Introduction
Objectives: improving upon a model for image segmentation using Convolutional Neural Networks.

Background and Motivation Stroke is the leading cause of adult disability worldwide, with up to two-thirds of individuals experiencing long-term disabilities. As predictive algorithms improve, a long-term goal is for clinicians to use MRI to predict the likelihood of recovery, or more importantly, their likelihood of responding to different and more personalized types of therapies.

Dataset
ATLAS (Anatomical Tracings of Lesions After Stroke) Release 1.1, is an open-source dataset consisting of 304 T1-weighted MRIs with manually segmented diverse lesions and metadata. The goal of ATLAS is to provide the research community with a standardized training and testing dataset for lesion segmentation algorithms on T1-weighted MRIs.

ATLAS 1.1 was released to the public only a few months ago in February 2018, thus there is no published research papers using the dataset.

Implementation: Models, Loss, and Performance Metrics

\[ \text{Dice coefficient: used for comparing the similarity of two samples.} \]
\[ \text{Weighted Cross Entropy: } w_0 \geq 1 \text{ decreases the false negative count, hence increasing the recall. A } w_0 < 1 \text{ decreases the false positive count and increases the precision.} \]

Tversky Loss: generalized loss function based on Tversky index to address data imbalance with very small number of training images, and achieve better trade-off between precision and recall.

Discussion, Conclusions, and Future Work
Our experiments primarily compared individual changes directly to the baseline model. However, the baseline's performance was heavily inhibited by the unoptimized weight parameter in the weighted CE loss function. The weight optimization proved to be a bottleneck in our performance, thus improvement due to independent changes made in other aspects of the model (e.g., hyperparameters, model architecture) was marginal, and provided little insight towards improvement.

Our attempt at solving the lesion segmentation problem employs an end-to-end approach with a limited dataset, inhibited by high imbalance, and low expressivity, mostly due to its small size. Our current end-to-end model shows promising performance, despite the limitations, thus improvements in the dataset may have a profound effect. This may be achieved by data augmentation. Further improvements may be found by segmenting the task into three problems: classification, bounding box prediction, and image segmentation.

References and Acknowledgments