Computer Vision Final Project Proposal

By: Mikey Joyce

* Title: Glaucoma Multi-class Classification for Detection of Glaucoma and Glaucomatous Progression
* Dataset: Harvard Glaucoma Detection and Progression with 1000 Samples (Harvard-GDP1000)
* Algorithm: Some form of convolutional neural network, might make multiple and benchmark them against each other

My research with Dr. Keller is tailored towards clinical glaucoma analysis. Because of this, most of our data is clinical studies that are massive amounts of tabular data, not images unfortunately. But one aspect of our data is derived from images, so I think it is worth exploring this type of data. The data I would like to look at are optical coherence tomography (OCT) scans which look at the retinal optic nerve of the eye. These measurements are essentially how ophthalmologists are able to detect glaucoma and glaucomatous progression. We have lots of measurements in the clinical data that are derived from these scans such as information on the thickness of the retinal nerve fiber layer and the cup to disk ratios of the eye. Initially, I wanted to use the Harvard dataset and train a GAN on it to essentially act as a new data generator because our project lacks progression data, as we only have access to ~100 patients. But I think the GAN will actually be hard for me to validate its success on this specific application because I am not an ophthalmologist, and I would not be able to determine if what the GAN produces is actually something that could occur in reality. If you think the GAN is an interesting idea, I could possibly go for it, but I do think it is somewhat risky. The GAN would also be useless if I did not design another network that goes with it that can calculate the RNFL and C/D ratio measurements that can further be utilized in clinical analysis. So, because of those limitations I decided it is probably wiser to just create a CNN, or multiple CNNs, to do what the dataset was designed to do: classify glaucoma and glaucomatous progression. Since the dataset has labels for the multiple types of progression with respect to glaucoma, and labels for whether or not someone has glaucoma the validation of this network will be trivial. The dataset is actually locked up, but I requested access to the data from the Harvard Ophthalmology AI Lab and they granted me access to their data.