Automated Detection Of Diabetic Retinopathy Using Smartphone-Based Photography

Group – 16
Supervisor: Dr. Irfan Ali Bhacho
Hina Lilaram - 18CS74
Sarmad Talpur – 18CS80
Sharjeel Memon – 18CS122

Content

Introduction

- Diabetic retinopathy is an eye condition that can cause permanent vision impairment or blindness in people who have diabetes.

- If you have diabetes, it's important to get a comprehensive eye exam at least once a year.

- According to the National Diabetes Survey of Pakistan 2016-2017, 27.4 million people over the age of 20 are affected by diabetes.

- Population-based studies suggest that about a third of all diabetics will be affected by diabetic retinopathy.

Research Analysis

Research Paper	Disease	Fundus Camera	Algorithm	Smartphone	Application	Report
Automated diabetic retinopathy detection in smartphone-based fundus photography using artificial	DR		Deep Learning	✓		
Deep learning algorithm predicts diabetic retinopathy progression in individual patients	DR	✓	Random Forest			
A deep learning system for detecting diabetic retinopathy across the disease spectrum.	DR	✓	Deep Learning			
Automated Diabetic Retinopathy Grading using Resnet	DR	✓	Machine learning			
Diagnosis of Diabetic Retinopathy by Using Image Processing and Convolutional Neural Network	DR	✓	volutional Neural Network			
Performance and Limitation of Machine Learning Algorithms for Diabetic Retinopathy Screening: Me	DR	✓	Machine learning			
Machine Learning-based Diabetic Retinopathy Early Detection and Classification Systems- A Survey	DR	✓	Machine learning			
An automatic detection system of diabetic retinopathy using a hybrid inductive machine learning alg	DR	✓	Machine learning			
Automated detection of diabetic retinopathy using machine learning classifiers.	DR	✓	Machine learning			
Adaptive machine learning classification for diabetic retinopathy	DR	✓	volutional Neural Network			
Diabetic Retinopathy Analysis Through Optimized Deep Learning with Multi Support Vector Machine	DR	✓	ML and DL			
Early Detection of Diabetic Retinopathy Using Machine Intelligence through Deep Transfer and Repr	DR	✓	Machine learning			
A Comparison of Two-Stage Classifier Algorithm with Ensemble Techniques On Detection of Diabeti	DR	✓	Machine learning			
A Novel Approach for the Early Recognition of Diabetic Retinopathy using Machine Learning	DR	✓	Machine learning			
Diabetic retinopathy classification based on multipath CNN and machine learning classifiers	DR	✓	Machine learning			
Decision support system for detection of diabetic retinopathy using smartphones	DR	✓	Support Vector Machine	✓	✓	
Medios– An offline, smartphone-based artificial intelligence algorithm for the diagnosis of diabetic	DR	✓	volutional Neural Netv	✓		
Improved Automated Detection of Diabetic Retinopathy on a Publicly Available Dataset Through Inte	DR		Convolutional Neural Network			
Performance and Limitation of Machine Learning Algorithms for Diabetic Retinopathy Screening: Me	DR	✓	Machine learning			

Problem Statement

The eye screening for Diabetic Retinopathy is not carried out in rural areas of Pakistan due to:

1. Lack of availability of eye specialists
2. Expensive eye screening equipment

Aims and Objectives

01

Detection of preventable blindness

02

Data can be analyzed to identify trends and improve diagnosis.

03

Making cost-effective DR screening possible in low-income areas

Methodology

STEP 01: COLLECTING DATASET

Collection of fundus images of Diabetic Retinopathy patients with the collaboration of SIOVS hospital.

STEP 02: SELECTION OF ALGORITHM

Study various Machine Learning and Deep Learning Algorithms in order to choose a best fit for the problem.

STEP 03: TRAINING THE MODEL

Create and train the model on the collected dataset in order to achieve the best results.
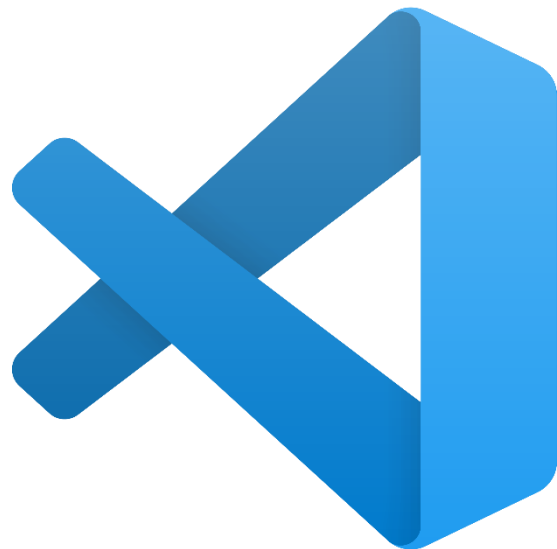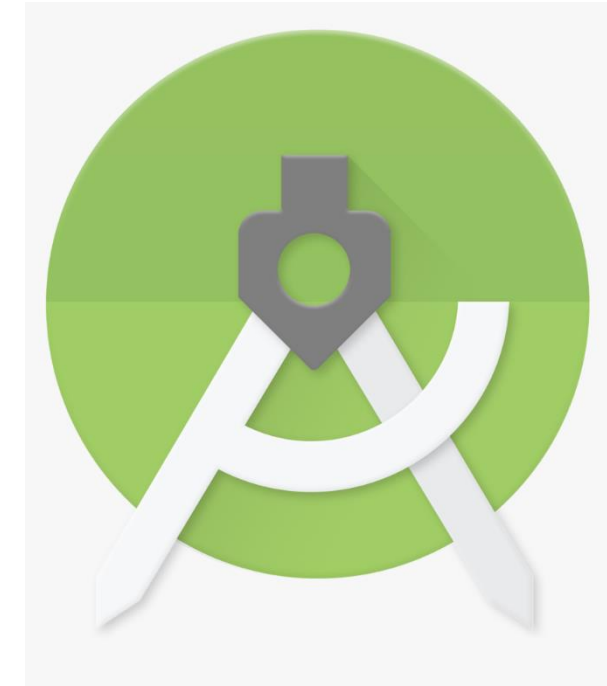
STEP 04: INTEGRATION OF MODEL IN MOBILE APPLICATION

Create a Mobile Application and deploy the trained model in it.

Tools and Technologies

Proposed Outcomes

To provide a mobile application for the detection of diabetic retinopathy (DR) disease using smartphone-based photography and a 20D lens and recommend patients to consult a retina specialist.

Dataset

- Fundus camera images data was collected from the Sindh Institute of Ophthalmology and Visual Sciences (SIOVS) Hyderabad and it was merged with an open-source Kaggle competition.
- Finally, a dataset of 35,122 total images was divided into two classes: DR and No DR. 9,313 images were labelled DR and 25,809 images were labelled No DR.
- Around 20 -25 smartphone-based 20D images were used for testing.
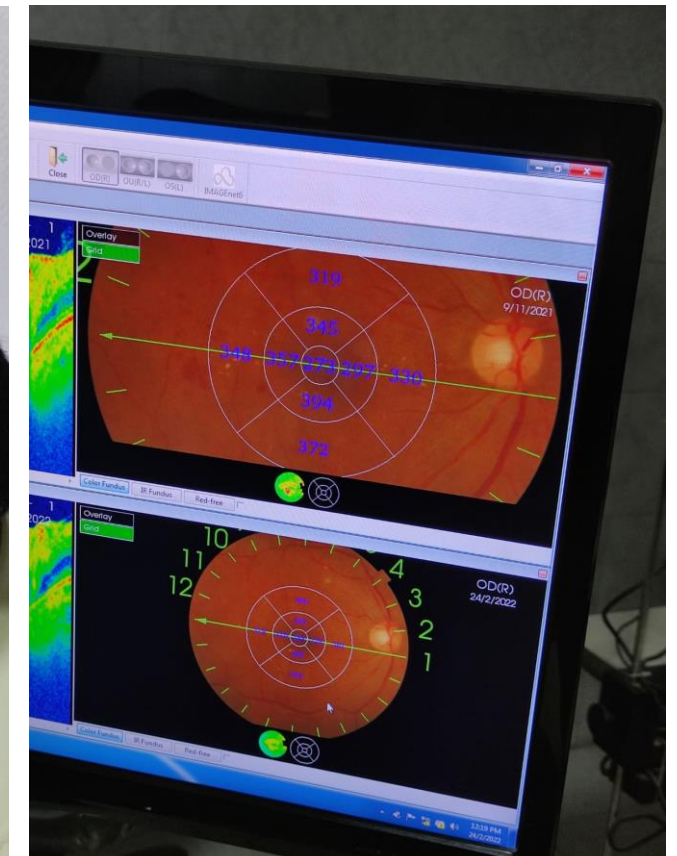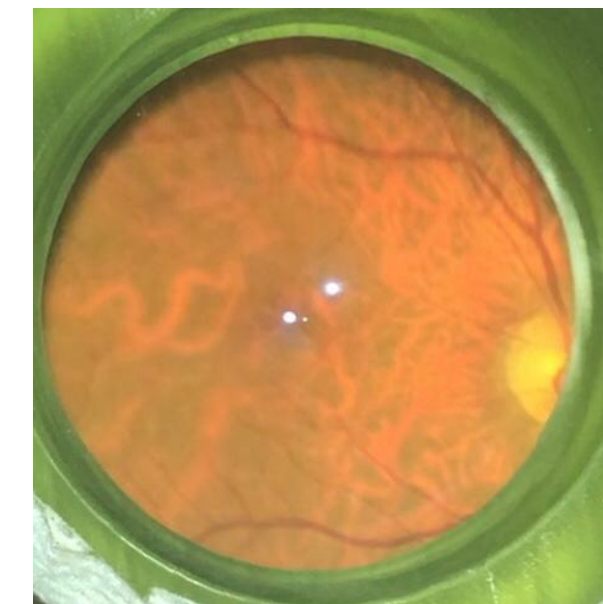
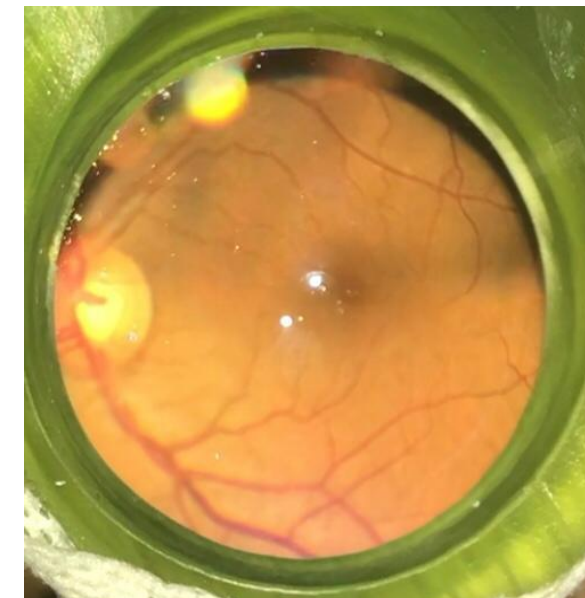# Prototype

3D Scope

Dilating Drops

20 Diopter Lens

Smartphone

Complete Prototype

Results

Algorithms

Model	Training Accuracy	Training Loss	Validation Accuracy	Validation Loss	AUC
VGG16	0.7372	0.5767	0.7453	0.5594	0.6174
ResNet50	0.7399	0.5762	0.7408	0.5872	0.5464
Custom CNN Model	0.7399	0.5736	0.7405	0.5726	0.5

References

[1]   S. Stolte and R. Fang, "A survey on medical image analysis in diabetic retinopathy," Med. Image Anal., vol. 64, p. 101742, 2020, doi: 10.1016/j.media.2020.101742.

[2]   R. E. Hacisoftaoglu, M. Karakaya, and A. B. Sallam, "Deep learning frameworks for diabetic retinopathy detection with smartphone-based retinal imaging systems," Pattern Recognit. Lett., vol. 135, pp. 409–417, 2020, doi: 10.1016/j.patrec.2020.04.009.

[3]   R. Rajalakshmi, V. Prathiba, S. Arulmalar, and M. Usha, "Review of retinal cameras for global coverage of diabetic retinopathy screening," Eye, vol. 35, no. 1, pp. 162–172, 2021, doi: 10.1038/s41433-020-01262-7.

[4]   R. A. Welikala et al., "Automated detection of proliferative diabetic retinopathy using a modified line operator and dual classification," Comput. Methods Programs Biomed., vol.   114, no. 3, pp. 247–261, 2014, doi: 10.1016/j.cmpb.2014.02.010.