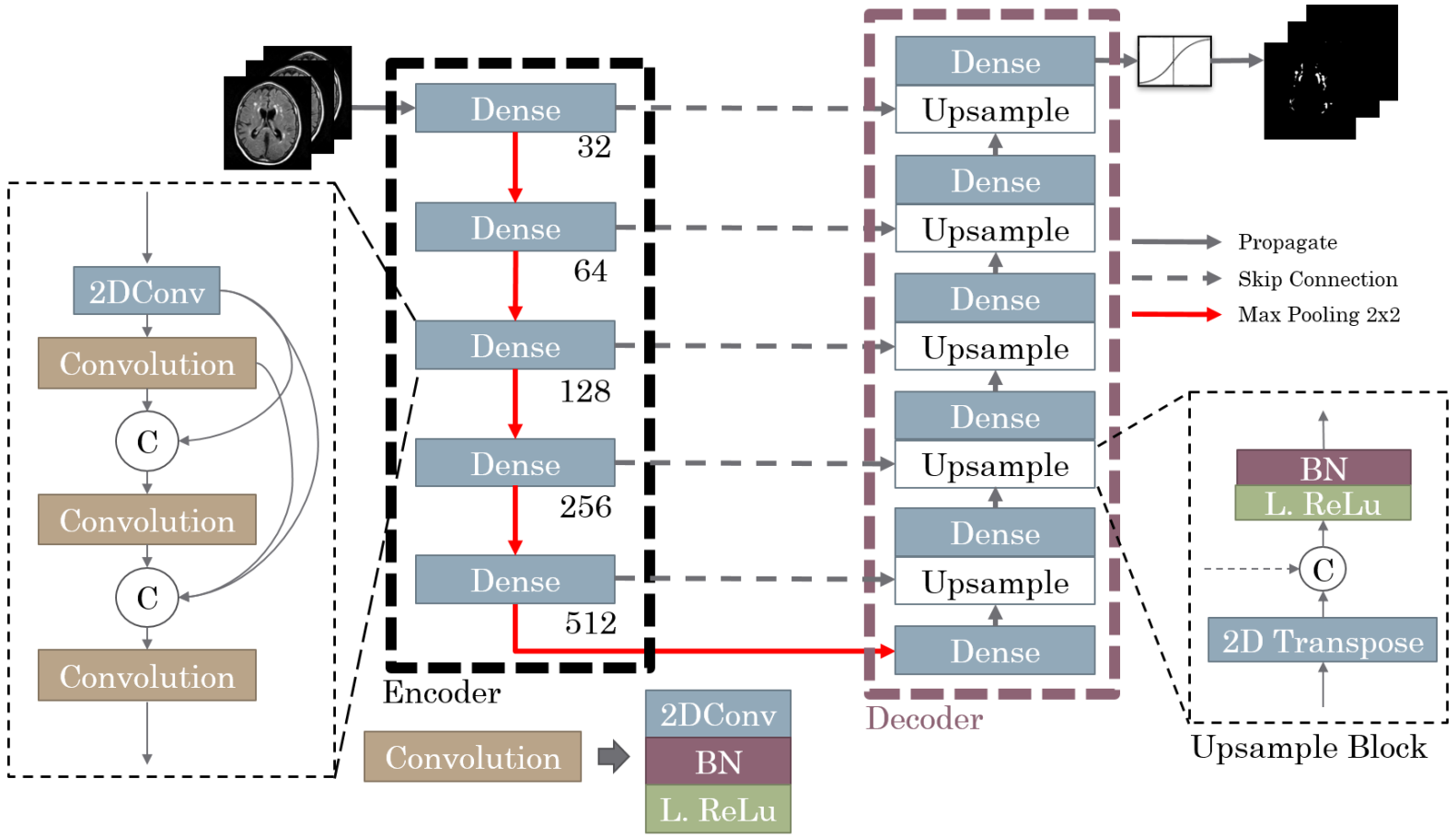
Class Imbalance Across Subjects



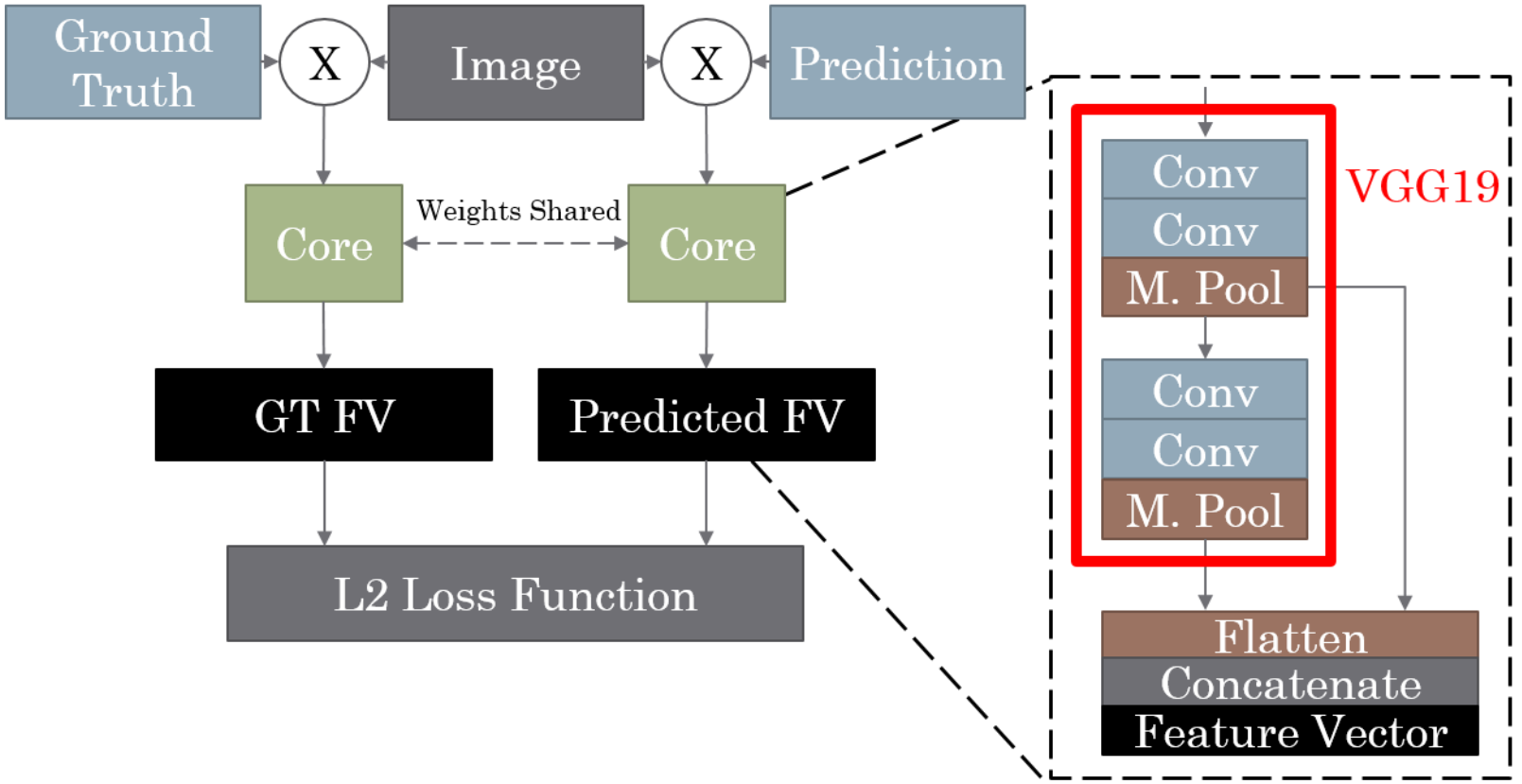
Method – Overview



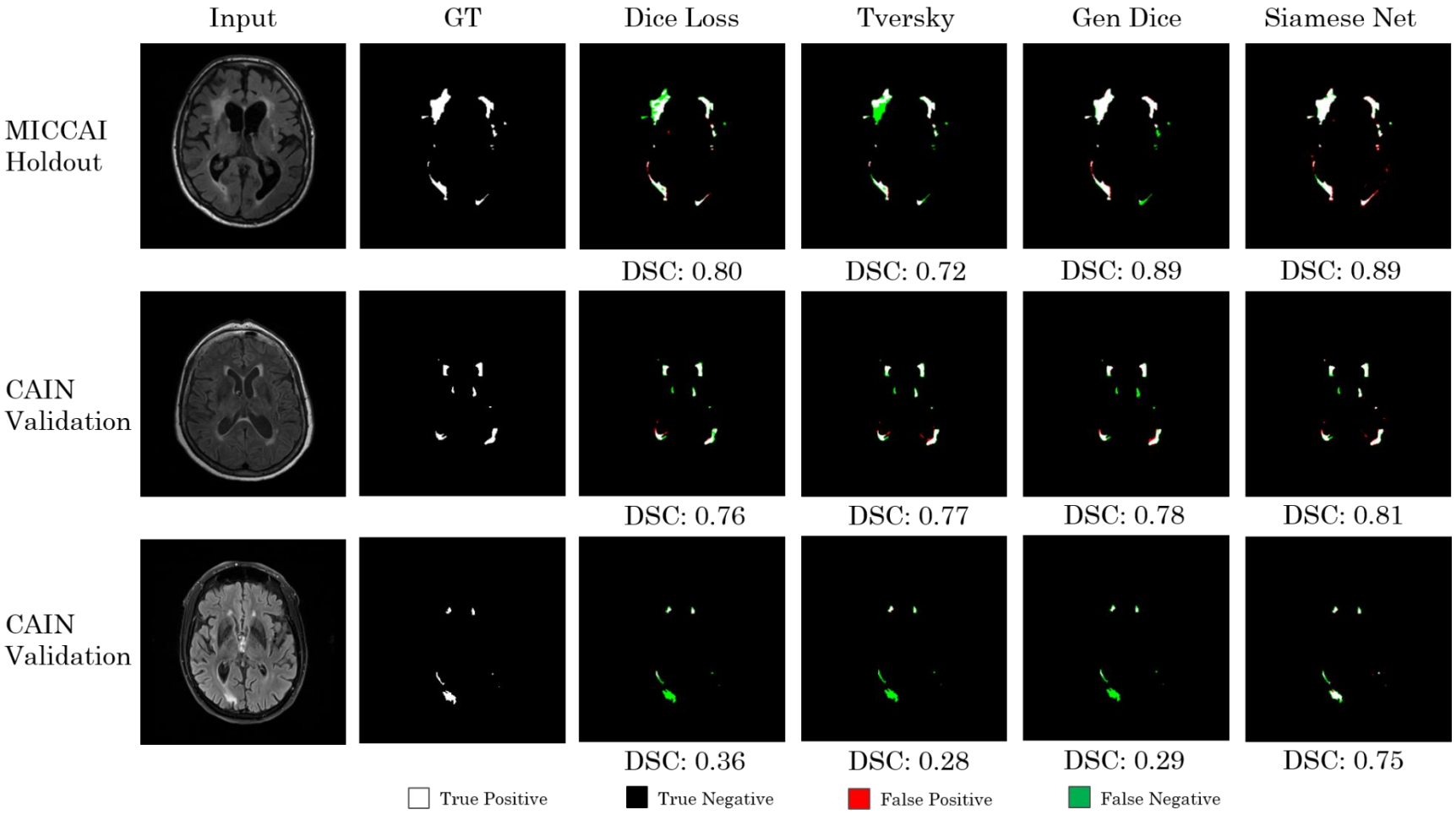
Method – Generator



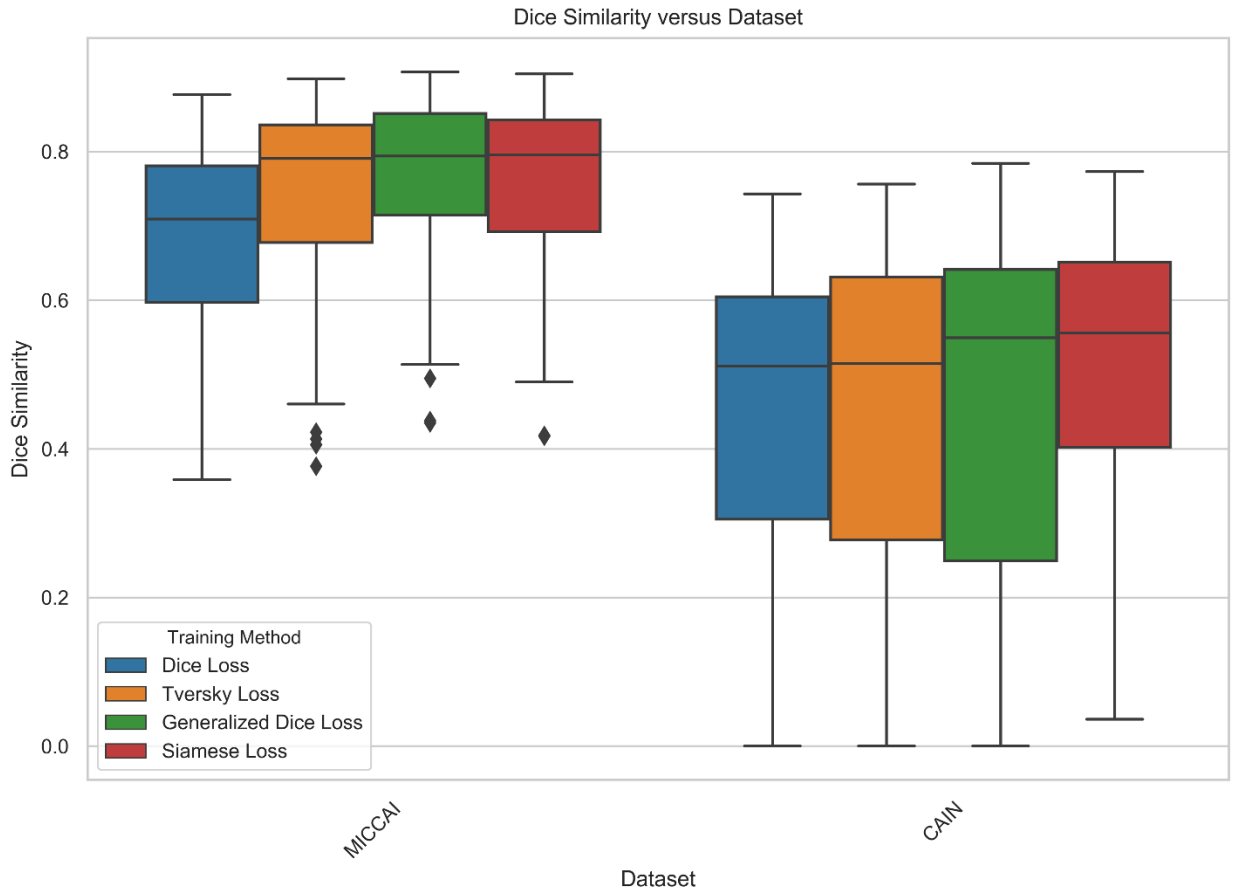
Method – Discriminator



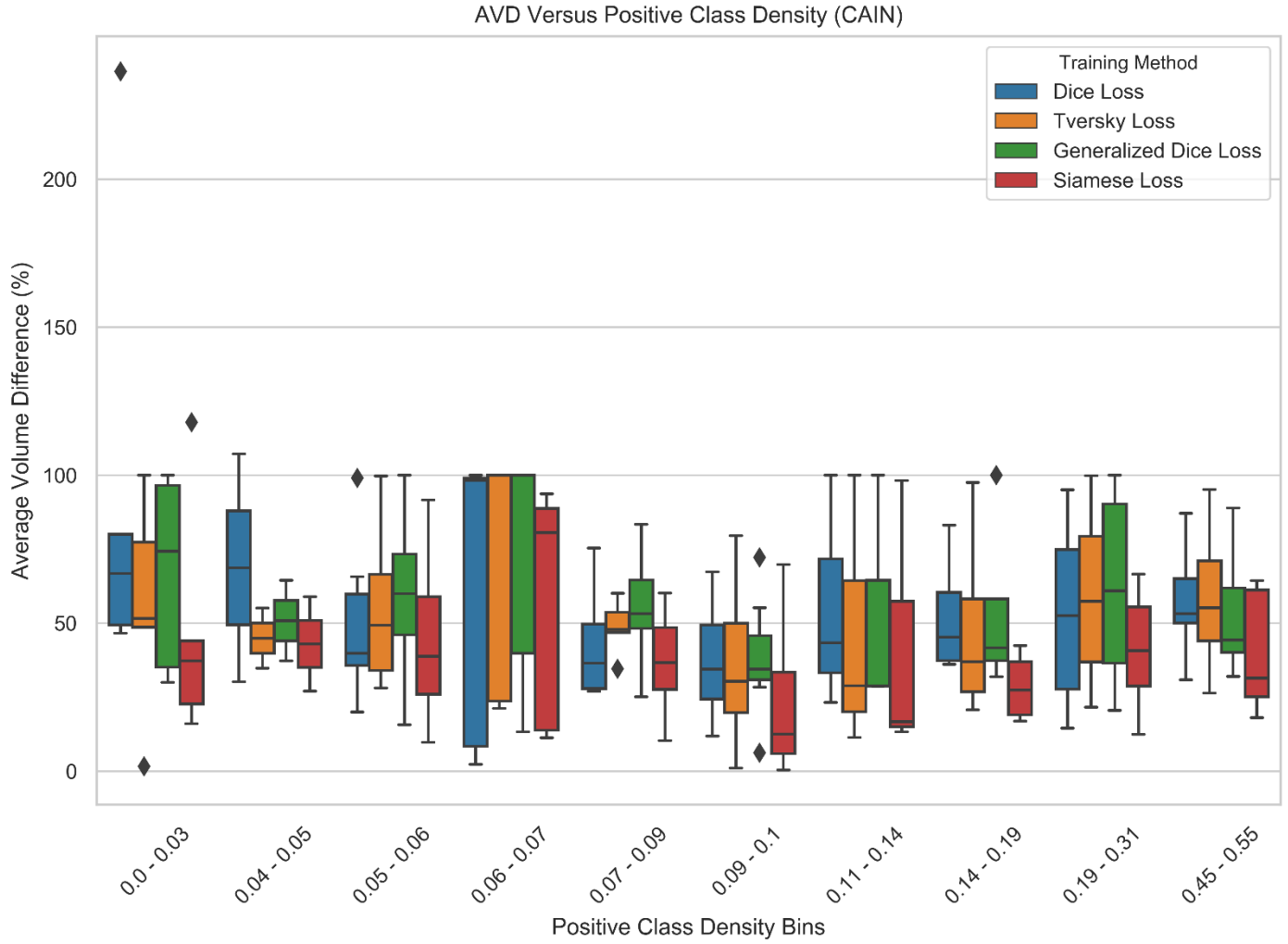
Results – Segmentation



Results – Dice Scores

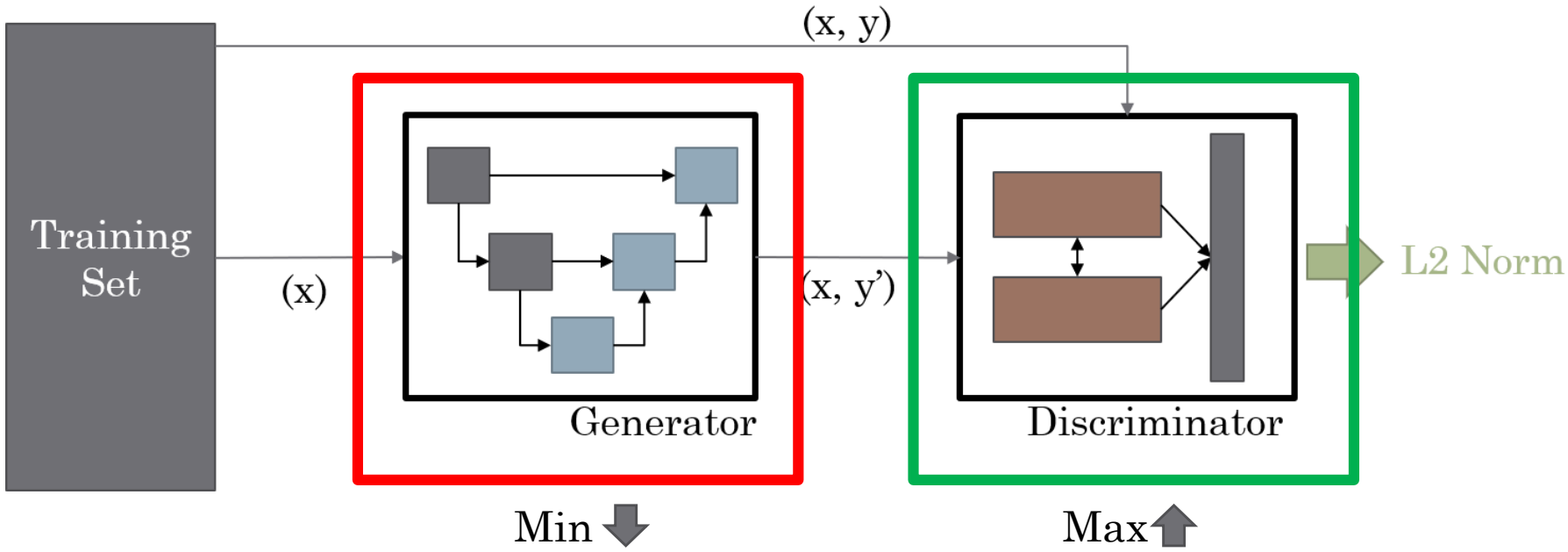


Results – Average Volume Difference



Future Works

- Explore configurations of the discriminator network
- Explore GANs and Deep Metric Learning methods



Thank you for Watching

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References

[1] H. J. Kuijf et al, "Standardized Assessment of Automatic Segmentation of White Matter Hyperintensities; Results of the WMH Segmentation Challenge," IEEE Transactions on Medical Imaging, vol. 38, (11), pp. 1-1, 2019.

[2] C. Egger *et al*, "MRI FLAIR lesion segmentation in multiple sclerosis: Does automated segmentation hold up with manual annotation?" *NeuroImage Clinical,* vol. 13, *(C),* pp. 264-270, 2017.[3] T. Falk et al, "U-Net: deep learning for cell counting, detection, and morphometry," Nature Methods, vol. 16, (1), pp. 67-70, 2019.

[3] M. D. Steenwijk *et al*, "Accurate white matter lesion segmentation by k nearest neighbor classification with tissue type priors (kNN-TTPs)," *NeuroImage. Clinical,* vol. 3, pp. 462-469, 2013.