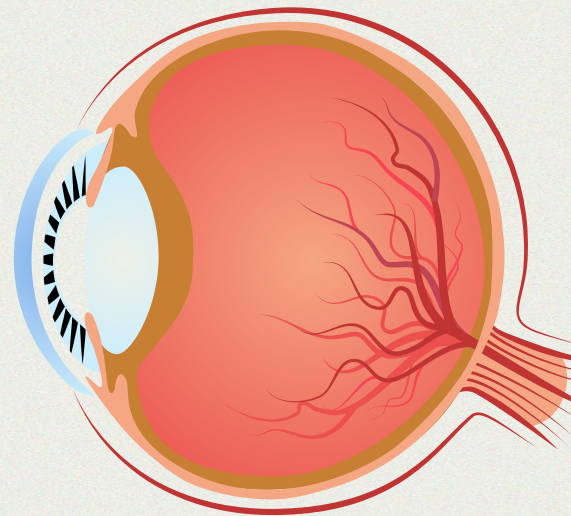


# Diabetic Retinopathy Classification

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Using a Convolutional Neural Network (CNN)

*Benjamin Gelman Fall 2024 Curriculum*





# Dataset

- 3,662 PNG images
- Sorted into different categories depending on disease severity



No\_DR  
(1,805)



Mild  
(370)



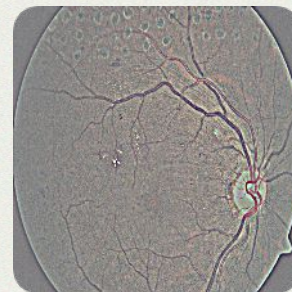
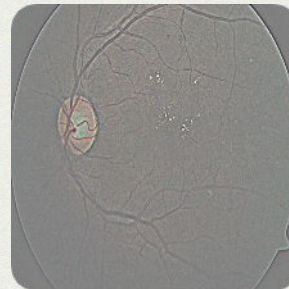
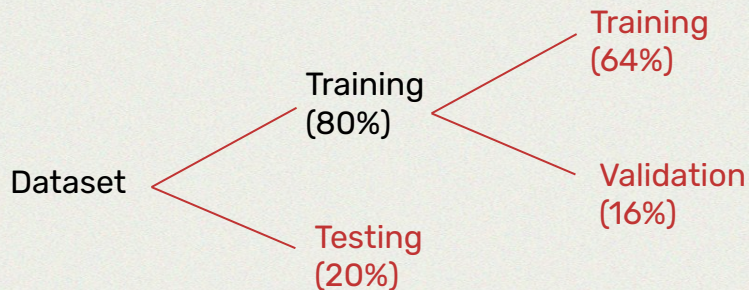
Moderate  
(999)



Severe  
(193)



Proliferate\_DR  
(295)





# Image Preprocessing

- Research paper concludes that CLAHE image processing and green channel extraction enhances DR images



Original

Enhanced

## Enhancement of Diabetic Retinopathy Imagery Using Contrast Limited Adaptive Histogram Equalization

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**Abstract**—Diabetic Retinopathy (DR), a common microvascular disease observed in diabetics, is also a major cause of adult blindness across the globe. It results in observable changes in retina which may be cured, provided, if it is detected in the preliminary stage. However, the ocular images produced by fluorescent ophthalmoscope are often noisy and low in contrast making it seriously difficult for doctors to precisely detect the inherent abnormalities. In the present paper, we propose to use a regional contrast enhancement scheme, popularly known as Contrast Limited Adaptive Histogram Equalization (CLAHE) to aid the detection of retinal changes in DR imagery. CLAHE is an adaptive extension of Histogram Equalization followed by thresholding, which helps in dynamic preservation of the local contrast characteristics of an image. Following CLAHE, median filtering of DR images is carried in order to smoothen the background noise. Results of the proposed algorithm show a considerable improvement in the enhancement of DR image.

**Keywords**—Diabetic retinopathy, contrast enhancement, histogram equalisation, clahe, smoothening.

### 1. INTRODUCTION

Diabetes is known for its dreaded complications and Diabetic Retinopathy (DR) is one such serious complication which invariably requires attention at a very preliminary stage [1]. DR is a progressive eye disease that

if detected at an early stage. Detection of DR at a very initial stage helps to reduce its severity and consequently, it's far reaching consequences. Usually, retinal images captured from fluorescence ophthalmoscope are of low gray level contrast and are of poor in contrast as a result of the acquisition process.

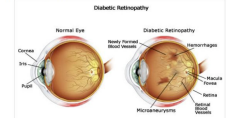


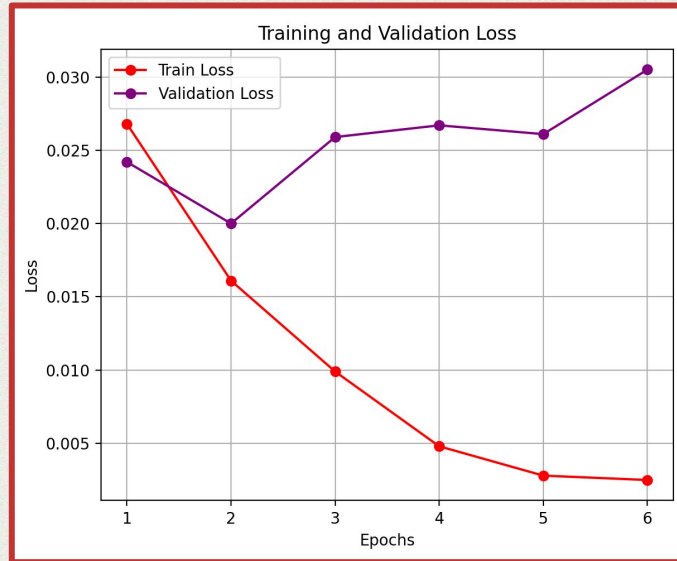
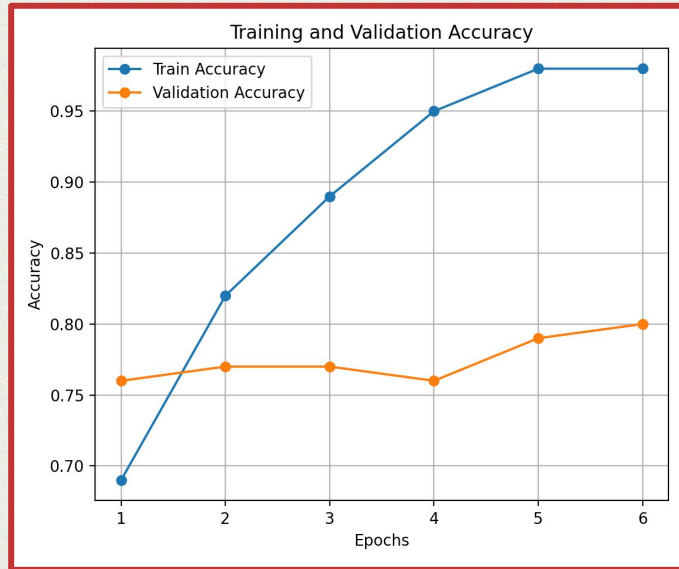
Fig.1: Observable changes in diabetic retinopathy effected eye as compared to that of normal eye.

A well known fact is that image enhancement techniques improve the quality of retinal images. Enhancement, in the present context, refers to bring out the finer details of the image-under-test while emphasizing the features of interest. The goal of image enhancement is to extract the important characteristics



# Multiple Image Classification using CNN

- ResNet-18 model was used
- Achieved testing accuracy of approximately **80%**
  - Most likely due to small dataset (only ~3,500 images)



# Binary Classification using CNN

- Took dataset and modified it so that anything that is not “No\_DR” is labeled as “Yes\_DR”
- ResNet-18 model was also used
- Achieved testing accuracy of approximately **97%**

