Photo by ©National Eye Institute

DEEP LEARNING PROJECT
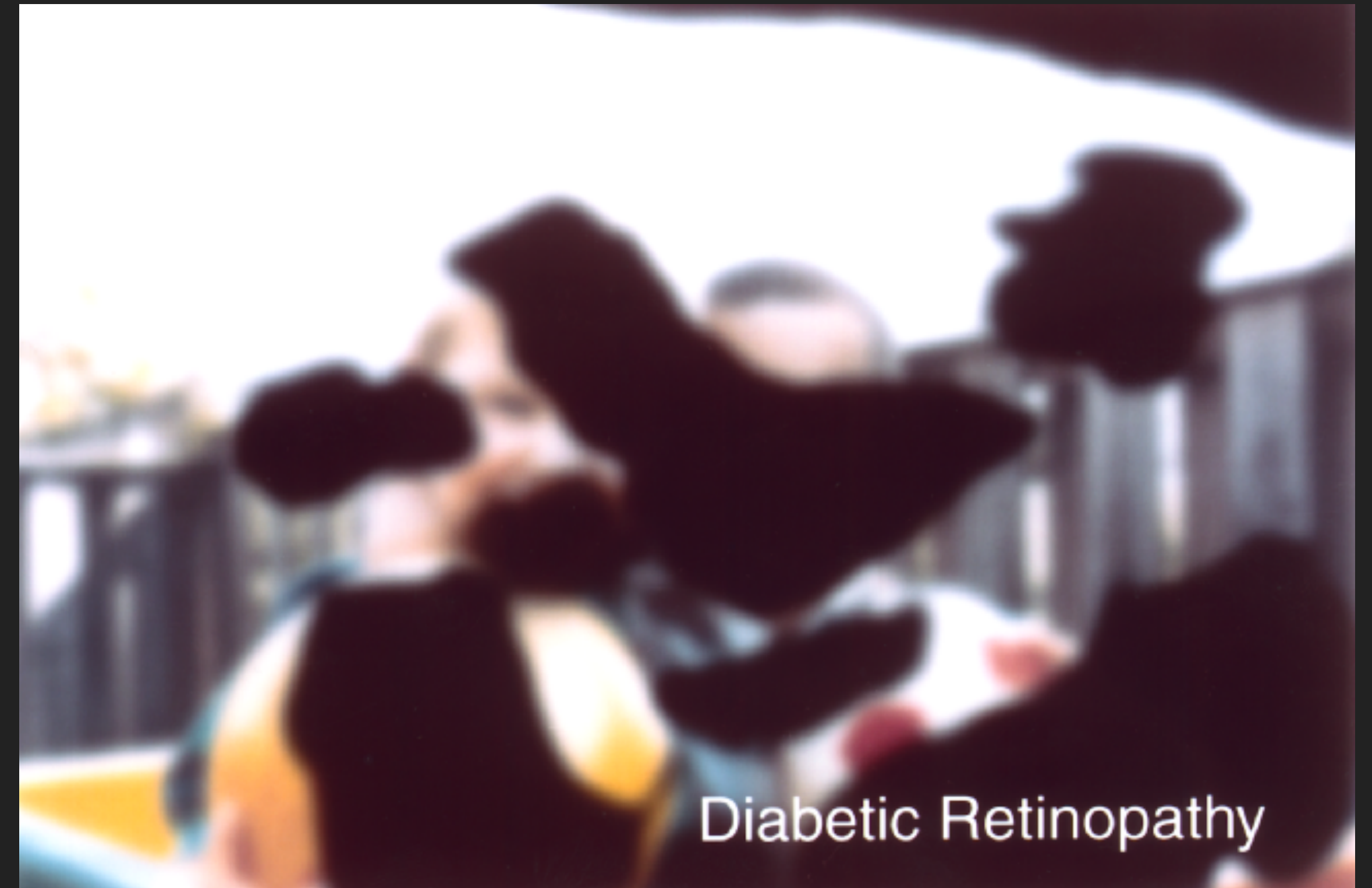
DETECTING DIABETIC RETINOPATHY

Sandra Paredes

INTRODUCTION

‣ **Motivation:** Eye clinical trials generate thousands of images that need to be classified with the correct diagnosis. [1,]

‣ **Research Question:** How well can a neural network diagnose diabetic retinopathy from a retinal image?

‣ **Impact Hypothesis:** Accelerate the National Eye Institute's research evaluation of retinal clinical trial data, and streamline publishing results.

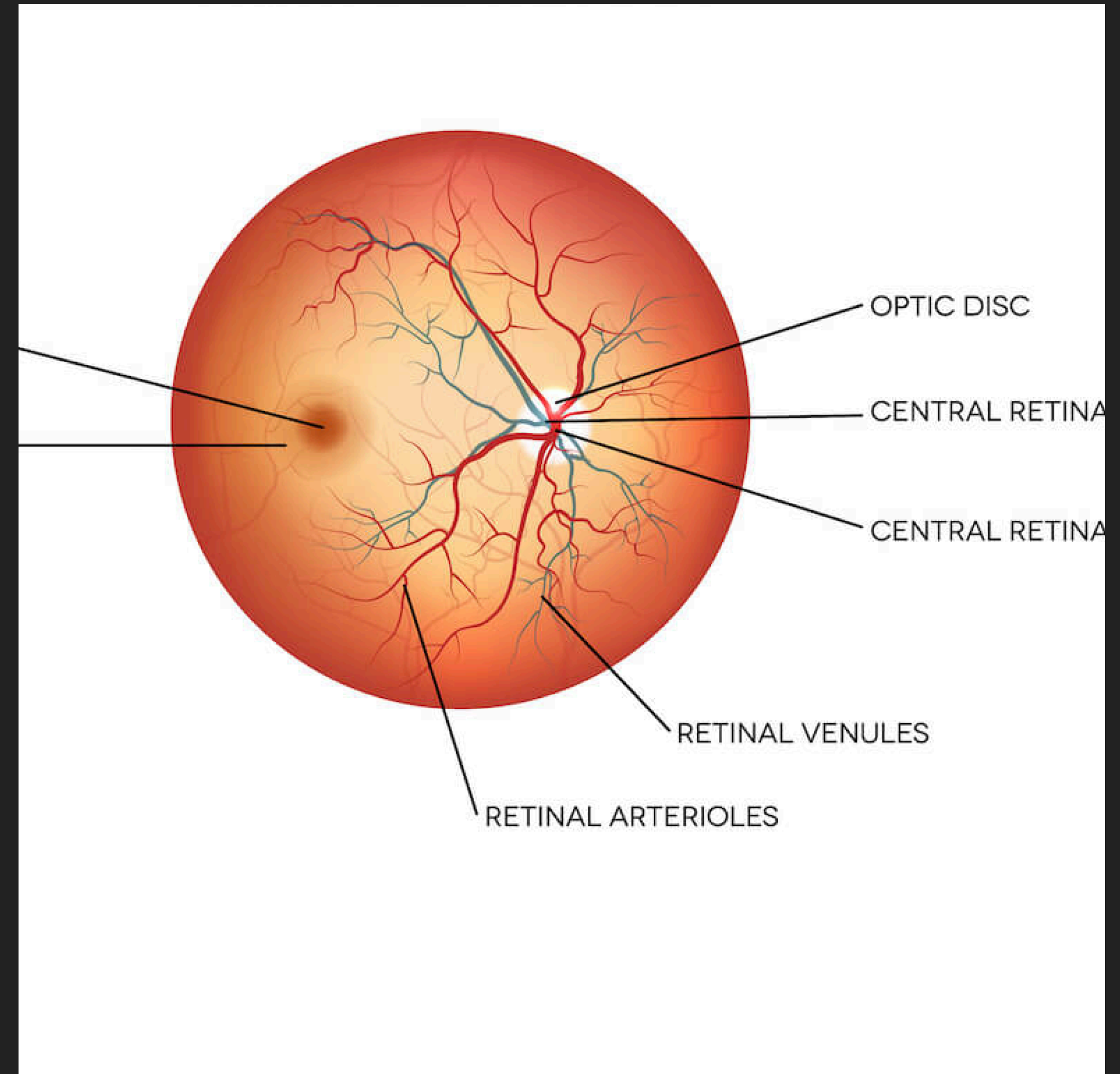A simulated view by a person with advanced diabetic retinopathy. Photo by © National Eye Institute

METHODOLOGY

▸ **Dataset**

  ▸ Diabetic Retinopathy 2015 Data Colored Resized [2]

  ▸ Images = 35,000

Preprocessing

  ▸ Resize

  ▸ Balance classes

  ▸ ImageDataGenerator

  ▸ Data Augmentation

OPTIC DISC

CENTRAL RETINA

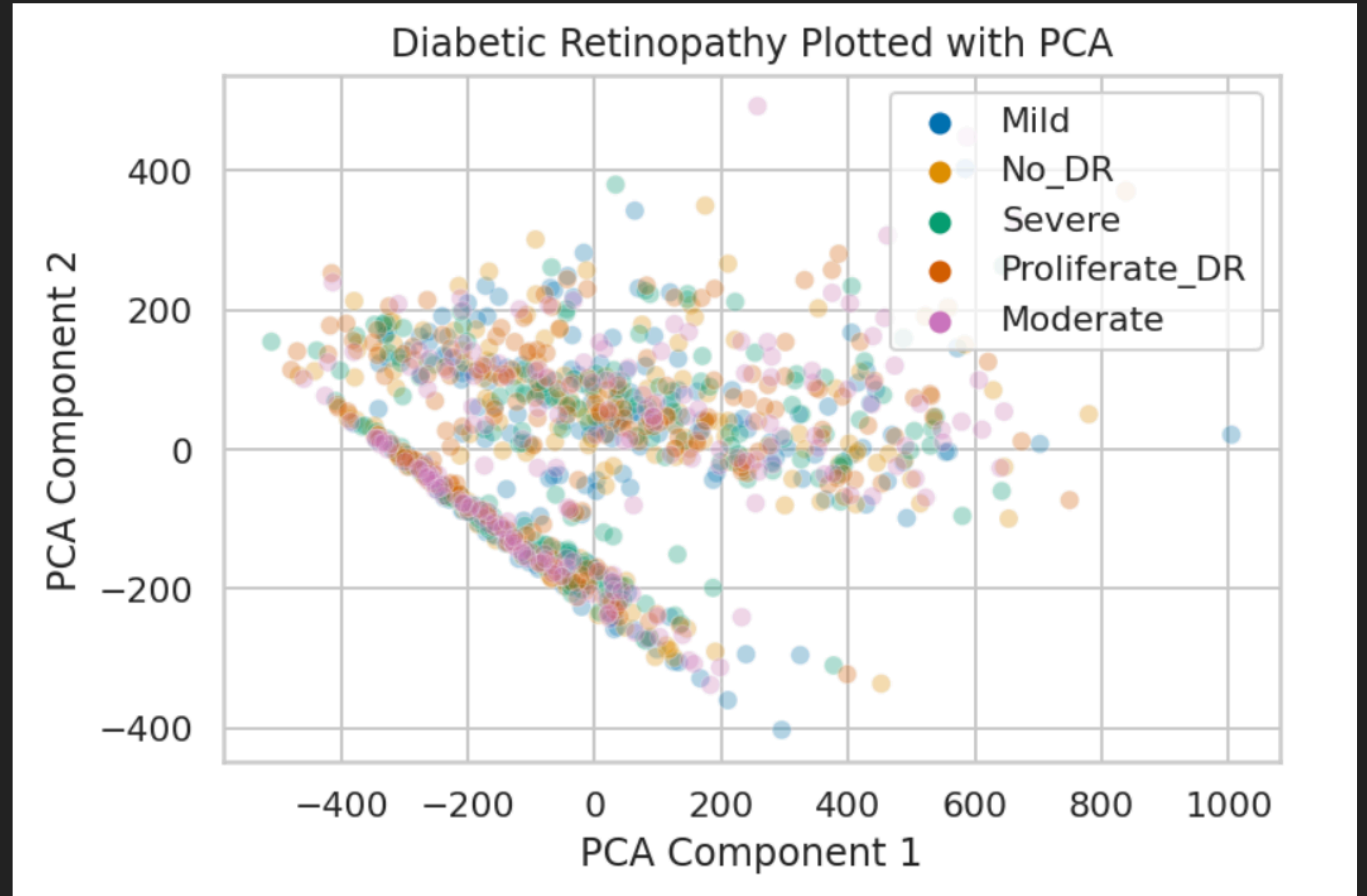CENTRAL RETINA

RETINAL VENULES

RETINAL ARTERIOLES

Normal Healthy Retina

METHODOLOGY

‣ **Model Approach**

 ‣ Do we need a deep learning model?

 ‣ Can logistic regression accomplish this task?

 ‣ Deep learning may solved this task best.

RESULTS

Deep Learning Models

‣ Neural Network

  ‣ accuracy = 0.3418

  ‣ val_accuracy = 0.3555

‣ Convolutional Neural Network

  ‣ accuracy = 0.3496

  ‣ val_accuracy = 0.5264

‣ Transfer Learning: VGG16

  ‣ accuracy = 0.3311

  ‣ val_accuracy = 0.5127
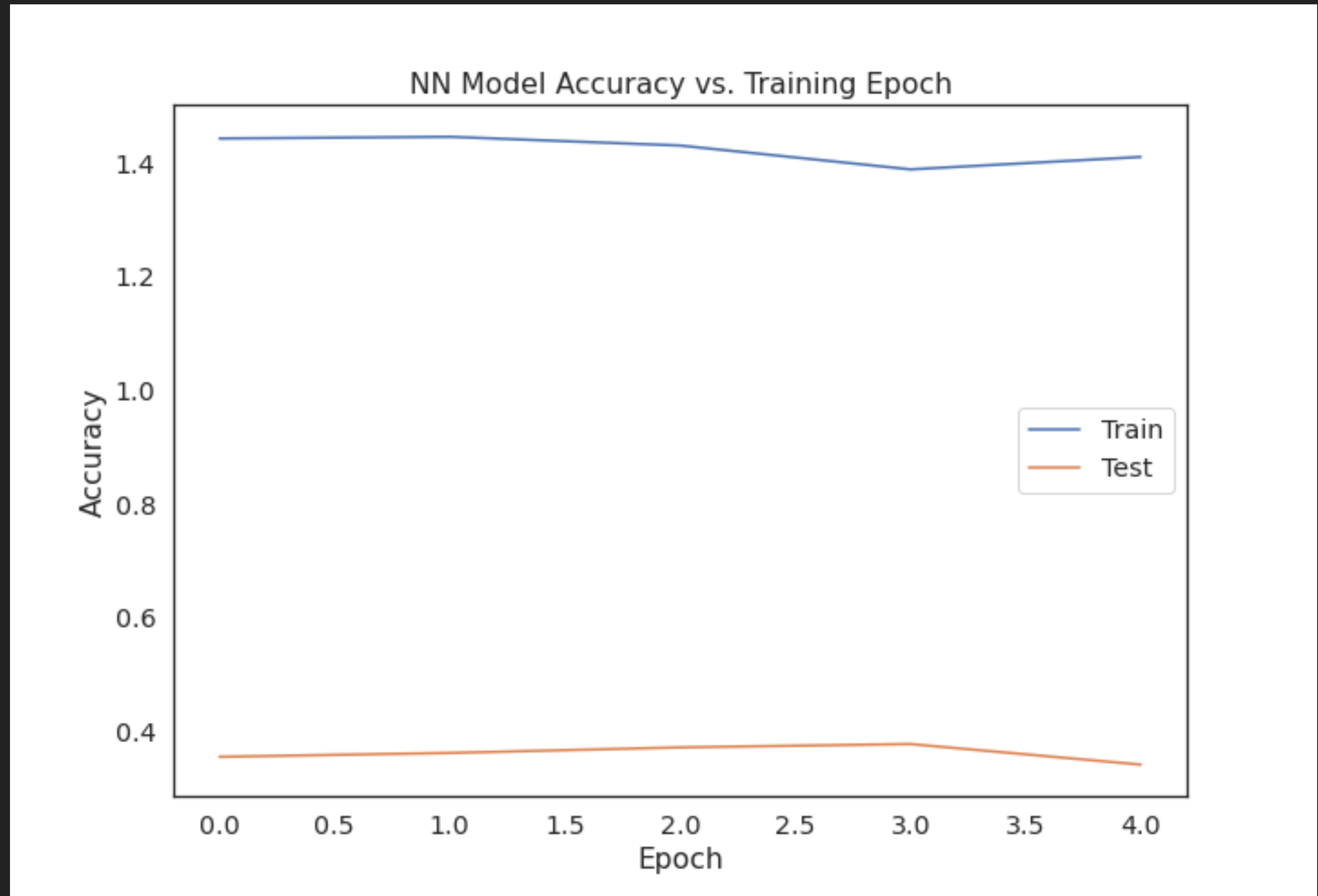
RESULTS

Predictions

‣ How well did the model predict?

‣ Bug in code predicts one class (the largest of the class).

‣ Explains the accuracy scores on train and test.

VGG16 Model Confusion Matrix (test_data)
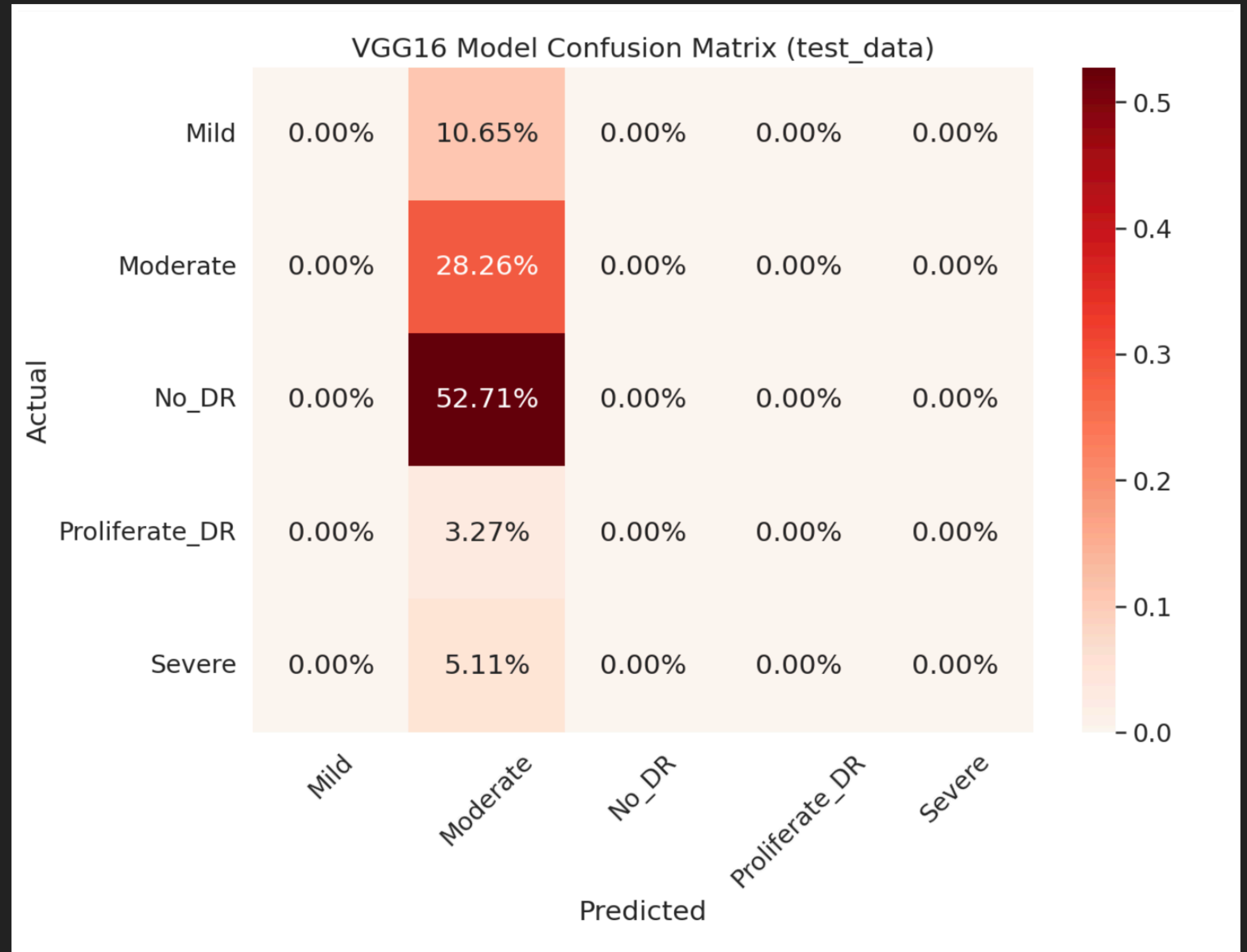
CONCLUSIONS

Insights

Recommendations

▶
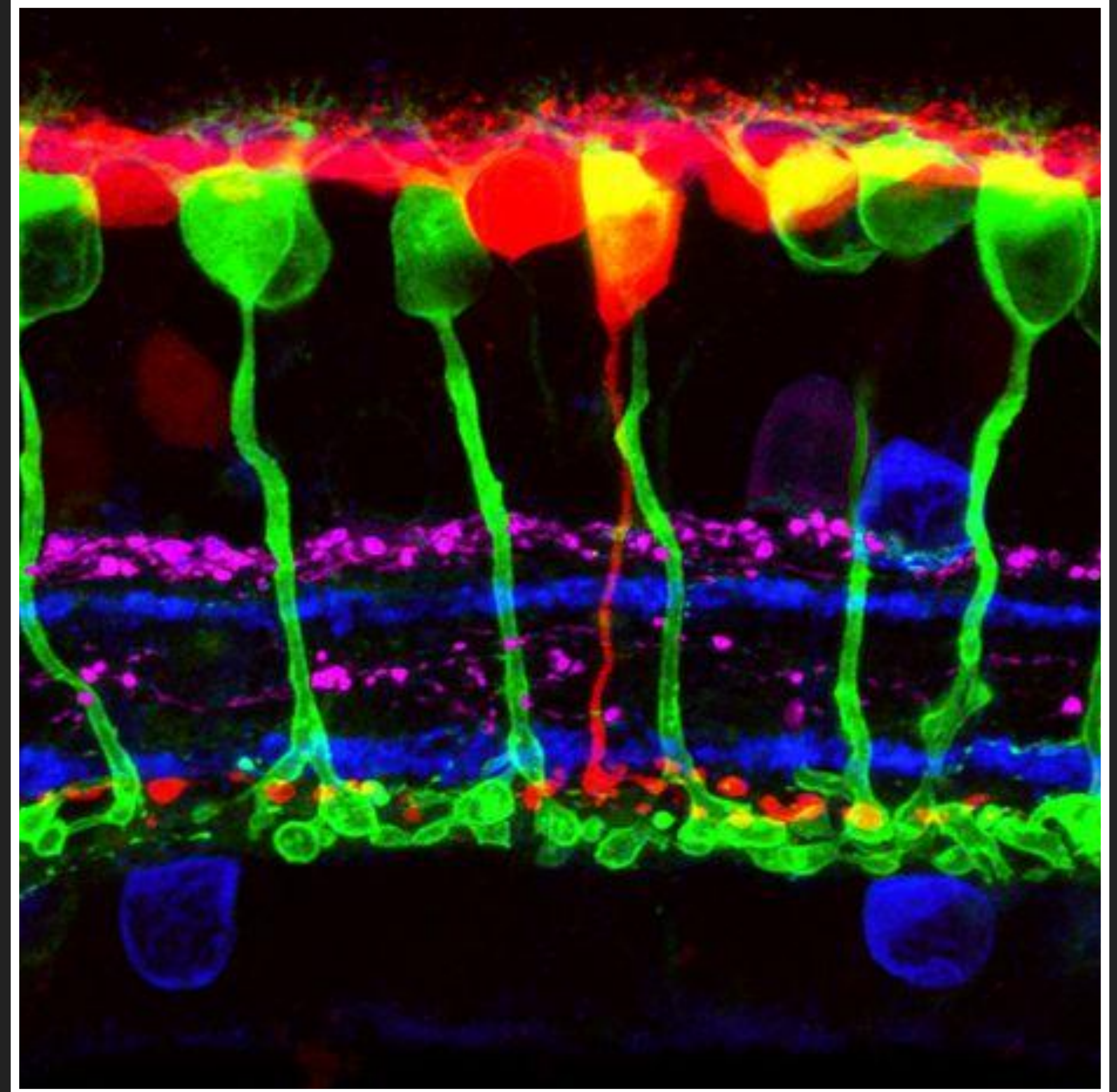

Photo by ©National Eye Institute

FUTURE WORK

▸ Deep learning model

Neural circuits in the retina.
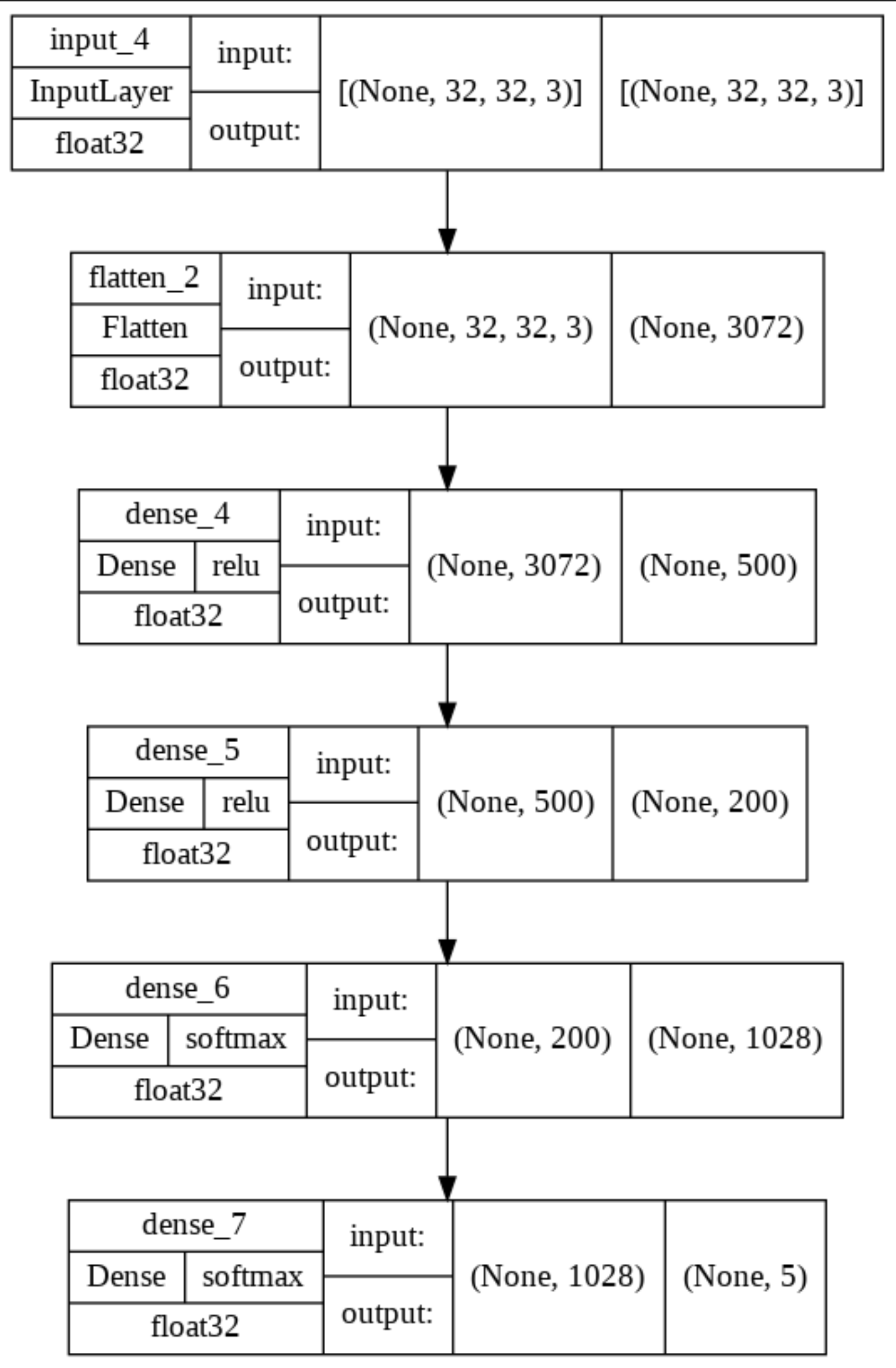Photo by Wei Li, © National Eye Institute

APPENDIX

▸ Summary, data, and slides are available at github.com/slp22/deep-learning-project

Dr. Emily Chew, Director of the Division of Epidemiology and Clinical Applications. Photo by © National Eye Institute

APPENDIX

VGG16 Model

APPENDIX: SOURCES

1. NIH adds first images to major research database: https://www.nei.nih.gov/about/news-and-events/news/nih-adds-first-images-major-research-database

2. Diabetic Retinopathy 2015 Data Colored Resized: https://www.kaggle.com/datasets/sovitrath/diabetic-retinopathy-2015-data-colored-resized

3. The Twitter pandemic: The critical role of Twitter in the dissemination of medical information and misinformation during the COVID-19 pandemic: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7170811

4. Kaggle – Early April 2020: https://www.kaggle.com/datasets/smid80/coronavirus-covid19-tweets-early-april

5. Kaggle – Late April 2020: https://www.kaggle.com/datasets/smid80/coronavirus-covid19-tweets-late-april