Diabetic Retinopathy Analysis

Kirti Katiyar, Ankitha Sreeramoju, Brendon Gutierrez

Problem

- Diabetic Retinopathy Complexity
  - Complication of diabetes, causing damage to retinal blood vessels
  - This damage leads to vision loss
- Manual Screen Challenges
  - Time Consuming, Labor Intensive and Susceptible to Inter–Observer Variability
- Need for Automation
  - Accurately & efficiently analyzing retinal images is needed to enable timely intervention
- Technology Integration
  - Leveraging technologies is essential. Systems need to be scalable, interpretable and seamlessly integrated into clinical workflows.

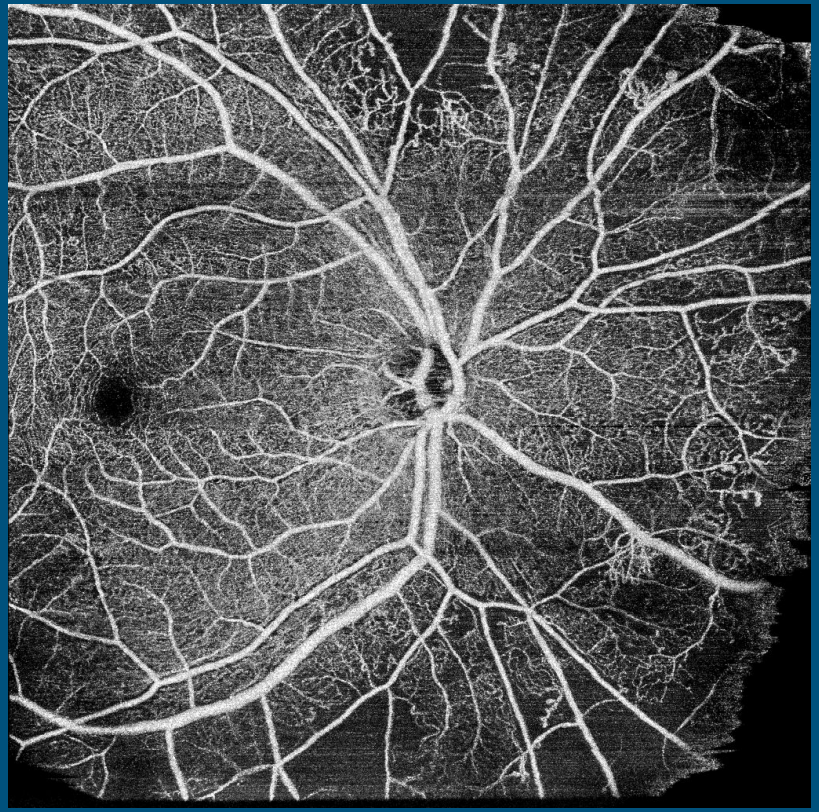
Data Description

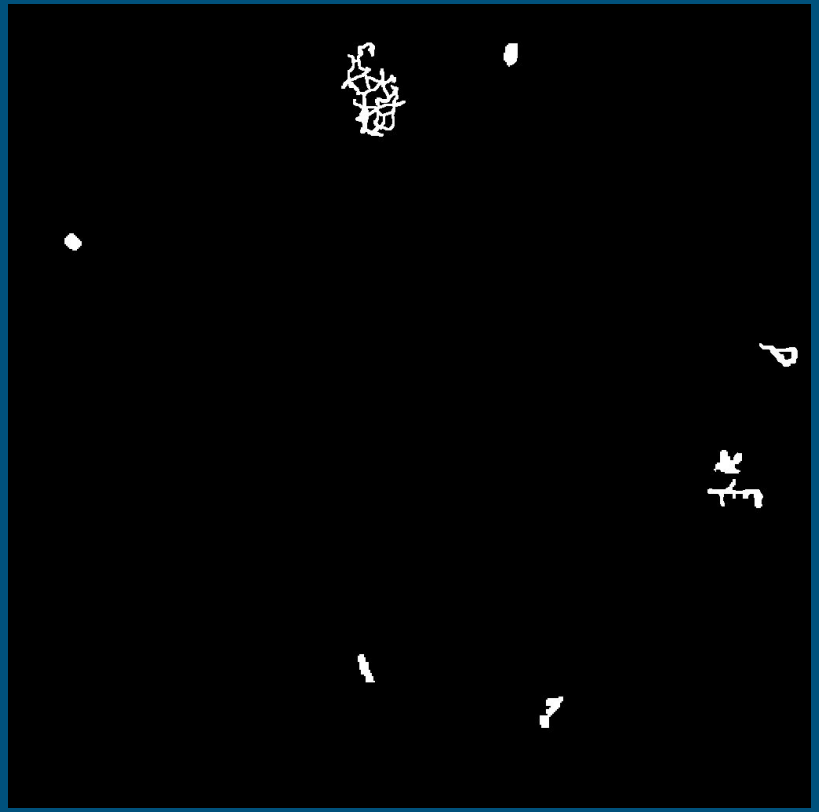
- Segmentation Section contains Training Sets and Testing Set.
- Images (png's) are ultra-wide optical coherence tomography angiography (UW-OCTA)
- Each section, segmentation included, contains "Ground Truths", which is a pre-labeled set of data.
- Labels are the following:
  - Intraretinal Microvascular Abnormalities (IRMA)
  - Nonperfusion Areas
  - Neovascularization

Classifications/Label Descriptions

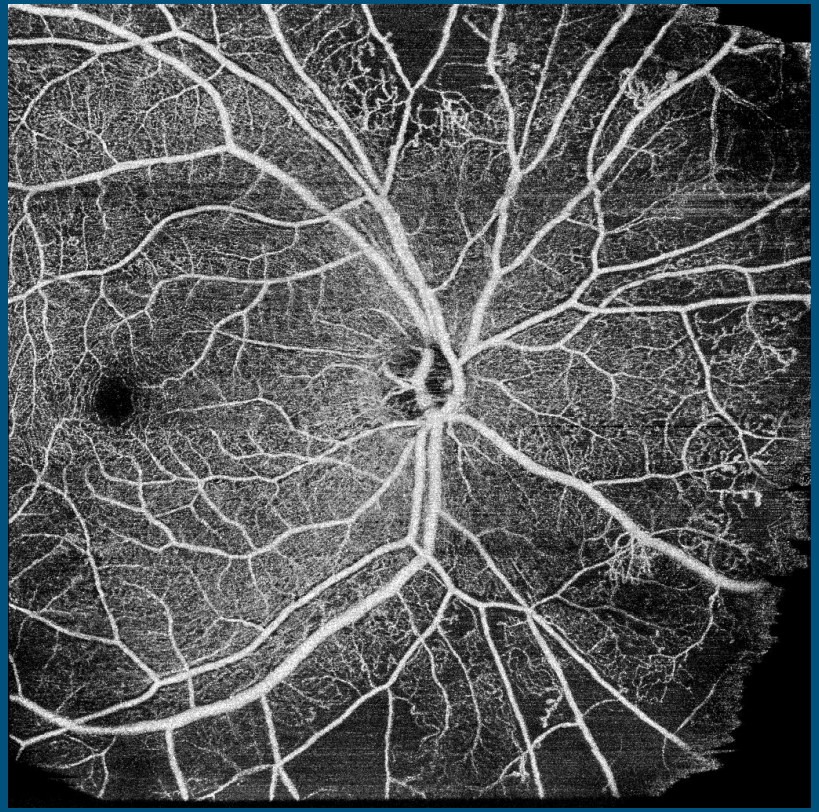
- Intraretinal Microvascular Abnormalities (IRMA)
  - Abnormal blood vessels within retina.
  - Appear as abnormal branching or dilation of existing blood vessels.
- Nonperfusion Areas
  - Areas that lack blood flow in an eye.
  - Gives high risk of Neovascularization.
- Neovascularization
  - Formation of new blood vessels, occurs in various parts of the eye.
  - These vessels may leak and cause vision loss.
  - Typically thinner and more delicate.

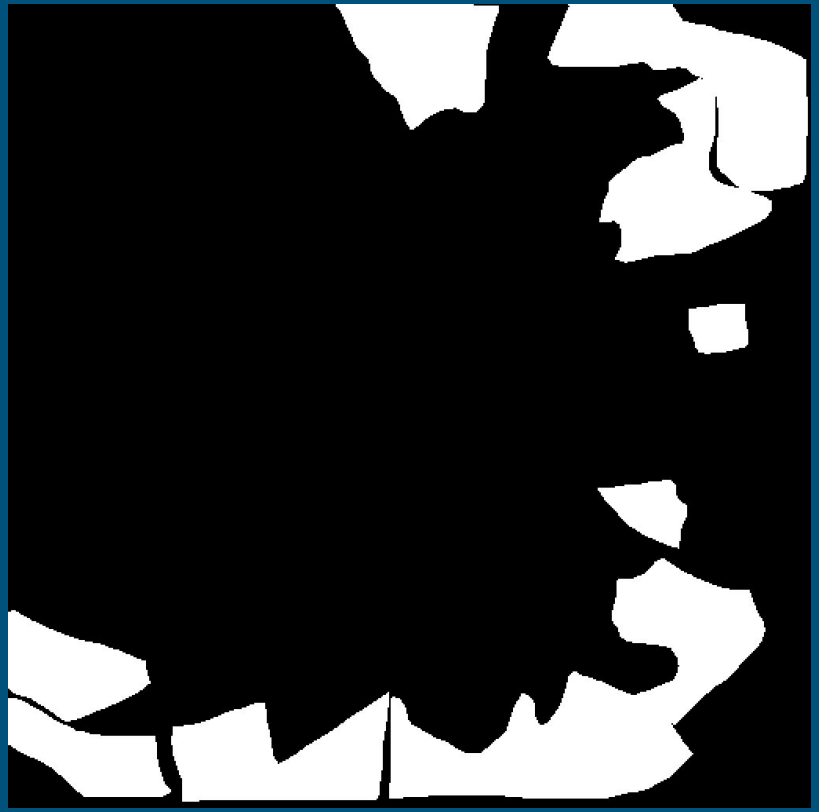
UW-OCTA vs IRMA



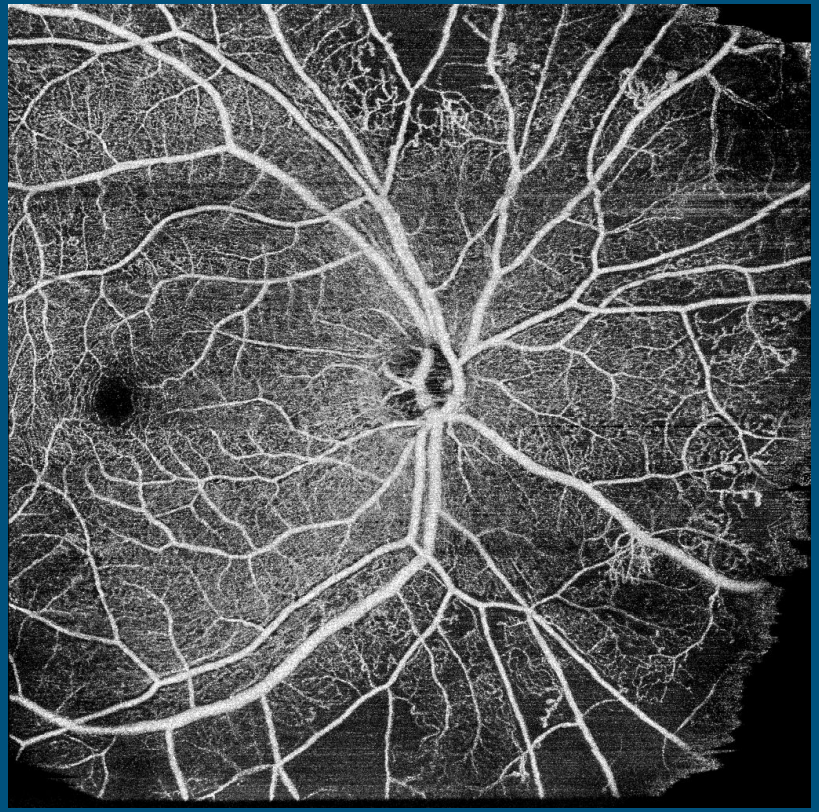


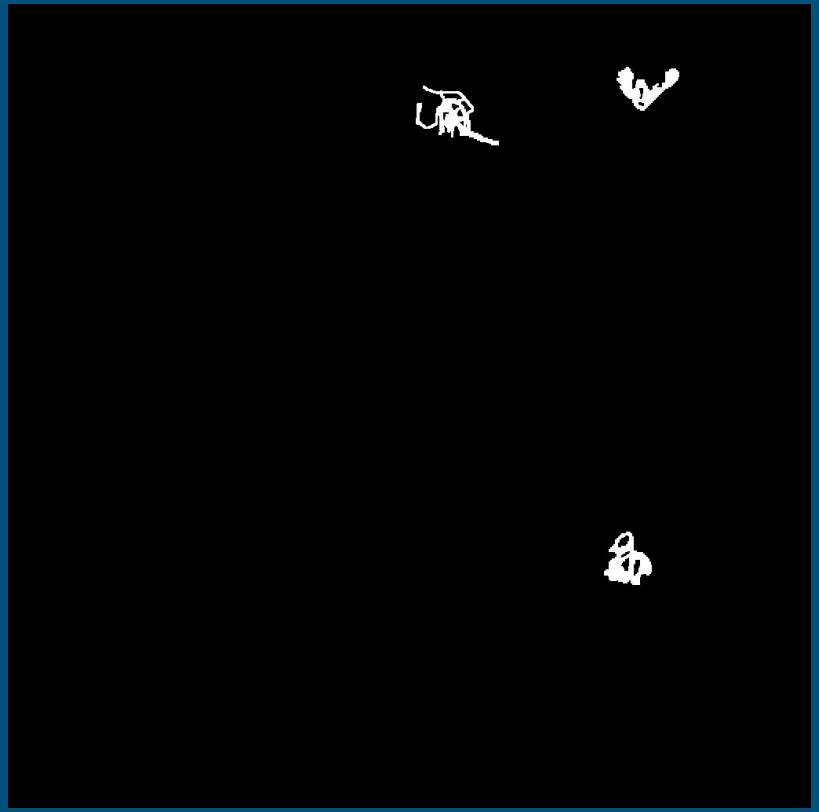
UW-OCTA vs Nonperfusion Areas



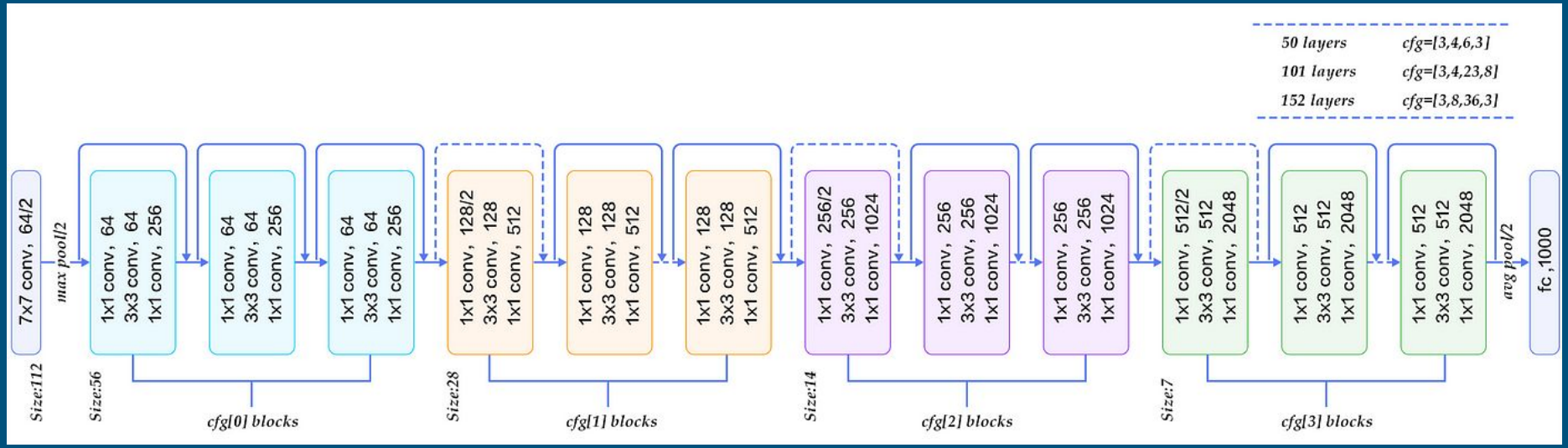


UW-OCTA vs Neovascularization





Proposed Model (FCN ResNet 50)



Bias & Variance

- Potential bias and variance given that each image is an Coronal perspective.
- Each image was also in the same rotational orientation.

Suggested Improvements

- Rotating images randomly within the dataset to provide a more robust model.
- Remove random noise found by implementing smoothing filters to the image