DIABETIC RETINOPATHY INTERPRETATION

PROJECT REPORT

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submitted to

Indian Institute of Information Technology, Kalyani

for 3rd Year Project

Bachelor of Technology

In

Computer Science and Engineering

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Certificate

This is to certify that project report entitled " **Diabetic Retinopathy Interpretation" being submitted by Akash Ramanand Rajak (Reg No. 435), Amaan Khan (Reg No. 438), Kumar Saurabh (Reg No. 470) and Palav Dubey (Reg No. 481)**, undergraduate student in the Department of Computer Science and Engineering, Indian Institute of Information Technology Kalyani, West Bengal, 741235, India, for the award of Bachelor of Technology in Computer Science and Engineering, is an original research work carried by them under my supervision and guidance.

The project has fulfilled all the requirements as per the regulations of the Indian Institute of Information Technology Kalyani and in my opinion, has reached the standards needed for submission. The work, techniques and the results presented have not been submitted to any other university or institute for the award of any other degree or diploma.

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Declaration

We hereby declare that the work being presented in this project entitled **Diabetic Retinopathy Interpretation**, submitted to Indian Institute of Information Technology Kalyani in partial fulfilment for the award of the degree of Bachelor of Technology in Computer Science and Engineering during the period from August 2021 to October 2021 under the supervision of Dr. Amiban Lakshman, Department of Computer Science and Engineering, Indian Institute of Information Technology Kalyani, West Bengal - 741235, India, does not contain any classified information.

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Name of the Department : Computer Science and Information Engineering

Institute Name : Indian Institute of Information Technology Kalyani

Date : 19/04/2022

Acknowledgment

Firsto fa llwe wo uld liket ot ake this opportunityt o thanks our supervisorD r. Amiban Lakhsman withoutwh osee fforts this project would noth aveb eenp ossible. Wea reg ratefult oh imf org uidingu s towardst hep rojectwh ereverp ossible. Wea re mostg ratefult o Departmento fComputerSc iencea nd Engineering,IIITKalyani, India, forp roviding us this wonderfulo pportunity toc omplete our3 rd year project.

Andl astb utt heb iggesto fa ll, We wantt ot hank toe acho ft heg roup members,f ora lways helping keepinga c ontinuous check that project neverwan dered offt het rack from our goal.

IIITKalyani

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Abstract

This project investigates and reports benchmarks for detecting and interpreting whether there is DR in pair of Retinal images or not.

This is very useful in various image processing and performing computer vision tasks. This schemes have been implemented in Python programming language, and using various tech-stacks like OpenCv[2], Deep Learning & Machine Learning[3], etc.

Keywords : Computer Vision, Deep Learning, Machine Learning

Content

Listo f Acronyms

GUI – GraphicalUserInterface[4]

KNN – K-Nearest Neighbours[3]

SVC – SupportVectorClassifier[2]

Chapter 1

Introduction

This chapterr esembles theb riefi ntroduction aboutt hem ostwi dely used fieldo fs tudy"Com puterVision"[1]. Heret alked about the variousa spects and uses ofc omputerv ision, basicm eaninga nd keywordsl iked etection, Preprocessing,a ndd iscussed ther oadmap tot her eport.

1.1) ComputerVision

Computerv ision is an interdisciplinarys cientific field thatd eals with how computers cang ain high-levelu nderstandingf romd igital images orv ideos. Iti s mostwi delyu sed field ofa rtificial intelligence (AI) that enables computers and systems tod erivem eaningful information fromd igitali mages, videos and otherv isuali nputs. [1]

Differentt ypes of computerv ision include images egmentation, objectd etection, facial recognition, edged etection, pattern detection, image classification, and featurem atching.

ComputerVision itselfi sa b igd omain and is dividedi nto

variouss ubdomainsl ike scener econstruction, objectd etection, eventd etection, DiseaseD etection, objectr ecognition, 3Dp ose estimation, learning,i ndexing,m otion estimation, visuals ervoing,3D scenem odeling,a ndi mager estoration. [2]

1.2) Applicationo f Computer Vision

Ith asv ariousd ifferenta pplication[1] that too in various fields. Someo ft hema rel isted below:

- DiseaseIn terpretation
- Screen Reader
- IntruderD etection
- Codea ndCharacterReader
- Robotics
- Motion Analysis
- ImageRestoration

Therea rem anyl eft tol ista s iti s verywi det opica ndh erei n this projectwe h aveu sed oneo ft hea pplication i.e. ObjectDetection.[2]

1.3) Detectionan d Analysis

Detection is a computert echnologyr elated toc omputerv ision and imagep rocessingt hatd eals with detectingi nstances ofs emantic objects ofa certain class (such ash umans, buildings, orc ars)i n digitali mages and videos.

ForD etection processi n computerv ision, therea rev arious methodsa nde ach oneh aved ifferentl evelo fa ccuracya ccordingt o theira dvancement level,l ikei s somem ethodst hati s invented in verye arlys tage,t heyg ivem orec aseso ff alsed etection asc ompared tot hea dvanced methodst hath adb een discovered aftert hat.

And herewe h aveu sed the eyer etina asa n entitywh ich we ared etecting and analysingwi th differentm achinea ndd eep learninga lgorithma ndd etectingt he presenceo fD Ri n it.

1.4) Roadmapt ot her eport

Thes tructure oft her eporti s as follows:

Chapter1: Itd iscusses aboutb riefi ntroduction ofwh atc omputer vision[1] is, whata ret herewi dea pplications,s omei mportant keywordsl iked etection and analysis in computerv ision, and finally roadmapo ft her eport.

Chapter2: Iti s based on thed iscussion ofo neo ft hed omain of computerv ision i.e. DiabeticRetinopathy and furtheri s emphasize thed etection of DRi np airs ofr etinai mages and analysingt het ype ofD Rp resent.

Chapter3: This chapteri s based on frontendG UI application and detection of DRi n imageb ys election ofp airs ofr etinai mages.

Chapter4: Itt alks thea ccuracyo f the deep learninga nd machine learninga lgorithmt hatwe h aveu sed in thed etection processa nd analysis of thea ccuracy.

Chapter5: Atl ast,t his chapterd eals with a brief conclusion and furthers copeo ft his project.

Chapter 2

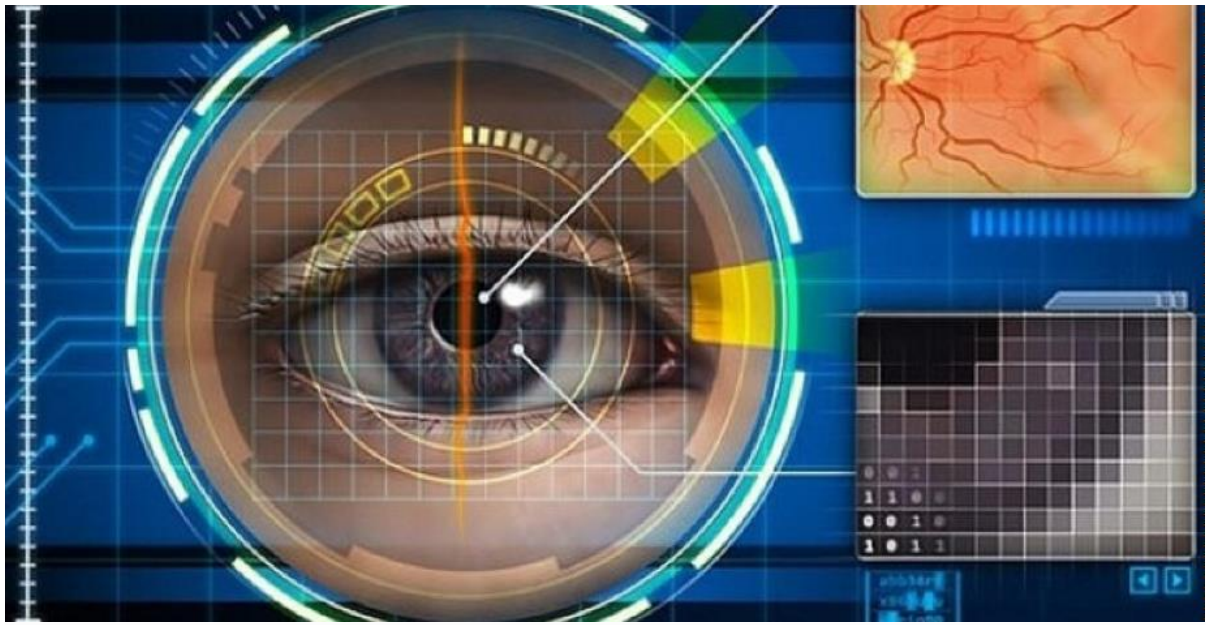
2.1) Diabetic Retinopathy Detection

Firstlyw hati s Diabetic Retinopathy? It is a DiabeticEye Disease, a medicalc ondition in which damageo ccurs to the retina due tod iabetes.I t is leading cause ofb lindnessi n thev arious developed countries.

Detecting Diabetic Retinopathym eans weh ave the pairs of Lefta nd RightRetina image of the patient, and using thatwe u sed predefined machine and deepl earninga lgorithm tod etermine whether the patienti s having Diabetic Retinopathyo r not.

Also, if the patient iss uffering from Diabetic Retinopathy, we have also implemented model to determine that the patienti s suffering fromw hich typeo fD iabeticRetinopathym edicald isease.

It'sa diabetic complication that affectse yes, causedb y damage to the bloodv essels of the light sensitive tissue att heb ack of the eye(retina).

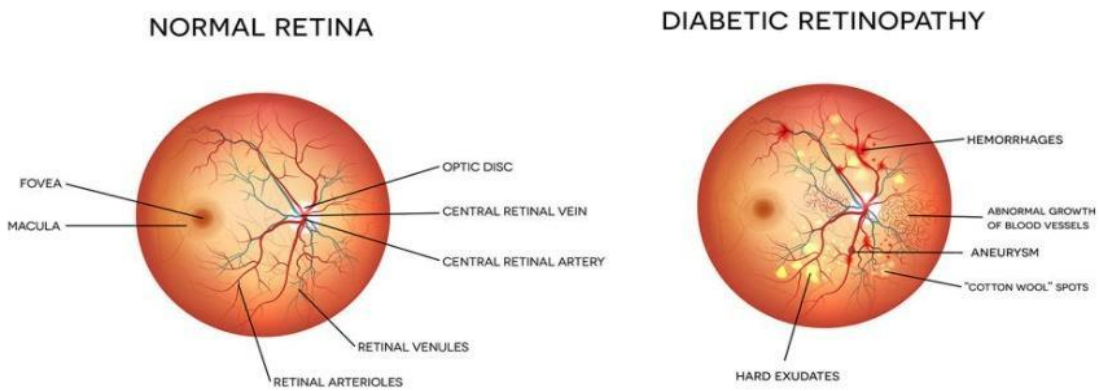


2.2) Signs andSy mptoms

Diabetes is them ostc ommon symptomi n allp atient.

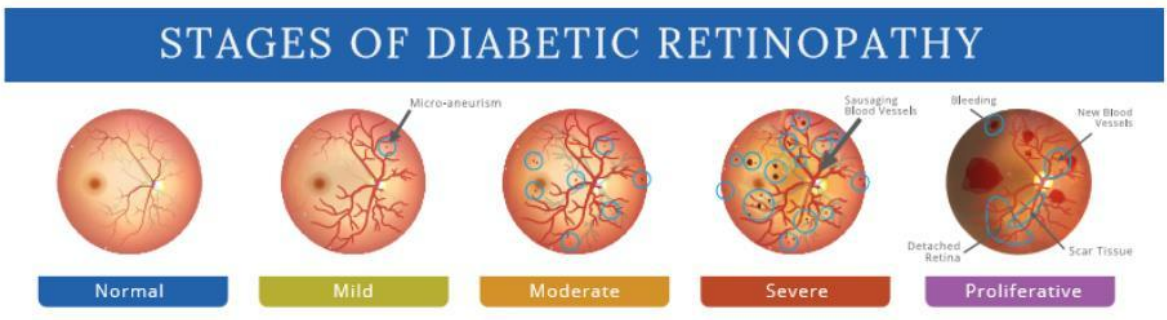
The patienth avingDiabeticRetinopathym edicald isease mostly havet hed evelopmento fd arks pots, blurred vision,e mptya reas in thev ision.

Thep atientwi llh avingv ision disordera nd difficultyi n perceiving differentc olours.



Therea reb asicallyf ours tages ofDiabeticRetinopathy:

- Mild Non-proliferative Retinopathy
- Moderate Non-proliferative Retinopathy
- Severe Non-proliferative Retinopathy
- Proliferative Diabetic Retinopathy



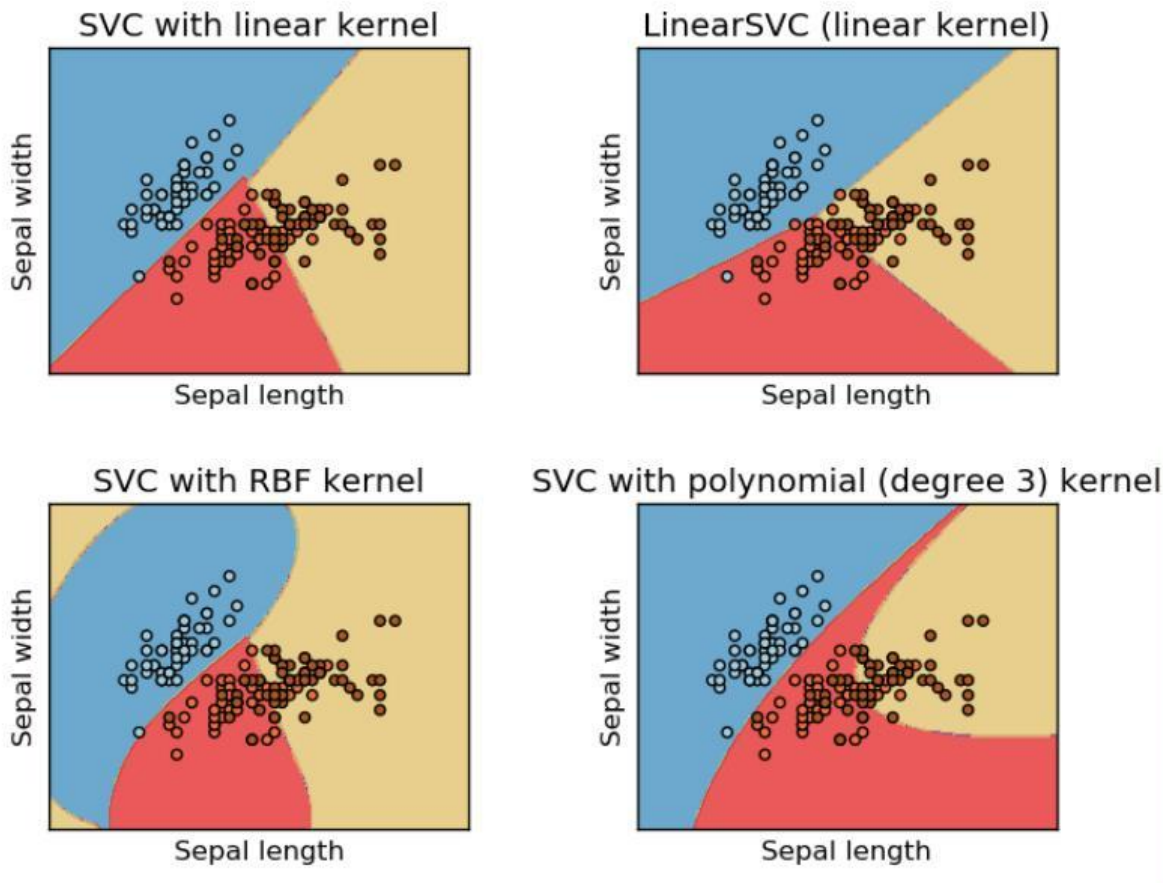
2.3) Processing Algorithm

Firstw er eadt hed ata and cleaned thed ata. Aftert his, we visualized the data usingd ifferentg raphs usingm atplotlib.plt library in python and analyzed thed ata.

Then wec reated the modelu singo neo ft hem ostc ommon algorithmi .e. SVC(SupportVe ctorClassifier).

SVCi s a non parametric clusteringa lgorithmt hatd oes not makea ny assumption on then umbero fs hape of thec lusters in the data.

TheO bjectiveo fLinearSVCi s tof itt hed ata wep rovide, returnsa "bestf it" hyperplanet hatd ivides orc ategorizes ourd ata. Fromt here,a fterg ettingt heh yperplane,o nec ant hen feed some features too ut classifier tos eewh at thep redicted class is...



2.4) Trainingan dTe stingAlgorithm

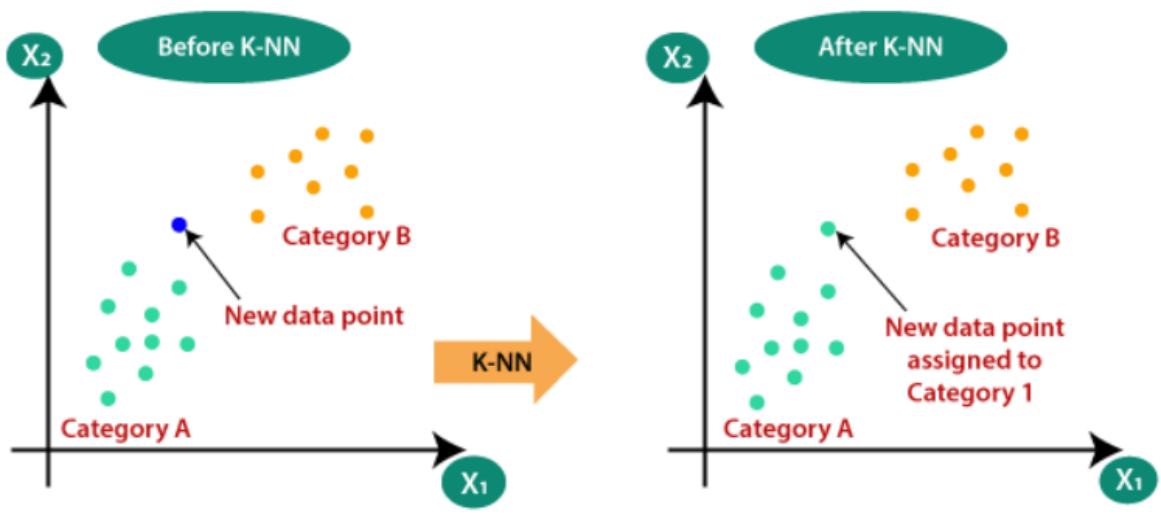
As wec an seet hatwe c reated them odel and trained and analyzed ther etinai mages usingSVC(SupportVe ctor Classifier) algorithm.

Then wet ested the trained modelu singKNN(K– Nearest Neighbours)a lgorithm. KNNalgorithmi s a simple,s upervised machinel earninga lgorithmt hatc an beu sed tos olveb oth classification andr egression problems.

It's easyt oi mplementa ndu nderstand,b uth asa m ajor drawbacko fb ecomings ignificantlys low ast hes izeo ft hed ata grows larger.

K-NNa lgorithma ssumes thes imilarity between thn ew case/data and the availablec asesa ndp utt he new case into the categoryt hat is mosts imilart ot hea vailable categories.

Iti s alsoa lazyl earnera lgorithmb ecausei t does notl earn from thet rainings eti mmediatelyi nsteads tores thed ataseta nda tt he time ofc lassification, itp erforms the action on thed ataset.



Chapter 3

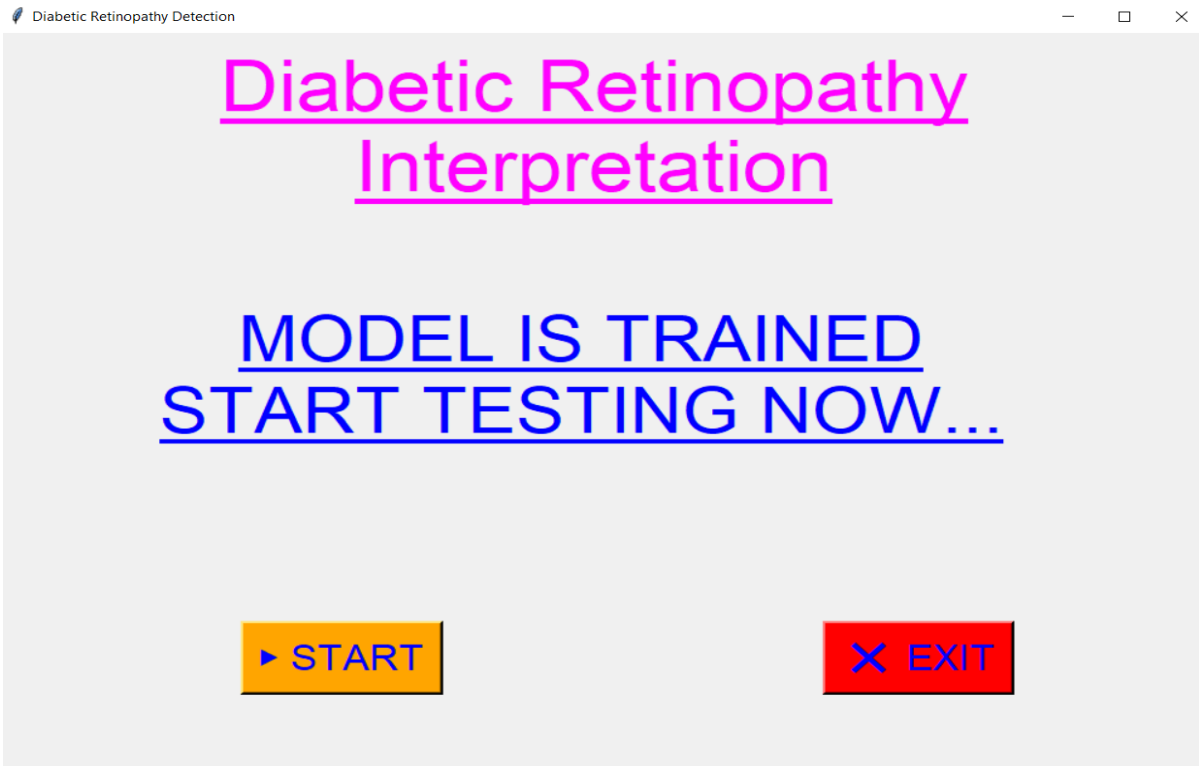
3.1) GUI and Detection

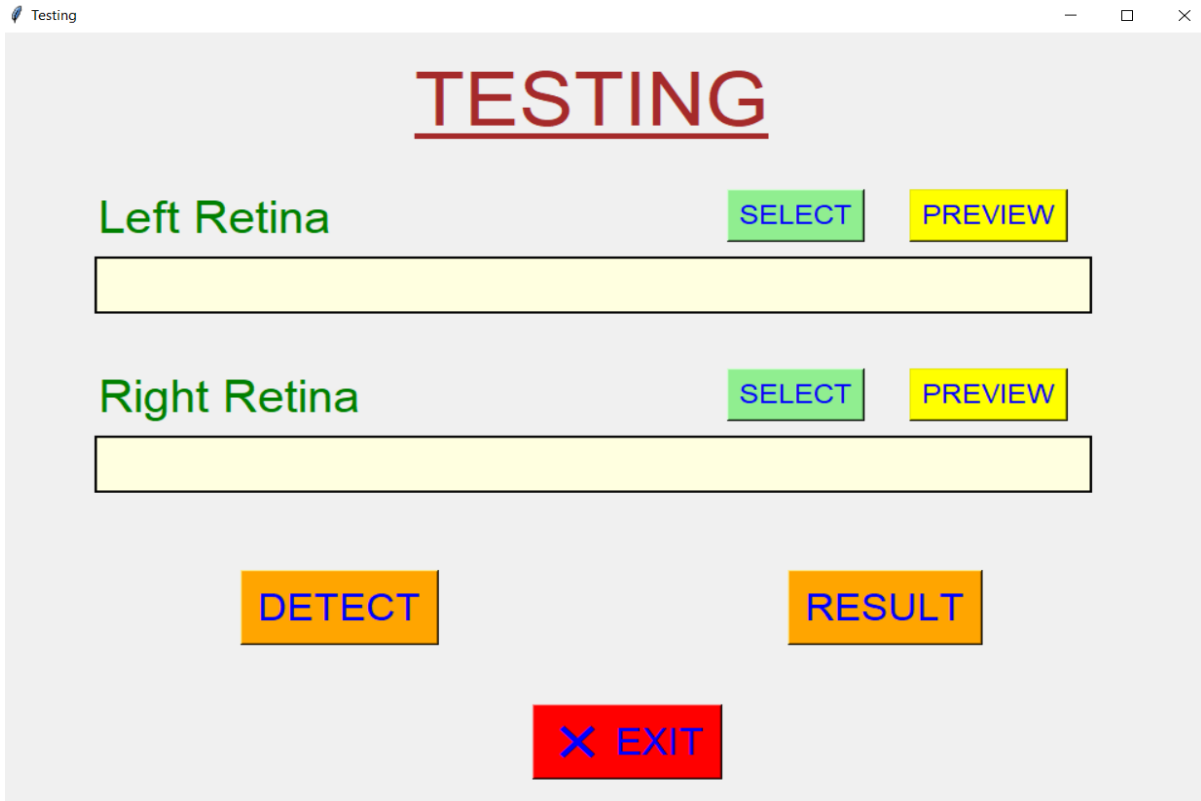
After the model is being created, trained and tested, we created a frontend GUI kind of thing. Where user will be able asked to select the pair of left and right retinal image, and can check whether patient is having DR or not.

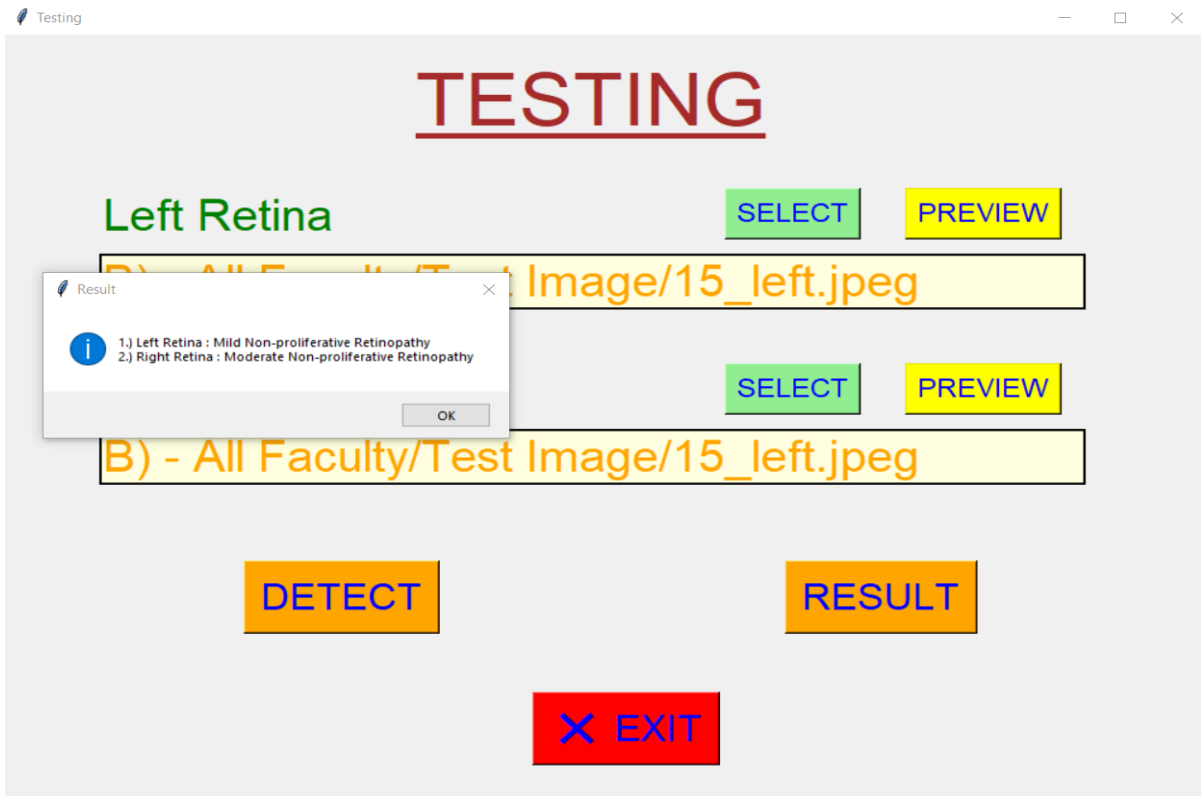
Also implemented the model to check if patient is suffering from only single eye i.e. either Left or Right eye.

In addition to it, user will also be able to figure out, that patient is suffering from which stage of DR is he/she is suffering.

Below are some screenshots of how GUI implementation looks like:




Testing
TESTING
Left Retina
SELECT
PREVIEW
Right Retina
SELECT
PREVIEW
DETECT
RESULT
EXIT


Testing
TESTING
Left Retina
SELECT
PREVIEW
Image/15_left.jpeg
Result
1.) Left Retina : Mild Non-proliferative Retinopathy
2.) Right Retina : Moderate Non-proliferative Retinopathy
OK
SELECT
PREVIEW
B) - All Faculty/Test Image/15_left.jpeg
DETECT
RESULT
EXIT

Chapter 4

4.1) Accuracy

The accuracy thatwe g ota fter testingt het rained model

Through SVC– 96.62 %

Through KNN– 94.38 %

Chapter 5

Conclusionan dFu tureSc opes

Now comingt ot hef utures copeo ft his projecto ra pplication, sincei n this wea re takinga ny pairo f retinai mages and detecting whetherD Ri s there orn ot. Sos ome oft hef utures copec anb e:

- This canb eu sed in various medical hospitals,f ora nalysingt he accuracy with then ormal procedure oft heD Rd etection.
- This canr eplacev ariousm entaljo bs, and this canb ed one moree fficientlywi th machines with this modela s backend application.
- Ift his modeli s used on larges cale,t his will ultimatelyl eads to betterd evelopment.

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