PROJECT DOCUMENTATION

Deep Learning Fundus Image Analysis For Early Detection of Diabetic Retinopathy

Team Id:- PNT2022TMID04178

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Project Report Format

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1. INTRODUCTION:

The main causing of visual loss in the world is diabetic retinopathy. In the initial stages of this disease, the retinal microvasculature is affected by several abnormalities in the eye fundus such as the micro aneurysms and/or dot haemorrhages, vascular hyper permeability signs, exudates, and capillary closures. Micro-aneurysm dynamics primarily increase the risk that the laser photo coagulation requires progression to the level. Diabetic retinopathy lesions are commonly accepted to be reversed and the progression of the retinopathy can only be slower during the early stages of the disease. The identification by repeated examination of patients affected of these initial lesions (mainly Micro aneurysms and small blood cells) is expected as a new possibility of improving retinopathy treatment. Floating and flashes, blurred vision, and loss of sudden vision can be common symptoms of diabetic retinopathy.

1.1 Project Overview:

Diabetic Retinopathy (DR) is a common complication of diabetes mellitus, which causes lesions on the retina that affect vision. If it is not detected early, it can lead to blindness. Unfortunately, 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.

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.

1.2 Purpose:

The Proposed work intends to automate the detection and classification of diabetic retinopathy from retinal fundus image which is very important in the existing methods use handcrafted features and those are fed to the detection and classification purpose. Recently convolutional neural network used for this classification problem but the architecture of CNN is manually this work, a genetic algorithm based technique is proposed to automatically.

The proposed CNN model consists of a series of convolution and pooling layer feature extraction. Finally support vector machine (SVM) is used for classification. Hyper-parameters like number of convolution and pooling layer, number of kernel kernel size of convolution layer are determined by using the genetic algorithm. proposed methodology is tested on publicly available Messidor dataset. The proposed method has achieved accuracy of 0.9867 and AUC of 0.9933. Experimental result that proposed auto-tuned CNN performs significantly better than the existing Use of CNN takes away the burden of designing the image features and on the genetic algorithm based methodology automates the design of CNN hyper-parameters.

2.LITERATURE SURVEY

2.1 Existing Problem:

S.No	Title	Authors	Description	Advantages
1	A deep learning system for detecting diabetic retinopathy across the disease spectrum Published on: 28 sMay 2021	Ling Dei, liang Wu, Chun Cai	To facilitate diabetic screening process, the paper proposes a deep learning model named DeepDR, that can detect early-to-late stages of diabetic retinopathy	Improved Data sources and network design, Performance of the DeepDR system, External validation, Real-time image quality feedback compared other models.
2.	Real Time Analysis of Diabetic Retinopathy Leions by Employing Deep Learning and Machine Learning Algorithms using Color Fundus Data	S. Gupta, A. Panwar, A. Kapruwan, N. Chaube and M. Chauhan.	The color fundus dataset scans after processing are passed to multiple Deep Learning (DL) models employed to learn characteristics.	The extracted result shows very eye-catching performance. This enables experts to create architecture that fully addresses the problem of classifying unidentified scans into the right class or category
3.	Diabetic Retinopathy detection through deep learning techniques: A review Published on: 20 June 2020	Wejdan L. Alyoubi, Wafaa M. Shalash, Maysooon F. Abulkhair	The paper reviews and analyses the recent state-of-the-art methods of DR color fundus images detection and classification using deep learning techniques.	The paper has reviewed 33 research papers on DR color fundus image detection and has provided valuable analysis about different methods used.
4.	Predicting the risk of developing diabetic retinopathy using	Ashish Bora, Siva Balasubramanian, Boris Babenko, Sunny Virmani, SubashiniVenugopalan	The paper aims on creating a deep learning system to predict the risk of patients with	Created and validated two versions of DL systems to predict the development of diabetic retinopathy in patients

	deep learning Published on: 03 September 2019		diabetes developing diabetic retinopathy within 2 years.	with diabetes who had telertinal diabetic retinopathy screening in a primary care setting.
5.	Automated Detection of Diabetic Retinopathy using Deep Learning Published on: 18 May 2018	Carson Lam, Darvin Yi, Margaret Guo, Tony Lindsey	The paper demonstrates the use of convolutional neural networks(CNNs) on color fundus images for the recognition task of diabetic retinopathy staging.	The network model developed here achieved test metric performance comparable to baseline literature results, with validation sensitivity of 95%.

2.2 Reference:

1. Ling Dei, liang Wu, Chun Cai, A deep learning system for detecting diabetic retinopathy across the disease spectrum Published on: 28 May 2021.
2. S. Gupta, A. Panwar, A. Kapruwan, N. Chaube and M. Chauhan, Real Time Analysis of Diabetic Retinopathy Leions by Employing Deep Learning and Machine Learning Algorithms using Color Fundus Data.
3. Wejdan L. Alyoubi, Wafaa M. Shalash, Maysooon F. Abulkhair, Diabetic Retinopathy detection through deep learning techniques: A review Published on: 20 June 2020.
4. Ashish Bora, Siva Balasubramanian, Boris Babenko, Sunny Virmani, SubashiniVenugopalan, Predicting the risk of developing diabetic retinopathy using deep learning Published on: 03 September 2019.
5. Carson Lam, Darvin Yi, Margaret Guo, Tony Lindsey, Automated Detection of Diabetic Retinopathy using Deep Learning Published on: 18 May 2018.

2.3 Problem Statement:

1.The study and analysis of various machine learning techniques that have been deployed such as Fuzzy C-means Clustering ,MLP and ELM, Neural Network, meta-SVM, SVM, NB Classifier, Probabilistic Classifier, Geometric Classifier, KNN Classifier and tree-based classifier , Bayesian Classifier, Mahalanobis classifier , KNN Classifier, Gaussian Bayes Classifier , Genetic Algorithm, AlexNet DNN, Convolutional Neural Network and various other Machine Learning techniques to model systems for early DR detection and classification .

2. Automated detection of lesions in retinal images can assist in early diagnosis and screening of a common disease: Diabetic Retinopathy. A robust and computationally efficient approach for the localization of the different features and lesions in a fundus retinal image is presented in this paper. Since many features have common intensity properties, geometric features and correlations are used to distinguish between them.

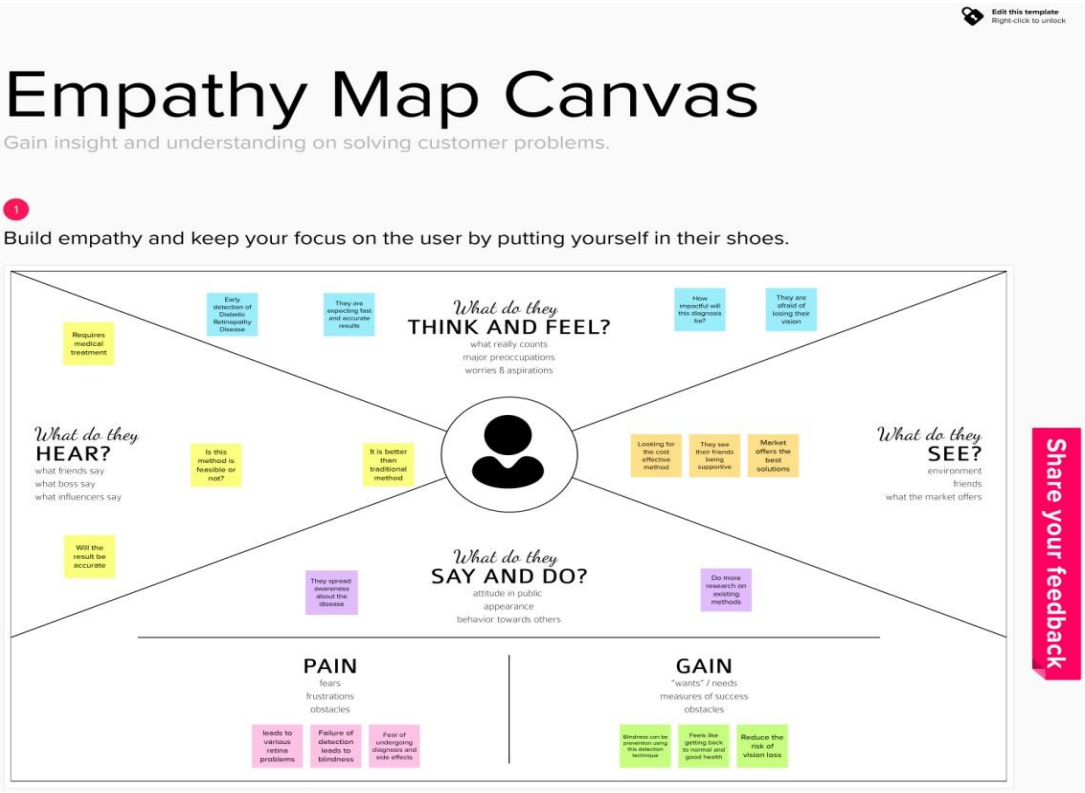
3. A neural network, with CNN architecture, identifies exudates, microaneurysms and hemorrhages in the retina image, by training with labeled samples provided by EyePACS, a free platform for retinopathy detection. The database consists of 35126 high-resolution retinal images taken under a variety of conditions. After training, the network shows a specificity of 93.65% and an accuracy of 83.68% on validation process.

4. The loss function is calculated across all data items during an epoch and guaranteed to give the quantitative loss measure at that epoch. However, plotting the curve over iterations only shows the loss for a subset of the entire dataset as shown.The final results show that the model outperformed with 84 percent validation accuracy.

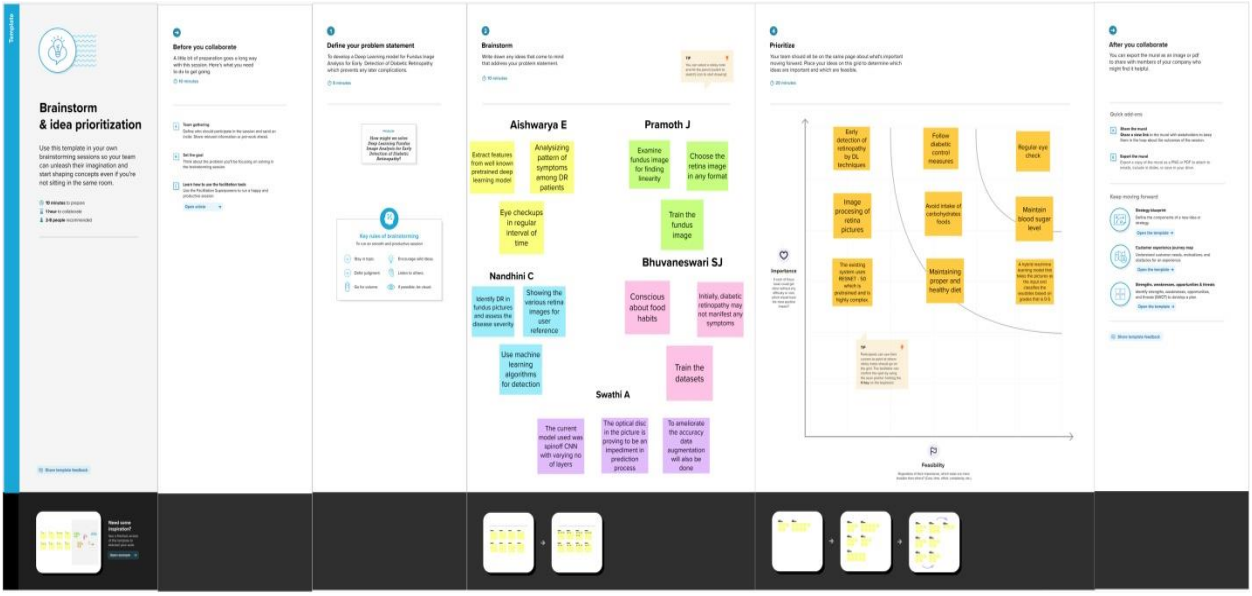
5. The ophthalmic fundus images are used in this automatic process . The preprocessing stage includes few issues such as image blurriness, non- clarity or problems related to image size. In the initial step, the image is resized and then the color space conversion and image restoration steps are performed further. The final stage includes the enhancement of image.

3.IDEATION & PROPOSED SOLUTION

3.1Empathy Map Canvas:



3.2Ideation & Brainstorming:



3.3 Proposed Solution:

AIM :

To write the proposed solution for Deep Learning Fundus Image Analysis for Early Detection of Diabetics Retinopathy.

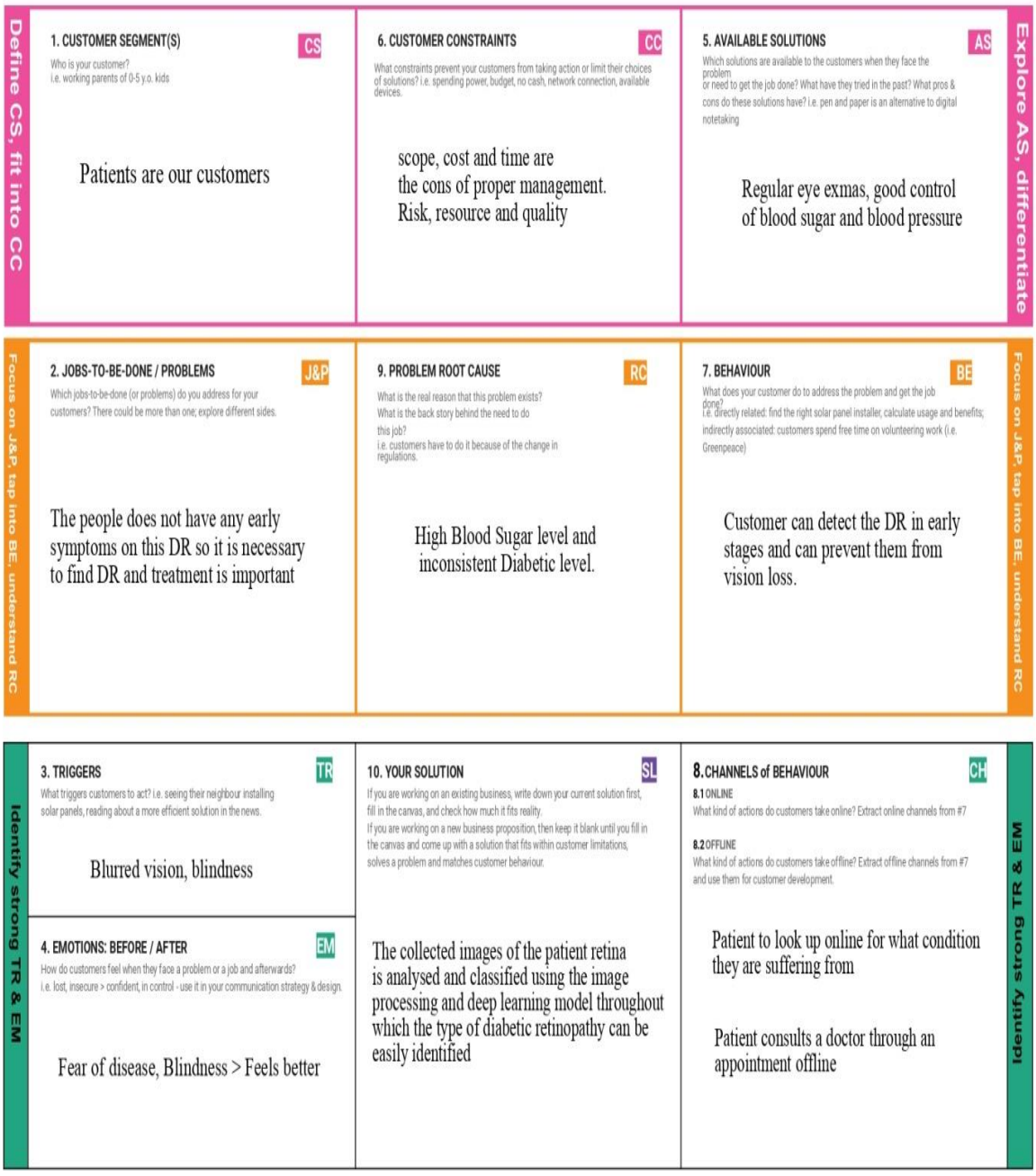
3.3 Proposed Solution :

S. No.	Parameter	Description
1	Problem Statement	Diabetic Retinopathy (DR) is a common complication of diabetes mellitus, DR mutilates the retinal blood vessels of a patient having diabetes. This causes damages to retinal blood vessels which lead to imperfect vision and if it is not detected early stages , it can lead to blindness. The early stage of DR does not have any Symptoms, so it is important to identify microaneurysms and haemorrhages to detect the early stage of DR. Unfortunately, DR is not a reversible process DR early detection and treatment can significantly reduce the risk of vision loss.
2	Idea/Solution description	Existing methods are lacking in the earlier detection. Because preprocessing techniques used in those methods are not effective to analyze such smaller features. We opt to use multi-layer neural networks as deep Neural network. In the fact that data is Image, the best type of neural network that we use to process is Convolutional Neural Networks. First the data preprocessing is done to the images (our dataset) it is highly recommended, For better accuracy to be achieved.

		As we have to do for most of the data, normalization plays an important role in our process. After preprocessing and normalizing, the prepared dataset could be used as input to our deep convolutional neural network. Then deep NN will run and fit our data and then the result will be produced by that. This report will cover steps how this deep convolutional network to be implemented
3	Novelty / Uniqueness	One of the most important decision had to be made is which programming language can be used for satisfying our goal for extracting knowledge from our data. The suitable programming language is Python. Because it has ,a lot of tools and framework to create a strong ANN. IBM Waston is also use to predict the future outcomes, automate complex processes and optimize user's time. The result accuracy can so be increased from the existing codes which are proposed
4	Social Impact / Customer Satisfaction	This may help the Diabetic patient to detect DR in early stages by health camps and in regular interval of checkup with their retinal images.
5	Business Model (Revenue Model)	Can be collaborated with the Diabetics Diagnosis center for regular check up. Government camps and NGO healthcare camps can be conducted for awareness

3.4Problem Solution fit:

Project Title: **Project Design Phase-I - Solution Fit Template** **Team ID:** PNT2022TMIDxxxxxx



4.REQUIREMENT ANALYSIS

4.1 Functional requirement:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement(Epic)	Sub Requirement (Story / Sub-Task)
FR -1	User Registration	The user registration process includes the creation of account through either email id or phone number with new password through the website.
FR - 2	User Login	The existing user can directly login to the web site by giving the Login credentials.
FR - 3	Admin Login	The admin can login to the website where the admin can find the analysis of the predicted data.
FR - 4	Upload Image	The user can upload the retinal image of eye in the dropdown menu from various assets like (drop box, gallery etc.,)
FR - 5	Data collection	Collecting the dataset related to the DR from source to Train the Model.
FR - 6	Creating Model	Creation of the model and Train the model using dataset for prediction.
FR - 7	Test the Model	Test the model for prediction.
FR - 8	Diagnosis	Diagnosis analysis of the application and carry on with the treatments

4.2Non-Functional requirements:

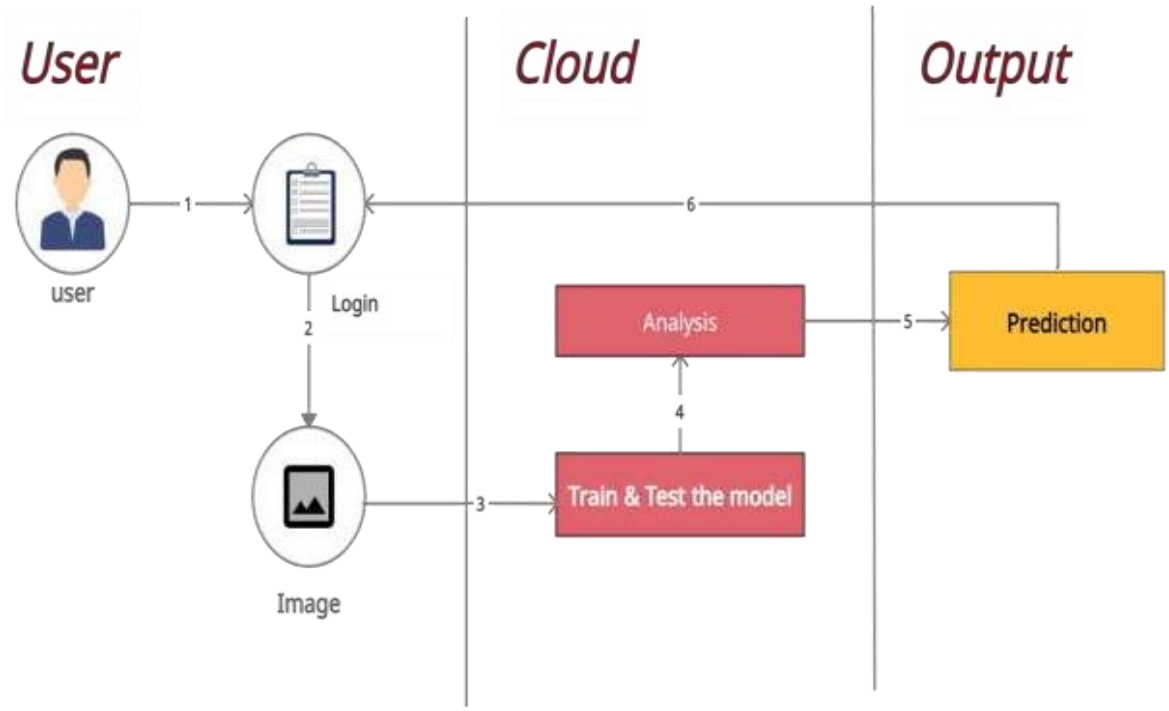
Diagnosis analysis of the application and carry on with the treatments.

NFR No.	Non-Functional Requirement	Description
NFR - 1	Usability	The application can be easily accessible by any type of individuals, the aged individual and affected by DR can also use this tool for Diagnosis.
NFR - 2	Security	Data security is important to store the customer data in the secured manner. The information should not be leaked outside.
NFR - 3	Reliability	Should provide novel results for five different screening and clinical grading systems for diabetic retinopathy including state-of-the-art results for accurately classifying images according to clinicalfivegrade diabetic retinopathy.
NFR - 4	Performance	The ability of Deep Learning is to perform pattern recognition by creating complex relationships based on input data and then comparing it with performance standards is a big step also to diagnosis in short time.
NFR - 5	Availability	Healthcare affordability, standards, and accessibility is made much more easier using this platform and the application will be available to all kinds of users.
NFR - 6	Scalability	The application must hold stable even when multiple users are using it at the same times.

5.PROJECT DESIGN

5.1 Data Flow Diagram:

Simplified Flow :



User:

1) New user register to the website , Existing user Login sitedirectly.
2) The User upload the photo image of Eye Retina.

Cloud:

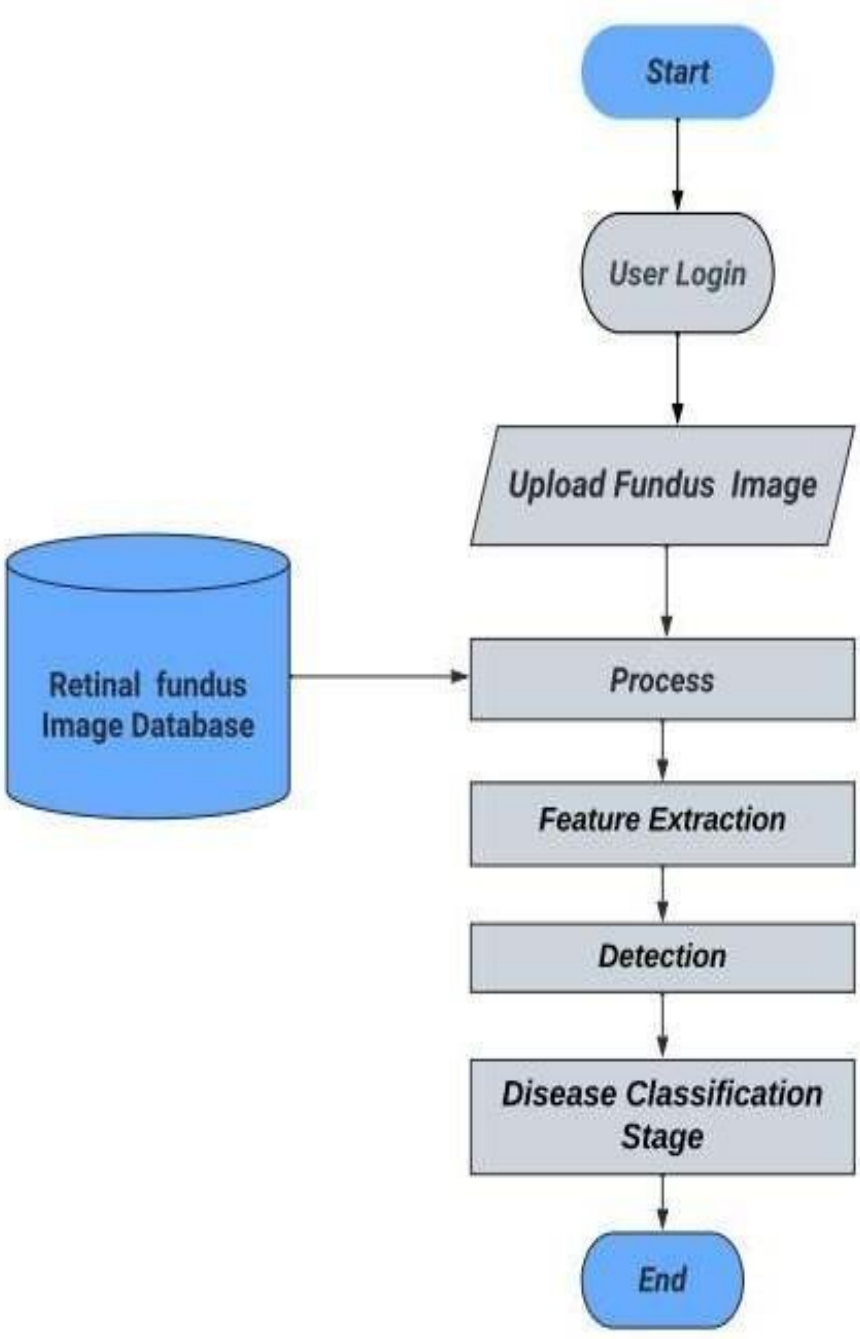
1) Training the Module is done.
2)Analysis is done with the Images.

Output :

1)Prediction is done with the Uploaded images.
2)Output is displayed in User Interface.

5.1.2 DATA FLOW DIAGRAM:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enter and leaves the system, what changes the information, andwhere data is stored.



5.2 . Solution & Technical Architecture

Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

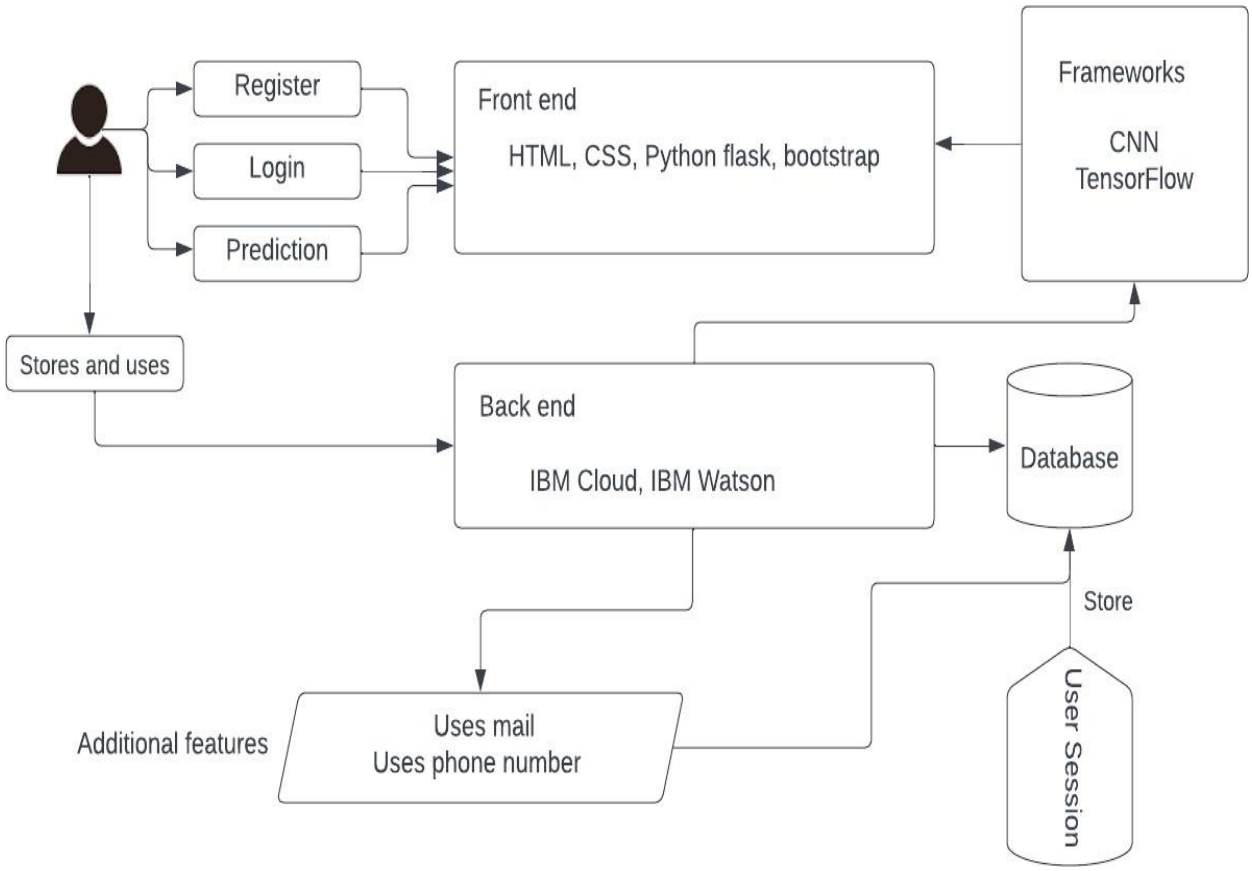


Table-1 : Components & Technologies:

This module concerns about the functional requirements and the important technology that has been used during the development of the app.

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g.Web UI is the main portal of the system	HTML, CSS, Python flask and bootstrap
2.	Register	New user registration is provided	Front end as python flask and back endinvolves cloud
3.	Login	User logs in to the application by their e-mail id andpassword	IBM Cloudant DB
4.	Prediction	Gives the prediction part page that uses the deeplearning	IBM Watson Assistant
5.	Database	Data Type, Configurations	MySQL
6.	Cloud Database	Database Service on Cloud	IBM Cloudant DB from IBM catalog services
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8.	Email Verification	Registered user email verification is required	Email verifier
9.	Phone number	Registered phone number is confirmed by sendinga test message	Phone number message sending.
10.	Image Classification	Analyzing input images	CNN and TensorFlow
11.	Infrastructure (Server / Cloud)	Cloud Server Configuration :	IBM

Table-2: Application Characteristics:

This module concerns about the non-requirement features of the application

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Front end apps
2.	Security Implementations	Email constraint and database	Mail notifications, IBM free trial cloudinstance service
3.	Scalable Architecture	scalability of architecture (3 – tier, Micro-services)is extensible since it is a web oriented with database application	Cloudant DB, front-end apps
4.	Availability	Availability of application (e.g. use of loadbalancers, distributed servers etc.)	Open source platforms provide greatservice
5.	Performance	Session management	User sessions from automatic controller provided by python

5.3 User Stories:

User Type	Functional Requirement(Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Common User	Dashboard	USN-1	As a user, I must be able to upload image of my eyes	I can upload or take image	High	Sprint-1
		USN-2	As a user, I will receive the diagnosis result whether I have retinopathy or not.	I can receive the diagnosis	High	Sprint-1
		USN-3	As a user, I receive the severity of the retinopathy	I can receive the severity of the retinopathy	Medium	Sprint-2
		USN-4	As a user, I can receive the suggested remedy	I can receive the suggested remedy	Medium	Sprint-2

6.PROJECT PLANNING & SCHEDULING

6.1SPRINT PLANNING AND ESTIMATION:

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1		USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	2
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	2
Sprint-2		USN-3	As a user, I can register for the application through mail	2	Low	2
Sprint-3		USN-4	Connecting to database	2	High	2
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	1	High	1
Sprint-4	Dashboard	USN-6	User can see their dashboard	2	Medium	3
Sprint-2	Validation	USN-7	Validates user login id	2	Low	4
Sprint-3	Patient's name and ID	USN-8	Doctor uses this report for seeing patient's activity	1	Medium	3
Sprint-2	Upload Images	USN-9	Prediction part	2	High	2
Sprint-4	Logout	USN-10	Logout from the current user	2	High	1

6.2 SPRINT DELIVERY SCHEDUDE

Project Tracker, Velocity & Burndown Chart:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	16	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	09 Nov 2022	18	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	15	19 Nov 2022

Velocity:

Velocity for Sprint-1 = 20/8 = 2.5

Velocity for Sprint-2 = 20/10 = 2

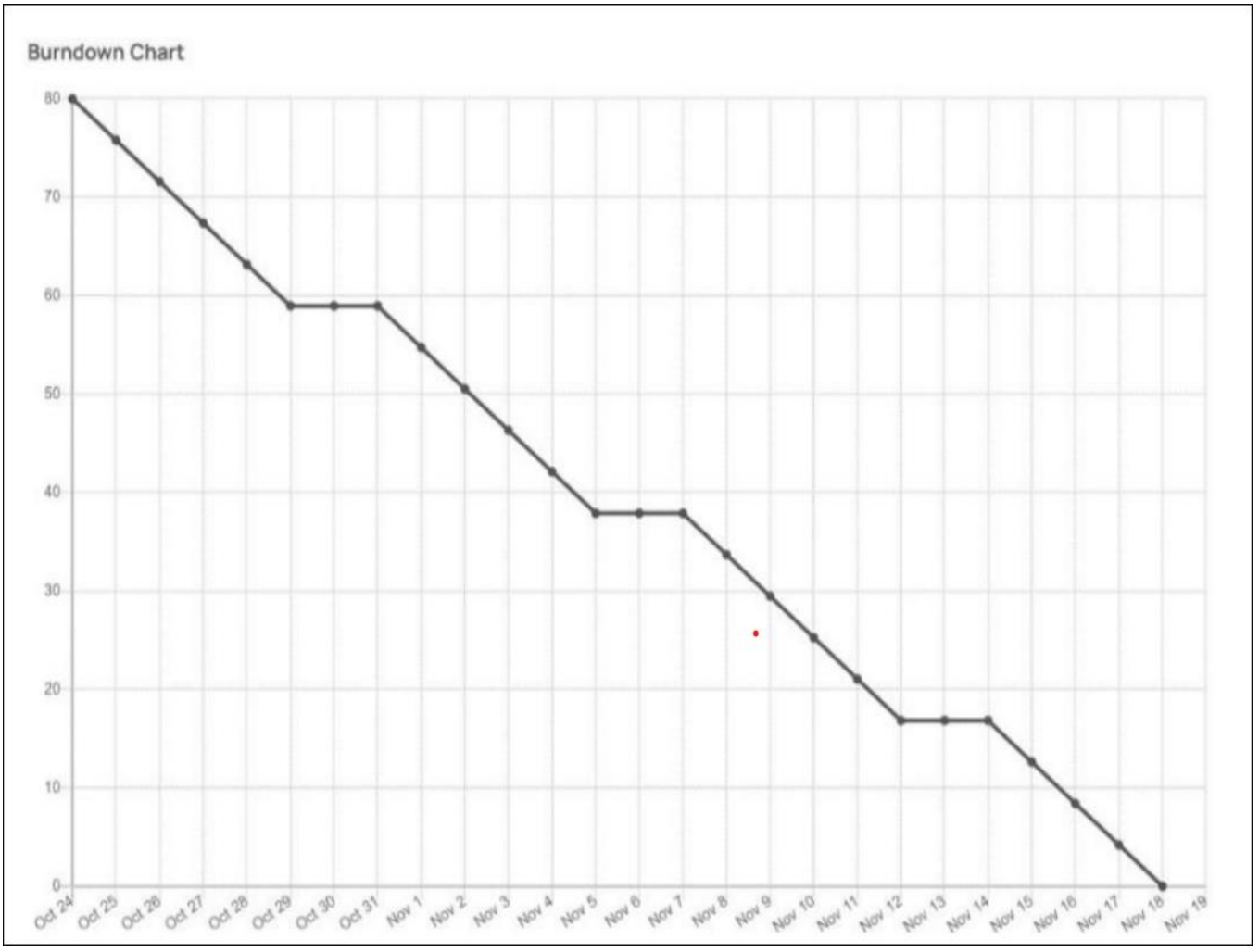
Velocity for Sprint-3 = 20/8 = 2.5

Velocity for Sprint-4 = 20/10 = 2

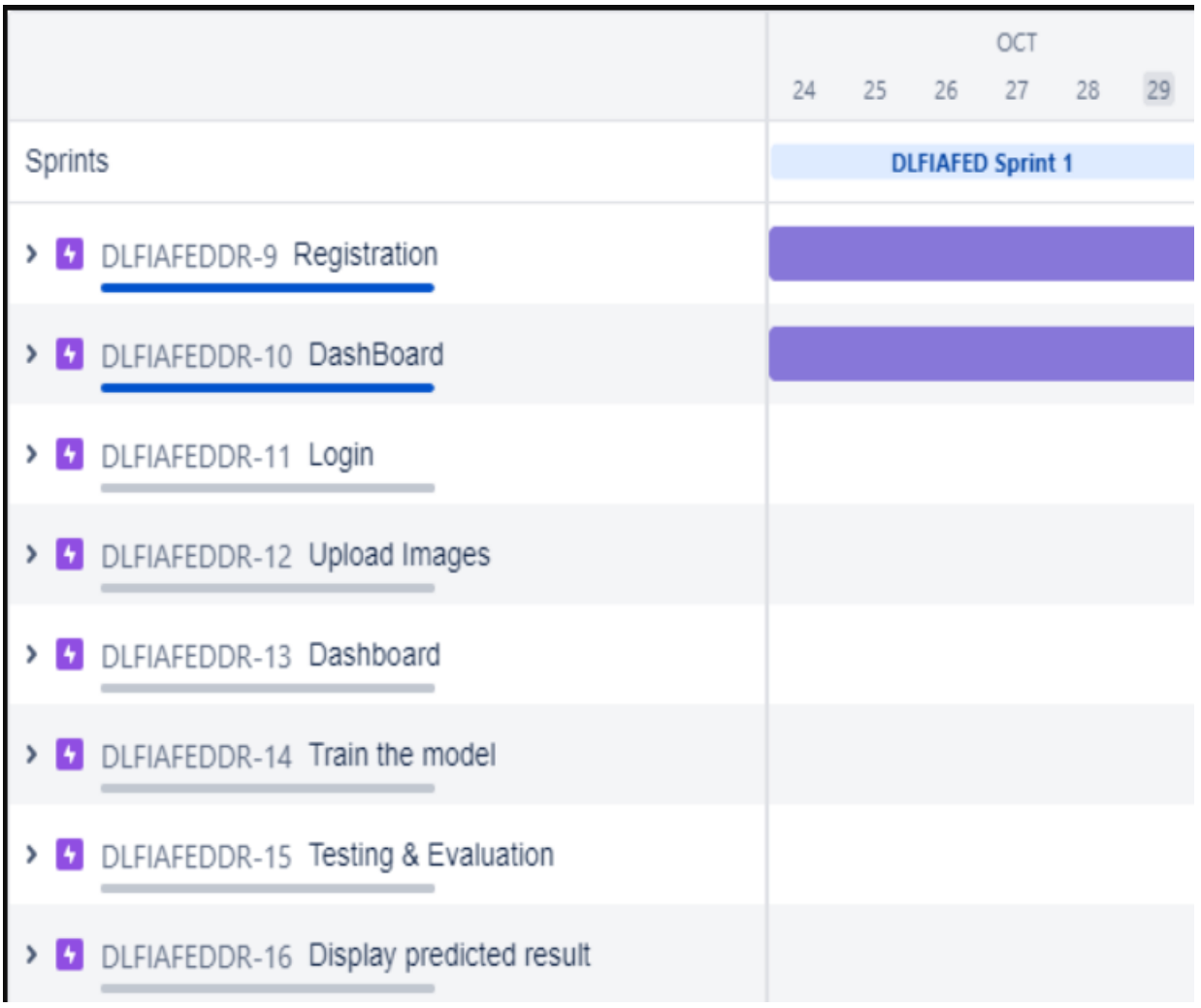
6.3REPORTS FROM JIRA:

BURN DOWN CHART:

A burn down chart plots the amount of work remaining to perform against the amount of time. In agile software development approaches like Scrum, it is frequently employed. Burn down charts, however, can beused for any project that makes observable progress over time.



JIRA screenshots:



JIRA Folder is created to show the Scrum methodologies and Burn Down chart progress.

7. CODING AND SOLUTIONING

7.1FEATURE 1:

We have developed a website which authenticates users and help them upload and check the seriousness of the diabetics.

7.2FEATURE 2:

1) We have developed a multilayer deep convolutional neural network that classifies the user image of a eye to which expense has the disease diabetics has been affected.

2) The model will classify the image into 5 categories of diabetics and report them on asking for prediction. We have also developed a messaging service for receiving for the type of diabetics.

8. TESTING:

8.1. TEST CASES

8.2 USER ACCEPTANCE TESTING

1) Purpose of Document

This document serves as a quick reference for the Deep Learning Fundus Image Analysis for Early Detection of Diabetic Retinopathy project's test coverage and open issues as of the project's release for user acceptance testing.

2) Defect Analysis

This shows how many bugs were fixed or closed at each severity level and how they were fixed.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	1	0	0	0	1
Duplicate	4	1	3	0	8
External	1	3	0	0	4
Fixed	2	4	4	2	12
Not Reproduced	0	0	0	1	1

Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	8	8	4	2	22

3) Test-Case Analysis

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

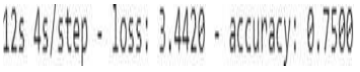
Section	Total Cases	Not Tested	Fail	Pass
Print Engine	5	0	0	5
Client Application	10	0	0	10
Security	2	0	0	2
Out-source Shipping	0	0	0	0
Exception Reporting	2	0	0	2
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9.RESULT

9.1 PERFORMANCE METRICS

MODEL PERFORMANCE TESTING

Project team shall fill the following information in model performance testing template.

S .No	Parameter	Values	Screenshot
1.	Model Summary	Total params: 21,885,485Trainable params: 1,024,005 Non-trainable params:20,861,480	
2.	Accuracy	Training Accuracy **- 0.7500** Validation Accuracy - **loss3.4420.**	
3.	Confidence Score (Only Yolo Projects)	Class Detected - Confidence Score -	----- -

10. ADVANTAGES AND DISADVANTAGES

10.1 ADVANTAGES:

- There are several advantages of using deep learning for fundus image analysis for early detection of diabetic retinopathy.
- First, deep learning is well-suited for image analysis tasks. This is because deep learning algorithms can automatically learn features from images, which is essential for accurate image analysis.
- Second, deep learning is efficient at handling large amounts of data. This is important for medical image analysis, as medical images are often very large.
- Third, deep learning is scalable. This means that it can be used to train models on very large datasets, which is important for medical image analysis tasks where data is often limited.
- Fourth, deep learning is able to learn from data with little supervision. This is important for medical image analysis, as often there is limited labelled data available.
- Finally, deep learning is robust. This means that it is less likely to overfit to the data, which is important for medical image analysis where data is often limited.

10.2 DISADVANTAGES:

- There are several disadvantages of deep learning for early detection of diabetic retinopathy.
- One disadvantage is that deep learning requires a large amount of data to train the models.
- This can be a challenge for researchers who do not have access to a large dataset.
- Another challenge is that deep learning models can be very complex, which can make them difficult to interpret.
- Finally, deep learning models can be computationally intensive, which can make them difficult to deploy in resource-limited settings.

11. CONCLUSION

- Diabetics retinopathy (DR) is a leading cause of blindness in the United States. Early detection and treatment of DR is critical to preventing vision loss. However, DR is often asymptomatic in its early stages making is difficult to defect.

- Deep learning (DL) is a type of artificial intelligence that can be used to automatically detect patterns in data. DL has been shown to be effective for detecting DR in images of the retina.

- In this study, a DL algorithm was used to automatically detect DR in fundus images. The algorithm was able to accurately detect DR in early stages, before it is symptomatic. This could potentially lead to earlier diagnosis and treatment of DR, which could help to prevent vision loss.

12.FUTURE SCOPE:-

- There is a great potential for deep learning in fundus image analysis for early detection of diabetic retinopathy. However, there are a few challenges that need to be addressed. First, the current data sets are small and lack diversity.

- Second, the images are often low quality and need to be pre-processed before they can be used for deep learning. Third, the ground truth labels for the images are often not available. Finally, the current deep learning models are not able to generalize well to real-world data.

LOGIN HTML

```
<!DOCTYPE
html>
            <html lang="en">
              <head>
                <meta charset="UTF-8" />
                <meta http-equiv="X-UA-Compatible" content="IE=edge" />
                <meta name="viewport" content="width=device-width, initial-scale=1.0" />
                <!-- CSS only -->
                <link
                  href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.1/dist/css/bootstrap.min.css"
                  rel="stylesheet"
                  integrity="sha384-iYQeCzEYFbKjA/T2uDLTpkwGzCiq6soy8tYaI1GyVh/UjpbCx/TYkiZhlZB6+fzT"
                  crossorigin="anonymous"
                />
                <!-- JavaScript Bundle with Popper -->
                <script
                  src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.1/dist/js/bootstrap.bundle.min.js"
                  integrity="sha384-u1OknCvxWvY5kfmNBILK2hRnQC3Pr17a+RTT6rIHI7NnikvbZlHgTPOOmMi466C8"
                  crossorigin="anonymous"
                ></script>
                <style>
                    #navbarRight {
                        margin-left: auto;
                        padding-right:10px;

                    }
                    .navbar-brand{
                        padding-left:15px;
                    }
                </style>
                <title>DR Predcition</title>
              </head>
              <form action="",method='POST'>
                <nav class="navbar navbar-expand-lg navbar-light bg-dark">
                    <div>
                    <a class="navbar-brand" href="#" style="color:aliceblue">User Login</a>
                    </div>
                    <div class="navbar-collapse collapse w-100 order-3 dual-collapse2" id="navbarNav">
                      <ul class="navbar-nav mr-auto text-center" id="navbarRight">
                        <li class="nav-item active">
                          <a class="nav-link" href="index.html" style="color: aliceblue;">Home </a>
                        </li>
```

```
            <li class="nav-item">
              <a class="nav-link" href="login.html" style="color: aliceblue;">Login</a>
            </li>
            <li class="nav-item">
              <a class="nav-link" href="register.html"style="color:
aliceblue;">Register</a>
            </li>
          </ul>
        </div>
      </nav>
      <br><br>
      <form class="form-inline" action="/login" method="GET">
      <div class="container" style="width: 600px; height: 600px;">
        <div class="mb-3 d-flex justify-content-center"><script
src="https://cdn.lordicon.com/xdjxvujz.js"></script>
            <lord-icon
                src="https://cdn.lordicon.com/elkhjhci.json"
                trigger="hover"
                style="width:200px;height:200px">
            </lord-icon></div>
            <div class="mb-3">
                <input type="email" class="form-control" id="exampleInputEmail1"
name="mail" aria-describedby="emailHelp" placeholder="Enter Registered Mail ID">
              </div>
              <div class="mb-3">
                <input type="password" class="form-control" id="exampleInputPassword1"
name="pass" placeholder="Enter Password">
              </div>
              <div class="mb-3">
              <button type="submit form-control" class="btn btn-dark btn-primary"
style="width:100%;" type="submit">Login</button>
            </div>

      </div>
    </form>
  </body>
</html>
```

INDEX HTML

```
<!DOCTYPE
html>
            <html lang="en">
              <head>
                <meta charset="UTF-8" />
                <meta http-equiv="X-UA-Compatible" content="IE=edge" />
                <meta name="viewport" content="width=device-width, initial-scale=1.0" />
                <!-- CSS only -->
                <link
                  href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.1/dist/css/bootstrap.min.css"
                  rel="stylesheet"
                  integrity="sha384-iYQeCzEYFbKjA/T2uDLTpkwGzCiq6soy8tYaI1GyVh/UjpbCx/TYkiZhlZB6+fzT"
                  crossorigin="anonymous"
                />
                <!-- JavaScript Bundle with Popper -->
                <script
                  src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.1/dist/js/bootstrap.bundle.min.js"
                  integrity="sha384-u1OknCvxWvY5kfmNBILK2hRnQC3Pr17a+RTT6rIHI7NnikvbZlHgTPOOmMi466C8"
                  crossorigin="anonymous"
                ></script>
                <style>
                    #navbarRight {
                        margin-left: auto;
                        padding-right:10px;
                    }
                    .navbar-brand{
                        padding-left:15px;
                    }
                </style>
                <title>DR Predcition</title>
              </head>
              <body>
                <nav class="navbar navbar-expand-lg navbar-light bg-dark">
                    <div>
                    <a class="navbar-brand" href="#" style="color:aliceblue">Diabetic Retinopathy
            Classification</a>
                    </div>
                    {{msg}}
                    <div class="navbar-collapse collapse w-100 order-3 dual-collapse2" id="navbarNav">
                      <ul class="navbar-nav mr-auto text-center" id="navbarRight">
```

```
            <li class="nav-item active">
              <a class="nav-link" href="index.html" style="color: aliceblue;">Home </a>
            </li>
            <li class="nav-item" style="visibility:{{ vis2 }}">
              <a class="nav-link" href="prediction.html" style="color:
aliceblue;">Prediction</a>
            </li>
            <li class="nav-item">
              <a class="nav-link" href="login.html" style="color: aliceblue;">Login</a>
            </li>
            <li class="nav-item" style="visibility:{{ vis }}">
              <a class="nav-link" href="register.html" style="color:
aliceblue;">Register</a>
            </li>
          </ul>
        </div>
      </nav>
      <br><br>
        <div class="jumbotron container">
          <h1 class="display-4">Diabetic Retinopathy</h1>
          <p class="lead">Diabetic retinopathy is a diabetes complication that affects
eyes. It's caused by damage to the blood vessels of the light-sensitive tissue at the back
of the eye (retina).
            At first, diabetic retinopathy might cause no symptoms or only mild vision
problems. But it can lead to blindness.
            The condition can develop in anyone who has type 1 or type 2 diabetes. The
longer you have diabetes and the less controlled your blood sugar is, the more likely you
are to develop this eye complication.</p>
          <hr class="my-4">
          <div class="d-flex justify-content-center">
            <img style="width:70vw;" src="C:\Users\Swathi A\Documents\IBM-Project-18403-
1659684750\Final Deliverables\static\diabetic-retinopathy-home.jpg">
            </div>
        </div>
  </body>
</html>
```

REGISTER HTML

```
<!--
<!DOCTYP
E html>
            <html lang="en">
              <head>
                <meta charset="UTF-8" />
                <meta http-equiv="X-UA-Compatible" content="IE=edge" />
                <meta name="viewport" content="width=device-width, initial-scale=1.0" />
                <!-- CSS only -->
                <link

            href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.1/dist/css/bootstrap.min.css"
                  rel="stylesheet"
                  integrity="sha384-
            iYQeCzEYFbKjA/T2uDLTpkwGzCiq6soy8tYaI1GyVh/UjpbCx/TYkiZhlZB6+fzT"
                  crossorigin="anonymous"
                />
                <!-- JavaScript Bundle with Popper -->
                <script

            src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.1/dist/js/bootstrap.bundle.min.
            js"
                  integrity="sha384-
            u1OknCvxWvY5kfmNBILK2hRnQC3Pr17a+RTT6rIHI7NnikvbZlHgTPOOmMi466C8"
                  crossorigin="anonymous"
                ></script>
                <style>
                    #navbarRight {
                        margin-left: auto;
                        padding-right:10px;

                    }
                    .navbar-brand{
                        padding-left:15px;
                    }
                </style>
                <title>DR Predcition</title>
              </head>
              <form action="{{url_for('register')}}" method="post" >
                <nav class="navbar navbar-expand-lg navbar-light bg-dark">
```

```
        <div>
        <a class="navbar-brand" href="#"
style="color:aliceblue">Registration</a>
        </div>
        <div class="navbar-collapse collapse w-100 order-3 dual-collapse2"
id="navbarNav">
          <ul class="navbar-nav mr-auto text-center" id="navbarRight">
            <li class="nav-item active">
              <a class="nav-link" href="index.html" style="color:
aliceblue;">Home </a>
            </li>
            <li class="nav-item">
              <a class="nav-link" href="login.html" style="color:
aliceblue;">Login</a>
            </li>
            <li class="nav-item">
              <a class="nav-link" href="register.html"style="color:
aliceblue;">Register</a>
            </li>
          </ul>
        </div>
      </nav>
      <br><br>
      <form class="form-inline" method ="POST">
      <div class="container" style="width: 600px; height: 600px;">
        <div class="mb-3 d-flex justify-content-center"><script
src="https://cdn.lordicon.com/xdjxvujz.js"></script>
            <lord-icon
                src="https://cdn.lordicon.com/elkhjhci.json"
                trigger="hover"
                style="width:200px;height:200px">
            </lord-icon></div>
                      <div class="mb-3">
                <input type="text" class="form-control" id="exampleInputName"
name = "name" aria-describedby="nameHelp" placeholder="Enter Name">
              </div>
              <div class="mb-3">
                <input type="email" class="form-control"
id="exampleInputEmail1" name="emailid" aria-describedby="emailHelp"
placeholder="Enter Mail ID">
              </div>
              <div class="mb-3">
```

```
                <input type="number" class="form-control"
id="exampleInputNumber1" name="num" aria-describedby="numberHelp"
placeholder="Enter Mobile number">
              </div>
              <div class="mb-3">
                <input type="password" class="form-control"
id="exampleInputPassword1" name="pass" placeholder="Enter Password">
              </div>
              <div class="mb-3">
              <button type="submit form-control" class="btn btn-dark btn-
primary" style="width:100%;">Register</button>
            </div>
                      <div class="mb-3 d-flex justify-content-center">
                      <a href="login.html" class="nav-link"> Already
Registered: Login Here</a>
      </div>

      </div>
    </form>
  </body>
</html> -->
```

PREDICTION HTML

```
<!DOCTYP
E html>
            <html lang="en">

            <head>
              <meta charset="UTF-8" />
              <meta http-equiv="X-UA-Compatible" content="IE=edge" />
              <meta name="viewport" content="width=device-width, initial-scale=1.0" />
              <!-- CSS only -->
              <link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.1/dist/css/bootstrap.min.css"
rel="stylesheet"
```

```
    integrity="sha384-
iYQeCzEYFbKjA/T2uDLTpkwGzCiq6soy8tYaI1GyVh/UjpbCx/TYkiZhlZB6+fzT"
crossorigin="anonymous" />
  <!-- JavaScript Bundle with Popper -->
  <script
src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.1/dist/js/bootstrap.bundle.min.
js"
    integrity="sha384-
u1OknCvxWvY5kfmNBILK2hRnQC3Pr17a+RTT6rIHI7NnikvbZlHgTPOOmMi466C8"
    crossorigin="anonymous"></script>
  <style>
    #navbarRight {
      margin-left: auto;
      padding-right: 10px;
    }

    .navbar-brand {
      padding-left: 15px;
    }

    .row {
      width: 90%;
    }
  </style>
  <title>DR Predcition</title>
</head>

<body>
  <nav class="navbar navbar-expand-lg navbar-light bg-dark">
    <div>
      <a class="navbar-brand" href="#" style="color:aliceblue">Diabetic
Retinopathy Classification</a>
    </div>
    <div class="navbar-collapse collapse w-100 order-3 dual-collapse2"
id="navbarNav">
      <ul class="navbar-nav mr-auto text-center" id="navbarRight">
        <li class="nav-item active">
          <a class="nav-link" href="index.html" style="color: aliceblue;">Home
</a>
        </li>
        <li class="nav-item">
          <a class="nav-link" href="logout.html" style="color:
aliceblue;">Logout</a>
```

```
          </li>
        </ul>
      </div>
    </nav>
    <br><br>
    <div class="container justify-content-center" style="width:700px">
      <form action = "/app.py" method = "POST" enctype="multipart/form-data">
      <label for="formFileLg" class="form-label">Upload Image</label>
      <input class="form-control form-control-lg" name ="file" type="file" />
      <br>
      <button class="btn btn-lg btn-dark" type = "submit">Predict</button>
      </form>
      <br>
      <h1>{{prediction}}</h1>
    </div>
    <br><br><br>
    <div class="d-flex justify-content-center" >
        <img src="static\level.png" style="width: 90%">
    </div>
  </body>
  </html>
```

LOGOUT HTML

```
<!DOCTYP
E html>
            <html lang="en">
              <head>
                <meta charset="UTF-8" />
                <meta http-equiv="X-UA-Compatible" content="IE=edge" />
                <meta name="viewport" content="width=device-width, initial-scale=1.0" />
                <!-- CSS only -->
                <link

            href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.1/dist/css/bootstrap.min.css"
                  rel="stylesheet"
                  integrity="sha384-
            iYQeCzEYFbKjA/T2uDLTpkwGzCiq6soy8tYaI1GyVh/UjpbCx/TYkiZhlZB6+fzT"
                  crossorigin="anonymous"
                />
```

```
    <!-- JavaScript Bundle with Popper -->
    <script

src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.1/dist/js/bootstrap.bundle.min.
js"
      integrity="sha384-
u1OknCvxWvY5kfmNBILK2hRnQC3Pr17a+RTT6rIHI7NnikvbZlHgTPOOmMi466C8"
      crossorigin="anonymous"
    ></script>
    <style>
        #navbarRight {
            margin-left: auto;
            padding-right:10px;
        }
        .navbar-brand{
            padding-left:15px;
        }
    </style>
    <title>DR Predcition</title>
  </head>
  <body>
    <nav class="navbar navbar-expand-lg navbar-light bg-dark">
        <div>
        <a class="navbar-brand" href="#" style="color:aliceblue">Diabetic
Retinopathy</a>
        </div>
        <div class="navbar-collapse collapse w-100 order-3 dual-collapse2"
id="navbarNav">
          <ul class="navbar-nav mr-auto text-center" id="navbarRight">
            <li class="nav-item active">
              <a class="nav-link" href="index.html" style="color:
aliceblue;">Home </a>
            </li>
            <li class="nav-item">
              <a class="nav-link" href="login.html" style="color:
aliceblue;">Login</a>
            </li>
            <li class="nav-item">
              <a class="nav-link" href="register.html"color:
aliceblue;">Register</a>
            </li>
          </ul>
        </div>
```

```
      </nav>
      <br><br>
      <div class="d-flex justify-content-center">
        <div class="row d-flex display-3 justify-content-center">
            Successfully Logged Out!
            <br><br>
            <a href="login.html" class="btn btn-lg btn-dark">Login for more
Information</a>
              </div>
        </div>
  </body>
</html>
```