Deep Learning Fundus Image Analysis for Early Detection of Diabetic Retinopathy

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CHAPTER 1-INTRODUCTION

PROJECT OVERVIEW

Diabetic Retinopathy (DR) is a common complication of diabetes mellitus, which causes lesions on the retina that affect vision. Diabetic Retinopathy is the leading cause of blindness among working aged adults around the world and estimated it may affect more than 93 million people. If it is not detected early, it can lead to blindness.Progression to vision impairment can be slowed or controlled if Diabetic Retinopathy is detected in time, however this can be difficult as the disease often shows few symptoms until it is too late to provide effective treatment. Currently, detecting Diabetic Retinopathy is a time-consuming and manual process, which requires an ophthalmologist or trained clinician to examine and evaluate digital color fundus photographs of the retina, to identify Diabetic Retinopathy by the presence of lesions associated with the vascular abnormalities caused by the disease.The automated method of Diabetic Retinopathy screening will speed up the detection and decision-making process, which will help to control or manage Diabetic Retinopathy progression. We used Transfer Learning techniques like Inception V3,Resnet50,Xception V3 that are more widely used as a transfer learning method in medical image analysis and they are highly effective. This classifies images into 5 categories ranging from 0 to 4, where 0 is no Diabetic Retinopathy and 4 is proliferative Diabetic Retinopathy

PURPOSE

The main aim of this project is to aid early detection of Diabetic Retinopathy using retinal fundus images which is useful in providing cost-effective way for early detection of DR in millions of people with diabetes to triage those patients who need further care at a time when they have early rather than advanced DR. It also provides a scope of scaling this method to help people in healthcare sector to provide a cost effective solution for this condition and prevent it from worsening further by identifying this condition at early stages.The aim of this project is to reduce the risk of vision impairment and blindness among people with diabetes through the prompt identification and effective treatment of sight threatening diabetic retinopathy.

CHAPTER 2-LITERATURE SURVEY

EXISTING PROBLEM

Early detection of Diabetic Retinopathy requires routine eye checks and good diabetes control and this might protect people's vision from this condition. However, this might not be possible for everyone as it is economically unfeasible and it is often difficult to identify anomalous retinal patterns. Moreover, this type of retinal disease diagnosis is highly influenced by the inherent subjectivity of each expert and it might be difficult to detect Diabetic Retinopathy at an early stage because the symptoms of this condition are frequently disregarded and tough to identify.

These above points suggest the need for developing an automatic screening method for this condition which can be used in primary health care reducing the cost as well as working time to the specialists and providing diagnosis before the condition worsens.

REFERENCES

We referred to a paper titled “Early detection of diabetic retinopathy from retinal fundus images using Eigen value analysis by R.Manjula Sri and V.Rajesh. The paper proposes an algorithm for Micro aneurisms (MA) detection based on Eigen value analysis using hessian matrix in retinal Fundus image. The method was effective in the detection of dark lesion in the retinal fundus images. MA particle analysis is employed to measure the area of MA in retinal image. Lab VIEW software is used to implement the algorithm.

S. Gupta, A. Panwar, A. Kapruwan, N. Chaube and M. Chauhan published a paper “Real Time Analysis of Diabetic Retinopathy Lesions by Employing Deep Learning and Machine Learning Algorithms using Color Fundus Data” which focuses on processing of color fundus dataset scans by passing it to multiple Deep Learning (DL) models employed to learn the characteristics after which several machine learning classifiers were used to classify lesions using the collected characteristics. It was noted that Inception V3 model can easily classify the MA scans from color fundus images and the benefit of using the Inception V3 architecture is that in very less time the detection and classification of MAs are done which will help the ophthalmologist in early detection of MAs.

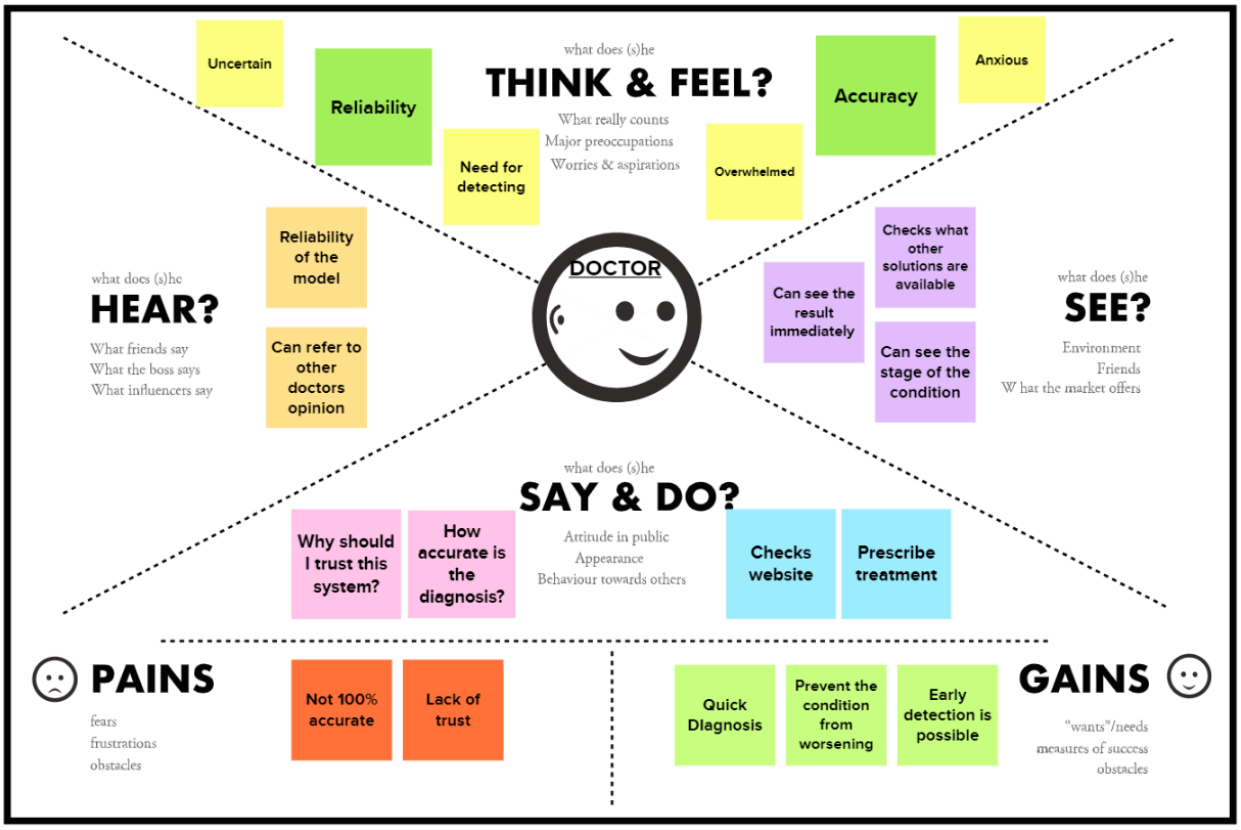
“Deep Learning Approach For Detection Of Retinal Abnormalities Based On Color Fundus Images” by B. Bulut, V. Kalın, B. B. Güneş and R. Khazhin reviews and analyzes state-of-the-art deep learning methods in supervised, self supervised models proposing retinal fundus image classification and detection. The paper discusses the available retinal fundus datasets for Diabetic Retinopathy that are used for tasks such as detection, classification, and segmentation. The paper also assesses research gaps in the area of DR detection/classification and addresses various challenges that need further study and investigation

PROBLEM STATEMENT DEFINITION

To automate the identification and classification of diabetic retinopathy to aid inexpensive and quick detection of the condition. To develop a website that classifies the retinal fundus images into various levels with level 0 being no diabetic retinopathy and level 5 being advanced diabetic retinopathy and to provide a cost-effective way for early detection of DR and thus reduce the risk of vision impairment

CHAPTER 3-IDEATION & PROPOSED SOLUTION

EMPATHY MAP CANVAS



This empathy map was prepared using the mural template. An Empathy Map consists of four quadrants. The four quadrants reflect four key traits, which the user demonstrated/possessed during the observation/research stage. The four quadrants refer to what the user: Said, Did, Thought, and Felt. It's fairly easy to determine what the user said and did.

In our case, the user talks about the reliability of our system and why they should even choose this solution. To counter this, they would have heard about this solution from their friends and family which gives them some trust. They might have also heard about this system from their doctor themselves. The user could search for other solutions, but our proposed solution shows them an accurate diagnosis, which they can see instantly. They are even notified which stage

their condition is in. Throughout the process, the user might feel anxious and stressed, and they might be uncertain about their results, but what they gain from it, outweighs the drawbacks

IDEATION/BRAINSTORMING

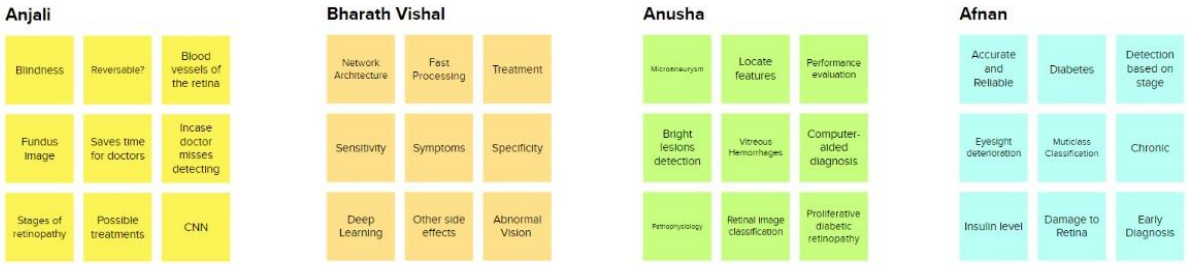


Figure: Brainstorm Solo Map

Based on the problem statement, each team member brought up different keywords about the disease symptoms, Ml algorithms to be used to design the model, diagnosis and treatment.

Some of the symptoms mentioned were blindness, abnormal vision, diabetes, eyesight deterioration and insulin level. Description of diseases such as reversibility, side effects and chronic level was mentioned. Attributes of the model such as fundus image, Locating features and Computer-Aided Diagnosis were mentioned. Algorithms and methods such as CNN,Deep learning method, Retinal image classification and multiclass classification were discussed. Advantages of the model such as saving time for doctors and early diagnosis was discussed.

After this, a group brainstorming session was had to categorize and organize the different ideas which were mentioned.

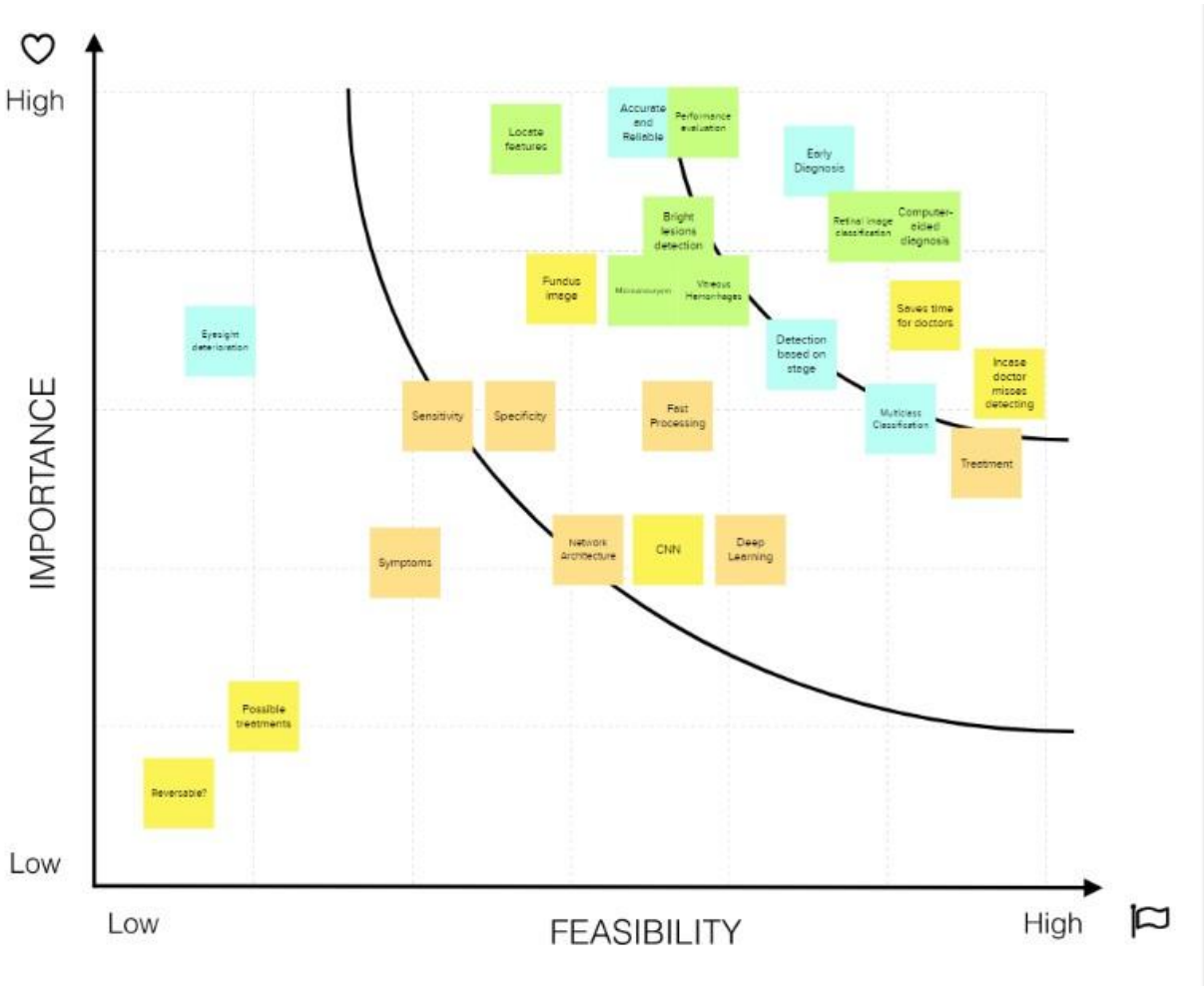


Figure: Brainstorm Priority Graph

A priority graph was drawn to prioritize the immediate necessities taken from a solo brainstorm map which had to be performed by the model and the categorized ideas were ranked by all the members together.

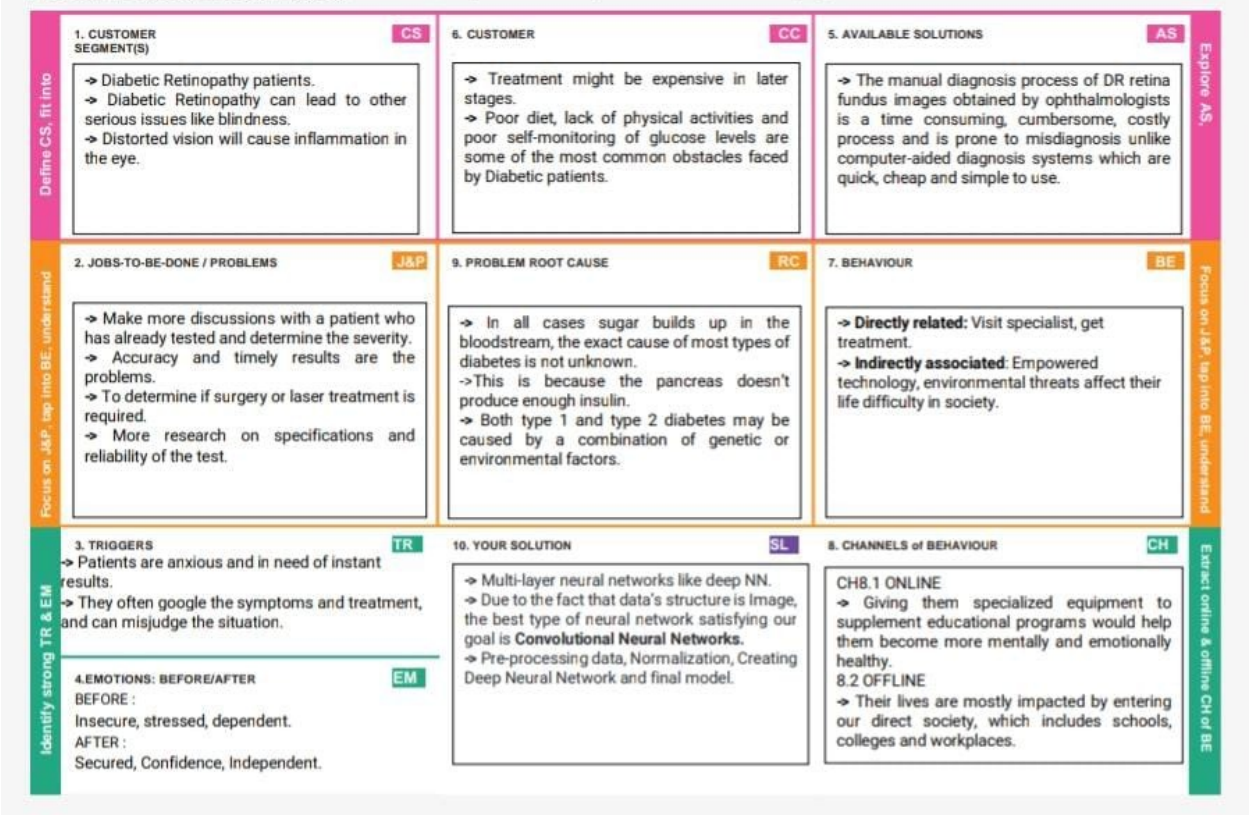
PROPOSED SOLUTION

S.No.	Parameter	Description
1.	**Problem Statement (Problem to be solved)**	Diabetic Retinopathy (DR) is a common complication of diabetes mellitus, which causes lesions on the retina that affect the eyesight of the person. If it is not detected early and treated, it can lead to blindness. Unfortunately, DR is not a reversible process, and treatment can only sustain vision and prevent worsening. DR early detection and treatment can significantly reduce the risk of vision loss.
2.	**Idea / Solution description**	The main objective is to detect the Diabetic Retinopathy in early stages by processing the Retinal fundus images. Transfer learning has become one of the most common techniques that has achieved better performance in many areas, especially in medical image analysis and classification. We used Transfer Learning techniques like Inception V3, Resnet50, Xception V3 that are more widely used as a transfer learning method in medical image analysis and they are highly effective. Deep Learning, Machine learning, Neural Networks and knowledge in Python will play a significant role in the development of our Project.

3.	**Novelty / Uniqueness**	The manual diagnosis process of DR retina fundus images obtained by ophthalmologists is a time consuming, cumbersome, costly process and is prone to misdiagnosis unlike computer-aided diagnosis systems which are quick, cheap and simple to use. One of the major decisions had to be made was choosing the suitable programming language satisfying our goal for extracting knowledge from our data. After some searching the suitable decision has been made by selecting Python as the project programming language. Due to the fact that, a lot of tools and frameworks are available for Python to create powerful Artificial Neural Networks. Also IBM Watson helps to predict future outcomes,automate complex processes,and optimize user's time. And also the result accuracy will be increased from 70% which is the accuracy of the test results that the previous developed codes produced.
4.	**Social Impact / Customer Satisfaction**	Helps in preventing the loss of visibility to the needs through CSR activities or through healthcare camps.
5.	**Business Model (Revenue Model)**	Can collaborate with diagnosis centers and hospitals. Can collaborate with the government for health awareness camps.
6.	**Scalability of the Solution**	This project will help us to detect DR more precisely than the existing methodologies. Also it can produce a result which specifies the stages of Diabetic Retinopathy.

PROBLEM SOLUTION FIT

Problem-solution fit is a term used to describe the point validating that the base problem resulting in a business idea really exists and the proposed solution actually solves that problem. After reading about different methods and ways to solve the problem statement, we came up with this solution fit.



CHAPTER 4-REQUIREMENT ANALYSIS

FUNCTIONAL REQUIREMENT

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Identification of eligible candidates for screening	Use registries to ensure that people's details are collected and updated, and decide which group needs to be tested based on the best available evidence.
FR-2	Invitation and information	Invite the entire group to the testing, and provide information that is appropriate for each group.
FR-3	Testing	Conduct screening test(s) using recommended methods
FR-4	Referral of screen positives and reporting of screen-negative results	Make sure to forward all screening-positive results to the proper services, and make sure to inform individuals of any screening-negative results so they can continue with the screening programme.
FR-5	Diagnosis	Diagnose true cases and identify false positives
FR-6	Treatment/follow up	treat cases appropriately; in some circumstances, surveillance or follow-up will also be necessary
FR-7	Reporting of outcomes	Identify false negatives and increase the performance and cost-efficiency of the screening programme by gathering, analysing, and reporting results.

- Functional requirements start with identification of eligible candidates for screening wherein a group is selected and registries are maintained to ensure people's details are up-to-date
- Next is Invitation and Information wherein the group is invited and provided information regarding testing.
- Testing is done and screen positive candidates are referred to hospitals and screen negative are informed.
- Diagnosis is done and treatment or follow up starts
- Finally, the report is evaluated to identify false negatives to improve performance of the model.

NON-FUNCTIONAL REQUIREMENTS

Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	provides cutting-edge results for precisely classifying images in accordance with clinical five-grade diabetic retinopathy, as well as innovative results for five separate screening and clinical grading systems for diabetic retinopathy.
NFR-2	**Security**	AI-powered deep learning can be more accurate when working with delicate organs and tissues and can also lessen discomfort, blood loss, and the danger of infection.
NFR-3	**Reliability**	The ability of Deep Learning is to perform pattern Recognition by creating complex relationships based on input data and then comparing it with Performance standard s is a big step.
NFR-4	**Performance**	When a task is completed primarily by a computer or a robot, with little to no assistance from humans, that is what artificial intelligence refers to. The accuracy of recording retinal findings using standard templates should be improved.
NFR-5	**Availability**	Health care affordability, quality, and accessibility Can be amplified using this technology.
NFR-6	**Scalability**	In order to make high-quality systematic diabetic retinopathy screening a universal Offer to all persons with diabetes, it is possible to expand on existing systems and adopt a stepwise approach to enhancing the effectiveness of present techniques.

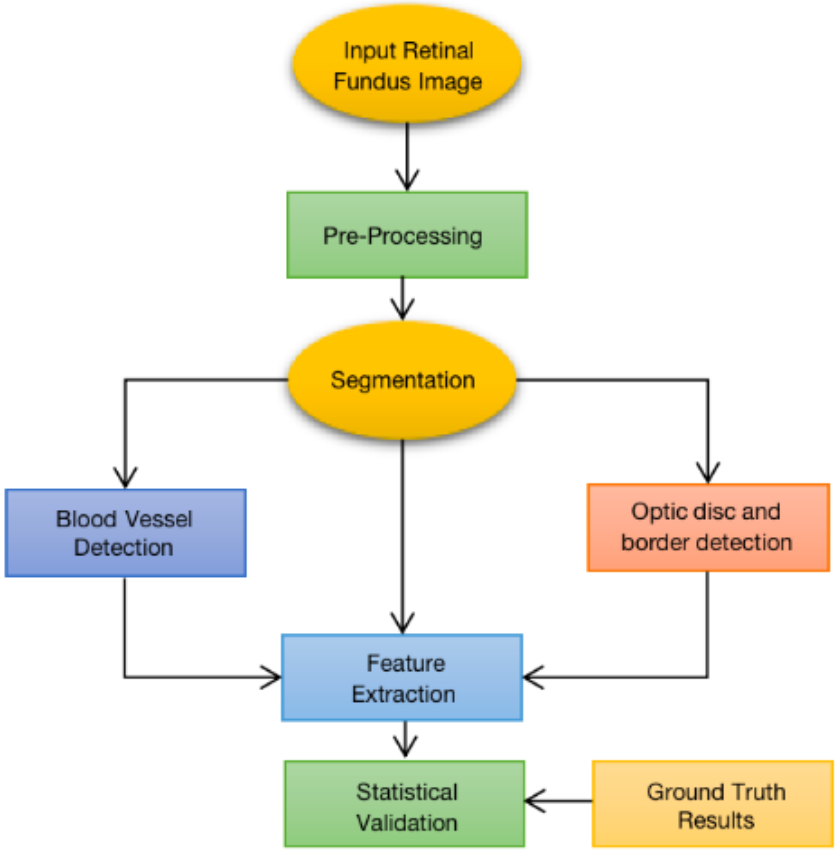
Non Functional requirements include the quality attributes of the model.

1. The model is usable as it precisely classifies images based on 5 stages of Diabetic retinopathy and provides novel results for the same.
2. It provides security as it works best around delicate organs. It is not painful and there's no blood loss involved.

3. It is a reliable model and provides good performance. Availability is good as it makes health care affordable and accessible.
4. Scalability is good as it is possible to build on existing models and take a stepwise approach to improve effectiveness.

CHAPTER 5-PROJECT DESIGN

DATA FLOW DIAGRAM



A Data Flow Diagram is a visual representation of how the information flows within a system.It shows how the data enters and leaves the system, what changes the information, and where data is stored.The main aim of a Data Flow Diagram is to show the scope and boundaries of a system and it can also be used as a communication tool between a system analyst and any person who plays a part in the order that acts as a starting point for redesigning a system. Here it shows how the data enters as input retinal fundus images and is subjected to pre-processing where augmentation is done to make the system more robust by producing transformed images. We

then use pre trained CNN models to detect and identify the severity level of Diabetic retinopathy using the retinal fundus images.

SOLUTION AND TECHNICAL ARCHITECTURE

The main objective is to detect the Diabetic Retinopathy in early stages by processing the Retinal fundus images. We used Transfer Learning techniques like Resnet50, Xception V3 that are more widely used as a transfer learning method in medical image analysis and they are highly effective. Deep Learning, Machine learning, Neural Networks and knowledge in Python will play a significant role in the development of our Project. Since the data we use are Images, the best type of neural network satisfying our goal is Convolutional Neural Networks. Before any classification, pre-processing techniques will be implemented. For this, mentioned techniques has been used to find and bold the intensity of the abnormal areas and pieces for decreasing the effect of outliers. Some of images have abnormal structures. For instance, optic disk and vessels are abnormal, using gray-scaled images reduces its effects. Consequently, better accuracy will be achieved by pre-processed data. After doing pre-processing and normalizing, appropriate features will be extracted for the neural network to be trained on. Over this the deep NN will be trained and results will be evaluated by varying the hyperparameters. A GUI (website) will be developed for the same. The user will be able to give his fundus image as the input, the output will be displayed as the level of severity or the stage of the disease.

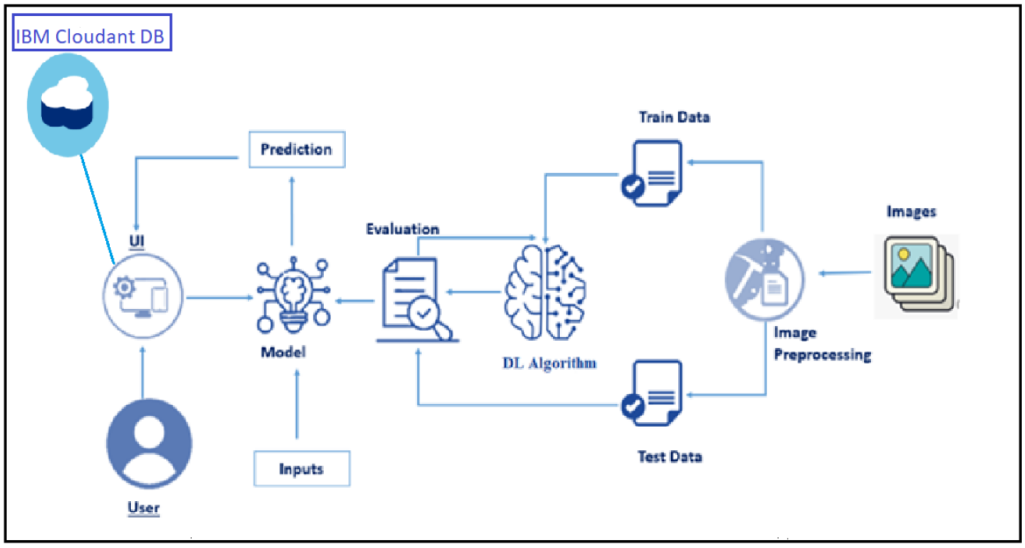


Fig. Solution Architecture

Technical Architecture consists of the technological stack which we are going to use in this project to attain the specific solution.

Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1	User Interface	Web UI	HTML, CSS, Java, Python
2	Application Logic-1	Image processing	Keras, TensorFlow, Numpy
3	Application Logic-2	CNN Model	Keras, TensorFlow, Numpy
4	Application Logic-3	Web UI Application	Flask

5	Database	DR images	Uploads Folder
6	File Storage	File storage requirements	IBM Block Storage or Google drive
7	External API-1	Keras	Image Processing API
8	Machine Learning Model	Inception V3 Architecture	Pretrained CNN
9	Infrastructure (Server)	Application Deployment on web server	Flask-A Python WSGI HTTP Server

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1	**Open-Source Frameworks**	[GM1] [GM2] Flask	Flask frameworks
2	**Security Implementations**	CSRF Protection	Flask-WTF, Session Cookie secure
3	**Scalable Architecture**	Micro-services	Micro Web application framework by Flask

4	**Availability**	Built-in development server and Fast debugger Integrated support for unit testing RESTful request dispatching jinjia2 Templating Unicode based	Werkzeug, jinjia2, Sinatra Ruby framework
5	**Performance**	Web framework, Wsgi 1.0 compliant, Http request handling functionality High flexibility.	SWLAlchemy, Werkzeug, jinjia2, Sinatra Ruby framework

USER STORIES

User Type	Functional Requirement	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Patient (Web user)	Registration	USN-1	As a user, I can register through website via email id or phone number with password.	I can create an account in the web page	High	Sprint-3
	Login into the web-page	USN-2	As a user, I can login to the site by the given Login credentials.	I can login	High	Sprint-3
	Upload Images	USN-3	As a user, I can upload my data in the form of pdf, doc, jpg etc.	I can upload my data	Medium	Sprint-3
Administration (Web developer)	Admin login	USN-4	As an Admin I can login to the site and analyse the user data.	I can login and analyse the user data	High	Sprint-3

	Data collection	USN-5	As an admin, I can collect the data related to the DR from source.	I can collect the data.	Low	Sprint-1
	Create model	USN-6	As an admin, I can create the model and train the model from the data for prediction.	I can create and train the model.	High	Sprint-1
	Test the model	USN-7	As an admin, I can test and validate the model for prediction.	I can test the model.	High	Sprint-2
Patient (Web user)	Diagnosis	USN-8	As a user I can get the diagnosis result on the application and web page	I can get the results and proceed with the treatment.	High	Sprint-2

CHAPTER 6- PROJECT PLANNING & SCHEDULING

SPRINT PLANNING & ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data collection	Task-1	As a developer we need to collect the data	5	Medium	Anjali, Anusha, Bharath
Sprint-1	Data preprocessing	Task-2	We import the required libraries for preprocessing. We instantiate the ImageDataGenerator class to configure and augment different types of image data.	5	Medium	Anusha, Afnan, Anjali
Sprint-2	Feature Extraction	Task-3	Build a CNN Model and only use it as a feature extraction by freezing the convolution blocks.	10	High	Anjali
Sprint-2	Building the layers	Task-4	Adding of dense layers with the aid of Keras. Addition of Optimizer, choosing loss function and the Metrics.	10	High	Anusha, Afnan
Sprint-2	Train, Save,Test	Task-5	To train the model with the	10	High	Anjali, Anusha,

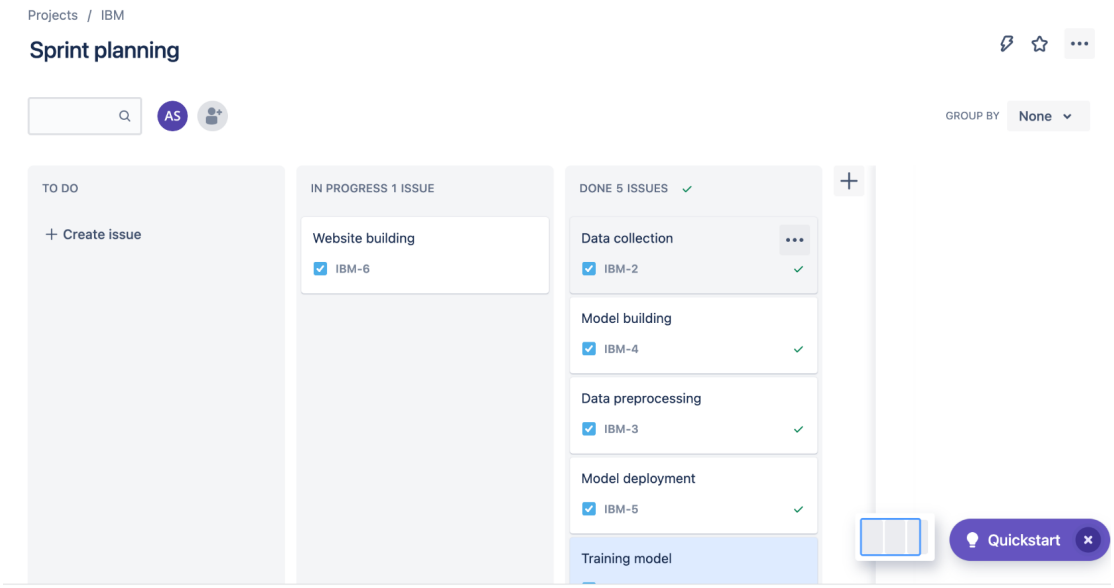
			configured neural network and save the model. Test the built model against the testing dataset.			Afnan, Bharath
Sprint-2	Building Registration Page	USN-1	As a user, they will be able to register for the application.	2	Low	Anusha
Sprint-3	Create Service Instance	Task-6	Configure the location of resources, such as web server, and Cloud Storage for an application	10	High	Afnan
Sprint-3	Configuring credentials and creating DB	Task-7	Define the credentials that are required to access the services offered by IBM Cloudant and add users to access the DB.	10	High	Bharath, Anjali
Sprint-3	Create Tables in DB	Task-8	Structure the required tables with necessary attributes in Cloudant DB.	5	Medium	Afnan
Sprint-3	Building Login Page	USN-2	As a user, they will be able to login using their credentials.	5	Medium	Bharath

Sprint-4	Building Homepage	USN-3	As a user, they will be given a brief description in the homepage.	5	Medium	Bharath
Sprint-4	Train Model On IBM	Task-9	train the model on IBM and integrate it with the flask Application.	10	High	Anjali, Anusha, Afnan, Bharath

SPRINT DELIVERY SCHEDULE

We split our work into four sprints which consisted of 6 days each. In the first sprint, Data Collection and data Pre-Processing was done. In the second sprint, the model was completed and deployment was done. And in the final sprint, the application building was planned to the complete the front end part of our project.

REPORTS FROM JIRA



CHAPTER 7- CODING & SOLUTIONING

Feature 1 (ML Model)

Our dataset consists of Retinal fundus images which are taken from Diabetic Retinopathy patients as well as people who are not diagnosed with Diabetic Retinopathy. For the pre-processing of image, we make use of the ImageDataGenerator function from the keras library (Tensorflow). The dimensions of the images are resized and converted into NumPy arrays to load it into model.

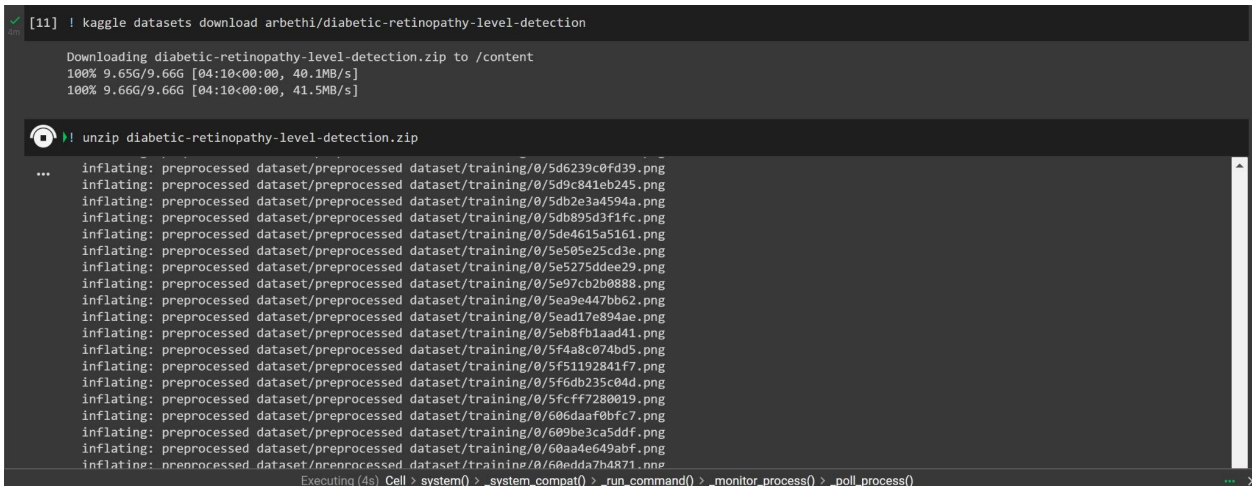


Fig. Data Loading

Dataset was taken from kaggle for Diabetic Retinopathy prediction and the google colaboratory which was used to develop the model was linked to Kaggle. This way the data was downloaded to Google Colab after which the images were pre-processed.

Fig. Pre-processing

After resizing and orienting the images, the images were fed into the deep learning model. The XceptionNet model uses transfer learning with pretrained weights from the imagenet model.

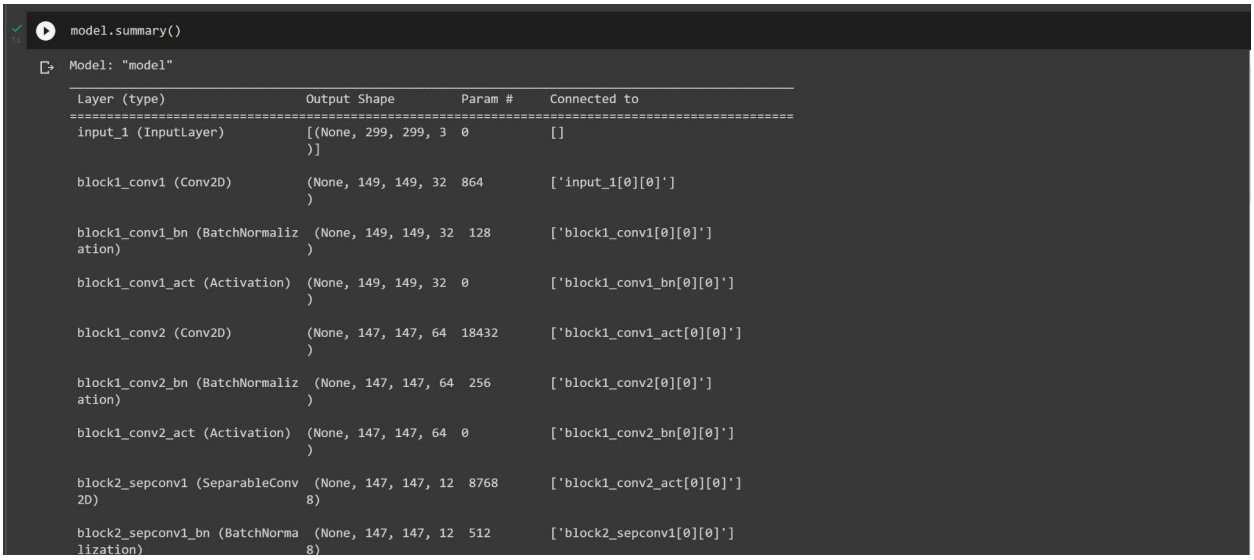


Fig. Deep learning Model (XceptionNet)

Xception is a convolutional neural network that is 71 layers deep. We can load a pretrained version of the network trained on more than a million images from the ImageNet database. The pretrained network can classify images into 1000 object categories, such as keyboard, mouse, pencil, and many animals. Here, we are using the model to classify the different stages of

Diabetic Retinopathy. Loss parameter used was categorical crossentropy, optimizer is Adam while the the accuracy metric was used to calculate the accuracy of the model.

Feature 2 (UI)

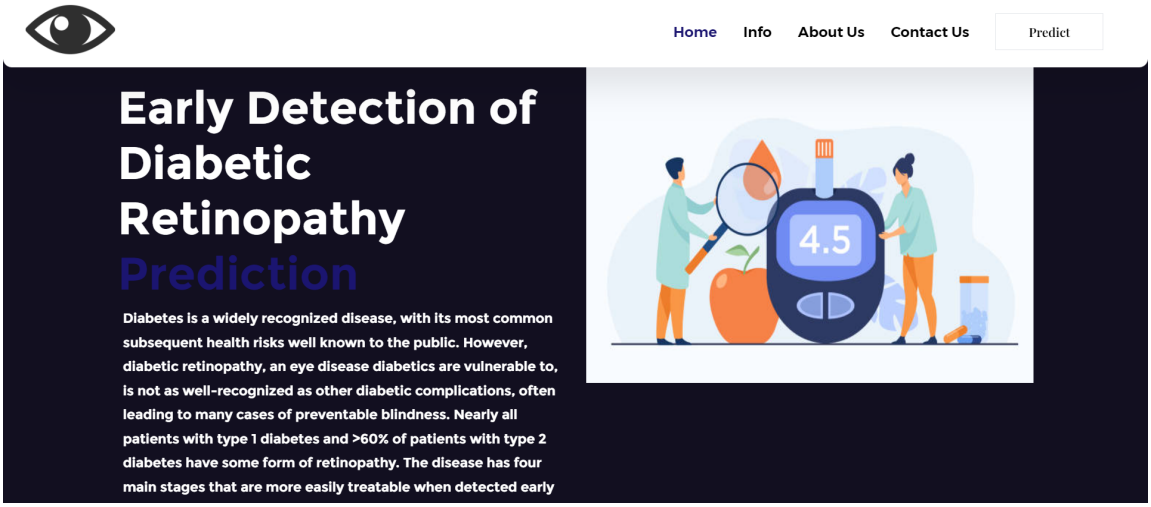


Fig. Home Page

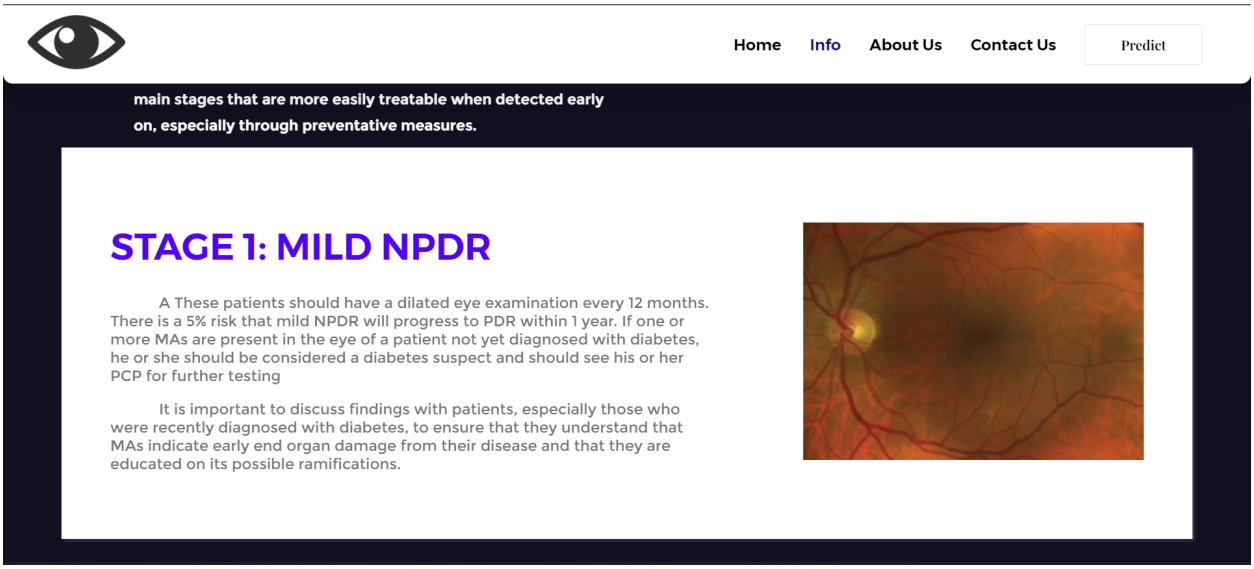


Fig. Info Page

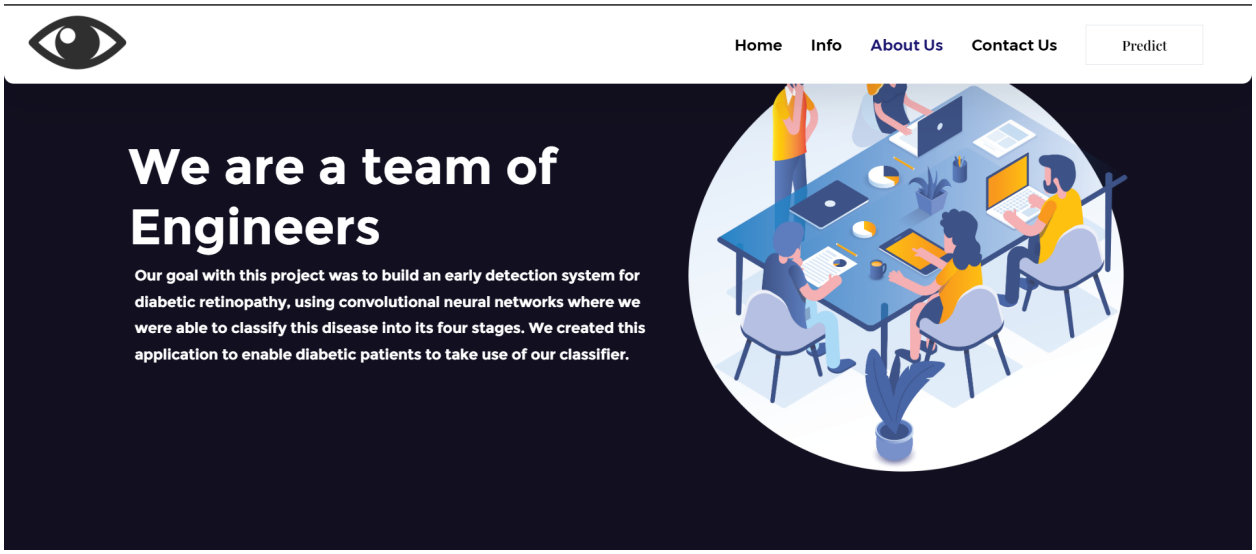


Fig. About us page

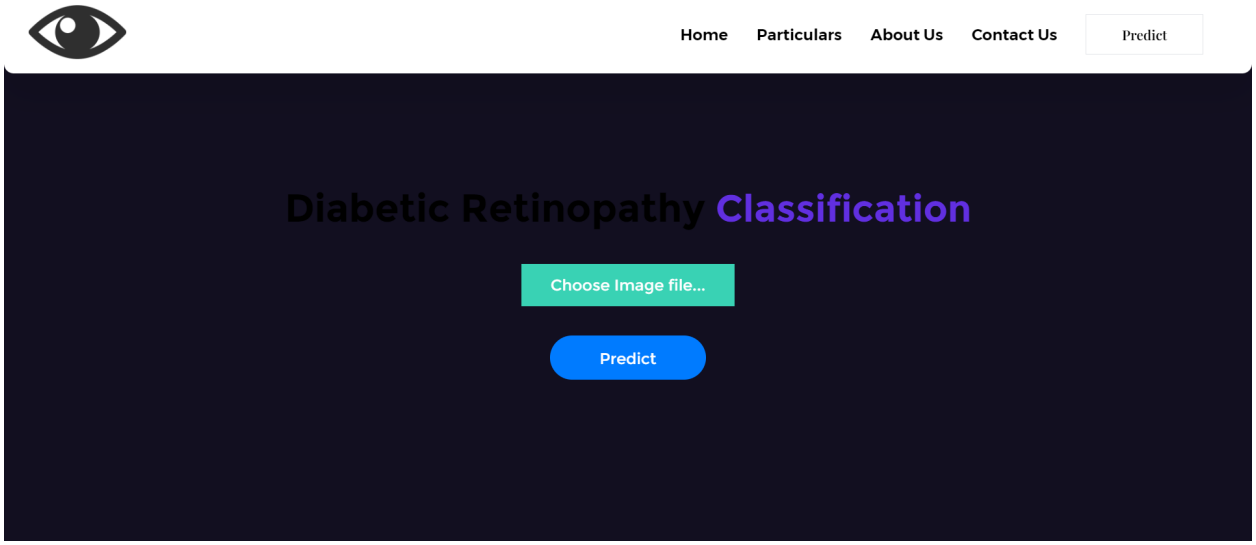


Fig. Prediction Page

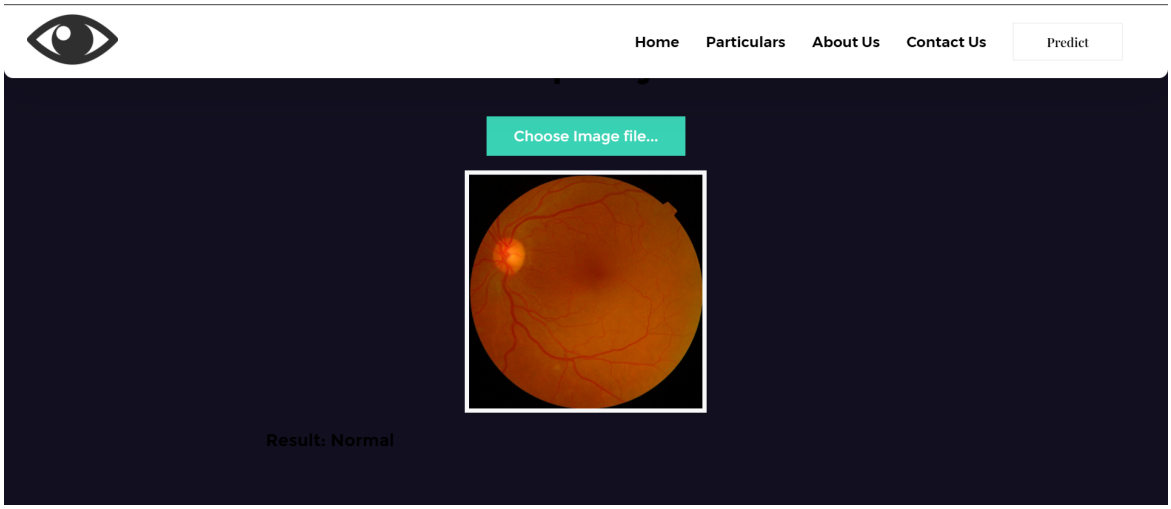


Fig. Predicted Result

CHAPTER 8-TESTING

TEST CASES

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation (Y/N)	BUG ID	Executed By
WelcomePage_TC_OO1	UI	Welcome Page	Verify that all the components of Welcome page are displayed		verify if about, predict and other options are displayed in the navigation bar		Application should display about, info, predict are displayed in the navigation bar	Working as expected	Pass				Anjali
WelcomePage_TC_OO2	Functional	Welcome Page	Verify that the welcome page displays all the necessary details		click on the the welcome page in navigation bar		Application should navigate the user to home page	Working as expected	Pass				Afnan
InfoPage_TC_OO1	UI	Info Page	Verify that all the components of Info page are displayed		1. In the welcome page click on info 2. verify if scroll features are working 3. check if symptoms and causes of the disease are displayed on the Info page		Application should display, about, predict are displayed in the navigation bar. The page should display symptoms and causes of the disease as well.	Working as expected	Pass				Anusha
PredictPage_TC_OO1	UI	Predict Page	Verify that all the components of predict page are displayed		1.In the welcome page click on predict 2. check if below UI Components are present: a.Choose image b.Submit button		Application should display, about, predict are displayed in the navigation bar. The page should have below UI Components: Choose image and Submit button	Working as expected	Pass				Bharath
PredictPage_TC_OO2	Functional	Predict Page	Verify that all the result of the prediction are displayed		1. Choose image 2. Upload the respective image file 3. Click on Submit button	Type: png File: 001639a390f0 .png	Application should display the predicted result by the ML model	Working as expected	Pass				Anjali, Anusha, Afnan, Bharath

USER ACCEPTANCE TESTING

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	0	2	0	0	2
Duplicate	0	0	2	0	2
External	2	1	5	1	9
Fixed	2	3	7	1	13
Not Reproduced	0	0	0	0	0
Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	4	6	14	2	26

3. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Web Application	7	0	0	7
Functional	8	0	0	8
Machine Learning Model	15	0	2	13

CHAPTER 9-RESULTS

We calculate the effectiveness of our model and by calculating the accuracy we get an average accuracy value to be 76.3%. The figure below shows the corresponding measurement metrics and the accuracy number where the parameters are:

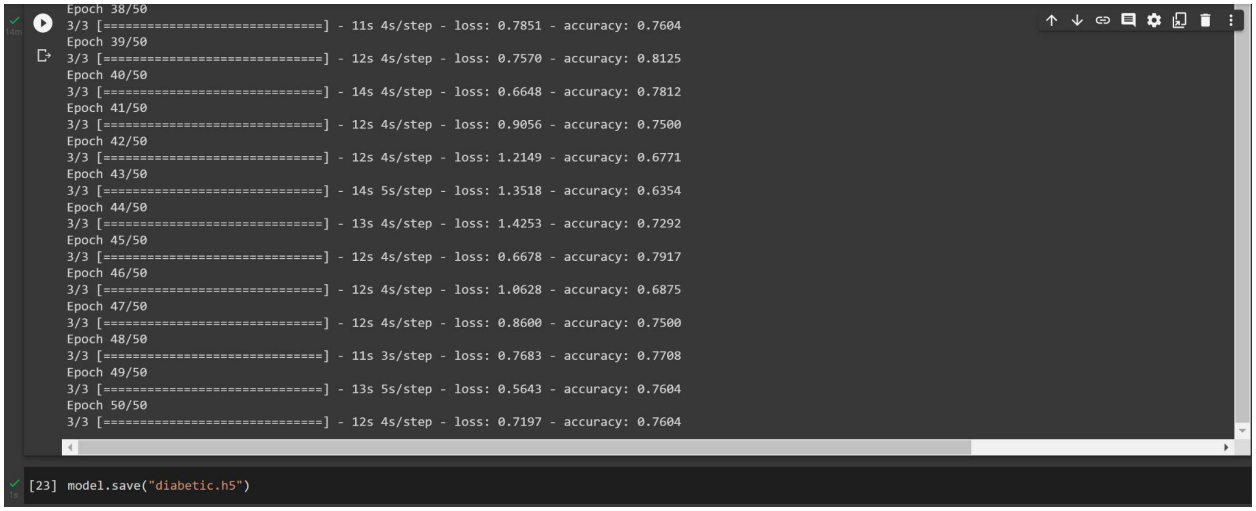


Fig. Accuracy

CHAPTER 10-ADVANTAGES & DISADVANTAGES

ADVANTAGES

- DR is not a reversible process, and treatment only sustains vision.
- DR early detection and treatment can significantly reduce the risk of vision loss.
- The manual diagnosis process of DR retina fundus images by ophthalmologists is time, effort and cost-consuming and prone to misdiagnosis unlike computer-aided diagnosis systems.
- The chances of error are high when diagnosed manually. Deep Learning method for detection of diabetic retinopathy is more accurate.
- Transfer Learning techniques like Inception V3,Resnet50,Xception V3 are used which are highly effective in medical image analysis.

DISADVANTAGES

- There's Lack of trust from patients involved in this system. People have doubts as to why this system should be trusted and how accurate can the diagnosis be.
- Some people still prefer manual diagnosis done by a certified doctor.
- Much research has not been done in this early detection method and it is high time research in this area needs to be explored
- Detection of diabetic retinopathy using this system is not 100% accurate.

CHAPTER 11-CONCLUSION

A common side effect of diabetes mellitus is diabetic retinopathy (DR), which results in lesions on the retina and impairs a person's ability to see. Blindness may result if it is not identified and treated in a timely manner. Treatment can only maintain vision and stop it from getting worse because DR is an irreversible process. The risk of vision loss can be significantly decreased with early detection and treatment of DR. By analyzing retinal fundus images, the primary goal is to identify diabetic retinopathy in its early stages. The main objective is to detect the Diabetic Retinopathy in early stages by processing the Retinal fundus images. We used Transfer Learning techniques like Inception V3, Resnet50, Xception V3 that are more widely used as a transfer learning method in medical image analysis and they are highly effective. Deep Learning, Machine learning, Neural Networks and knowledge in Python will play a significant role in the development of our Project.A GUI (website) will be developed for the same. The user will be able to give his fundus image as the input, the output will be displayed as the level of severity or the stage of the disease.

CHAPTER 12-FUTURE SCOPE

We plan to extend our work not only in the better prediction of the disease by taking into consideration other parameters but also propose treatments corresponding to the severity of the disease which is detected.

Our current work is done on a small scale level but it can be employed in hospitals for real time screening of Diabetic retinopathy which can be done in a more cost effective and a faster way than the traditional method**.**

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Demolink: https://drive.google.com/file/d/1y6SWbtccT_MPRTeIyBLR2Xk6YfUKNCPs/view?usp=share_link