

CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

Liver diseases avert the normal function of the liver. Mainly due to the large amount of alcohol consumption liver disease arises. Early prediction of liver disease using classification algorithms is an efficacious task that can help the doctors to diagnose the disease within a short duration of time. Discovering the existence of liver disease at an early stage is a complex task for the doctors. The main objective of this project is to analyze the parameters of various classification algorithms and compare their predictive accuracies so as to find out the best classifier for determining the liver disease. This Project examines data from liver patients concentrating on relationships between a key list of liver enzymes, proteins, age and gender using them to try and predict the likeliness of liver disease. Here we are building a model by applying various machine learning algorithms find the best accurate model. And integrate to flask based web application. User can predict the disease by entering parameters in the web application.

1.2 PURPOSE

Current screening strategies for liver disease focus on detection of subclinical advanced liver fibrosis but cannot identify those at high future risk of severe liver disease. Our aim was to develop and validate a risk prediction model for incident liver disease in the general population based on widely available factors. The diagnosis is often delayed until severe complications occur and prognosis becomes poor. In order to identify individuals in the general population who have a high risk of developing severe liver disease in the future, we developed and validated a Liver Disease risk prediction with or without measurement of the liver enzyme gamma-glutamyltransferase. The Liver Disease score can be used as part of health counseling, and for planning further liver investigations and follow-up.

CHAPTER 2

LITERATURE SURVEY

2.1 EXISTING PROBLEMS

S.No.	YEAR	AUTHOR NAME	TITLE	ALGORITHM	DRAWBACKS
1	2009	P.Karule, Dr. Sanjay Vasant Dudul	Intelligent Diagnosis of Liver Diseases from Ultrasonic Liver Images: Neural Network Approach	MLPNN classifier	In the early stages, HV tends to be asymptomatic and can be detected only through screening.
2	2010	G.Sakr, I.Elhadj, H. Huijer	Support Vector Machines to Define and Detect Agitation Translation	Support Vector Machine Classifier	Unlike generative machine learning approaches, which require computations of conditional probability distributions
3	2012	H. Al-Angari, A. Sahakian	Automated Recognition of Obstructive Sleep Apnea Syndrome Using Support Vector Machine Classifier.	Support Vector Machine (SVM) Classifier	The features can be incorporated into automatic algorithms for portable OSA monitoring using the available respiratory and oxygen saturation devices.
4	2021	Adekola Olubukola Daniel, Ekanem Edikan Uwem	Prediction Diagnosis of Liver Disease in Human of using Machine Learning	Neural network	The need to develop a tool that could aid doctors and prevent from unwarranted errors and unwanted biases in diagnosis is established in this research.
5	2021	Sana Ansari, I. Shafi, J.Ahmad, Syed Ismail Shah	Neural network-based approach for the non-invasive diagnosis and classification of hepatotropic viral disease, December 2021	Neural network	The respiratory and magnitude features showed sensitivity in the apnea minute classification compared to the other features.

Table 2.1 - Existing Problems

2.2 REFERENCES

1. P.Karule, Dr. Sanjay Vasant Dudul, "Intelligent Diagnosis of Liver Diseases from Ultrasonic Liver Images: Neural Network Approach", July 2009.
2. G.Sakr, I.Elhadj, H. Huijer, "Support vector machine to define and detect Agitation Translation", February 2010.
3. H. Al-Angari, A. Sahakian, "Automated Recognition of Obstructive SleepApnea Syndrome Using Support Vector Machine Classifier", May 2012.
4. Adekola Olubukola Daniel, Ekanem Edikan Uwem, "Prediction and Diagnosis of Liver Disease in Human Using Machine Learning", August 2021.
5. Sana Ansari, I. Shafi, J.Ahmad, Syed Ismail Shah, "Neural network-based approach for the non-invasive diagnosis and classification of hepatotropic viral disease", December 2021.

2.3 PROBLEM STATEMENT DEFINITION

Liver diseases avert the normal function of the liver. Mainly due to the large amount of alcohol consumption liver disease arises. Early prediction of liver disease using classification algorithms is an efficacious task that can help the doctors to diagnose the disease within a short duration of time. Discovering the existence of liver disease at an early stage is a complex task for the doctors. The main objective of this project is to analyse the parameters of various classification algorithms and compare their predictive accuracies so as to find out the best classifier for determining the liver disease. This Project examines data from liver patients concentrating on relationships between a key list of liver enzymes, proteins, age and gender using them to try and predict the likeliness of liver disease. Here we are building a model by applying various machine learning algorithms find the best accurate model and integrate to flask based web application.

I am	The person to predict the liver disease using Machine Learning techniques
I'm trying to	Use the recent technologies to predict the human liver disease.
But	I am unaware of the existing technology that can help me a lot to predict the disease and I don't know to use the correct technology.
Because	I don't want to waste the cost and time.
Which makes me feel	I want a best accuracy which can predict the disease so that the people can move with their necessary treatments.

Table 2.2 - Problem Statement Definition

CHAPTER 3

IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

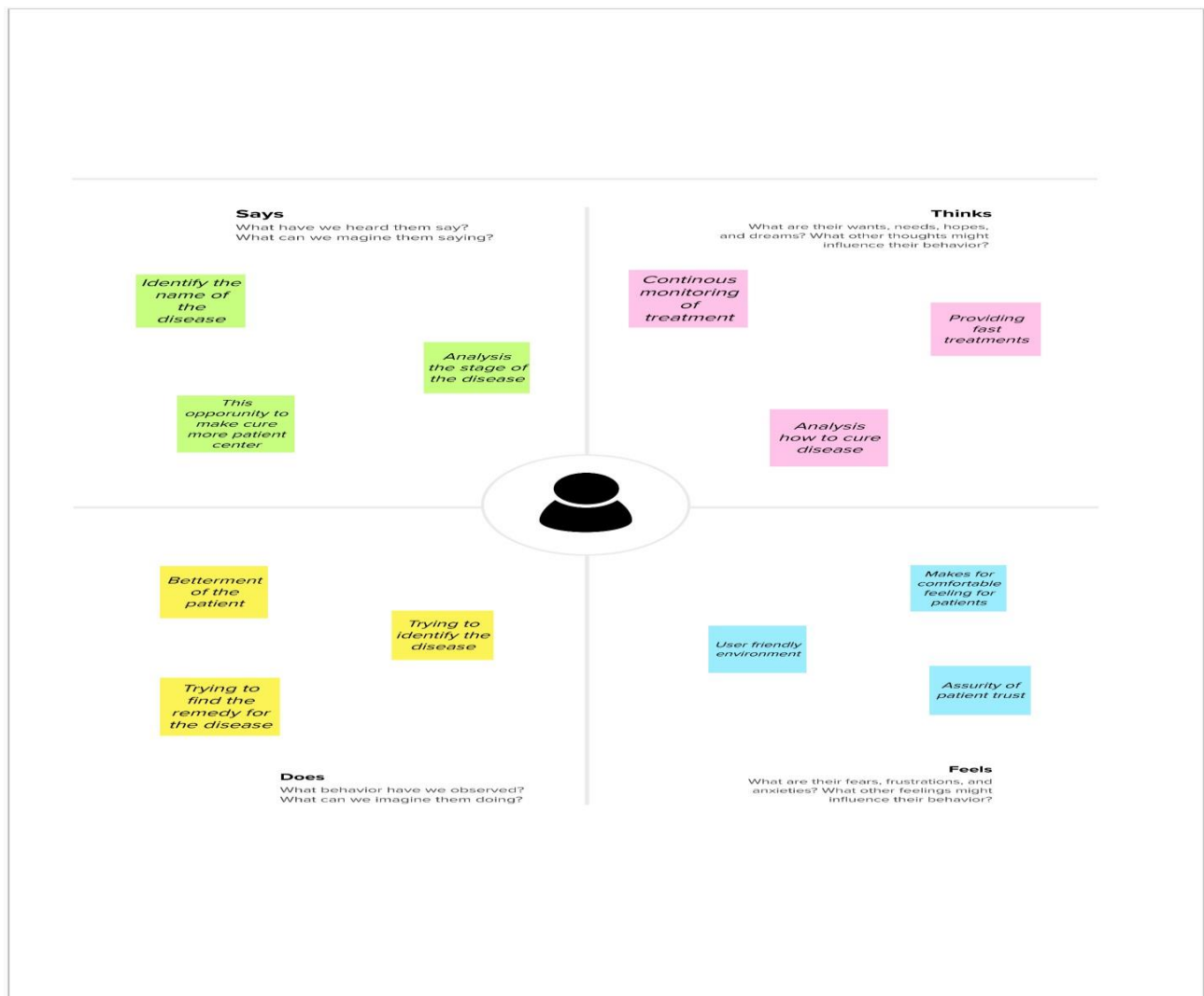



Figure 3.1 - Empathy Map

An empathy map is a widely-used visualization tool within the field. In relation to **empathetic** design, the primary purpose of an empathy map is to bridge the understanding of the end user.

3.2 IDEATION AND

BRAINSTORMING Step-1:



Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

- 🕒 10 minutes to prepare
- 🕒 1 hour to collaborate
- 👥 2-8 people recommended

➔

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

🕒 10 minutes

A Team gathering
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

B Set the goal
Think about the problem you'll be focusing on solving in the brainstorming session.

C Learn how to use the facilitation tools
Use the Facilitation Superpowers to run a happy and productive session.

[Open article](#) ➔


1

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

🕒 5 minutes

PROBLEM
How might we [your problem statement]?



Key rules of brainstorming

To run an smooth and productive session

🕒 Stay in topic.	💡 Encourage wild ideas.
🕒 Defer judgment.	👂 Listen to others.
🗣️ Go for volume.	👁️ If possible, be visual.

Figure 3.2 - Ideation and Brainstorming

A principal difference between ideation and brainstorming is that ideation is commonly more thought of as being an individual pursuit, while brainstorming is almost always a group activity.

Step 2:

2
Brainstorm

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

10 minutes

TIP
You can select a sticky note and hold it up next to others to quickly compare ideas.

3
Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

20 minutes

TIP
After clustering, take time to identify which ideas are most important and which are most relevant to the problem.

Hari	Yaswin	Vijay	Shabari
helps to reduce the burden on the doctor by analyzing patients conditions	It gives best accuracy	Possible to diagnose people based on symptoms	It gives an idea of how machine learning helps in medical field
It helps people to know their results quickly	It has increasing scope in future	Has significantly higher accuracy for predicting liver disease	Provides betterment for patients
Easily identifies the disease	Highly beneficial for a large section of society	People can quickly start the necessary steps	Predicts the accuracy based on specific algorithms

Cost efficient for the patients

User friendly

Saves patient time

Easy identification using algorithms

Figure 3.3 - Brainstorm, Idea Listing and Grouping

The idea listing and grouping is used to organize and analyse large numbers of ideas by categorising them. By organising and reorganising ideas, students gain a better appreciation of, and dialogue about, their ideas. As students create idea clusters, new contexts and connections among themes emerge.

Step 3:

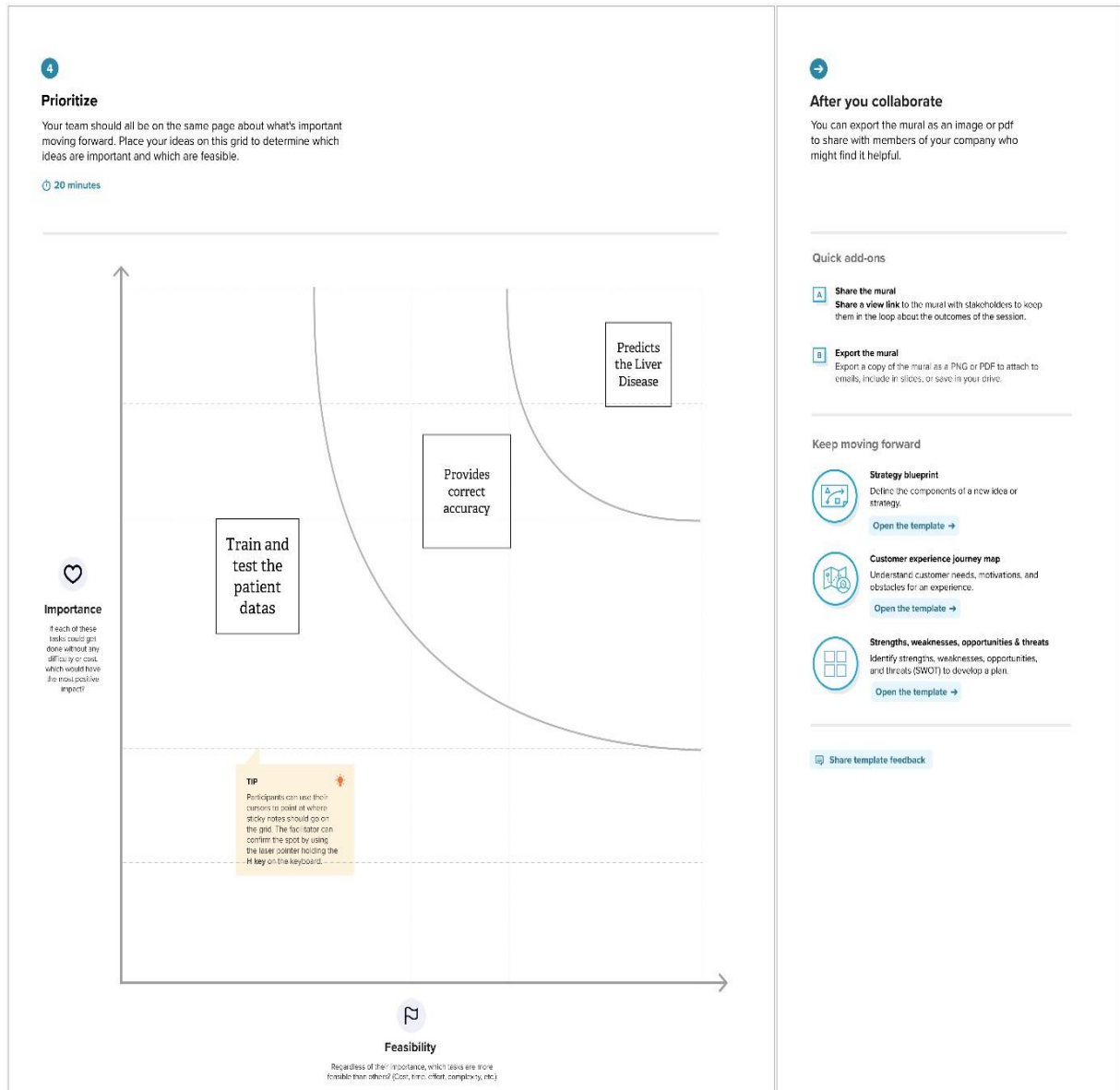


Figure 3.4 - Idea Prioritization

Idea prioritization is just a part of the idea management process. Having a structured idea management process and a systematic way of gathering, evaluating and prioritizing new ideas takes time. To make it work, the entire idea management process should be integrated to the everyday ways of working.

3.3 PROPOSED SOLUTION

S.No.	PARAMETERS	DESCRIPTION
1.	Problem Statement (Problem to be solved)	Liver diseases avert the normal function of the liver. Early prediction of liver disease using classification algorithms are an effective task that can help the doctors to diagnose the disease within a short duration
2.	Idea/Solution description	One of the easiest solutions to predict the liver disease using Machine Learning techniques
3.	Novelty / Uniqueness	This project provides the best accuracy for predicting the liver disease
4.	Social Impact / Customer Satisfaction	It helps to identify the liver disease in effective way, reduce the cost and user friendly
5.	Scalability of the Solution	This project can be improved by giving medical suggestion for patients

Table 3.1 - Proposed Solution

3.4 PROBLEM SOLUTION FIT

Define CS, fit into CC		1. CUSTOMER SEGMENT(S) The common people who are affected by liver disease are the customer of this application.	5. AVAILABLE SOLUTIONS By doctor diagnoses the people can identify the disease in final stage and that may cause the risk to <u>patients</u> life.	8. CHANNELS of BEHAVIOUR 8.1 ONLINE Basic perception of patients will be used 8.2 OFFLINE Trying to identify by using some test analysis	Explore AS, differentiate	
Focus on J&D, Jan into RC, understand		2. JOBS-TO-BE-DONE / PROBLEMS Early prediction of liver disease using classification algorithms are an effective task that can help the doctors to diagnose the disease within a short duration of time.	6. CUSTOMER CONSTRAINTS Availability of good analysis, images in pixels to get accurate prediction of disease	9. PROBLEM ROOT CAUSE: Liver diseases avert the normal function of the liver. Mainly due to the large amount of alcohol consumption liver disease arises. Discovering the existence of liver disease at an early stage is a complex task for the doctors.	Focus on J&D, Jan into RC, understand	
Identify strong T & E M	3. TRIGGERS As many people are affected by liver disease because of late analysis so that to reduce loss of life	7. BEHAVIOUR: Directly: The people who are affected can easily identify their problem and knowledge about the causes. Indirectly: People can be able to get results through online as soon as possible.	10. YOUR SOLUTION No need medical expertise: You don't have to have any knowledge of medical science High accuracy: The system predicts the results with 100 % accuracy for the dataset that we have used while creating this application. Immediate results: The results here are predicted within seconds of entering the details. You don't need to wait for a doctor to come, unlike in traditional method		Identify strong T & E M	
	4. EMOTIONS: BEFORE / AFTER Before: losing self-confidence, tensed After: gaining better improvement, relief					

Figure 3.5 - Solution fit of design with user requirements

This occurs when the user have evidence that customers care about certain jobs, pains, and gains. At this stage the user proved the existence of a problem and have designed a value proposition that addresses customers' jobs, pains and gains

CHAPTER 4

REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Upload image	The user can upload the medical test image. The image should be in jpeg, png or jpg format
FR-2	Read image	The image will be scanned before augmentation takes place.
FR-3	Transform image	The scanned image is then transformed into a format that is needed by the saved model.
FR-4	Evaluate image	The saved model creates a feature map of the uploaded medical test image and predicts the image.
FR-5	Determine and predict the output	The predicted output is then analyzed and converted to a user-friendly language.
FR-6	Display the output	The analyzed result is then displayed to the user.

Table 4.1 - Functional Requirements

4.2 NON-FUNCTIONAL REQUIREMENTS

NFR No.	Non-Functional Requirements	Description
NFR-1	Usability	Datasets of all the liver is used to detecting the disease that present in the liver.
NFR-2	Security	The information belongs to the user and liver are secured highly.
NFR-3	Reliability	It is important for predicting the disease in liver.
NFR-4	Performance	The performance is based on the technology used for disease prediction
NFR-5	Availability	It is available for all user to predict the disease in the liver.
NFR-6	Scalability	Increasing the prediction of the disease in the liver.

Table 4.2 - Non Functional Requirements

CHAPTER 5

PROJECT DESIGN

5.1 DATAFLOW DIAGRAMS

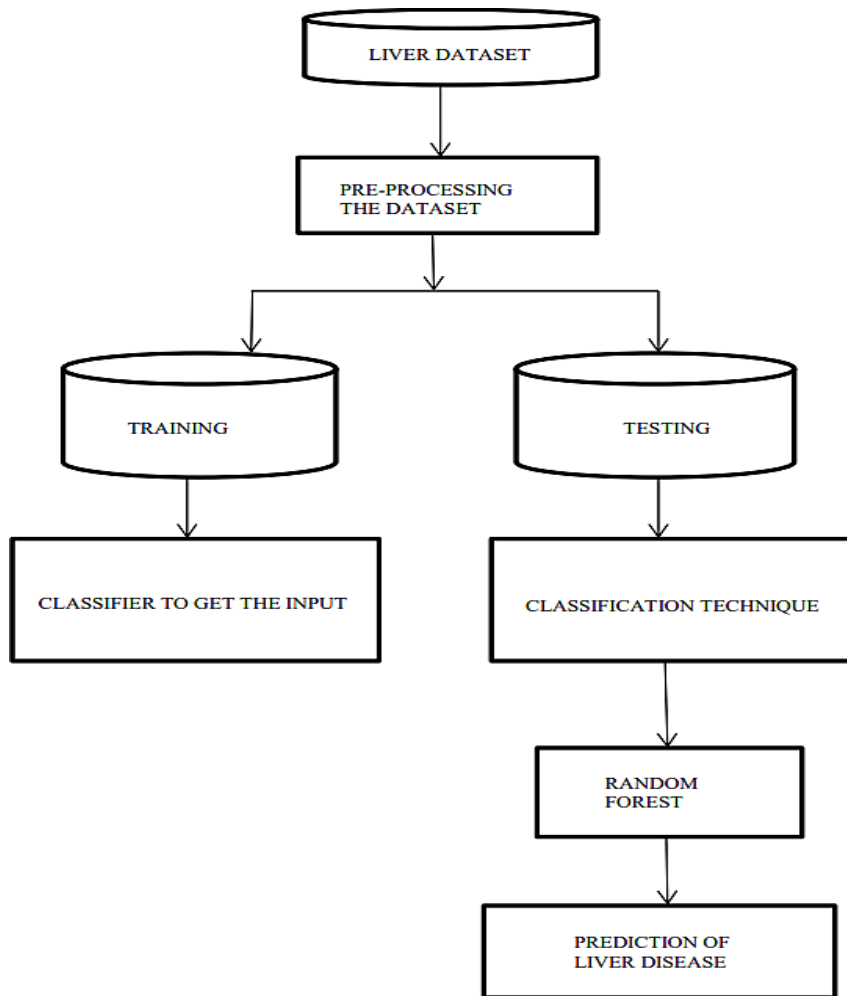


Figure 5.1 - Data flow Diagram

A data flow diagram is a graphical or visual representation using a standardized set of symbols and notations to describe a business's operations through data movement. They are often elements of a formal methodology such as Structured Systems Analysis and Design Method.

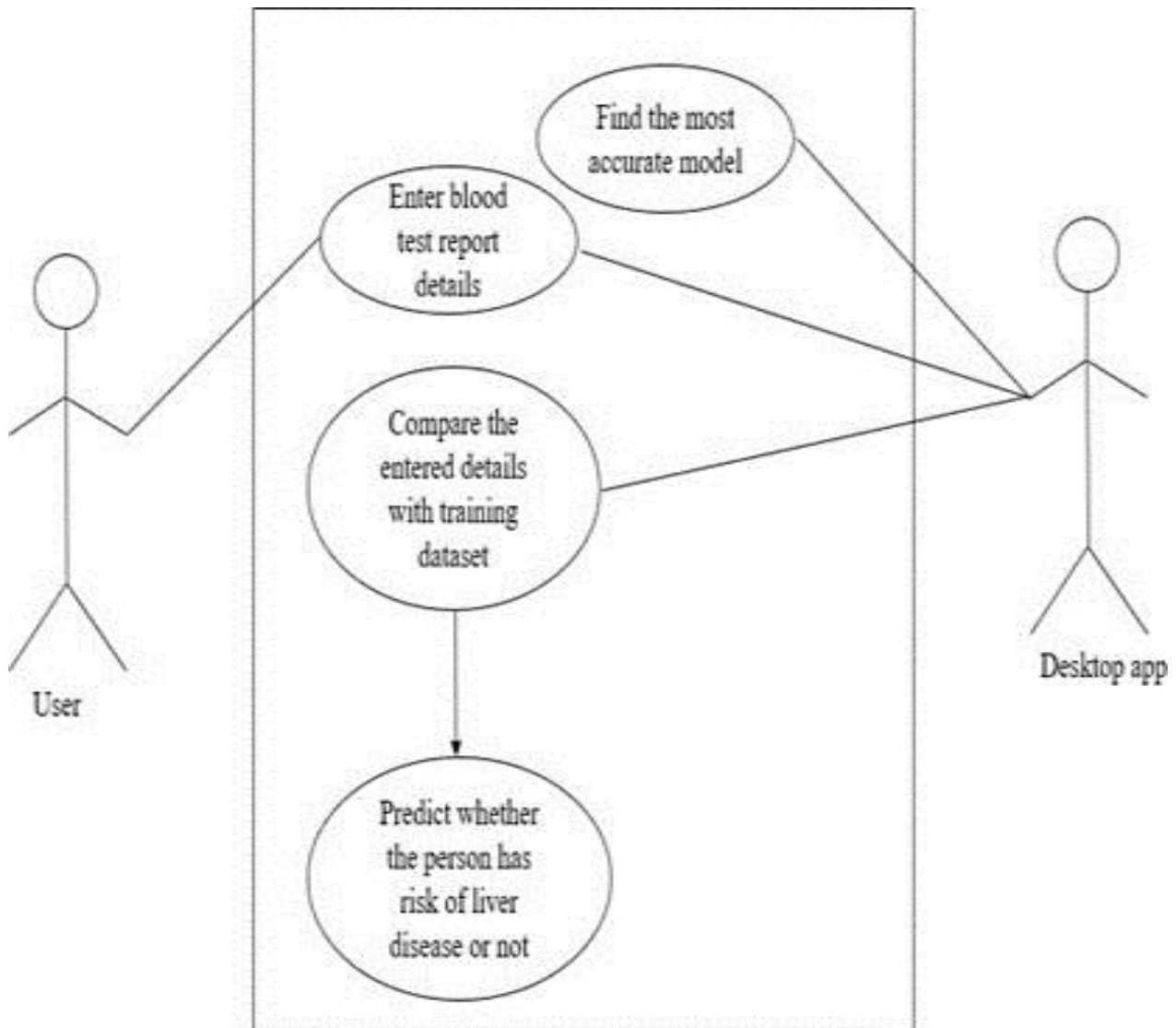


Figure 5.2 - Describes the flow of the project deployment

The flow through which applications, modules, updates, and patches are delivered from developers to users. The methods used by developers to build, test and deploy new code will impact how fast a product can respond to changes in customer preferences or requirements and the quality of each change.

5.2 SOLUTION AND TECHNICAL ARCHITECTURE

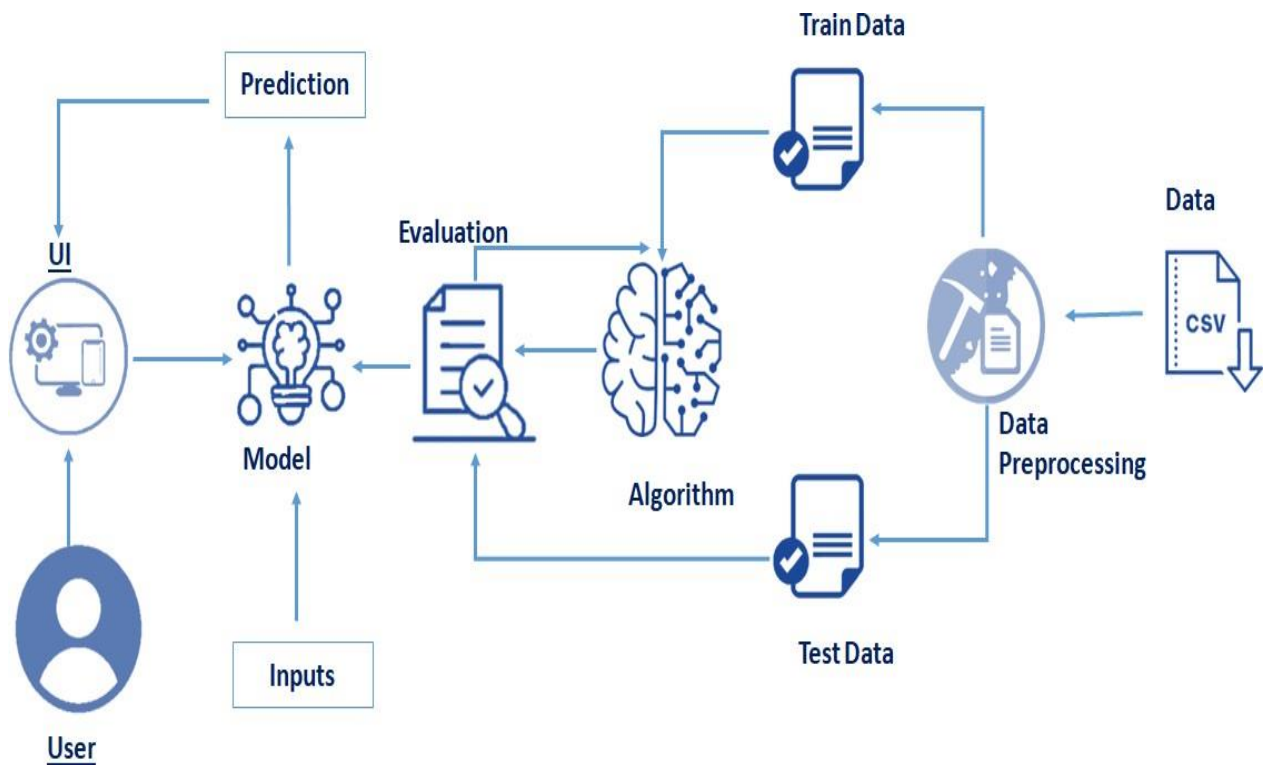


Figure 5.3 - The process of architectural description

Solution Architects are most similar to project managers, ensuring that all parties, including stakeholders, are on the same page and moving in the right direction at all stages. Technical architects manage all activities leading to the successful implementation of a new application. A solution architect must have a technical background with at least eight years of work experience in one or more IT areas including but not limited to: IT architecture, infrastructure, and cloud development.

5.3 USER STORY

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Web user) Step 1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
Customer Step 2	Login	USN-2	As a user, I can log into the application by entering email & password	I can access my account / dashboard	Medium	Sprint-1
Customer Step 3	Dashboard	USN-3	In our dashboard it will display about the symptoms of the liver disease	User can know the details about the liver disease	Medium	Sprint-2
Customer Step 4	Liver predication page	USN-4	The user should enter the details of the parameter	Details of the parameter	Medium	Sprint-2

Table 5.1 - User Story

CHAPTER 6

PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Model Creation		As a user, I built a model to predict the liver disease of the patients	10	High	Srihariraja T, Yaswin Sagar K S, Vijay V, Sri Shabari Suriya U
Sprint-2	Home Page Creation	USN-1	Creation of home page is done for initiation	8	High	Srihariraja T, Yaswin Sagar K S, Vijay V, Sri Shabari Suriya U
	Prediction Page Creation	USN-2	The information of patients necessary for liver disease predictions are given	7	High	Srihariraja T, Yaswin Sagar K S, Vijay V, Sri Shabari Suriya U
Sprint-3	Output Page Creation	USN-3	The results are predicted according to the information given	7	Medium	Srihariraja T, Yaswin Sagar K S, Vijay V, Sri Shabari Suriya U
	Base Flask App	USN-4	A base flask web app must be created as an interface for the ML model	8	High	Srihariraja T, Yaswin Sagar K S, Vijay V, Sri Shabari Suriya U
Sprint-4	Integration	USN-5	Integrate Flask, CNN model with cloudant DB	5	Low	Srihariraja T, Yaswin Sagar K S, Vijay V, Sri Shabari Suriya U
	Dashboard	USN-6	As a user, I can view the previous results and history	5	Low	Srihariraja T, Yaswin Sagar K S, Vijay V, Sri Shabari Suriya U

Table 6.1 - Sprint planning and estimation

6.2 SPRINT DELIVERY SCHEDULE

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	10	5 Days	21 Oct 2022	31 Oct 2022	10	31 Oct 2022
Sprint-2	15	10 Days	1 NOV 2022	05 Nov 2022	15	05 Nov 2022
Sprint-3	15	10 Days	07 Nov 2022	12 Nov 2022	15	12 Nov 2022
Sprint-4	10	7 Days	14 Nov 2022	19 Nov 2022	10	19 Nov 2022

Table 6.2 - Sprint Delivery Schedule

6.3 REPORTS FROM JIRA

Burndown Chart

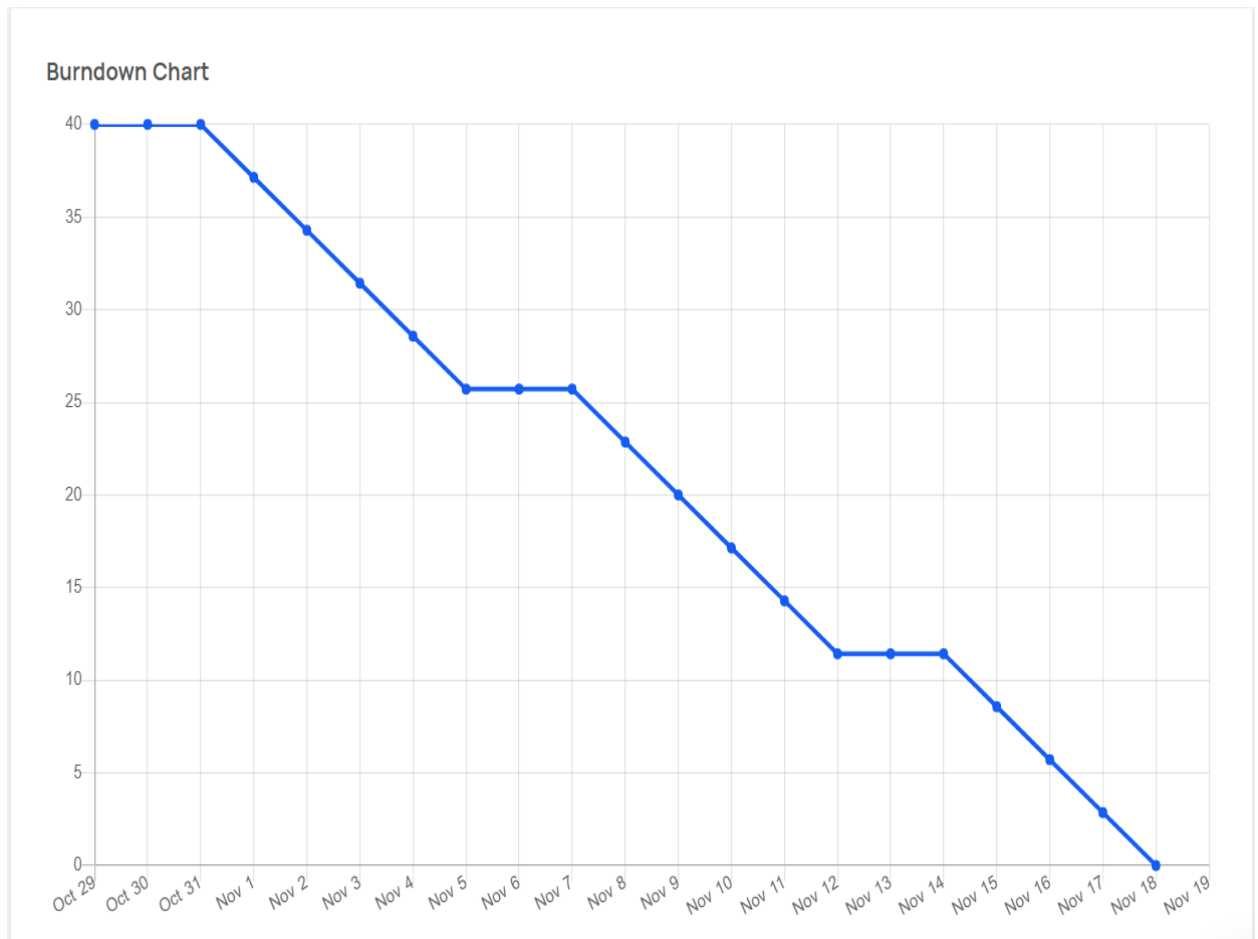


Figure 6.1 - Burndown Chart

A burndown chart shows the amount of work that has been completed in a sprint, and the total work remaining. Burndown charts are used to predict your team's likelihood of completing their work in the time available.

Burnup Chart

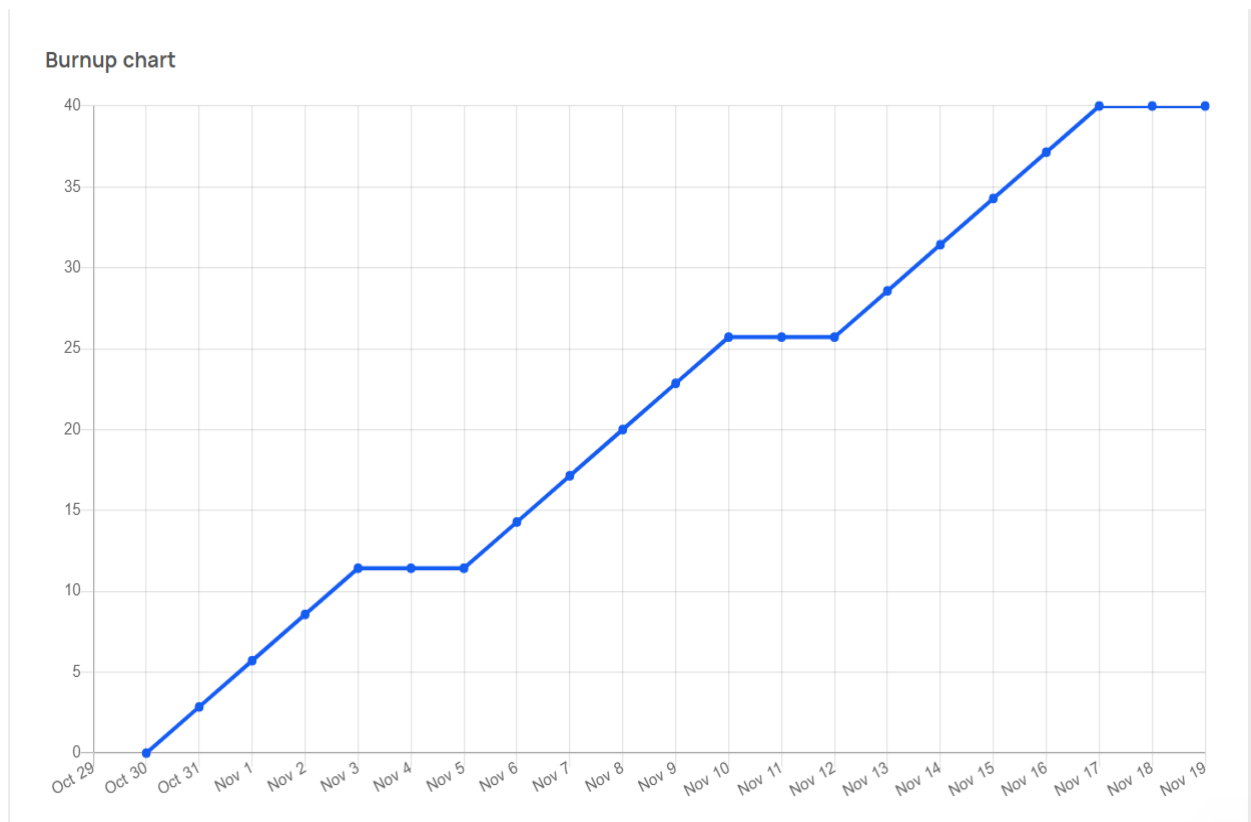


Figure 6.2 - Burnup Chart

A burnup chart highlights the work you've completed against your total project scope while a burn down chart highlights the amount of work remaining in a project. A burnup chart contains a work completed line and a project scope line. It displays the scope of a project and the work completed.

CHAPTER 7

CODING AND SOLUTION

7.1 FEATURE 1

The first feature of the deployment is the process of Random Forest Classifier is used to train and test the model for detecting the Liver Disease with the help of collected and pre-processed dataset collections.

```
# Train Test Split:
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test=train_test_split(X_smote,y_smote,
test_size=0.3, random_state=33)
```

Random forest is a Supervised Machine Learning Algorithm that is used widely in Classification and Regression problems. It builds decision trees on different samples and takes their majority vote for classification and average in case of regression.

```
# RandomForestClassifier:
from sklearn.ensemble import RandomForestClassifier
RandomForest = RandomForestClassifier() RandomForest =
RandomForest.fit(X_train,y_train)
```

```
# Predictions:
y_pred = RandomForest.predict(X_test)
```

```
# Performance:
print('Accuracy:', accuracy_score(y_test,y_pred))
print(confusion_matrix(y_test,y_pred))
```

```
print(classification_report(y_test,y_pred))
```

Gradient boosting classifiers are a group of machine learning algorithms that combine many weak learning models together to create a strong predictive model. Decision trees are usually used when doing gradient boosting.

```
# GradientBoostingClassifier:
```

```
from sklearn.ensemble import GradientBoostingClassifier
```

```
GradientBoost = GradientBoostingClassifier() GradientBoost =  
GradientBoost.fit(X_train,y_train)
```

```
# Predictions:
```

```
y_pred = GradientBoost.predict(X_test)
```

```
# Performance:
```

```
print('Accuracy:', accuracy_score(y_test,y_pred))
```

```
print(confusion_matrix(y_test,y_pred)) print(classification_report(y_test,y_pred))
```

AdaBoost can be used to boost the performance of any machine learning algorithm. It is best used with weak learners. These are models that achieve accuracy just above random chance on a classification problem. The most suited and therefore most common algorithm used with AdaBoost are decision trees with one level.

```
# AdaBoostClassifier:
```

```
from sklearn.ensemble import AdaBoostClassifier
```

```
AdaBoost = AdaBoostClassifier()
```

```
AdaBoost = AdaBoost.fit(X_train,y_train)
```

```
# Predictions:
```

```
y_pred = AdaBoost.predict(X_test)
```

```
# Performance:
```

```
print('Accuracy:', accuracy_score(y_test,y_pred))
```

```
print(confusion_matrix(y_test,y_pred)) print(classification_report(y_test,y_pred))
```

7.2 FEATURE 2

Python flask is the first feature that helps to complete this project. It allows the user to create local server and host the website in a local machine.

```
from flask import Flask, render_template, request
import numpy as np
import pickle
import requests
import json
```

Here we import all the necessary features of this project involving in Pythonflask.

```
header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' +
mltoken}
app = Flask(__name__)
model = pickle.load(open('liver2.pkl', 'rb'))

@app.route('/',methods=['GET']) def
Home():
    return render_template('index.html')
```

Here we created a local client's own server which serves the .html pages to the

users.

```
@app.route("/predict", methods=['POST'])def
predict():
    if request.method == 'POST': Age
        = int(request.form['Age'])
        Gender = int(request.form['Gender'])
        Total_Bilirubin = float(request.form['Total_Bilirubin']) Alkaline_Phosphotase =
        int(request.form['Alkaline_Phosphotase'])
        Alamine_Aminotransferase = int(request.form['Alamine_Aminotransferase'])
        Aspartate_Aminotransferase = int(request.form['Aspartate_Aminotransferase'])
        Total_Protiens = float(request.form['Total_Protiens'])
        Albumin = float(request.form['Albumin']) Albumin_and_Globulin_Ratio =
float(request.form['Albumin_and_Globulin_Ratio']) values =
np.array([[Age,Gender,Total_Bilirubin,Alkaline_Phosphotase,Alamine_Aminotran
sferase,Aspartate_Aminotransferase,Total_Protiens,Albumin,Albumin_and_Glob
ulin_Ratio]])
        prediction = model.predict(values)
        return render_template('result.html', prediction=predictionif
_name_ == "_main_":
    app.run(debug=True)
```

Here we use the inputs from the html pages which has to be get by using request method in Python Flask. By validating the values from the database, we allow the user to access the home page. render_template: Used for rendering html pages on browser. url_for: Passing the control of the program to another function. session: Creates a separate session for the individual use.

CHAPTER 8

TESTING

8.1 TEST CASES

TEST CASE ID	15358	TEST CASE DESCRIPTION	STATISTICAL MACHINE LEARNING APPROACHES TO LIVER DISEASE PREDICTION
---------------------	-------	------------------------------	---

S.No.	PREREQUISITES	TEST DATA
1	Access to Chrome Browser	By clicking the website link
2	Entering the details required	Details should be in a integer format
3	Check for correct values	Data should be filled
4	Application to train the model	Provide the datasets for model training

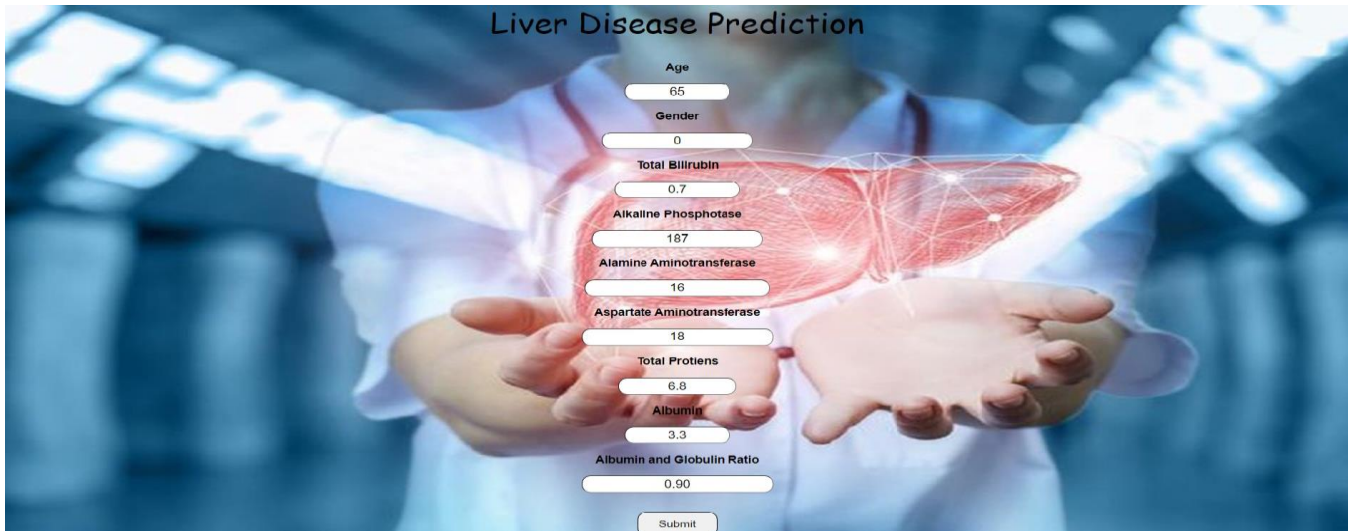
Table 8.1 - Test Details

Test Scenario :

Step	Step Details	Expected Results	Actual Results	Pass/Fail/Not/Executed/Suspended
1	Navigate to website link	Site should open	As Expected	pass
2	Enter the details	Details should be entered	As Expected	pass
3	Click Submit	Check the result	As Expected	Pass
4	Output results	Result are generated	As Expected	Pass

Table 8.2 - Test Cases

8.2 USER ACCEPTANCE TESTING



Liver Disease Prediction

Age: 65

Gender: 0

Total Bilirubin: 0.7

Alkaline Phosphatase: 187

Alamine Aminotransferase: 16

Aspartate Aminotransferase: 18

Total Protiens: 6.8

Albumin: 3.3

Albumin and Globulin Ratio: 0.90

Submit

Figure 8.1 - User Acceptance Test 1

In this the user will be entering tested values which is moved for prediction.

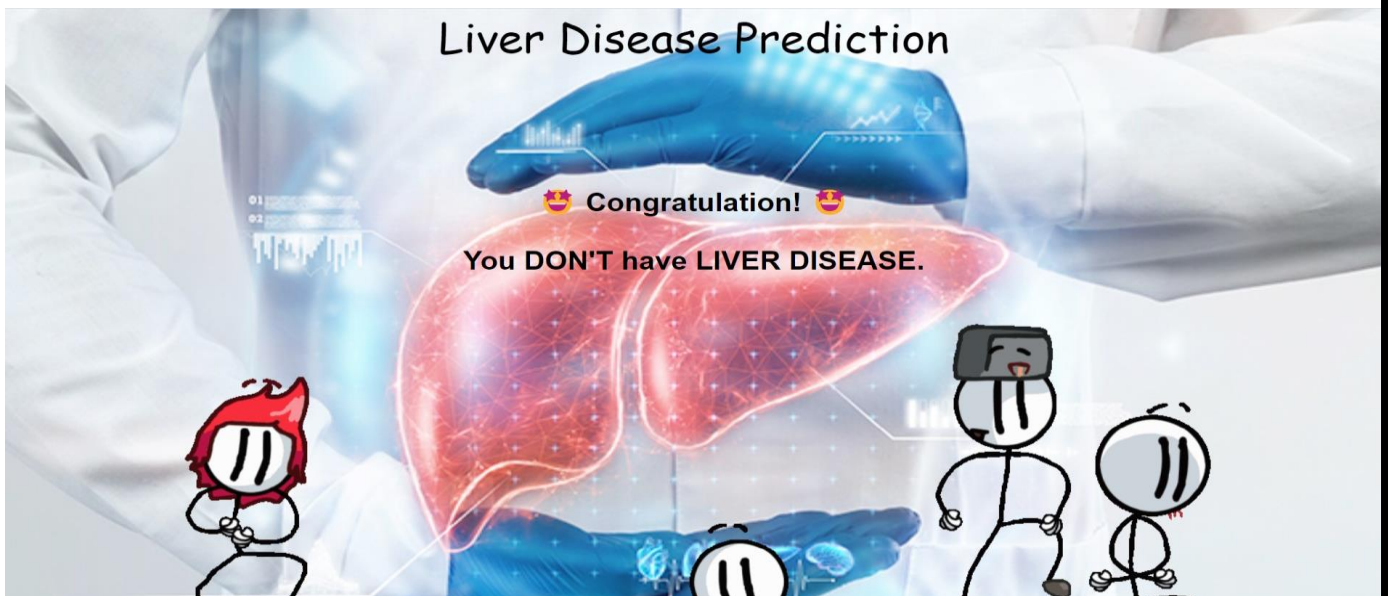


Figure 8.2 - User Acceptance Test 2

In this the data which was entered by the user will be analyzed. This figureshows the person does not have liver disease.

.

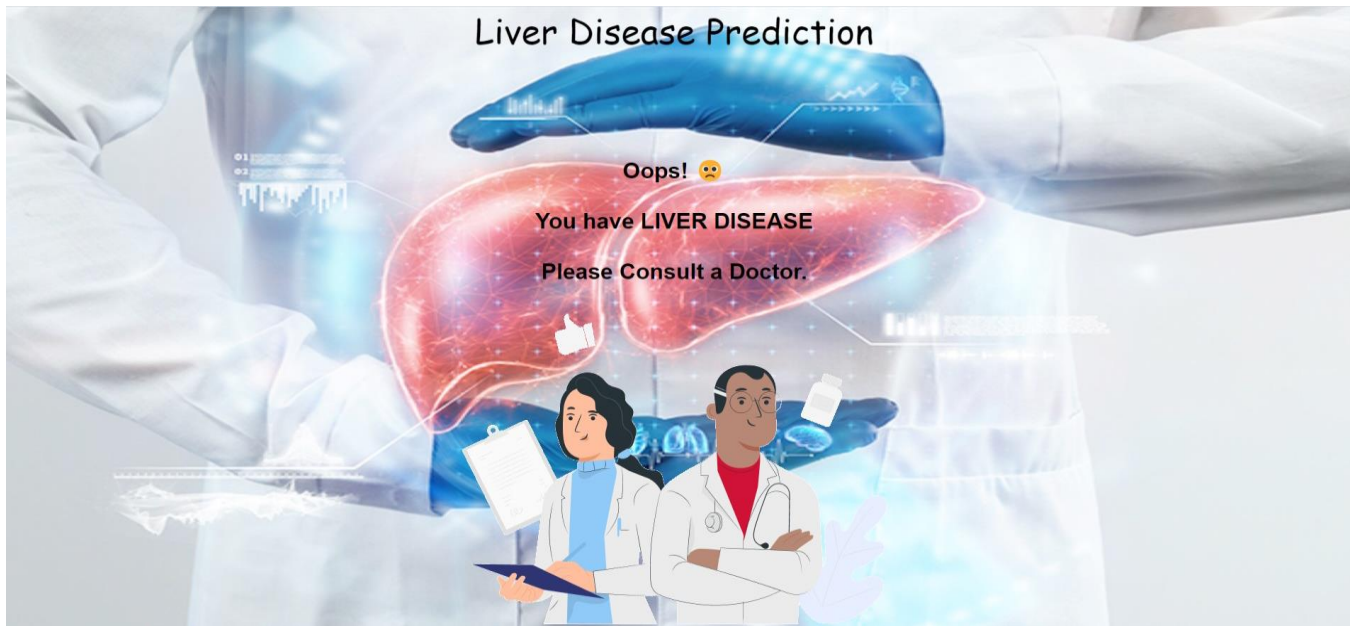


Figure 8.3 - User Acceptance Test 3

In this the data which was entered by the user will be analyzed. This figure shows the person has a liver disease.

CHAPTER 9

RESULTS

9.1 PERFORMANCE METRICS

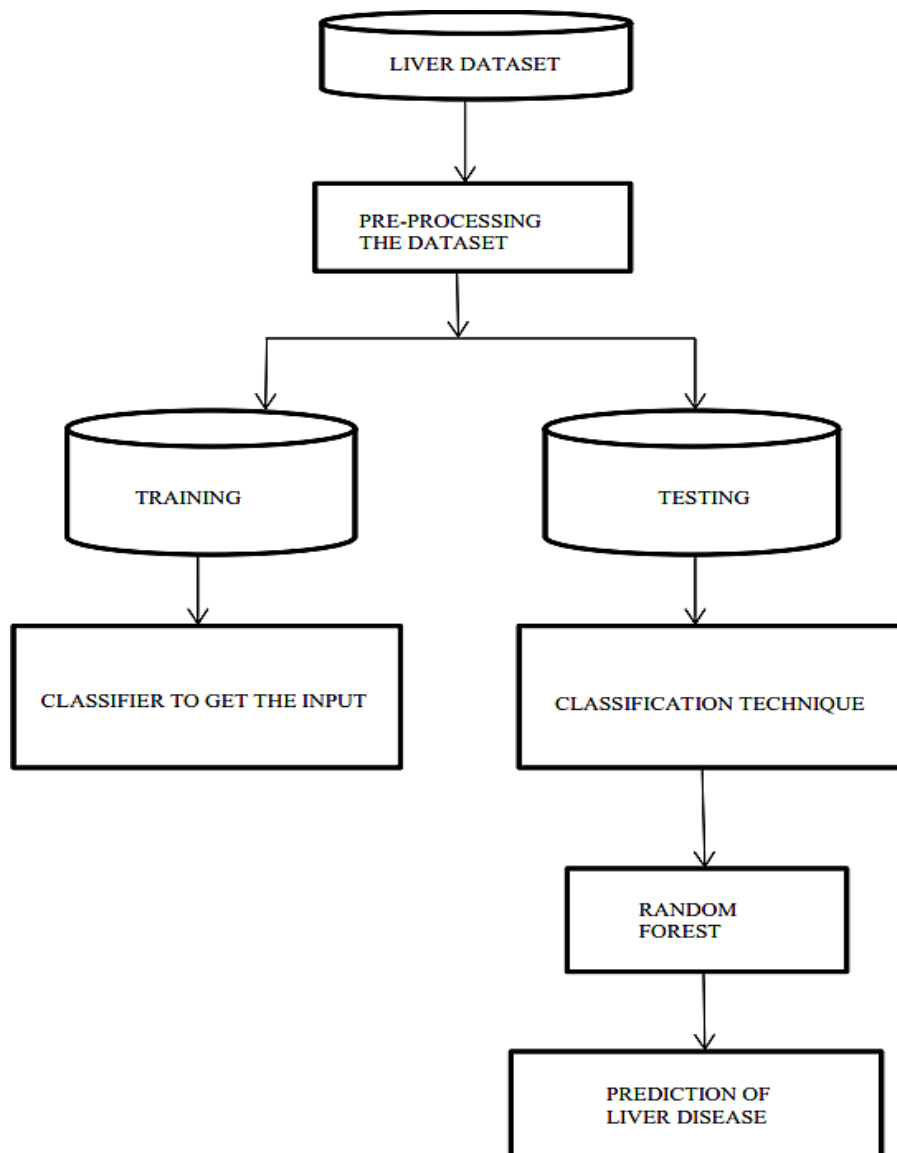


Figure 9.1 - Flow of the Performance

Performance Metrics is performed along for all the above assigned tasks. In each and every task, various metrics are performed in order to provide the optimum outcome. Results give the best outcome as expected in project.

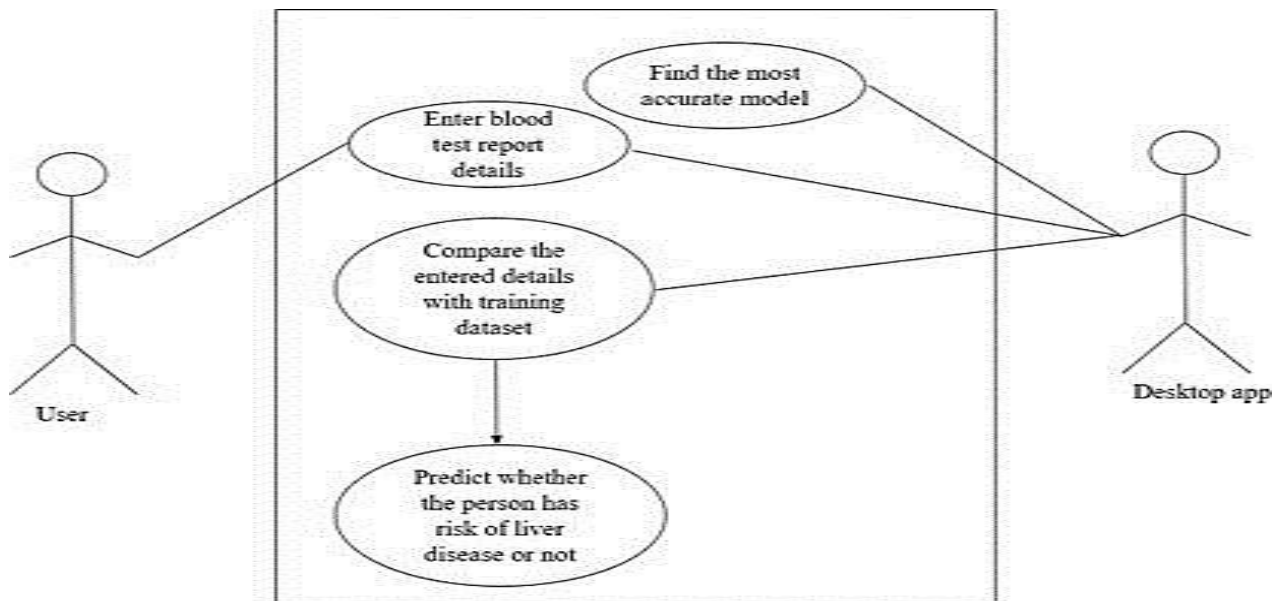


Figure 9.2 - Performance Matrix

One can use following execution measures for the request and figure of imperfection slanted module as shown by his/her own need.

Confusion Matrix: The confusion matrix is used to measure the introduction of two class issue for the given instructive record. The right corner to corner parts TP (True positive) and TN (True Negative) adequately describe instances similarly as FP (false positive) and FN (false negative) wrongly request instances. Confusion Matrix correctly classify instance TP+TN incorrectly classify instances.

- True positives imply the positive liver tuples that were precisely named by the classifier,
- True negatives are the negative liver tuples that were precisely set apart by the classifier.
- False positives are the negative liver tuples that were erroneously set apart as positive tuples.
- False negatives are the positive liver tuples that were incorrectly stamped negative tuples.

CHAPTER 10

ADVANTAGES AND DISADVANTAGES

ADVANTAGES

In pharmaceutical industries, random forest can be used to identify the potential of a certain medicine or the composition of chemicals required for medicines. Random forest can also be used in hospitals to identify the diseases suffered by a patient, risk of liver disease and many other diseases where early analysis and research play a crucial role. Our study has successfully developed and validated the first risk prediction model and subsequent user-friendly scoring tool, the algorithm for Liver Function Investigations, for liver condition diagnosis in patients with no obvious liver condition at the time of incident liver function testing in primary care.

DISADVANTAGES

The idea for the approach of this project arises from the current situation regarding the increase in the confirmatory diagnosis of liver, and lack of treatment or the user's ignorance of its pathologies leads to irreversible kidney failure in the final stages of disease, such as dialysis for life, financially affecting the health system, as it is a costly treatment that generates the most significant amount of absorption of the resources available for health. This could be reduced by using tools such as machine learning to classify from the initial stages. Although the application of machine learning in healthcare and other areas is favorable, the field of liver disease has not yet exploited its full potential.

CHAPTER 11

CONCLUSION

The principal part of this work is to make an effective diagnosis system for liver infection patients. The application will have the option to predict liver infection prior and advise the wellbeing condition. This application can be surprisingly gainful in low-salary nations where our absence of medicinal foundations and just as particular specialists. In our study, there are a few bearings for future work in this field. We just explored some popular supervised machine learning algorithms, more algorithms can be picked to assemble an increasingly precise model of liver disease prediction and performance can be progressively improved. Additionally, this work likewise ready to assume a significant role in health care research and just as restorative focuses to anticipate liver infection.

CHAPTER 12

FUTURE SCOPE

Diseases related to liver is becoming more and more common with time. With continuous technological advancements, these are only going to increase in the future. Although people are becoming more conscious of health nowadays and are joining yoga classes, dance classes; still the sedentary lifestyle and luxuries that are continuously being introduced and enhanced; the problem is going to last long. So, in such a scenario, our project will be extremely helpful to the society. With the dataset that we used for this project, we got 81% accuracy for Random forest model, and though it might be difficult to get such accuracies with very large datasets, from this projects results, one can clearly conclude that we can predict the risk of liver diseases with accuracy of 90 % or more. Also it can be incorporated into a website and these app and website will be highly beneficial for a large section of society.

CHAPTER 13

APPENDIX

SOURCE CODE:

Algorithm :

#Importing The Libraries

import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import seaborn as sns

import pickle

#Reading the Dataset data=pd.read_csv(path)

#Exploratory Data Analysis

data.head()

data.tail()

data.info()

data.describe()

#Checking For Null Values And Handling Null Values

data.isnull().any()

data.isnull().sum()

data['Albumin_and_Globulin_Ratio']=data.fillna(data['Albumin_and_Globulin_Ratio']
.mode()[0])

data.isnull().sum()

#Data Visualization

sns.countplot(data=data,x='Gender',lable='Count')

m,f=data['Gender'].value_counts()

print("No of Males:",m)

print("No of Females:",f)

```
sns.countplot(data=data, x='Dataset')
LD,NLD=data['Dataset'].value_counts()
print("liver disease patients:",LD)
print("Non-liver disease patients:",NLD)
```

#Splitting The Dataset Into Dependent And Independent Variable

```
x=data.iloc[:,0:-1]
y=data.iloc[:,-1]
```

#Split The Dependent And Independent Features Into Train Set And TestSetfrom

```
sklearn.model_selction import train_test_split
xtrain,xtest,ytrain,ytest=train_test_split(x,y,test_size=0.2)
```

#Check the shape of both xtrain and xtest.

```
xtrain.shape
```

```
xtest.shape
```

#importing the machine learning model

```
from sklearn.svm import svc
```

```
from sklearn.ensemble import RandomForestClassifierfrom
```

```
sklearn.neighbors import KNeighborsClassifier #initializing
```

the machine learning models

```
svm=SVC()
```

```
RFmodel=RandomForestClassifier()
```

```
KNNmodel=KNeighborsClassifiers()
```

```
svm=SVC()
```

#Train the data with SVM model

```
svm.fit(xtrain,ytrain)
```

#Random forest classifiers model

```
from sklearn.ensemble import RandomForestClassifier
```

```
RFmodel=RandomForestClassifier()
```

#Train the data with random forest model

```
RFmodel.fit(xtrain,ytrain)
```

```
SVMaccuracy=accuracy_score(SVMPred,ytest)
```

```
SVMaccuracy
```

```

from sklearn.ensemble import RandomForestClassifier
RFmodel=RandomForestClassifier()
RFmodel.fit(xtrain,ytrain) RFpred=RFmodel.predict(xtest)
RFaccuracy=accuracy_score(RFpred,ytest)
RFaccuracy RFcm=confusion_matrix(RFpred,ytest)
RFcm
from sklearn.neighbors import KNeighborsClassifierKNN=KNeighborsClassifier()
KNN.fit(xtrain,ytrain)
KNNpred=KNN.predict(xtest)
KNNaccuracy=accuracy_score(KNNpred,ytest)
KNNaccuracy
KNNcm=confusion_matrix(KNNpred,ytest)
KNNcm
# saving the model
import pickle
pickle.dump(svm,open('liver_analysis.pkl','wb'))

```

Flask Connection

```

from flask import Flask, render_template, request
import numpy as np
import pickle
app = Flask(__name__)
model = pickle.load(open('Liver2.pkl', 'rb'))
@app.route('/',methods=['GET'])
def Home():
    return render_template('index.html')
@app.route("/predict", methods=['POST'])def
predict():
    if request.method == 'POST': Age
        = int(request.form['Age'])

```

```

Gender = int(request.form['Gender'])
Total_Bilirubin = float(request.form['Total_Bilirubin']) Alkaline_Phosphotase =
int(request.form['Alkaline_Phosphotase'])Alamine_Aminotransferase =
int(request.form['Alamine_Aminotransferase'])
Aspartate_Aminotransferase =
int(request.form['Aspartate_Aminotransferase']) Total_Protiens =
float(request.form['Total_Protiens'])Albumin =
float(request.form['Albumin']) Albumin_and_Globulin_Ratio
=
float(request.form['Albumin_and_Globulin_Ratio'])
values =
np.array([[Age,Gender,Total_Bilirubin,Alkaline_Phosphotase,Alamine_Amino
transferase,Aspartate_Aminotransferase,Total_Protiens,Albumin,Albumin_a
nd_Globulin_Ratio]])
prediction = model.predict(values)
return render_template('result.html', prediction=prediction) if
name_== "_main_":
app.run(debug=True)

```

HTML

Templates

index.htm

```

<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Liver Prediction Model</title>

</head>
<body>
  <div class="container">
    <h2 class='container-heading'><span class="heading_font">LiverDisease
Prediction</span></h2>

```

</div>

<div class="ml-container">

<form action="{ { url_for('predict') } }" method="POST">

<h3>Age</h3>

<input id="first" name="Age" placeholder="in Year"required="required">

<h3>Gender</h3>

<input id="second" name="Gender" placeholder="Male = 1,Female=0"
required="required">

<h3>Total Bilirubin</h3>

<input id="third" name="Total_Bilirubin" placeholder="Total Bilirubin"
required="required">

<h3>Alkaline Phosphotase</h3>

<input id="fourth" name="Alkaline_Phosphotase"
placeholder="Alkaline Phosphotase" required="required">

<h3>Alamine Aminotransferase</h3>

<input id="fifth" name="Alamine_Aminotransferase" placeholder="Alamine
Aminotransferase" required="required">

<h3>Aspartate Aminotransferase</h3>

<input id="sixth" name="Aspartate_Aminotransferase" placeholder="Aspartate
Aminotransferase" required="required">

<h3>Total Protiens</h3>

```

        <input id="seventh" name="Total_Protiens" placeholder="TotalProtiens"
required="required">
        <br>
        <h3>Albumin</h3>
        <input id="eight" name="Albumin" placeholder="Albumin"
required="required">
        <br>
        <h3>Albumin and Globulin Ratio</h3>
        <input id="ninth" name="Albumin_and_Globulin_Ratio" placeholder="Albumin
and Globulin Ratio" required="required">
        <br>
        <br>
        <br>
        <button id="sub" type="submit ">Submit</button>
        <br>
        <br>
        <br>
        <br>
        </form>
    </div>
<style>
/* Background Image */
body
{
background-
image:url("https://akcdn.detik.net.id/community/media/visual/2020/12/17
/6-makanan-untuk-mencegah-penyakit-liver-salah-satunya-kopi- 5_43.jpeg?w=250&q=");
height: 100%;
/* Center and scale the image nicely */

```

```

background-position: center;
background-repeat: no-repeat;
background-size: 100% 100%;
}
/* Color */
body{
    font-family: Arial, Helvetica,sans-serif;
    text-align: center;
    margin: 0;
    padding: 0;
    width: 100%;
    height: 100%;
    display: flex;
    flex-direction: column;
}
/* Heading Font */
.container-heading{
    margin: 0;
}
.heading_font{
    color: #black;
    font-family: 'Pacifico', cursive;
    font-size: 50px;
    font-weight: normal;
}
/* Box */
#first {
    border-radius: 14px;height:
    25px;
    width: 150px;

```

```
    font-size: 20px;
    text-align: center;
}
#second {
    border-radius: 14px; height:
    25px;
    width: 220px;
    font-size: 20px;
    text-align: center;
}
#third {
    border-radius: 14px; height:
    25px;
    width: 180px;
    font-size: 20px;
    text-align: center;
}
#fourth {
    border-radius: 14px; height:
    25px;
    width: 250px;
    font-size: 20px;
    text-align: center;
}
#fifth {
    border-radius: 14px; height:
    25px;
    width: 270px;
    font-size: 20px;
    text-align: center;
```



```
}  
#sixth {  
    border-radius: 14px; height:  
    25px;  
    width: 280px;  
    font-size: 20px;  
    text-align: center;  
}  
#seventh {  
    border-radius: 14px; height:  
    25px;  
    width: 170px;  
    font-size: 20px;  
    text-align: center;  
}  
#eight {  
    border-radius: 14px; height:  
    25px;  
    width: 150px;  
    font-size: 20px;  
    text-align: center;  
}  
#ninth {  
    border-radius: 14px; height:  
    25px;  
    width: 280px;  
    font-size: 20px;  
    text-align: center;  
}  
/* Submit Button */
```

```
#sub {
    width: 120px;height:
    43px;
    text-align: center;
    border-radius: 14px;
    font-size: 18px;
}
```

```
</style>
```

```
</body>
```

```
</html>
```

result.html

```
<!DOCTYPE html>
```

```
<html lang="en">
```

```
<head>
```

```
    <meta charset="UTF-8">
```

```
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
```

```
    <title>Liver Disease Result</title>
```

```
</head>
```

```
<body>
```

```
    <div class="container">
```

```
        <form action="{{ url_for('predict')}}" method="post">
```

```
            <h2 class='container-heading'><span class="heading_font">LiverDisease
Prediction</span></h2>
```

```
            <br><br><br><br><br><br><br>
```

```
            <!-- Result -->
```

```
            <div class="results">
```

```
                {% if prediction==2 %}
```

```
                    <h1><span class='danger'>Oops! ☹<br><br>You have LIVERDISEASE
<br><br>Please Consult a Doctor.</span></h1>
```

```
                    
    { % elif prediction==1 % }
        <h1><span class='safe'> ☐ Congratulation! ☐ <br><br>You DON'T have
LIVER DISEASE.</span></h1>
        
    { % endif % }
</div>
</form>
</div>
<style>
/* Background Image */
body
{
background-image:url("https:// d1vbn70lmn1nqe.cloudfront.net/prod/wp-
content/uploads/2022/05/11050117/hepatitis-kronis-halodoc.jpg"); height:
100%;
/* Center and scale the image nicely */
background-position: center; background-
repeat: no-repeat; background-size: 100%
100%;
}
/* Color */
body{
font-family: Arial, Helvetica,sans-serif;
text-align: center;
margin: 0;
padding: 0;
width: 100%;
height: 100%;

```

```
display: flex;
flex-direction: column;
}
/* Heading Font */
.container-heading{
margin: 0;
}
.heading_font{
color: #black;
font-family: 'Pacifico', cursive;
font-size: 50px;
font-weight: normal;
}
</style>
</body>
</html>
```

Github and Project Video Demo Link

Github Link:

<https://github.com/IBM-EPBL/IBM-Project-21493-1659781484>

Project Video Demo Link:

https://drive.google.com/file/d/1oDR98t31iOrWxh_XNKuts_FCVokc_XlQ/view?usp=share_link