Deep Fund-us Image Analysis Learning For Early Detection Of Diabetic Retinopathy

professional Readiness For Innovation , Employability And Entrepreneurship

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1.INTRODUCTION

PROJECT OVERVIEW

The retina of the human eye can develop visible micro vascular consequences from diabetes,including diabetic nephropathy and oracular enema,the images of which are being

employed for manual disease screening and diagnosis.These findings imply that a deep learning system could improve screening and diagnostic cost effectiveness while delivering performance above required levels and that the technology could be used in clinical exams demanding finer grading.

PURPOSE

The most prominent micro vascular consequences of diabetes is diabetic nephropathy and retinal imaging is the most used tool for diagnosing because of its great sensitivity.An automation system could help with this both as a mechanism for complete diagnosis or as a complement for the work of scientific professionals the application of deep learning models for automated identification of diabetic nephropathy has been examined in two recent publications both demonstrate that a deep learning artificial neutral network_based automated system can diagnosis pertaining diabetic nephropathy which is classified as moderate or worse eye disease with significant sensitivity and specificity other related eye disorders such as diabetic vascular enema,potential glaucoma,and age-related oracular degeneration,have also recently been studied with this method.

Additionally, we outline the preprocessing and regularisation processes that must be performed on the data for the deep learning system to perform properly and carefully examine how the scale and quantity of photos used in training affect the system performance.

2. LITERATURE SURVEY

EXISTING PROBLEM

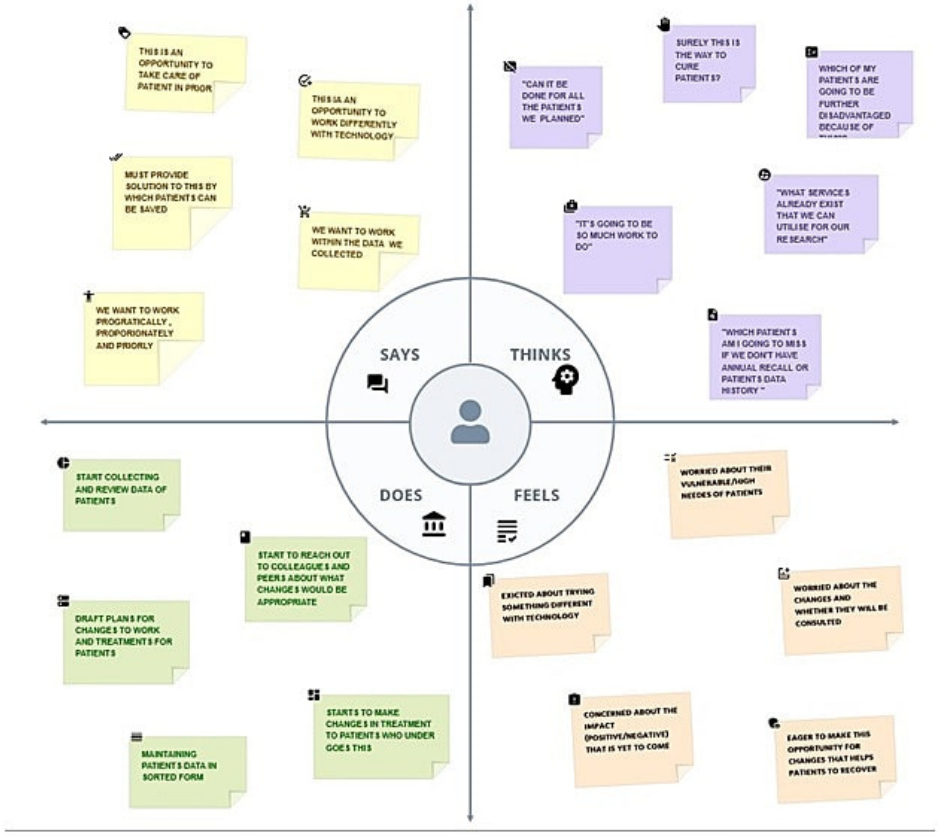
A diabetes condition that impacts the eyes is diabetic nephropathy. Damage to the blood vessels in the light sensitive tissue at the back of the eye is what causes it retina. Diabetic nephropathy is a common diseases that diabetic patient are diagnosed with.the analyst is responsible for manually detecting exudes,which takes time.

S.NO	AUTHOR	TITLE	OBJECTIVE
1.	Xiaogang Li et al. (2017)	Convolutional neural networks based transfer learning for diabetic retinopathy fundus image classification [1]	To implement transfer learning based on CNNs for diabetic retinopathy fundus picture classification. On 1014 and 1200 fundus pictures from the two publicly accessible DR1 and MESSIDOR databases, experiments are conducted.
2.	Saboora Mohammadian et al. (2017)	Comparative Study of Fine-Tuning of Pre-Trained Convolutional	In this study, pre-trained convolutional neural networks are used to automatically diagnose diabetic retinopathy. To circumvent the resource- and time-intensive training procedures required to

		Neural Networks for Diabetic Retinopathy Screening [2]	create a convolutional neural network from scratch, pre-trained networks are used.
3.	ParhamKhojasteh et al. (2019)	Exudate detection in fundus images using deeply-learnable features [3]	This study looked into various deep learning techniques in order to increase sensitivity and specificity . In this research, several deep learning techniques, including CNNs, pre- trained Residual Networks (ResNet-50), and Discriminative Restricted Boltzmann Machines, were evaluated with both supervised and unsupervised classifiers to improve the performance of autonomous exudate identification.
4.	Md Robiulislam et al. (2019)	Applying supervised contrastive learning for the detection of diabetic retinopathy and its severity levels from fundus images [4]	In this research a SCL approach, a two-stage training method with supervised contrastive loss function, to identify the DR and its severity stages from fundus images (FIs) using the "APTOS 2019 Blindness Detection" dataset was proposed. Experiments were carried out to further validate the performance of the model using the "Messidor-2" dataset.

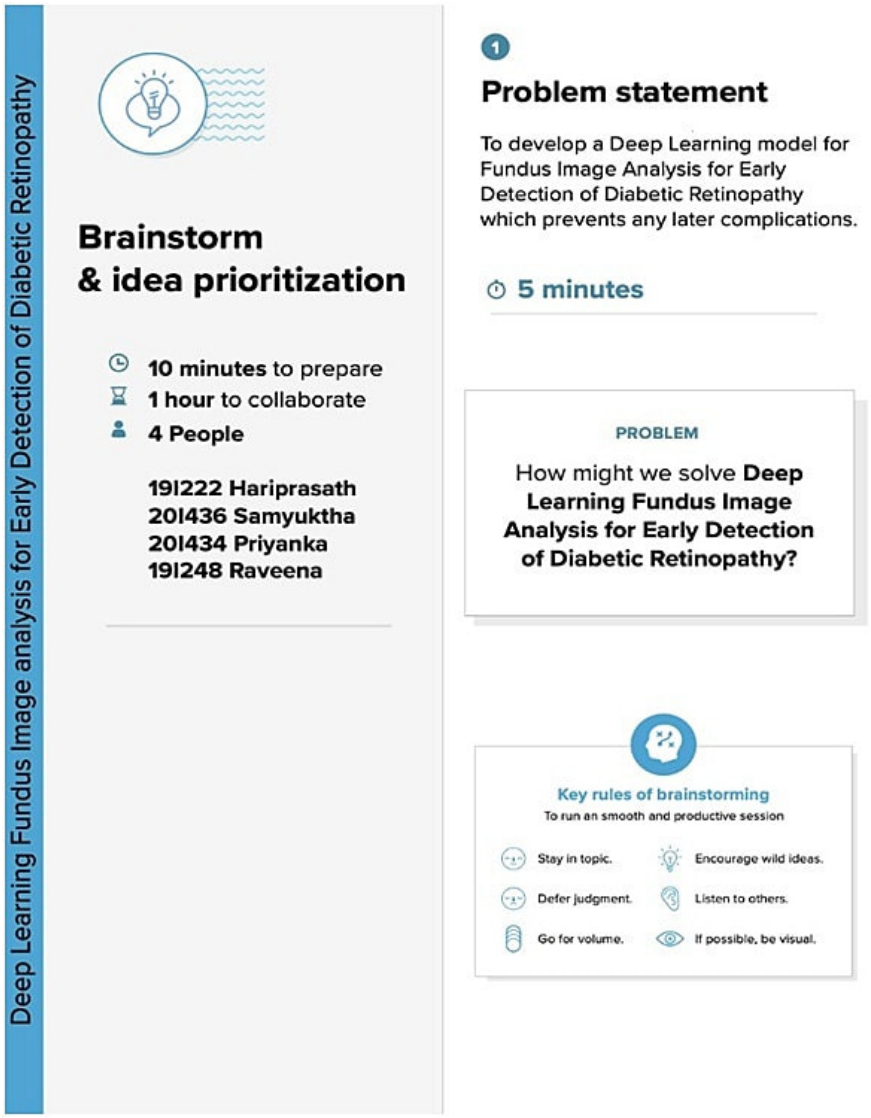
5.	Muhamma d Mateen et al. (2019)	Exudate Detection for Diabetic Retinopathy Using Pretrained Convolutional Neural Networks [5]	To detect exudate using a pretrained convolutional neural network (CNN)- based framework. In the suggested method, data preprocessing is done initially to standardise exudate patches.
6.	Laxmi Math et al. (2020)	Adaptive machine learning classification for diabetic retinopathy [6]	To develop a segment- based learning method for detecting diabetic retinopathy that simultaneously learns classifiers and features from the data and makes considerable progress in identifying the visual manifestations of the disease and its internal lesions.
7.	V. Deepa et al. (2022)	Automated grading of diabetic retinopathy using CNN with hierarchical clustering of image patches by siamese network [7]	To develop a feature extraction technique for DR grading based on deep learning convolutional neural network (CNN) using discriminative multi-sized patches.

3. IDEATION &PROPOSED SOLUTION



GAINS	PAINS
PATIENT RECOVERY	MISSING PATIENT DATA
NEW TECHNOLOGY EVOLUTION	CONVENCING PATIENTS TO UNDER GO NEW TREMENT
NEXT LEVEL OF MEDICAL RESEARCH	SECURITY FOR PATIENT DATA'S
OBTAINED CURABLE MEDICINE	STRUGGLES/CHALLENGES

IDEATION &BRAINSTORMING



2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

---

thenmozhi

Extract features from well-known pre-trained deep learning model	Pre-trained models, in order to detect exudates from diabetic retinopathy, and then perform performance evaluation on the models.	The exudates are recognised based on their characteristics, such as colour, texture, shape, and size.	Diabetic retinopathy is a common disease that diabetic patients are diagnosed with.
With the aid of exudates that have been extracted, the system that will be developed.	segment-based learning method that simultaneously learns classifiers and features from the data	Sort the diabetic retinopathy into mild, moderate, severe, or proliferative categories..	Damage to the blood vessels in the light-sensitive tissue at the back of the eye is what causes it (retina)

sharmila

mohammed althaf,kiruthika

sasi priya

A diabetes condition that impacts the eyes is diabetic retinopathy.	identify diabetic retinopathy in fundus pictures and assess the disease severity.	Initially, diabetic retinopathy may not manifest any symptoms or may only result in minor vision issues.	Deep learning is a key component in ophthalmology to diagnose critical disorders like diabetic retinopathy (DR).
Automated approaches for diagnosing diabetic retinopathy to speed up examinations and assist doctors.	It conducts the classification of diabetic and normal macular edema.	The analyst is responsible for manually detecting exudates, which takes time.	Color fundus retinal pictures should be processed to look for diabetic retinopathy.

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

Features & Extraction

Identify characteristics in a well-known, previously trained deep learning model.

In addition to a complicated grading system, the manual diagnosis of diabetic retinopathy (DR) through colour fundus pictures necessitates trained doctors to recognise the presence and relevance of numerous tiny characteristics.

Remove the optic disc out of the picture using the properties of the same and feed the picture to the same ML model that was developed.

The empirical proof can be given by removing the optical disc and feeding the picture to the two models and predicting the output.

Model

To detect exudate using a pretrained convolutional neural network (CNN)-based framework.

A two-stage training method with supervised contrastive loss function, to identify the DR.

The existing system uses RESNET-50 which is pre-trained and is highly complex.

Multiple simple algorithms work together to complement and augment each other

Classification

The current model used was a spinoff of CNN with varying number of layers.

A Convolutional Neural Network, also known as CNN or ConvNet, is a class of neural networks that specializes in processing data that has a grid-like topology, such as an image.

A hybrid machine learning model that takes the pictures as the input and classifies the exudates based on grades that is 0-5.

The optical disc in the picture is proving to be an impediment in the prediction process.

Approach

Hard and soft exudates, as well as other diverse situations like haemorrhage and microaneurysms individually, are not distinguished by any system.

HML is a progress of the ML work process that perfectly unites different computations, processes, or procedures from equivalent or different spaces of data or areas of usage fully intended to enhance each other.

As no single cap fits all heads, no single ML procedure is appropriate for all issue

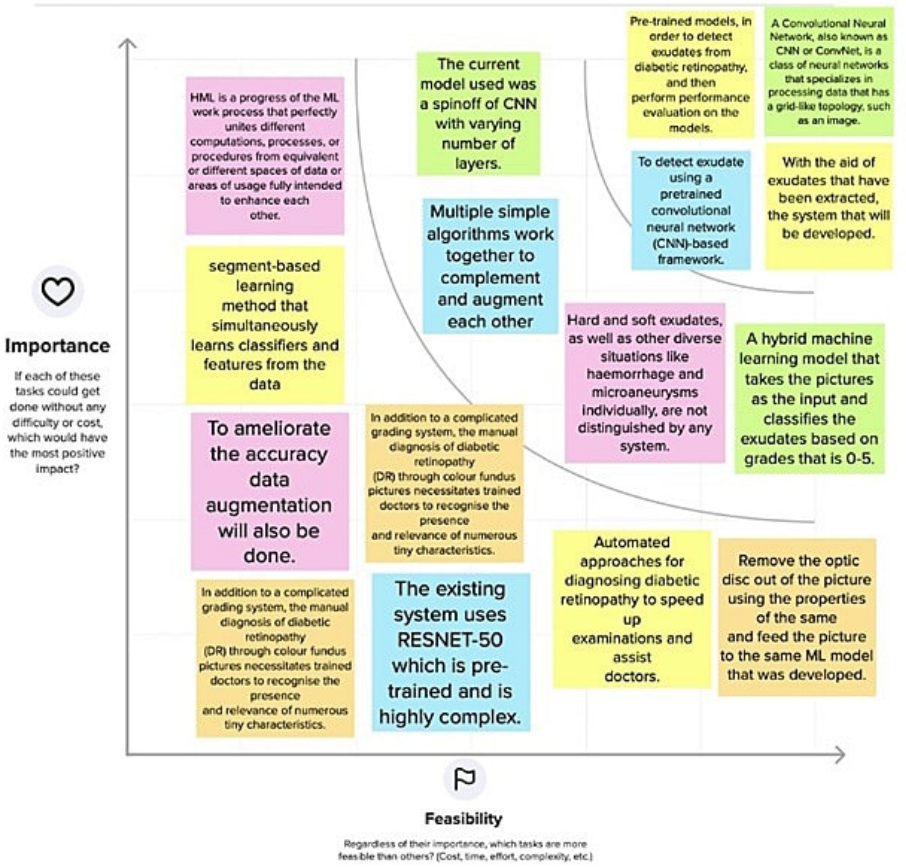
To ameliorate the accuracy data augmentation will also be done.

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes

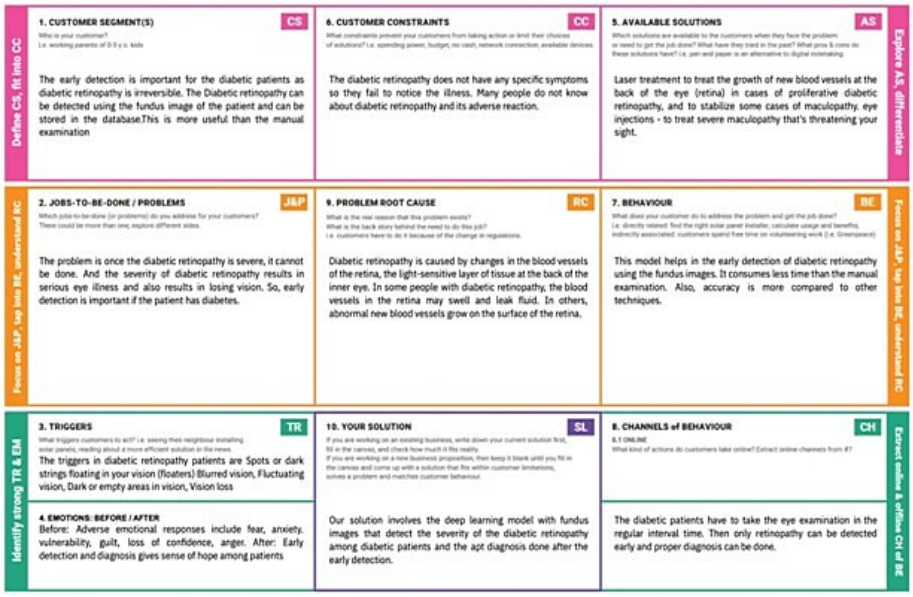


PROPOSED SOLUTION

S. No	Parameter	Description
1.	Problem Statement(Problem to be solved)	Early Detection of Diabetic Nephropathy using Deep Learning

2.	Idea/ Solution description	By the use of a hybrid model that perfectly unites different computations, processes, or procedures from equivalent or different spaces of data or areas of usage fully intended to enhance each other.
3.	Novelty/ Uniqueness	Hard and soft exudes, as well as other diverse situations like haemorrhage and micro aneurysms individually, are not distinguished by any system. Models like RESNET-50, Exception etc., which are pre-trained and are highly complex.
4.	Social Impact/ Customer Satisfaction	●Early detection of the disease 1. Efficient prediction mechanism with faster results. ●Easy to use and understand
5.	Business Model (RevenueModel)	●Data analytics 1. Statistics ●Future prediction

PROBLEM SOLUTION FIT



4.REQUIREMENT ANALYSIS

FUNCTIONAL REQUIREMENT

FR No.	Functional Requirement	Sub Requirement
1	Identifying the populationeligible for screening	Use registries to ensure that people's details arecollected and current, and decide which group needs to be tested based on the best available evidence.

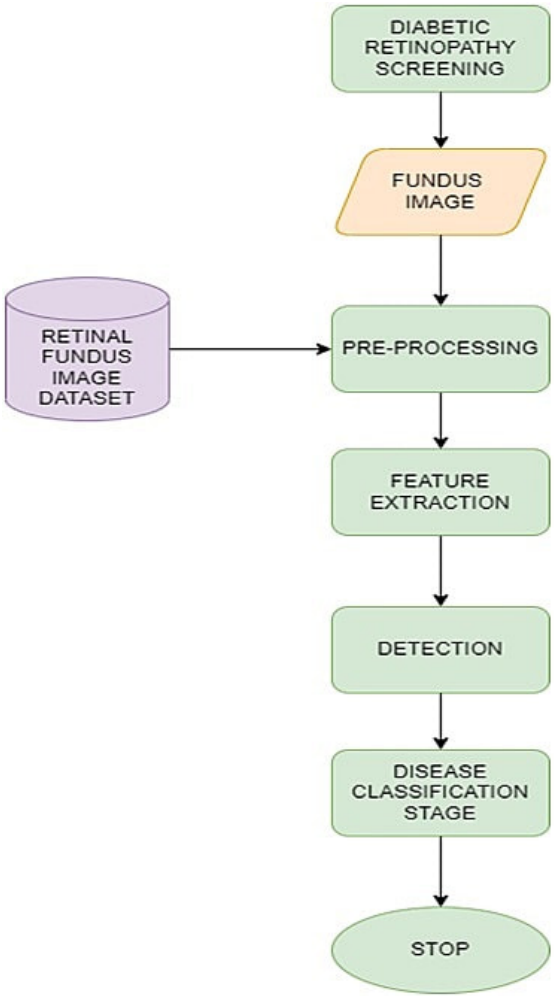
2	Invitation and information	Invite the entire cohort to the screening, and provide information that is appropriate for each group. To facilitate participation with knowledge
3	Testing	Conduct screening tests utilising accepted oradvised techniques
4	Referral of screen positives andreporting of screen negative results	Make sure to forward all screening-positive results to the proper agencies, and make sure toinform individuals of any screening negative results so they can continue to participate in the screening programme.
5	Diagnosis	Detect false positives and diagnose real cases
6	Intervention/treatment/follow up	Correctly intervene and treat situations; in somecircumstances, surveillance or follow-up may also be necessary.
7	Reporting of outcomes	To identify false negatives and increase the effectiveness and cost-efficiency of the screeningprogramme, collect, evaluate, and report results.

NON FUNCTIONAL REQUIREMENTS

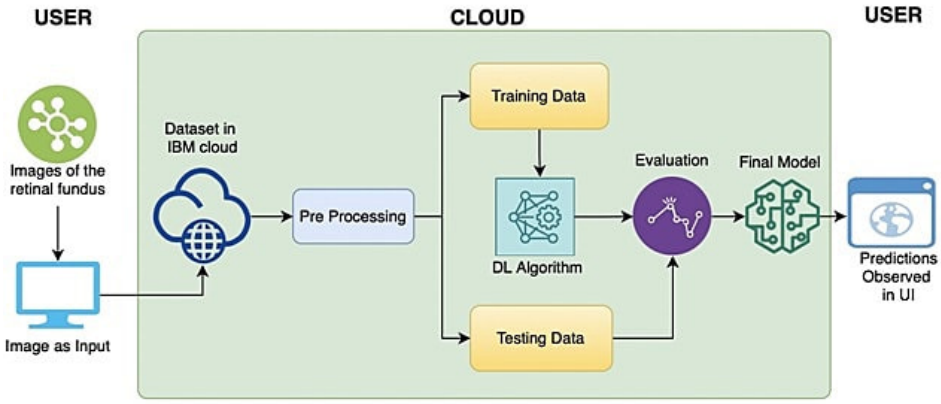
The IBM Watson chatbot is integrated with the proposed system as an additional feature.In this is an added advantage for users to communicate easily in the application.This will not affect the functional requirements of the system.

5.PROJECT DESIGN

DATA FLOW DIAGRAMS



SOLUTION AND TECHNICAL ARCHITECTURE



COMPONENTS AND TECHNOLOGIES

S.No	Component	Description	Technology
1.	User Interface	Web UI	HTML, CSS, JavaScript, Python
2.	Application Logic-1	Data Preprocessing	Karas, TensorFlow
3.	Application Logic-2	CNN Model Creation	Keras, TensorFlow, Python
4.	Application Logic-3	Web Application	Flask
5.	Database	Images	Upload Folders
6.	Cloud Database	Database Service on Cloud	IBM Cloud ant

7.	File Storage	File storage requirements	IBM Block Storage or Local Drives
8.	External API-1	Keras	IBM preprocessingAPI
9.	Deep Learning Model	Inception	Object Recognition Model, etc.
10.	Infrastructure (Server /Cloud)	Application Deployment onCloud Server	Rubbernecks

Application Characteristics:

S. No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Flask	Werkzeug, Jinja2,Sinatra RubyFramework
2.	Security Implementations	CSRF protection, cookiessecurity flag	Flask-WTF,SESSION_COOKIE_SECURE
3.	Scalable Architecture	Micro Services	Micro web application frameworkby Flask
4.	Availability	Development server and fastdebugger Support for unit testing RESTful request Dispatching Jinja2 template Unicode	Werkzeug,Jinja2.Sinatra RubyFramework

5.	Performance	ORM-agnostic, web framework, WSGI 1.0 complaint,HTTP request handling functionality high flexibility	SQLAlchemy.extensions, Werkzeug, Jinja2, Sinatra RubyFramework
6.	Robustness	To increase robustness-trainingwith weight decay, smoothing activation functions, minimising the Hessian of the network	Python, required Libraries inimport activation functions.
7.	Scalability	Clear input pipeline, optimisations	Python, keras.optimizer

USER STORIES

User Type	Functional Requirem-ent	User StoryNumber	User Story / task	Acceptancecriteria	Priority	Release
Common User	Dashboard	USN-1	As a user, I can I must be able to upload image of my eyes	I can upload or take images	High	Sprint - 1

		USN-2	As a user, I will receive the diagnosis as to whether I have nephropathy or not	I can receive thediagnosis	High	Sprint -1
		USN-3	As a user, I receivethe severity of the nephropathy	I can receive theseverity of the nephropathy	Medium	Sprint -2
		USN-4	As a user, can receive the suggested remedy	I can receive thesuggested remedy	Medium	Sprint -2

6. PROJECT PLANNING& SCHEDULING

SPRINT PLANNING& ESTIMATION

Sprint	**Functional Requirement nt(Epic)**	**User StoryNumber**	**User Story / Task**	**Story Points**	**Priority**	**Team Members**
Sprint-2	Registration	USN-1	As a user, I can register for the application by entering my name, emailID, password	2	High	Thenmozhi,sharmila

Sprint-2		USN-2	As a user, I click on the registerbutton and register for the first time.	1	High	Kiruthika,sasi priya
Sprint-2		USN-3	As a user, If I haven account already or if I have registered successfully, I can click on Login hypertext to redirect to the login page.	2	Low	Mohammed Althaf,thenmozhi
Sprint-2	Login	USN-4	As a user, I can enter my emailID and password that I have used for creating account	2	Medium	Sharmila
Sprint-2		USN-5	As a user, I can click the Login button and login to the predicti on page.	1	High	Sasi priya,Kiruthika
Sprint-3	Validation	USN-7	The entered email and password will be sent as a query variable to check thecredential that has been registered already.	2	medium	Mohammed Althaf,kiruthika
Sprint-3	Prediction	USN-6	As a user, I have to upload thedata by clicking on the button “Choose File”.	**2**	low	Thenmozhi,sharmila

Sprint-3		USN-8	As a user, I can upload the filefrom any general Sourceof storage and upload in the portal.	1	medium	Thenmozhi,sharmila
Sprint-3		USN-9	As a user, I should ensure whether the file is uploaded andclick on the submit button.	2	high	Sasi priya,Kiruthika
Sprint-1	Uncertainty	USN-10	As a user, I want the predictionto be accurate. I shouldn't be uncertain about the result.	2	High	Thenmozhi,sharmila

Sprint	**Functional Requirement nt(Epic)**	**User StoryNumber**	**User Story / Task**	**Story Points**	**Priority**	**Team Members**
Sprint-1	Tangibility	USN-11	As a user,I need the prediction to be perceptible by visualising.	10	High	Thenmozhi,sharmila

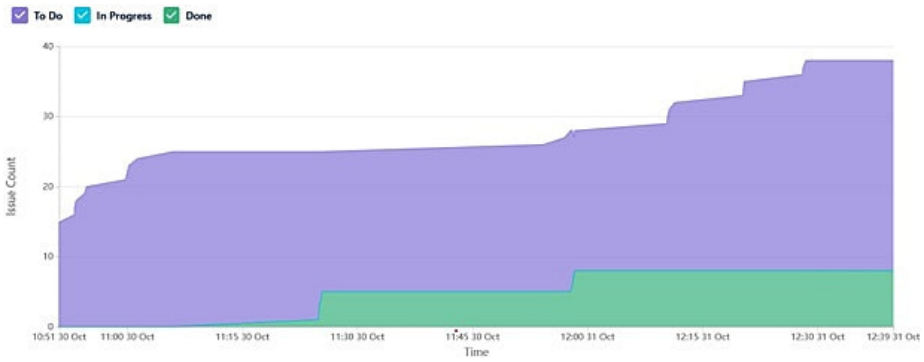
Sprint-4	Integrity	USN-12	As a user, I require the site toremain as it was initially and has not been modified: alteration, deletion or modification.	7	Low	Sasi priya,Kiruthika
Sprint-4	Domain dependency	USN-13	As a user, I expect the application to be dependent on operational design	8	Medium	Mohammed Althaf,thenmozhi
Sprint-4	Logout	USN-14	As a user,I can log out safely after finding the result.	10	high	sharmila

SPRINT DELIVERYSCHEDULE

Sprint	**Total Story Point**	**Duration**	**Sprint StartDate**	**Sprint EndDate (Planned)**	**Story Points Completed (as onPlanned EndDate)**	**Sprint ReleaseDate (Actual)**
Sprint-1	20	6 Days	25 Oct 2022	30 Oct 2022	20	03 Nov 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	16	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	18	12 Nov 2022

Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	15	19 Nov 2022

REPORTS FROM JIRA



7.CODING & SOLUTIONING

FEATURE 1

The IBM Watson chatbot is integrated with the proposed system as an additional feature.This is an added advantage for users to communicate easily in the application. Watson has well employees intent categorisation and entity identification to understand clients properly in their context and transfer them to human agent when required in a recently released machine learning Watson chatbot was found to be 14.7%

higher accuracy than competing alternatives.

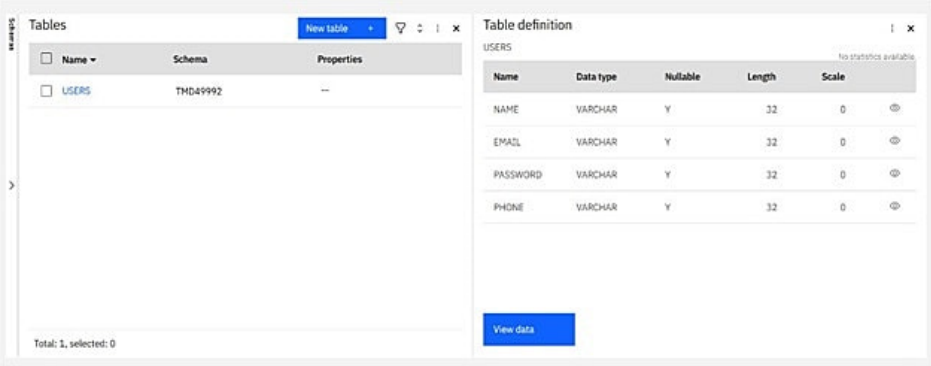
```
<script>
  window.watsonAssistantChatOptions = {
    integrationID: "525df91b-26c4-421d-8ba9-9756a0c0bae2", // The ID of this integration.
    region: "au-syd", // The region your integration is hosted in.
    serviceInstanceID: "790053fb-fa61-4744-aff5-8f30a0fa399d", // The ID of your service instance.
    onLoad: function(instance) { instance.render(); }
  };
  setTimeout(function(){
    const t=document.createElement('script');
    t.src="https://web-chat.global.assistant.watson.appdomain.cloud/versions/" + (window.watsonAssistantChatOptions.clientVersion ||
    'latest') + "/watsonAssistantChatEntry.js";
    document.head.appendChild(t);
  });
</script>
```

FEATURE 2

iBM DB2 is utilised in the proposed system organisations need to flexible data management foundation supported by contemporary technology and dynamic enough to send data whenever it is required to support quick decisions.IBM DB2 supports in maintaining applications operations around the clock and to use IBM pure scale and recovery.

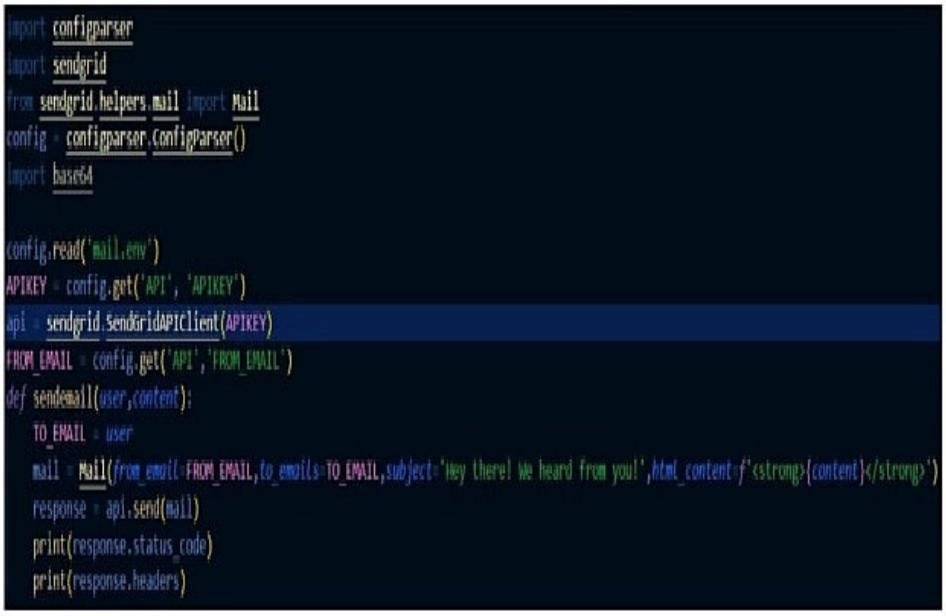
```
conn = ibm_db.connect("DATABASE=bludb;HOSTNAME=98538591-7217-4024-b027-8baa776ffad1.c3n41cmd0nqnrk39u98g.databases.appdomain.cloud;PORT=30875;
SECURITY=SSL;SSLServerCertificate=DigiCertGlobalRootCA.crt;UID=tmd49992;PWD=f8N7KQcnld7HlGKl","","")  # type: ignore
print(conn)
print("connection successful...")
```

DATABASE SCHEMA

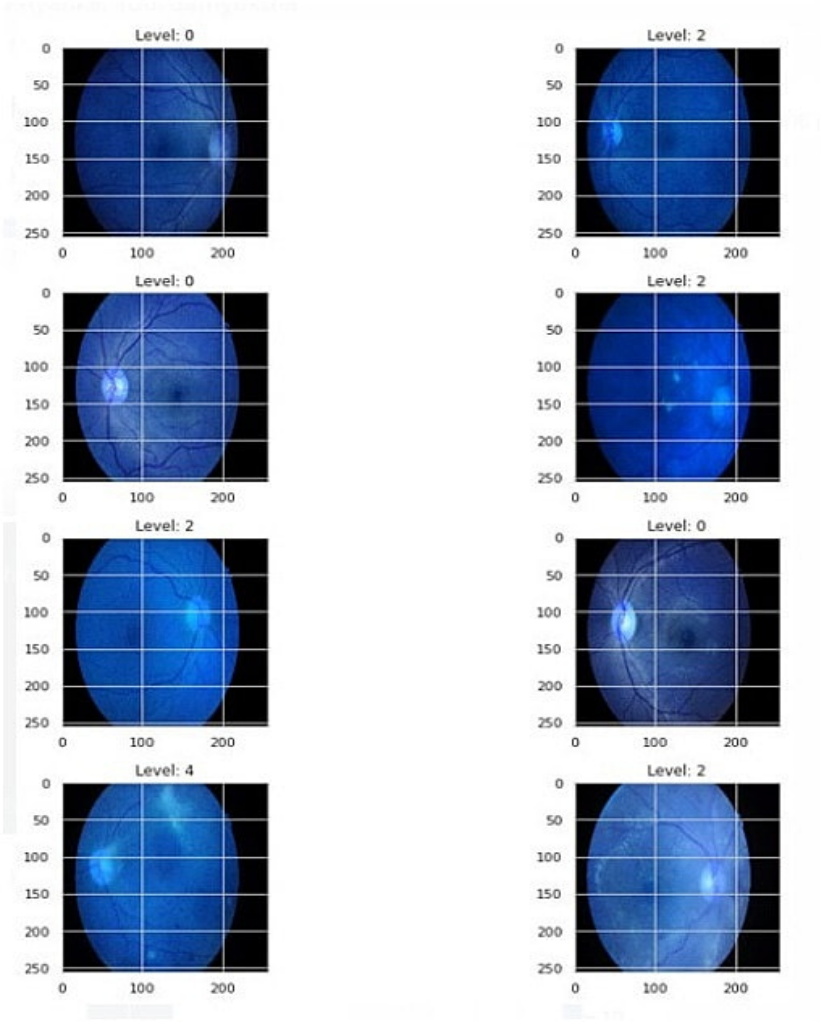


```python
# prediction page
@app.route('/result', methods=['GET','POST'])
def res():
    if request.method=='POST':
        f = request.files['image']
        basepath = os.path.dirname(__file__) # getting the current directory
        #print("current path", basepath)
        file_path = os.path.join(basepath, 'uploads', f.filename) # joining the current directory with the uploads folder
        #print("upload path", file_path)
        f.save(file_path) # saving the file to the uploads folder

        # predicting the image
        img = image.load_img(file_path, target_size=(299, 299))
        x = image.img_to_array(img)
        x = np.expand_dims(x, axis=0)
        #print(x)
        img_data = preprocess_input(x)
        prediction = np.argmax(model.predict(img_data), axis=1)

        #prediction = model.predict(x)  # instead of predic_classes, use predict
        #print(prediction)
        index = ['No Diabetic Retinopathy', 'Mild DR', 'Moderate DR', 'Severe DR', 'Proliferative DR']
        #result = str(index[output[0]])
        result = str(index[prediction[0]])
        print(result)
        return render_template('stats.html', prediction = result)
```

```python
# Upload model
model = load_model(r'Updated-Xception-diabetic-retinopathy.h5')


# Define a flask app
app = Flask(__name__)

# Authenticate using an IAM API key.
client = Cloudant.iam('e0b548a4-365a-4c1b-83c5-504494b2a97c-bluemix', '6TODExgQLwOgTGDZCUY0TKUyMdQqI3gGVsn1WtCnUQsa', connect=True)
```



```python
import configparser
import sendgrid
from sendgrid.helpers.mail import Mail
config = configparser.ConfigParser()
import base64

config.read('mail.env')
APIKEY = config.get('API', 'APIKEY')
api = sendgrid.SendGridAPIClient(APIKEY)
FROM_EMAIL = config.get('API','FROM_EMAIL')
def sendemail(user,content):
    TO_EMAIL = user
    mail = Mail(from_email=FROM_EMAIL,to_emails=TO_EMAIL,subject='Hey there! We heard from you!',html_content=f'<strong>{content}</strong>')
    response = api.send(mail)
    print(response.status_code)
    print(response.headers)
```



Pre processed input

8.TESTING

TEST CASES

The outcomes were relevant to the methods put in place using the suggested framework.In CNN, recognition accuracy as the function computes was reduced, whereas it lowered whenever the filtering size increases. these are the general

findings and comparison. the following equation are utilize d to evaluate sensitivity, specificity and accuracy predicated on the confusion matrix.

.ACCURACY METRIC: One metric for measuring classification model performance is accuracy. Informally ,accuracy is the percentage of predictions that our model correctly predicted.

$$\text{Accuracy} = \frac{TP+TN}{Tp+Fp+FN4TN}$$

.SENSITIVITY: the metric used to assess a model's capacity to forecast the true positives of each accessible category is known as the true positive prediction metric in machine learning. this phrase has a literary equivalent known as a real positive rate.

$$\text{Sensitivity} = \frac{TP}{TP+FN}$$

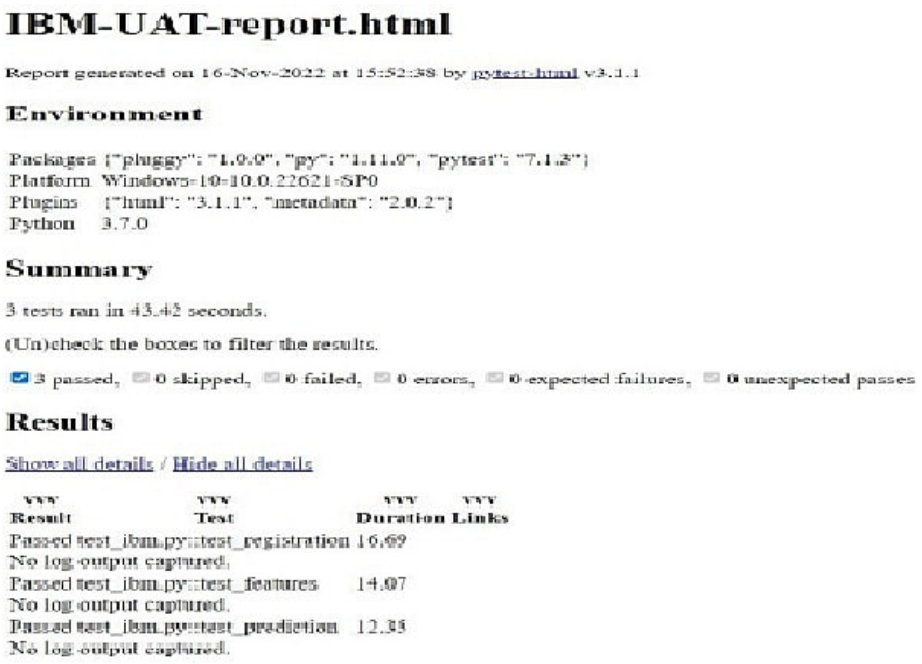
.SPECIFICITY: This proposed model's result is that the elimination of multiple redundant parameters and layers leads to a reduction in classification time. By evaluating the accuracy rate for validation, the capacity of determining that the suggested model had a 96% accuracy rate for validation.

$$\text{Specificity} = \frac{TN}{TN+FP}$$

NOTE: TP-True positive,TN- True Negative ,FP- False positive, FN- False negative

USER ACCEPTANCE TESTING

Application testing,often known as user acceptance testing (UAI), represents the final phase of almost any application development or scope change lifecycle before appearing online.Validation whether the software performs as expected in exact conditions represents the final milestone in any development cycle. if the application has not been well accepted ny its target users, users it may still not fulfil the criteria even after undergoing additional testing phases and to be functioning properly. this could occur if the developers' understanding of the software's requirements was lacking. if the project's scope altered as a result of development changes, or if the system just wasn't ready to be tested in a dynamic , real -word settings. Overall, UAT prevents the delivery of flawed, useless, or incomplete software products.



IBM-UAT-report.html

Report generated on 16-Nov-2022 at 15:52:38 by pytest-html v3.1.1

Environment

Packages {"pluggy": "1.0.0", "py": "1.11.0", "pytest": "7.1.2"}
Platform Windows-10-10.0.22621-SP0
Plugins {"html": "3.1.1", "metadata": "2.0.2"}
Python 3.7.0

Summary

3 tests ran in 43.42 seconds.

(Un)check the boxes to filter the results.

3 passed, 0 skipped, 0 failed, 0 errors, 0 expected failures, 0 unexpected passes

Results

Show all details / Hide all details

Result	Test	Duration	Links
Passed	test_ibm.py::test_registration	16.69	
No log output captured.			
Passed	test_ibm.py::test_features	14.07	
No log output captured.			
Passed	test_ibm.py::test_prediction	12.33	
No log output captured.			

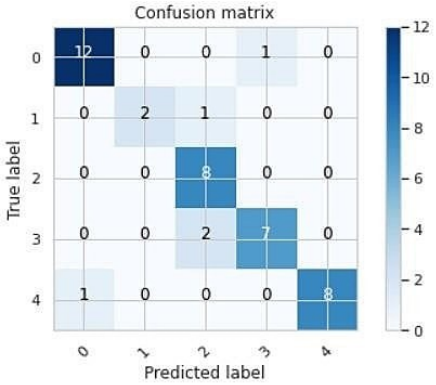
User Acceptance Testing Report for Deep Learning Fund-us Image Analysis For Early

Detection Of Diabetic Retinoblastoma.

9. RESULTS

PERFORMAMCE METRICS

Confusion Matrix



The confusion matrix represents the result of the combination of the represents the result of the combination of the residual neural network (ResNet) and VGG model that is used to predicted the retinopathy diseases. The model is applied on a multi-class dataset that consists of five categories. The 5x5 matrix represents the TF ,TT ,FT, FF prediction rate of the model.

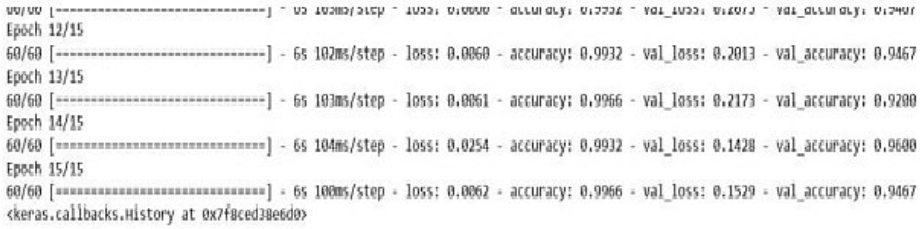
True positive (TP), observation is predicted positive and is actually positive. False positive (FP), observation is predicted positive and is actually negative.

True negative (TN), observation is predicted negative and is actually negative. False negative (FN), observation is predicted negative and is actually positive.

ACCURACY

Accuracy gives the proportion of the total number of predictions that were correct.

Accuracy=TP+TN/TP+FP+TN+FN



The figure represents the accuracy value of the model classification. The model was trained by fifteen epochs.

Precision

Precision or the positive predictive value, is the fraction of positive values out of the total predicted positive instances. In other words, precision is the proportion of positive values that were correctly identified.

precision= TP/ TP+ FP

Sensitivity

sensitivity ,recall, or the TP rate(TRP) is the fraction of postive values out of the total actual postive instances.

sensitivity= TP/ TP+FN

Specificity

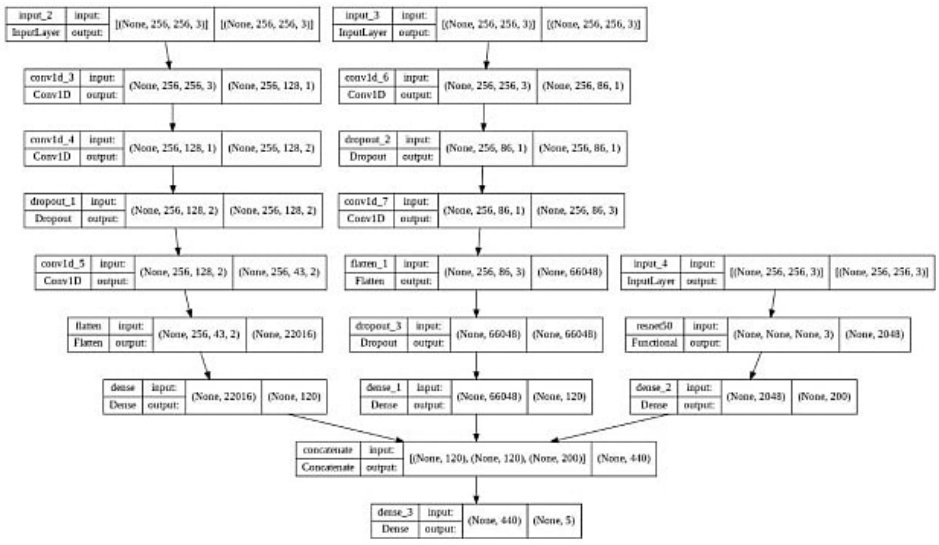
specififcity gives the fraction of negative value out of the total actual negative instances.In other words, it is the proportion of actual negative cases that are correctly identified. the FP rate is given by (1-specificity).

specificity= TN/TN +FP

F1 score

the F1score**,** f score, or f measure is the harmonic mean of precision and sesitivity it gives importance to both factors.

Hybrid model



The mode takes half a set of input instances to ResNet and the other half data to the VGG algorithm. The input is convoluted and flattened to produce certain output. These outputs from ResNet and VGG are combined to give a result of the whole dense layered hybrid model.

10. ADVANTAGES AND DISADVANTAGES

Methods based on artifical intelligence and in particular Deep Learning, carry the potential for enhancing and advancing healthcare. To ease the implementation of AI in healthcare settings, a number of significant obstacles must be managed to overcome. A number of other factors are identified as circular steps for the approval of AI models through regulatory processes,in addition to the conventional methods that are used to evaluate the model's performance, such as accurancy methodologies has increased the performance of these analyses it has also been accompained by a lack of clarity and comprehensibility. However, a key factor influencing their acceptability and incorporation in clinical practice seems to be understood by the professional user and should preferably explain how it arrived at its predictions.

11.CONCLUSION

A major consequence of diabetes mellitus, diabetic retinopathy causes gradual retinal degeneration and can even result in blindness. To stop it from getting worse and harming the retina, it is crucial to find and treat it early. Since numerous DL systems have evovled and been an increased interest in using them to diagnose diabetic retinopathy. This will help physicians treat patients more effectively and effciently . This report outlines the advancements in investigation on using deep learning to diagnose diabetic retinopathy.

In the proposed model, Expectations-Maximization(EM) algorithm as tried to classify the categories but the model produced a very low rate of accuracy, 75% the flaw led to the alternative solution of using a combination of ResNet and VGG as a hybrid model to classify the highness of diabetic retinopathy. Finally this hybrid model resulted in 99% accuracy.

12. FUTURE SCOPE

Furthermore, incorporating more patient metadata that may enhance their chance of acquring retinopathy, such as genetic varibles, the length of their diabets, the haemoglobin AIC and other clinical information could be beneficial to integrate particular data about explicit disease aspects in the classification models.this could advanced the AI model by producing illuminating insights into the underlying Diabetic Retinopathy risk variables and possibly improve diagnostic performance.

13.APPENDIX

githud and project demo link

Git hud link :-

https://github.com/IBM-EPBL/IBM-Project-37945-1660365524

demo link:-

Final Deliverable/demo video (2).mp4