PROJECT REPORT

submitted by

PN T2022TMID39453

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CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

Machine learning and deep learning play an important role in computer technology and artificial intelligence. With the use of deep learning and machine learning, human effort can be reduced in recognizing, learning, predictions and in many more areas.

Food is essential for human life and has been the concern of many healthcare conventions. Nowadays new dietary assessment and nutrition analysis tools enable more opportunities to help people understand their daily eating habits, exploring nutrition patterns and maintain a healthy diet. Nutritional analysis is the process of determining the nutritional content of food. It is a vital part of analytical chemistry that provides information about the chemical composition, processing, quality control and contamination of food.

1.2 Purpose

The main aim of the project is to building a model which is used for classifying the fruit depends on the different characteristics like colour, shape, texture etc. Here the user can capture the images of different fruits and then the image will be sent the trained model. The model analyses the image and detect the nutrition based on the fruits like (Sugar, Fibre, Protein, Calories, etc.).

CHAPTER 2

LITERATURE SURVEY

2.1. EXISTING PROBLEM

The main problem associated with the previous stages are collecting the datasets, even if we collect the required dataset the pixels, width, orientation and margins do not always the same size

2.2 REFERENCES

1. Banot, S., Mahajan, P.M.: A fruit detecting and grading system based on image processing-review. Int. J. Innov. Res. Electr. Electron. Instrum. Control Eng. 4(1), 47–53 (2016)

This work presents a literature review study for fruit detecting and grading system based on image processing techniques. Different types of algorithms are available to extract feature of fruit characters by capturing the fruit image. With the help of this feature fruit is detected and graded according to quality of fruit this can be done using different types of classifier. The grading system has the advantage of high accuracy, high speed and low cost. It will have a good scene of application in fruit quality detecting and grading areas. This work aimed to study different types of algorithms used for quality grading to developed an algorithm for detecting and sorting of fruit from the acquire image..

Vinyals, O., Toshev, A., Bengio, S., Erhan, D.: Show and tell: a neural image caption generator. In: Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition,pp. 3156–3164 (2015)

Automatically describing the content of an image is a fundamental problem in artificial intelligence that connects computer vision and natural language processing. In this paper, we present a generative model based on a deep recurrent architecture that combines recent advances in computer vision and machine translation and that can be used to generate natural sentences describing an image. The model is trained to maximize the likelihood of the target description sentence given the training image. Experiments on several datasets show the accuracy of the model and the fluency of the language it learns solely from image descriptions. Our model is often quite accurate, which we verify both qualitatively and quantitatively. For instance, while the current state-of-the-art BLEU-1 score (the higher the better) on the Pascal dataset is 25, our approach yields 59, to be compared to human performance around 69. We also show BLEU-1 score improvements on Flickr30k, from 56 to 66, and on SBU, from 19 to 28. Lastly, on the newly released COCO dataset, we achieve a BLEU-4 of 27.7, which is the current state-of-the-art.

Patel, H.N., Jain, R.K., Joshi, M.V.: Fruit detection using improved multiple features based algorithm. Int. J. Comput. Appl. 13(2), 1–5 (2011)

Efficient locating the fruit on the tree is one of the major requirements for the fruit harvesting system. This paper presents the fruit detection using improved multiple features based algorithm. To detect the fruit, an image processing algorithm is trained for efficient feature extraction. The algorithm is designed with the aim of calculating different weights for features like intensity, color, orientation and edge of the input test image. The weights of different features represent the approximate locations of the fruit within an image. The Detection Efficiency is achieved up to 90% for different fruit image on tree, captured at different positions. The input images are the section of tree image.

Arivazhagan, S., Shebiah, R.N., Nidhyanandhan, S.S., Ganesan, L.: Fruit recognition usingcolor and texture features. J. Emerg. Trends Comput. Inf. Sci. 1(2), 90–94 (2010)

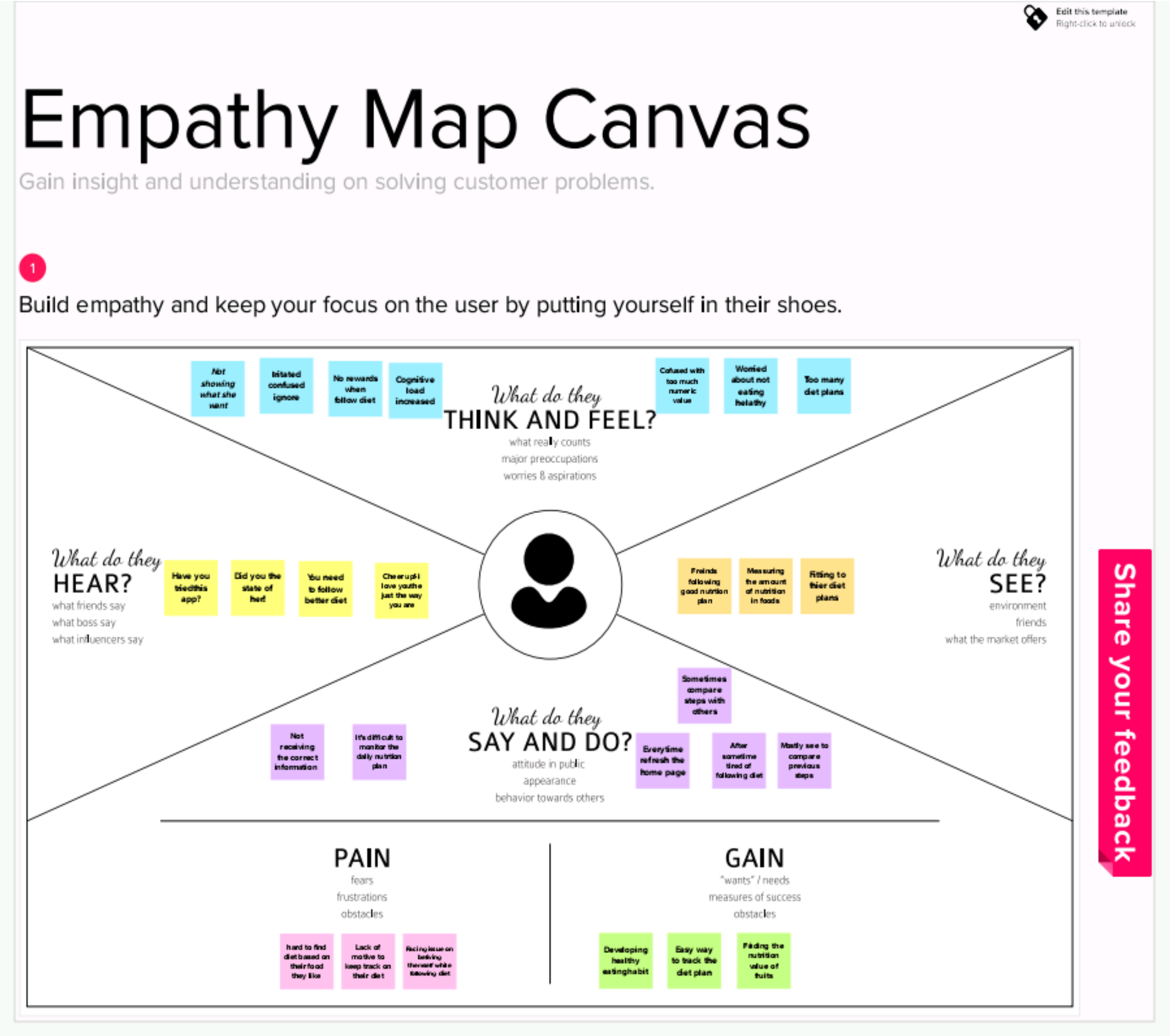
This paper presents a simple and efficient approach to perform fruit detec-tion and predict nutrition information of the fruits using deep Alex networks (DAN).The datasets employed for analysis are acquired from fruit 360 database of image processing challenges. Fruit categories include apples, berries, banana, grape, papaya,peach, avocado, and multiple flavors of apple. And also, the experimentations are carried out on various other fruit samples collected from multiple Web repositories.The network architecture is as usual comprised of to five convolution layers and three fully connected layers including the max pooling, RELU layers. The input images are assumed to be of dimensions 227 ×227 ×3 with number of filters of 96 of size11 ×11 ×3 with a stride length of 4. The results of experiment prove that fruitdetection using DAN .

2.3. PROBLEM STATEMENT DEFINATATION

Due to the modern lifestyle, carefree attitude and being materialistic, people are taking their health and diet otherwise. Therefore, to facilitate them with a proper diet chart according to their lifestyle and cope up with their busy schedule, a need for an app emerges that can provide diet consultancies to the people at their preferred time and mobile phones without having to visit a dietician. The users can take advantage of the app by registering themselves, entering the basic details and signing in with a username and password. The prime objective of the app is to list all the possible diet plans along with the nutrient value of the food items for the user in accordance with his/her lifestyle by taking their height, weight, working hours, and eating hours and practices as inputs. The app is beneficial for the young generation who live away from their homes and cannot have a proper diet maintained. This app provides them with alternatives to manage the balance. The another yet distinguishable aim of our App is to provide solutions on how to gain more with minimum affordable eateries, a basic plan that suggests a diet that can fulfill the essential needs of the body and not only it replenishes the loss but also helps to gain energy. A person needs a dietician not only when he is malnutrition or is unable to get the best. The ever increasing problem today is obesity. Youth is stressed about how to lose weight healthily without starving or spending lumps on money on a gym membership. The App comes to aid by providing a slow and steady yet robust plan that provides a diet with which you can loose/gain extra calories without any fret and lead a stress-free life because yes! What we eat is what we feel. The diet plan not only covers the nutritional aspect but also provides light exercises that can help one to keep their body in shape and discipline.

CHAPTER 3
IDEATION & PROPSED SOLUTION

3.1. EMPATHY MAP CANVAS



Edit this template
Right-click to unlock

Empathy Map Canvas

Gain insight and understanding on solving customer problems.

1

Build empathy and keep your focus on the user by putting yourself in their shoes.

What do they THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations

- Not showing what she want
- Irritated confused ignore
- No rewards when follow diet
- Cognitive load increased
- Cofused with too much numeric value
- Worried about not eating helathy
- Too many diet plans

What do they HEAR?
what friends say
what boss say
what influencers say

- Have you triedthis app?
- Did you the state of her!
- You need to follow better diet
- Cheer up!-I love youthe just the way you are

What do they SEE?
environment
friends
what the market offers

- Freinds following good nutrition plan
- Measuring the amount of nutrition in foods
- Fitting to thier diet plans

What do they SAY AND DO?
attitude in public
appearance
behavior towards others

- Not receiving the correct information
- It's difficult to monitor the daily nutrition plan
- Sometimes compare steps with others
- Everytime refresh the home page
- After sometime tired of following diet
- Mostly see to compare previous steps

PAIN
fears
frustrations
obstacles

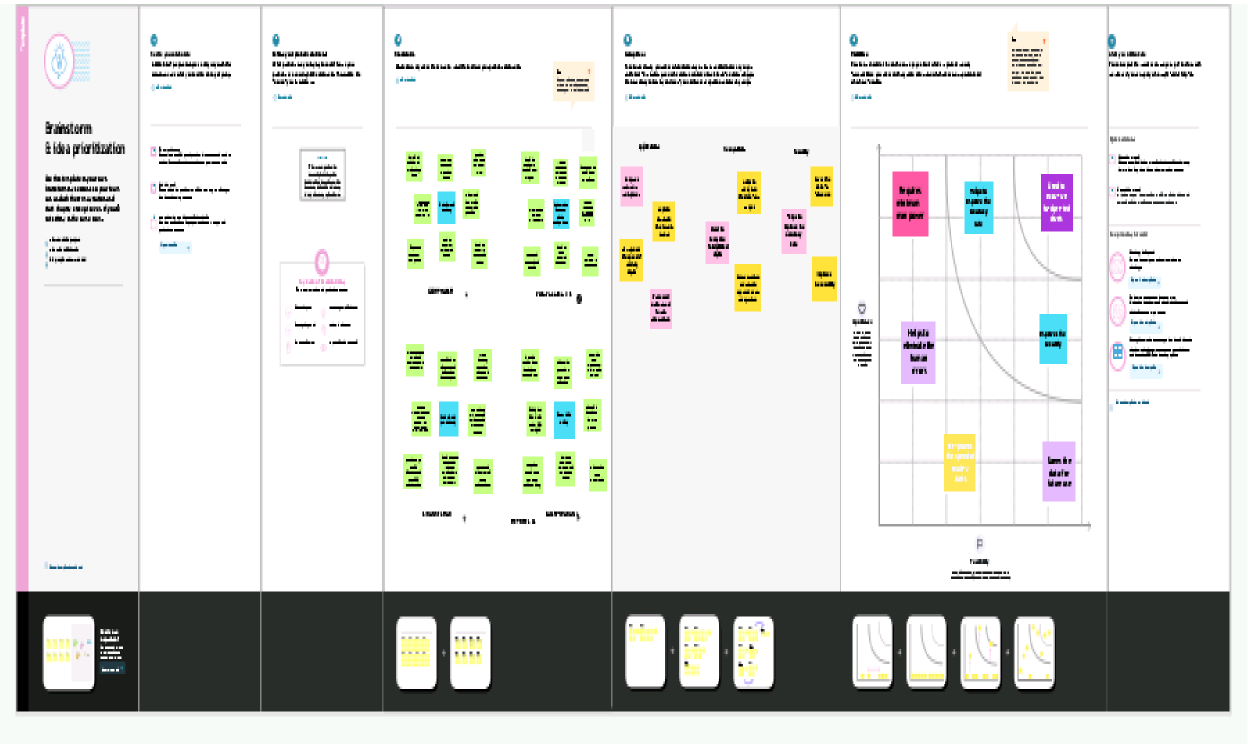
- hard to find diet based on their food they like
- Lack of motive to keep track on their diet
- Facing issue on believing themself while following diet

GAIN
"wants" / needs
measures of success
obstacles

- Developing healthy eatinghabit
- Easy way to track the diet plan
- Finding the nutrition value of fruits

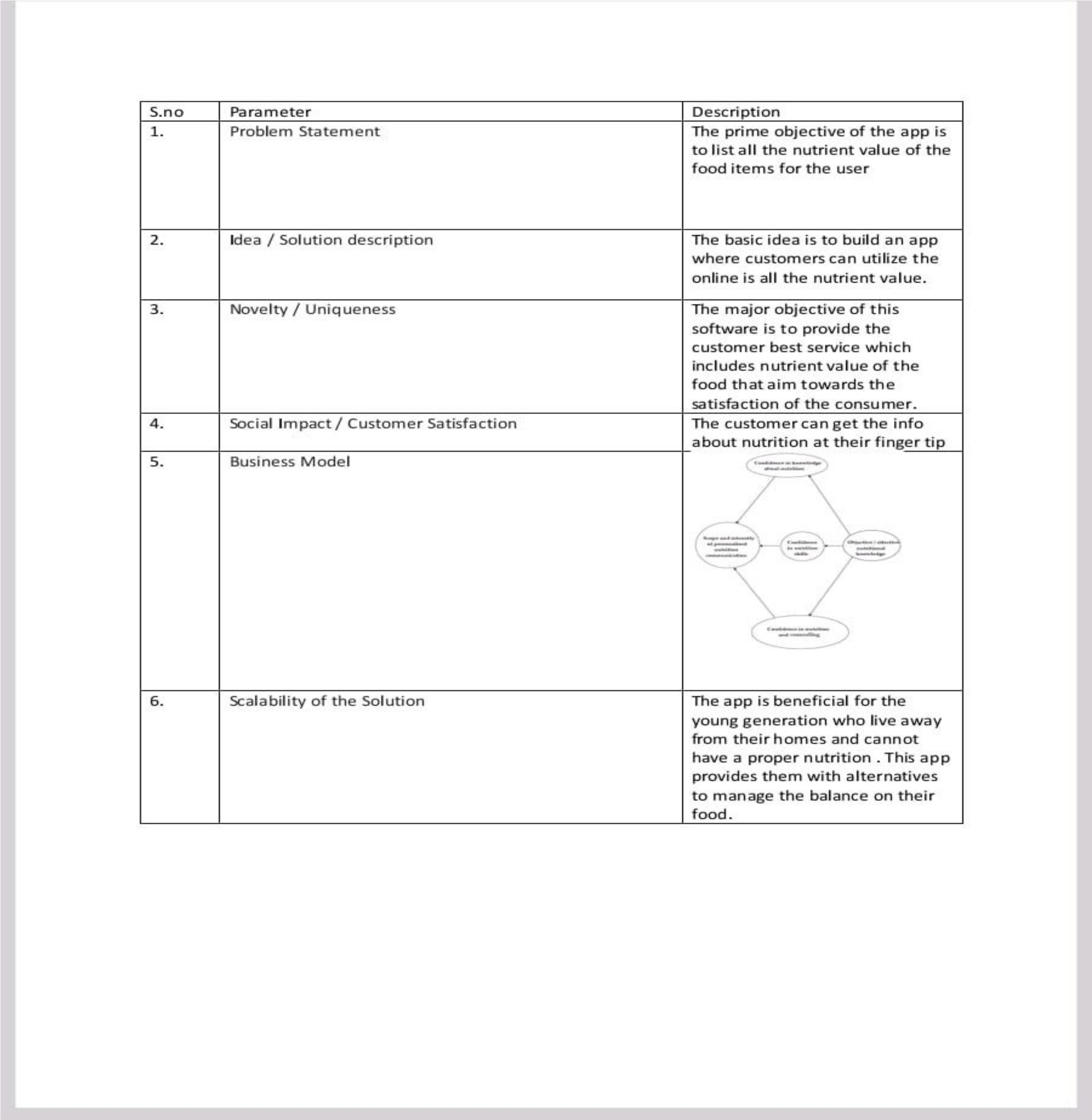
Share your feedback

3.2. IDEATION & BRAINSTROMING



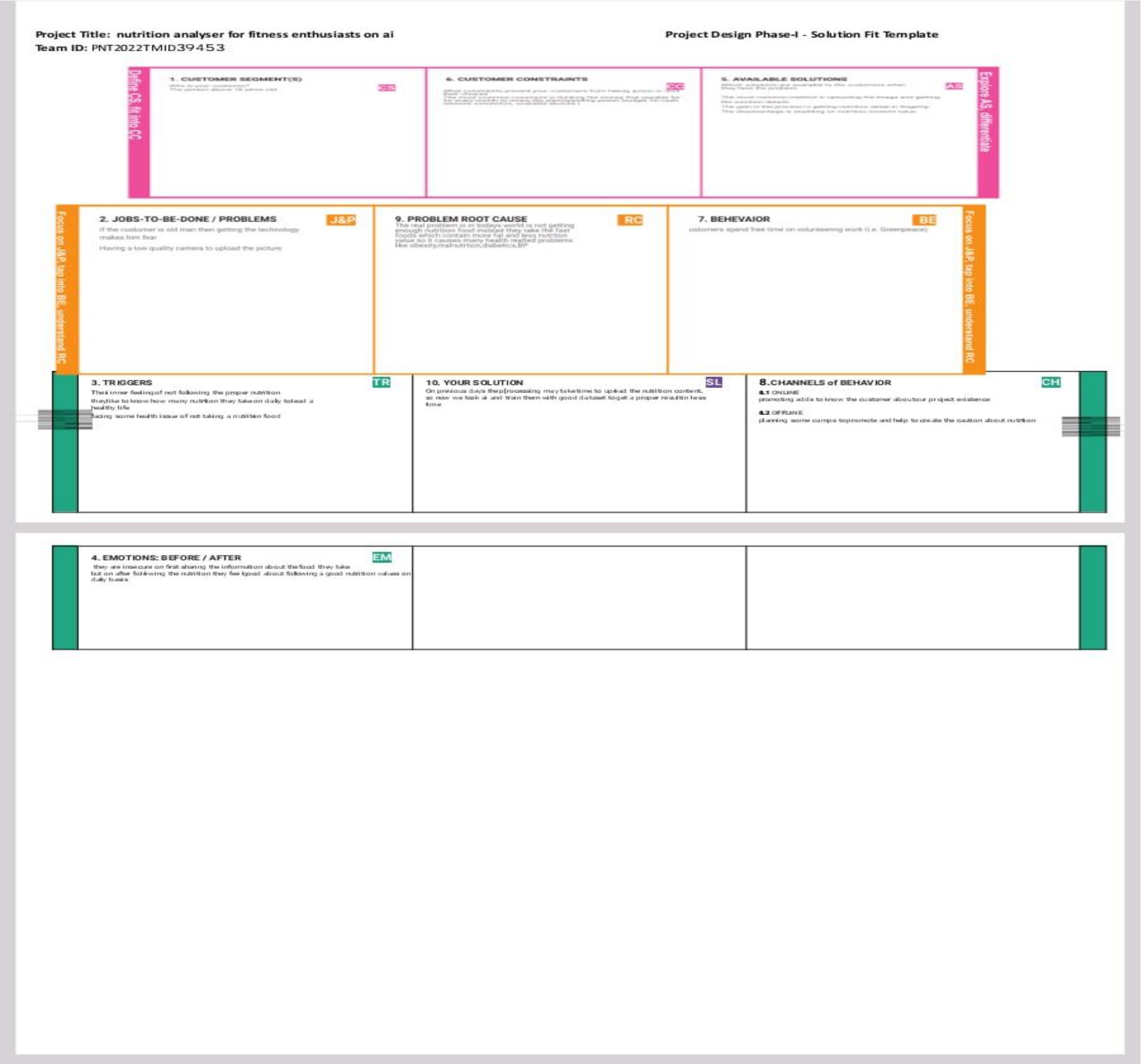
Brainstorm & idea prioritization

3.3. PROPSED SOLUTION



S.no	Parameter	Description
1.	Problem Statement	The prime objective of the app is to list all the nutrient value of the food items for the user
2.	Idea / Solution description	The basic idea is to build an app where customers can utilize the online is all the nutrient value.
3.	Novelty / Uniqueness	The major objective of this software is to provide the customer best service which includes nutrient value of the food that aim towards the satisfaction of the consumer.
4.	Social Impact / Customer Satisfaction	The customer can get the info about nutrition at their finger tip
5.	Business Model	Confidence in knowledge about nutrition Scope and intensity of personalized nutrition communication Confidence in nutrition skills Objective / effective nutritional knowledge Confidence in nutrition and counselling
6.	Scalability of the Solution	The app is beneficial for the young generation who live away from their homes and cannot have a proper nutrition . This app provides them with alternatives to manage the balance on their food.

3.4PROBLEMSOLUTIONFIT



Project Title: nutrition analyser for fitness enthusiasts on ai
Team ID: PNT2022TMID39453

Project Design Phase-I - Solution Fit Template

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Who is your customer?
The person above 18 years old

6. CUSTOMER CONSTRAINTS CC

What constraints prevent your customers from taking action or limit their choices
The most common constraint is thinking the income that capable for [illegible] [illegible] spending power, budget, no cash, network connection, available devices.)

5. AVAILABLE SOLUTIONS AS

Which solutions are available to the customers when they face the problem

The most common method is uploading the image and getting the nutrition details
The gain in the process is getting nutrition detail in fingertip
The disadvantage is doubting on nutrition content value

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS J&P

If the customer is old man then getting the technology makes him fear

Having a low quality camera to upload the picture

9. PROBLEM ROOT CAUSE RC

The real problem is in todays world is not getting enough nutrition food instead they take the fast foods which contain more fat and less nutrition value so it causes many health realted problems like obesity,malnutrition,diabetics,BP

7. BEHEVAIOR BE

ustomers spend free time on volunteering work (i.e. Greenpeace)

Focus on J&P, tap into BE, understand RC

3. TRIGGERS TR

Thei inner feelingof not following the proper nutrition
theylike to know how many nutrition they take on daily tolead a healthy life
facing some health issue of not taking a nutrition food

10. YOUR SOLUTION SL

On previous days thep[rocessing may taketime to upload the nutrition content. so now we task ai and train them with good dataset toget a proper resultin less time

8.CHANNELS of BEHAVIOR CH

8.1 ONLINE
promoting adds to know the customer aboutour project existence

8.2 OFFLINE
planning some camps topromote and help to create the caution about nutrition

4. EMOTIONS: BEFORE / AFTER EM

they are insecure on first sharing the information about thefood they take
but on after following the nutrition they fee lgood about following a good nutrition values on daily basis

CHAPTER 4
REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

FR.NO	FUNCTIONAL REQUIREMENTS	SUB REQUIREMENTS
FR-1	Model Creation	Get access the MNIST dataset
		Analyze the dataset
		Define a CNN model
		Train and Test the Model
FR-2	Application Development	Create a website to let the user recognize handwritten digits.
		Create a home page to upload images
		Create a result page to display the results
		Host the website to let the users use it from anywhere
FR-3	Input Image Upload	Let users upload images of various formats.
		Let users upload images of various size
		Prevent users from uploading unsupported image formats
		Pre-Process the image to use it on the model

		Create a database to store all the input images
FR-4	Display Results	Display the result from the model
		Display input image
		Display accuracy the result
		Display other possible predictions with their respective accuracy

4.2 NON FUNCTIONAL REQUIREMENTS

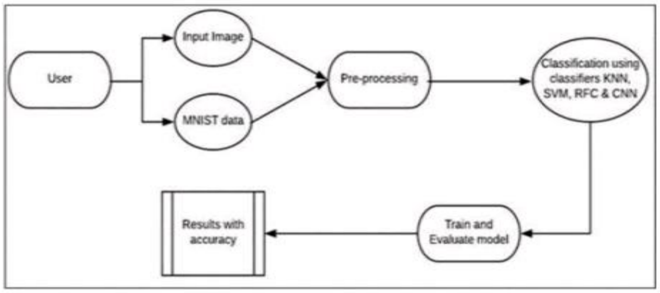
NFR	NON-FUNCTIONAL REQUIREMENTS	DESCRIPTION
NFR-1	Usability	The application must be usable in all devices
NFR-2	Security	The application must protect user uploaded image
NFR-3	Reliability	The application must give an accurate result as much as possible
NFR-4	Performance	The application must be fast and quick to load up
NFR-5	Availability	The application must be available to use all the time
NFR-6	Scalability	The application must scale along with the user base

CHAPTER 5

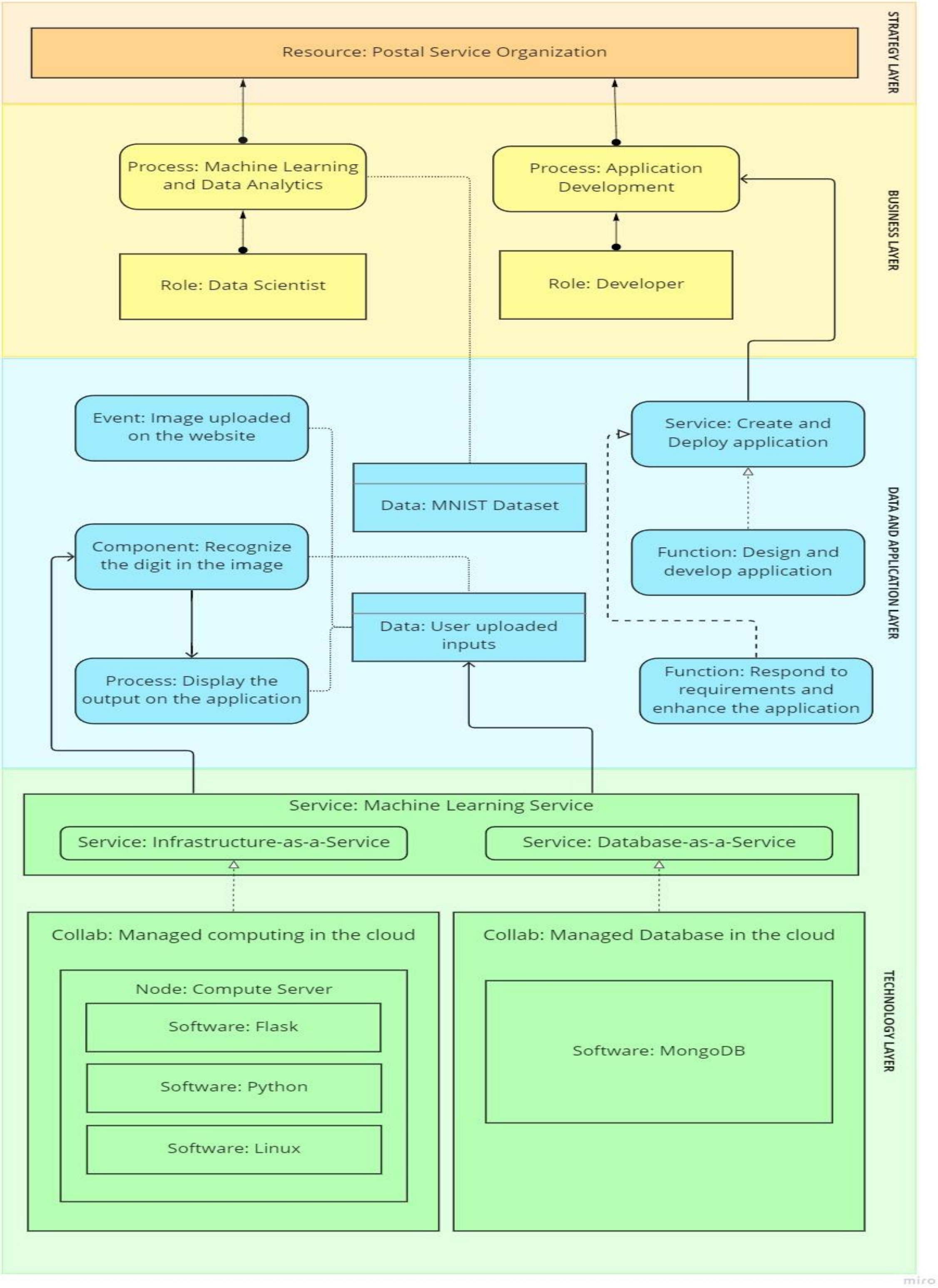
PROJECT DESIGN

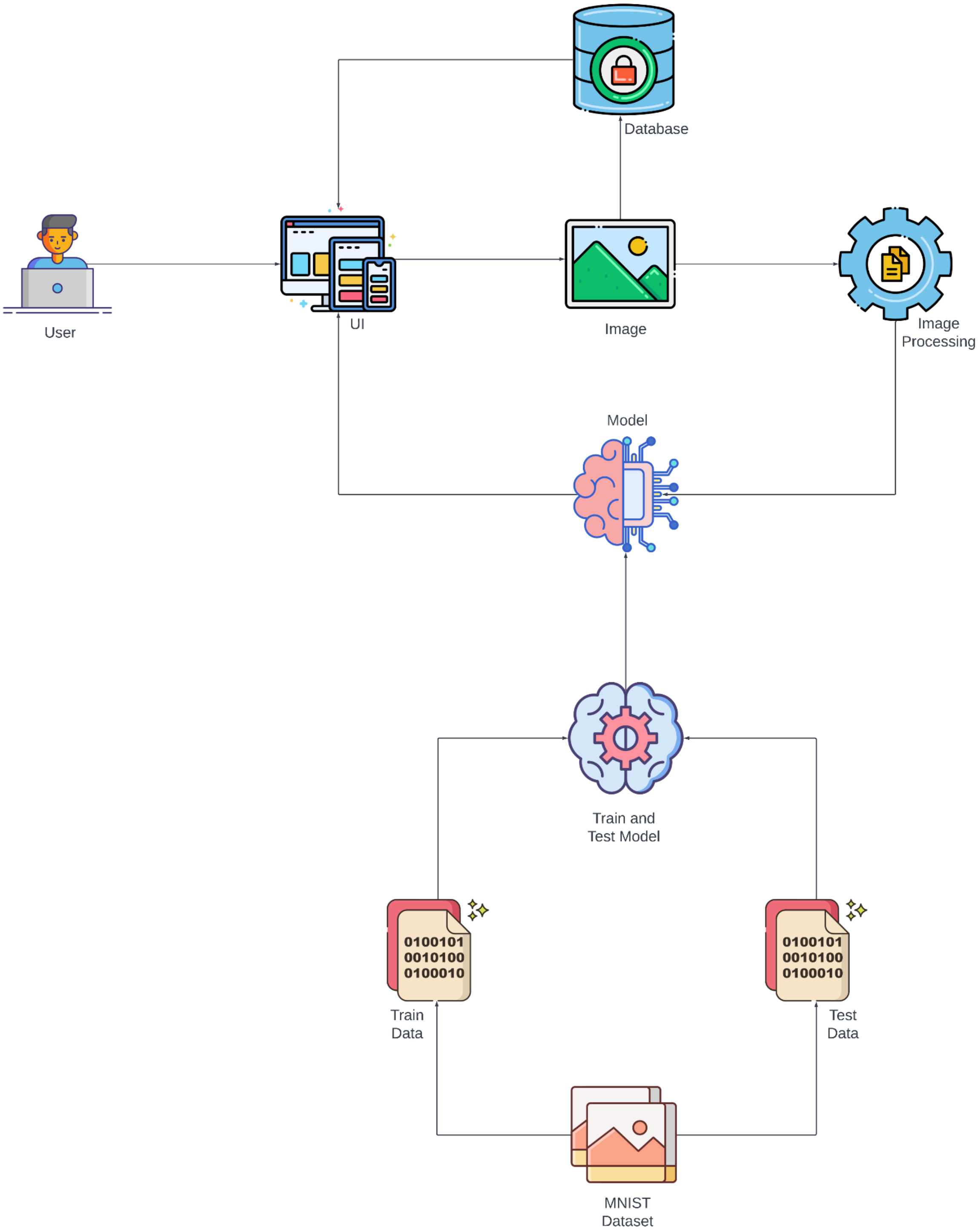
5.1 DATA FLOW DIAGRAM

A two-dimensional diagram explains how data is processed and transferred in a system. The graphical depiction identifies each source of data and how it interacts with other data sources to reach a common output. Individuals seeking to draft a data flow diagram must identify external inputs and outputs, determine how the inputs and outputs relate to each other, and explain with graphics how these connections relate and what they result in. This type of diagram helps business development and design teams visualize how data is processed and identify or improve certain aspects.



5.2 SOLUTION & TECHNICAL ARCHITECTURE


STRATEGY LAYER
Resource: Postal Service Organization
BUSINESS LAYER
Process: Machine Learning and Data Analytics
Process: Application Development
Role: Data Scientist
Role: Developer
DATA AND APPLICATION LAYER
Event: Image uploaded on the website
Service: Create and Deploy application
Data: MNIST Dataset
Component: Recognize the digit in the image
Function: Design and develop application
Data: User uploaded inputs
Process: Display the output on the application
Function: Respond to requirements and enhance the application
TECHNOLOGY LAYER
Service: Machine Learning Service
Service: Infrastructure-as-a-Service
Service: Database-as-a-Service
Collab: Managed computing in the cloud
Collab: Managed Database in the cloud
Node: Compute Server
Software: Flask
Software: Python
Software: Linux
Software: MongoDB
miro

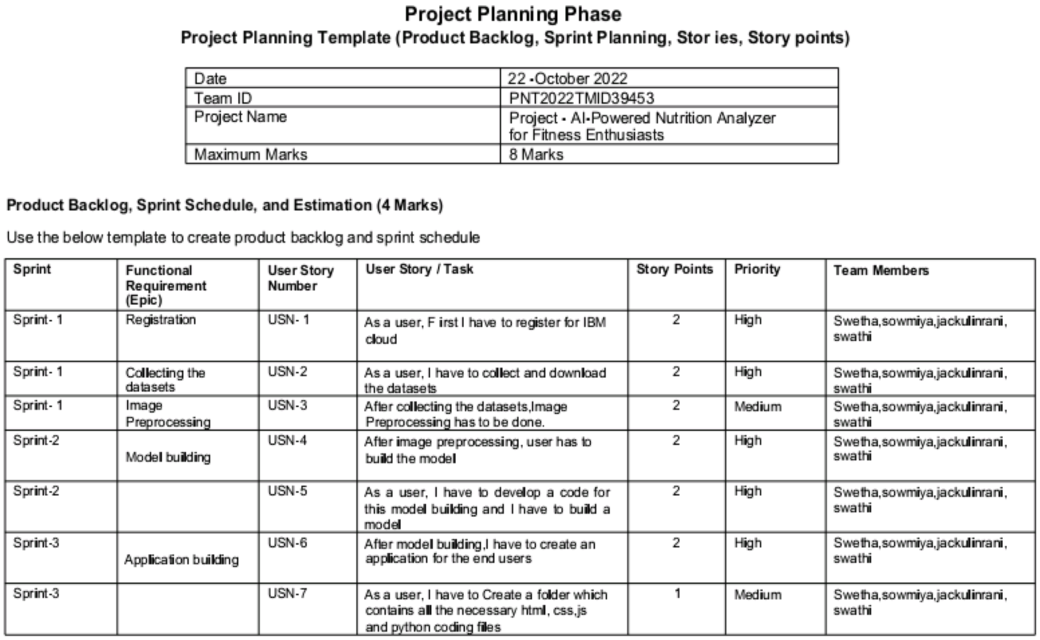

Database
User
UI
Image
Image
Processing
Model
Train and
Test Model
0100101
0010100
0100010
Train
Data
0100101
0010100
0100010
Test
Data
MNIST
Dataset

5.3 USER STORIES

User Type	Functional Requirements	User Story Number	User Story / Task	Acceptance Criteria	Priority	Release
Customer	Accessing the Application	USN-1	As a user, I should be able to access the application from anywhere and use on any devices	User can access the application using the browser on any device	High	Sprint-4
	Uploading Image	USN-2	As a user, I should be able to upload images to predict the digits	User can upload images	High	Sprint-3
	Viewing the Results	USN-3	As a user, I should be able to view the results	The result of the prediction is displayed	High	Sprint-3
	Viewing Other Prediction	USN-4	As a user, I should be able to see other close predictions	The accuracy of other values must be displayed	Medium	Sprint-4
	Usage Instruction	USN-5	As a user, I should have a usage instruction to know how to use the application	The usage instruction is displayed on the home page	Medium	Sprint-4

PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATOR



Project Planning Phase

Project Planning Template (Product Backlog, Sprint Planning, Stor ies, Story points)

Date	22 -October 2022
Team ID	PNT2022TMID39453
Project Name	Project - AI-Powered Nutrition Analyzer for Fitness Enthusiasts
Maximum Marks	8 Marks

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

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	Registration	USN- 1	As a user, F irst I have to register for IBM cloud	2	High	Swetha,sowmiya,jackulinrani, swathi
Sprint- 1	Collecting the datasets	USN-2	As a user, I have to collect and download the datasets	2	High	Swetha,sowmiya,jackulinrani, swathi
Sprint- 1	Image Preprocessing	USN-3	After collecting the datasets,Image Preprocessing has to be done.	2	Medium	Swetha,sowmiya,jackulinrani, swathi
Sprint-2	Model building	USN-4	After image preprocessing, user has to build the model	2	High	Swetha,sowmiya,jackulinrani, swathi
Sprint-2		USN-5	As a user, I have to develop a code for this model building and I have to build a model	2	High	Swetha,sowmiya,jackulinrani, swathi
Sprint-3	Application building	USN-6	After model building,I have to create an application for the end users	2	High	Swetha,sowmiya,jackulinrani, swathi
Sprint-3		USN-7	As a user, I have to Create a folder which contains all the necessary html, css,js and python coding files	1	Medium	Swetha,sowmiya,jackulinrani, swathi

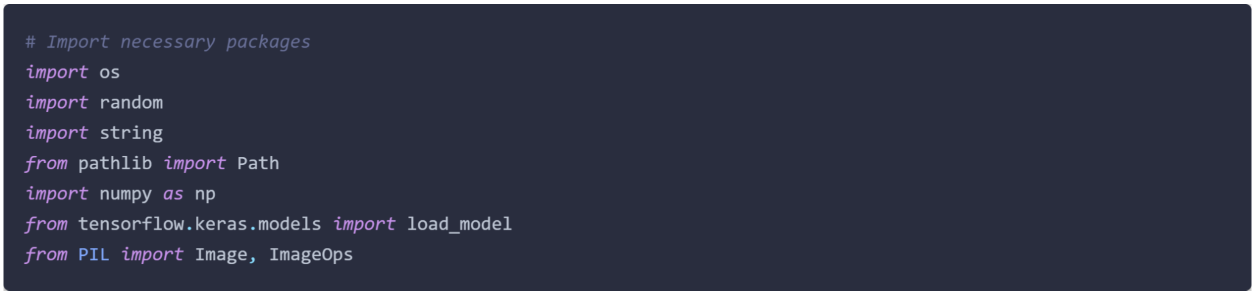
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-3		USN-8	I have to create a folder name flask,where I have to paste all the above mentioned coding files in that fo lder	2	High	Swetha,sowmiya,jackulinrani, swathi
Sprint-4	Outputs	USN-9	Link the flask file with html files and I have to share the screenshots of the output webpage	2	High	Swetha,sowmiya,jackulinrani, swathi
Sprint-4		USN- 10	As a user, I have to deploy the model on IBM	2	High	Swetha,sowmiya,jackulinrani, swathi

Project Tracker, Velocity & Burndown Chart: (4 Marks)

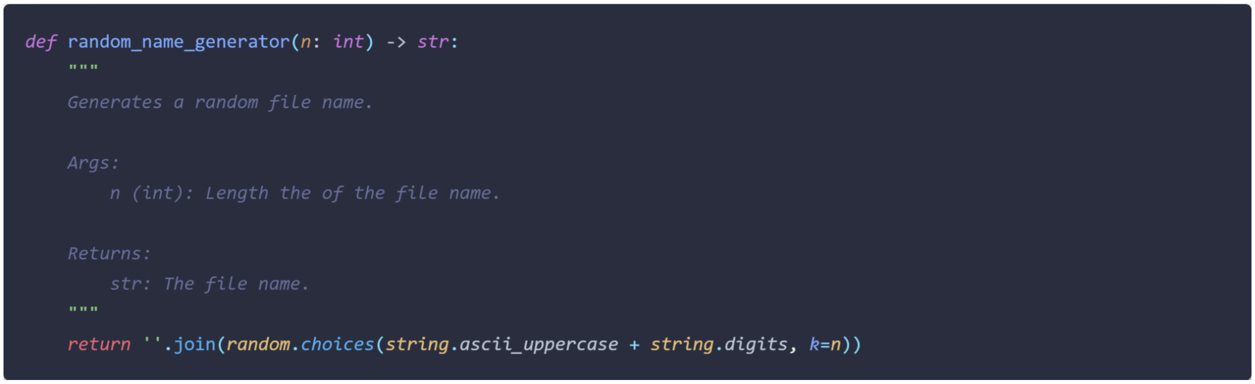
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint- 1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20 (In-process)	05 Nov 2022
Sprint-3	20	6 Days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

CHAPTER 7

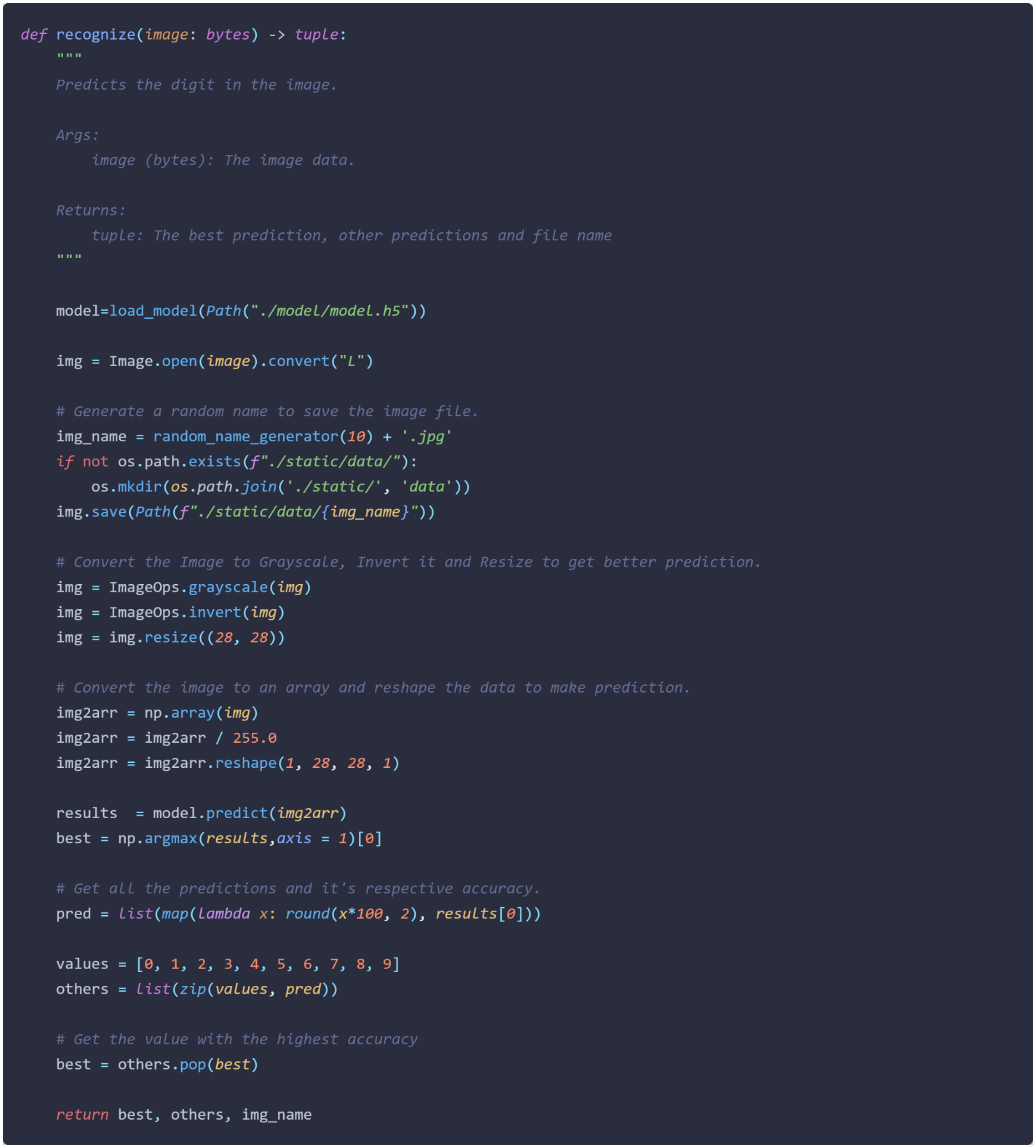
CODING & SOLUTIONING



```python
# Import necessary packages
import os
import random
import string
from pathlib import Path
import numpy as np
from tensorflow.keras.models import load_model
from PIL import Image, ImageOps
```



```python
def random_name_generator(n: int) -> str:
    """
    Generates a random file name.

    Args:
        n (int): Length the of the file name.

    Returns:
        str: The file name.
    """
    return ''.join(random.choices(string.ascii_uppercase + string.digits, k=n))
```



```python
def recognize(image: bytes) -> tuple:
    """
    Predicts the digit in the image.

    Args:
        image (bytes): The image data.

    Returns:
        tuple: The best prediction, other predictions and file name
    """

    model=load_model(Path("./model/model.h5"))

    img = Image.open(image).convert("L")

    # Generate a random name to save the image file.
    img_name = random_name_generator(10) + '.jpg'
    if not os.path.exists(f"./static/data/"):
        os.mkdir(os.path.join('./static/', 'data'))
    img.save(Path(f"./static/data/{img_name}"))

    # Convert the Image to Grayscale, Invert it and Resize to get better prediction.
    img = ImageOps.grayscale(img)
    img = ImageOps.invert(img)
    img = img.resize((28, 28))

    # Convert the image to an array and reshape the data to make prediction.
    img2arr = np.array(img)
    img2arr = img2arr / 255.0
    img2arr = img2arr.reshape(1, 28, 28, 1)

    results  = model.predict(img2arr)
    best = np.argmax(results,axis = 1)[0]

    # Get all the predictions and it's respective accuracy.
    pred = list(map(lambda x: round(x*100, 2), results[0]))

    values = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
    others = list(zip(values, pred))

    # Get the value with the highest accuracy
    best = others.pop(best)

    return best, others, img_name
```

CHAPTER 8
TESTING

8.1 TEST CASES

Test case ID	Feature Type	Component	Test Scenario	Expected Result	Actual Result	Status
HP_TC_001	UI	Home Page	Verify UI elements in the Home Page	The Home page must be displayed properly	Working as expected	PASS
HP_TC_002	UI	Home Page	Check if the UI elements are displayed properly in different screen sizes	The Home page must be displayed properly in all sizes	The UI is not displayed properly in screen size 2560 x 1801 and 768 x 630	FAIL
HP_TC_003	Functional	Home Page	Check if user can upload their file	The input image should be uploaded to the application successfully	Working as expected	PASS
HP_TC_004	Functional	Home Page	Check if user cannot upload unsupported files	The application should not allow user to select a non image file	User is able to upload any file	FAIL
HP_TC_005	Functional	Home Page	Check if the page redirects to the result page once the input is given	The page should redirect to the results page	Working as expected	PASS

BE_TC_001	Functional	Backend	Check if all the routes are working properly	All the routes should properly work	Working as expected	PASS
M_TC_001	Functional	Model	Check if the model can handle various image sizes	The model should rescale the image and predict the results	Working as expected	PASS
M_TC_002	Functional	Model	Check if the model predicts the Nutrition	The model should predict the nutrition	Working as expected	PASS
M_TC_003	Functional	Model	Check if the model can handle complex input image	The model should predict the number in the complex image	The model fails to identify the digit since the model is not built to handle such data	FAIL
RP_TC_001	UI	Result Page	Verify UI elements in the Result Page	The Result page must be displayed properly	Working as expected	PASS
RP_TC_002	UI	Result Page	Check if the input image is displayed properly	The input image should be displayed properly	The size of the input image exceeds the display container	FAIL
RP_TC_003	UI	Result Page	Check if the result is displayed properly	The result should be displayed properly	Working as expected	PASS
RP_TC_004	UI	Result Page	Check if the other predictions are displayed properly	The other predictions should be displayed properly	Working as expected	PASS

8.2 USER ACCEPTANCE TESTING

8.2.1 DEFECT ANALYSIS

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Total
By Design	1	0	1	0	2
Duplicate	0	0	0	0	0
External	0	0	2	0	2
Fixed	4	1	0	1	6
Not Reproduced	0	0	0	1	1
Skipped	0	0	0	1	1
Won’t Fix	1	0	1	0	2
Total	6	1	4	3	14

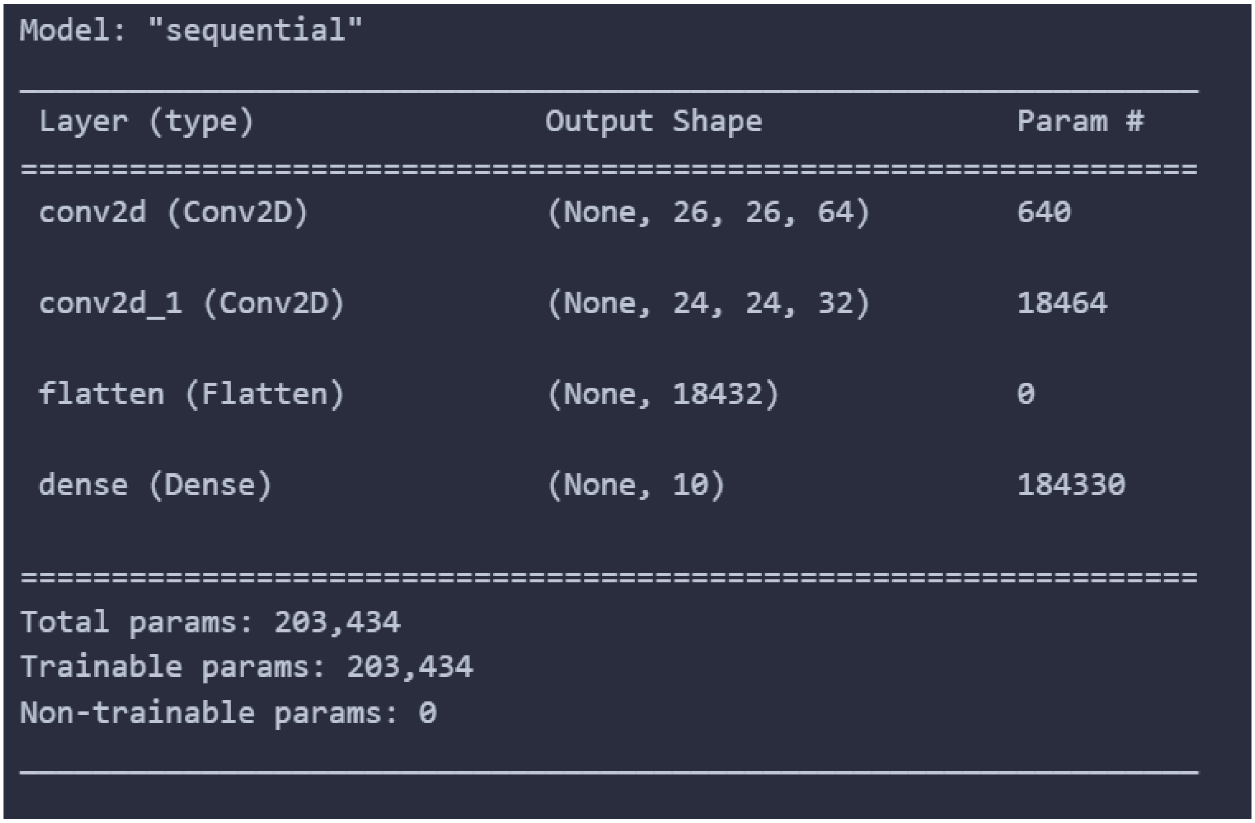
8.2.2 TEST CASE ANALYSIS

Section	Total Cases	Not Tested	Fail	Pass
Client Application	10	0	3	7
Security	2	0	1	1
Performance	3	0	1	2
Exception Reporting	2	0	0	2

CHAPTER 9
RESULTS

9.1 PERFORMANCE METRICS

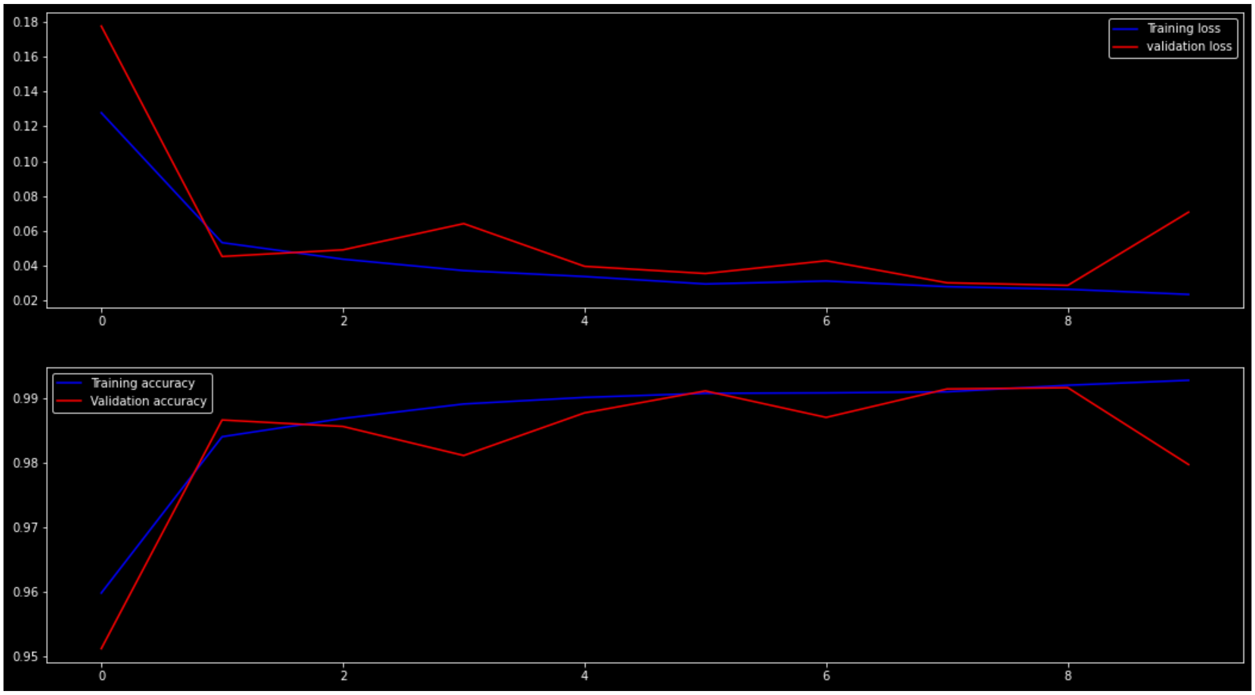
9.1.1 MODEL SUMMARY



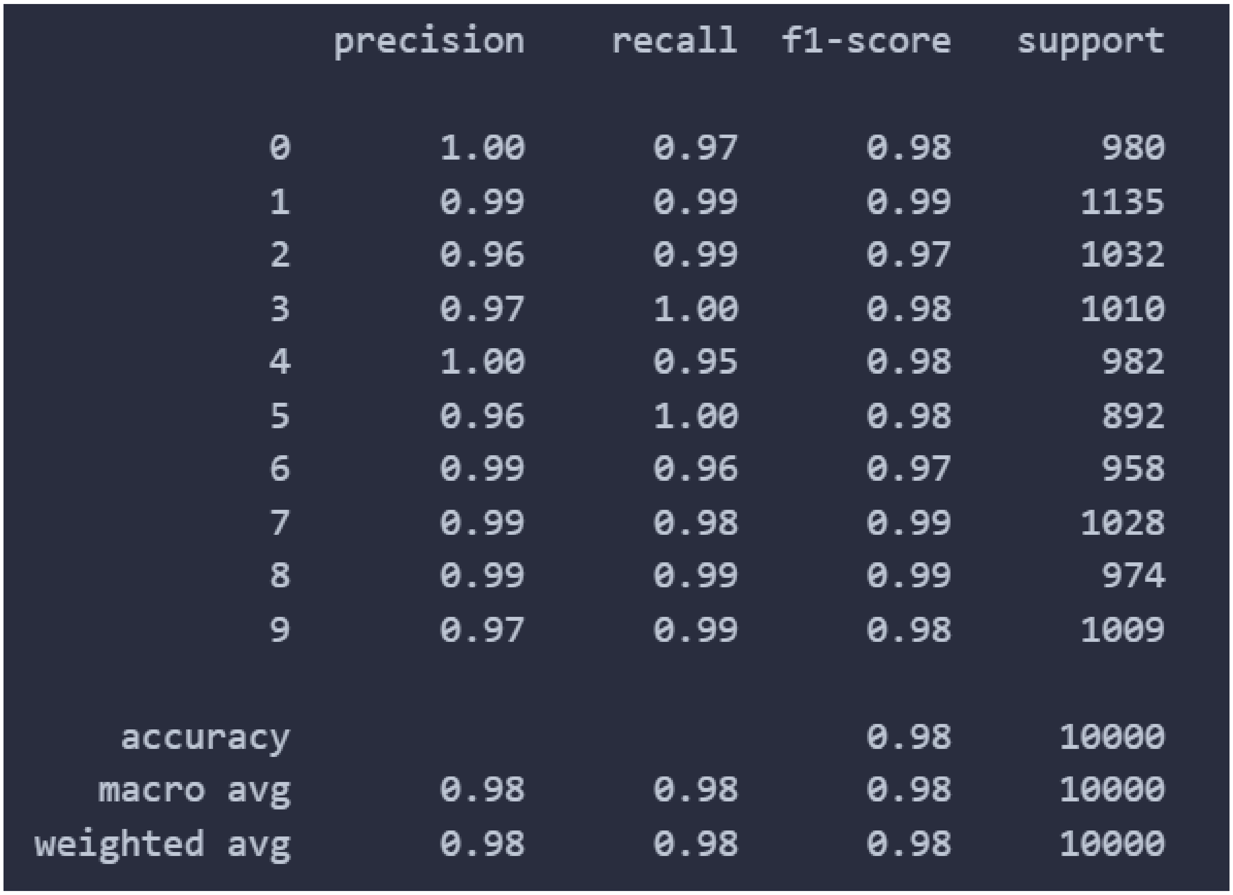
```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 26, 26, 64)        640

 conv2d_1 (Conv2D)           (None, 24, 24, 32)        18464

 flatten (Flatten)           (None, 18432)             0

 dense (Dense)               (None, 10)                184330

=================================================================
Total params: 203,434
Trainable params: 203,434
Non-trainable params: 0
_________________________________________________________________
```

9.1.2 ACCURACY

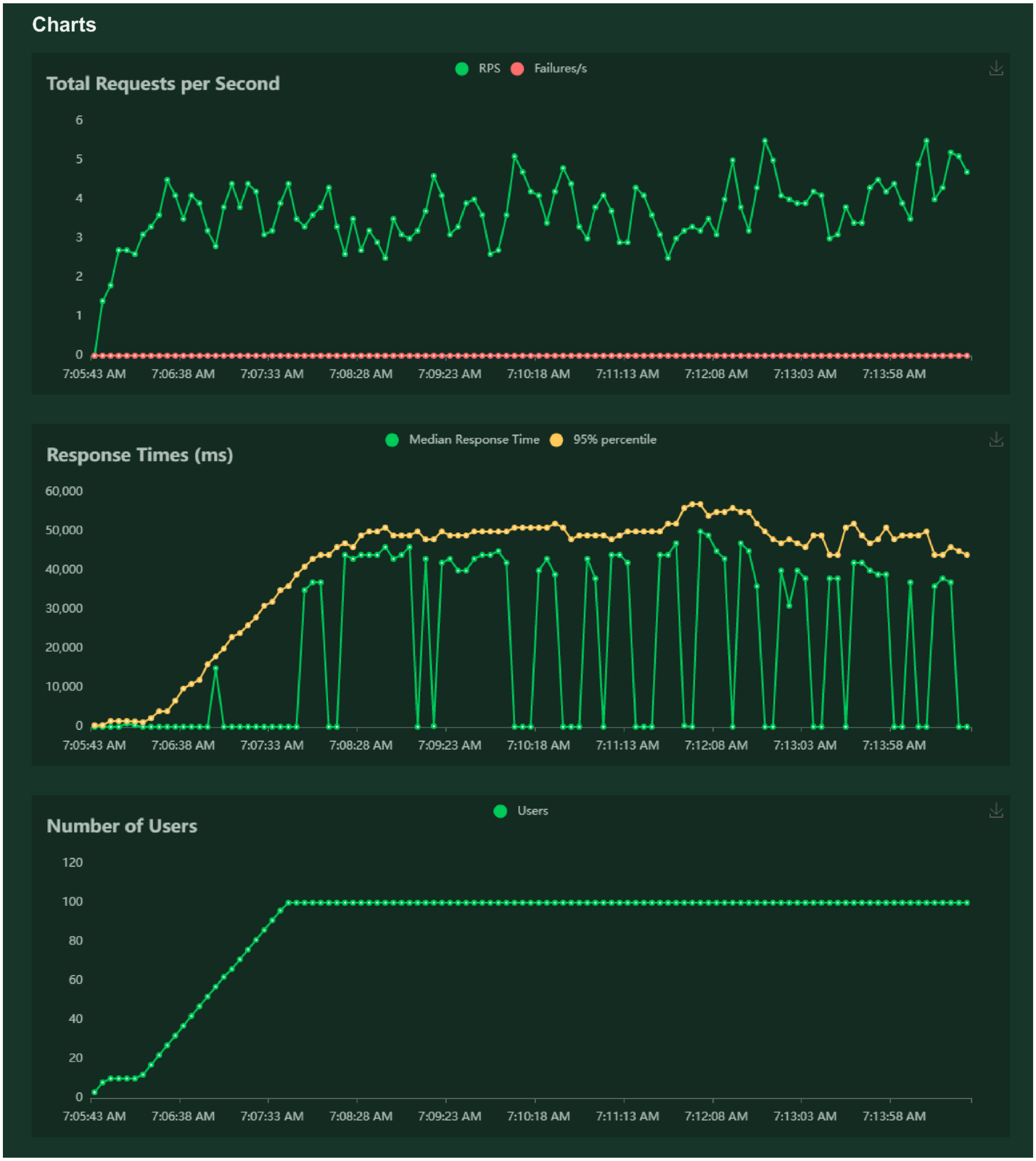
CONTENT	VALUE
Training Accuracy	99.14%
Training Loss	2.70%
Validation Accuracy	97.76%
Validation Loss	10.36%



9.1.4 CLASSIFICATION REPORT



```
              precision    recall  f1-score   support

           0       1.00      0.97      0.98       980
           1       0.99      0.99      0.99      1135
           2       0.96      0.99      0.97      1032
           3       0.97      1.00      0.98      1010
           4       1.00      0.95      0.98       982
           5       0.96      1.00      0.98       892
           6       0.99      0.96      0.97       958
           7       0.99      0.98      0.99      1028
           8       0.99      0.99      0.99       974
           9       0.97      0.99      0.98      1009

    accuracy                           0.98     10000
   macro avg       0.98      0.98      0.98     10000
weighted avg       0.98      0.98      0.98     10000
```


Charts
Total Requests per Second
RPS
Failures/s
6
5
4
3
2
1
0
7:05:43 AM
7:06:38 AM
7:07:33 AM
7:08:28 AM
7:09:23 AM
7:10:18 AM
7:11:13 AM
7:12:08 AM
7:13:03 AM
7:13:58 AM
Response Times (ms)
Median Response Time
95% percentile
60,000
50,000
40,000
30,000
20,000
10,000
0
7:05:43 AM
7:06:38 AM
7:07:33 AM
7:08:28 AM
7:09:23 AM
7:10:18 AM
7:11:13 AM
7:12:08 AM
7:13:03 AM
7:13:58 AM
Number of Users
Users
120
100
80
60
40
20
0
7:05:43 AM
7:06:38 AM
7:07:33 AM
7:08:28 AM
7:09:23 AM
7:10:18 AM
7:11:13 AM
7:12:08 AM
7:13:03 AM
7:13:58 AM

CHAPTER 10

ADVANTAGES & DISADVANTAGES

ADVANTAGES

- Reduces manual work
- More accurate than average human
- Capable of handling a lot of data
- Can be used anywhere from any device

DISADVANTAGES

- Cannot handle complex data
- All the data must be in digital format
- Requires a high performance server for faster predictions
- Prone to occasional errors

CHAPTER 11

CONCLUSION

This project demonstrated a web application that uses machine learning to recognise handwritten numbers. Flask, HTML, CSS, JavaScript, and a few other technologies were used to create this project. The model predicts the handwritten digit using a CNN network. During testing, the model achieved a 99.61% recognition rate. The proposed project is scalable and can easily handle a huge number of users. Since it is a web application, it is compatible with any device that can run a browser. This project is extremely useful in real-world scenarios such as recognizing and analyze and recognize fruits based on color and texture features. In present work we have studied different types of techniques used for fruit detection.

CHAPTER 12

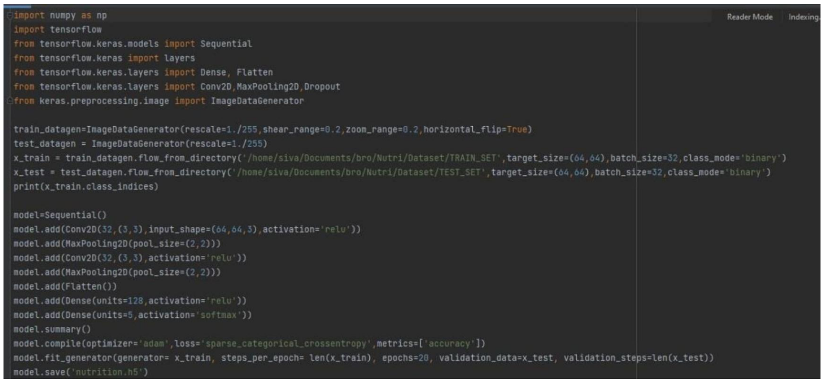
FUTURE SCOPE

This project is far from complete and there is a lot of room for improvement. Some of improvements that can be made to this project are as follows we plan to create a mobile application which takes the picture of fruits and labels them accordingly. Another object is to expand the training and testing sets to include more items. This is time-consuming process since we want to include the items that were not used in most other examples .This project has endless potential and can always be enhanced to become better. Implementing this concept in the real world will benefit several industries and reduce the workload on many workers, enhancing overall work efficiency.

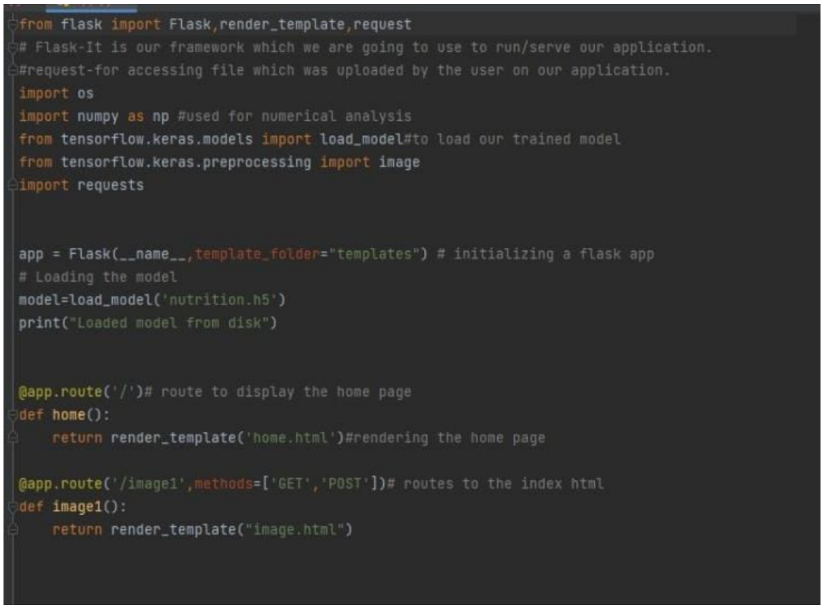
APPENDIX

SOURCE CODE

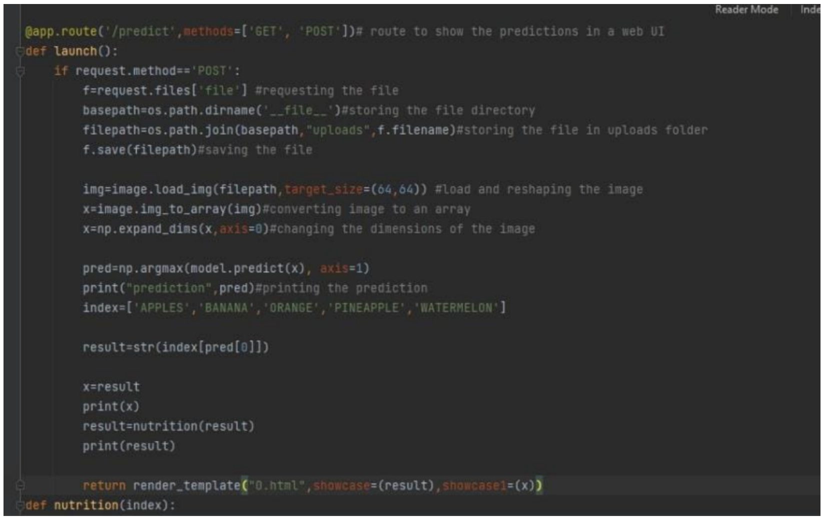
MODEL CREATION



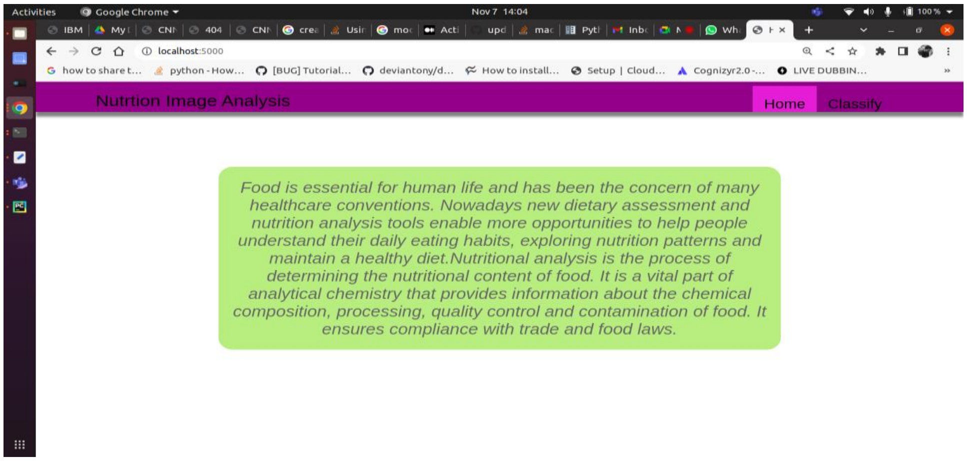
```
import numpy as np
import tensorflow
from tensorflow.keras.models import Sequential
from tensorflow.keras import layers
from tensorflow.keras.layers import Dense, Flatten
from tensorflow.keras.layers import Conv2D,MaxPooling2D,Dropout
from keras.preprocessing.image import ImageDataGenerator

train_datagen=ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)
test_datagen = ImageDataGenerator(rescale=1./255)
x_train = train_datagen.flow_from_directory('/home/siva/Documents/bro/Nutri/Dataset/TRAIN_SET',target_size=(64,64),batch_size=32,class_mode='binary')
x_test = test_datagen.flow_from_directory('/home/siva/Documents/bro/Nutri/Dataset/TEST_SET',target_size=(64,64),batch_size=32,class_mode='binary')
print(x_train.class_indices)

model=Sequential()
model.add(Conv2D(32,(3,3),input_shape=(64,64,3),activation='relu'))
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Conv2D(32,(3,3),activation='relu'))
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Flatten())
model.add(Dense(units=128,activation='relu'))
model.add(Dense(units=5,activation='softmax'))
model.summary()
model.compile(optimizer='adam',loss='sparse_categorical_crossentropy',metrics=['accuracy'])
model.fit_generator(generator= x_train, steps_per_epoch= len(x_train), epochs=20, validation_data=x_test, validation_steps=len(x_test))
model.save('nutrition.h5')
```



```
from flask import Flask,render_template,request
# Flask-It is our framework which we are going to use to run/serve our application.
#request-for accessing file which was uploaded by the user on our application.
import os
import numpy as np #used for numerical analysis
from tensorflow.keras.models import load_model#to load our trained model
from tensorflow.keras.preprocessing import image
import requests


app = Flask(__name__,template_folder="templates") # initializing a flask app
# Loading the model
model=load_model('nutrition.h5')
print("Loaded model from disk")


@app.route('/')# route to display the home page
def home():
    return render_template('home.html')#rendering the home page

@app.route('/image1',methods=['GET','POST'])# routes to the index html
def image1():
    return render_template("image.html")
```

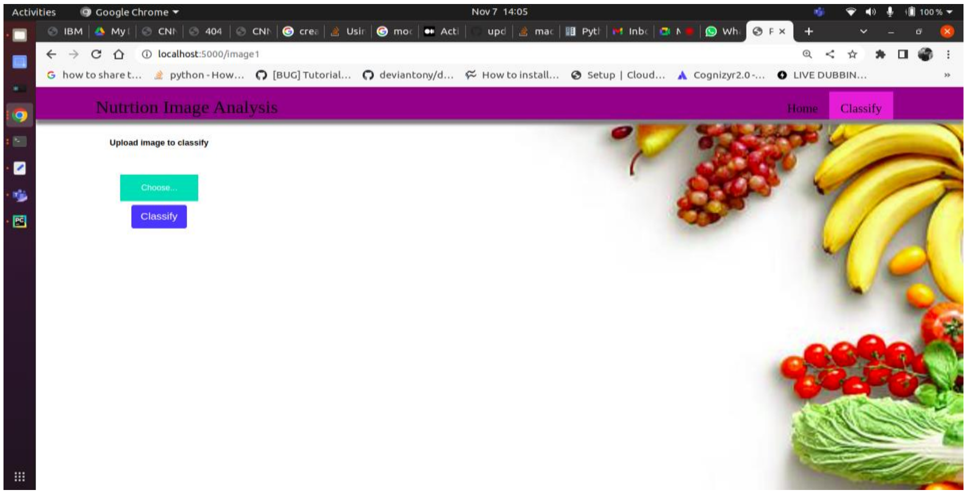


```
@app.route('/predict',methods=['GET', 'POST'])# route to show the predictions in a web UI
def launch():
    if request.method=='POST':
        f=request.files['file'] #requesting the file
        basepath=os.path.dirname('__file__')#storing the file directory
        filepath=os.path.join(basepath,"uploads",f.filename)#storing the file in uploads folder
        f.save(filepath)#saving the file

        img=image.load_img(filepath,target_size=(64,64)) #load and reshaping the image
        x=image.img_to_array(img)#converting image to an array
        x=np.expand_dims(x,axis=0)#changing the dimensions of the image

        pred=np.argmax(model.predict(x), axis=1)
        print("prediction",pred)#printing the prediction
        index=['APPLES','BANANA','ORANGE','PINEAPPLE','WATERMELON']

        result=str(index[pred[0]])

        x=result
        print(x)
        result=nutrition(result)
        print(result)

        return render_template("0.html",showcase=(result),showcase1=(x))
def nutrition(index):
```



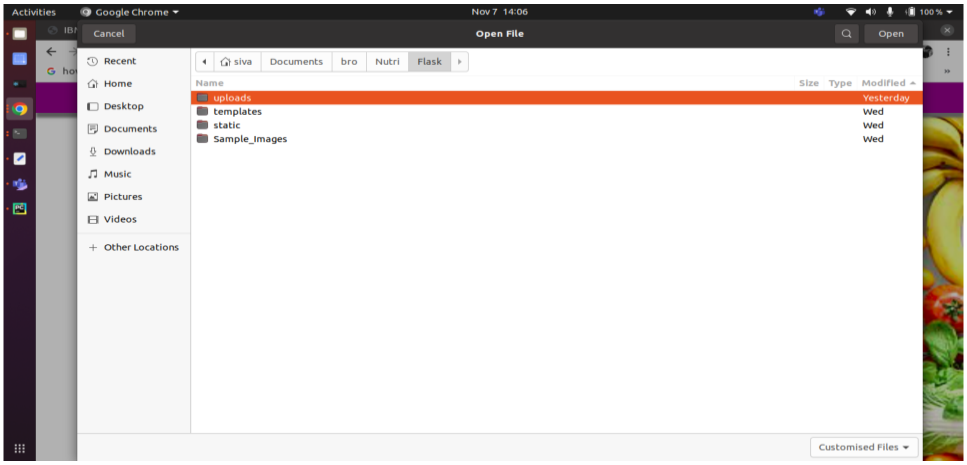
Nutrtion Image Analysis

Food is essential for human life and has been the concern of many healthcare conventions. Nowadays new dietary assessment and nutrition analysis tools enable more opportunities to help people understand their daily eating habits, exploring nutrition patterns and maintain a healthy diet.Nutritional analysis is the process of determining the nutritional content of food. It is a vital part of analytical chemistry that provides information about the chemical composition, processing, quality control and contamination of food. It ensures compliance with trade and food laws.

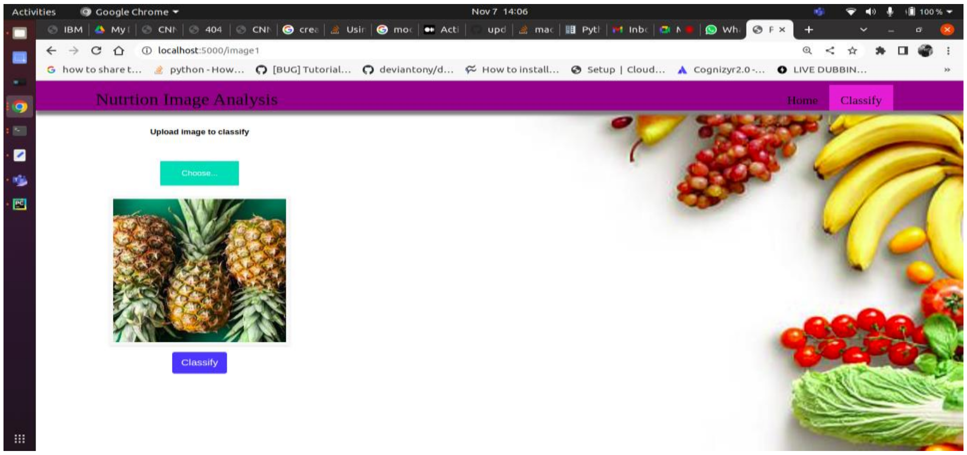


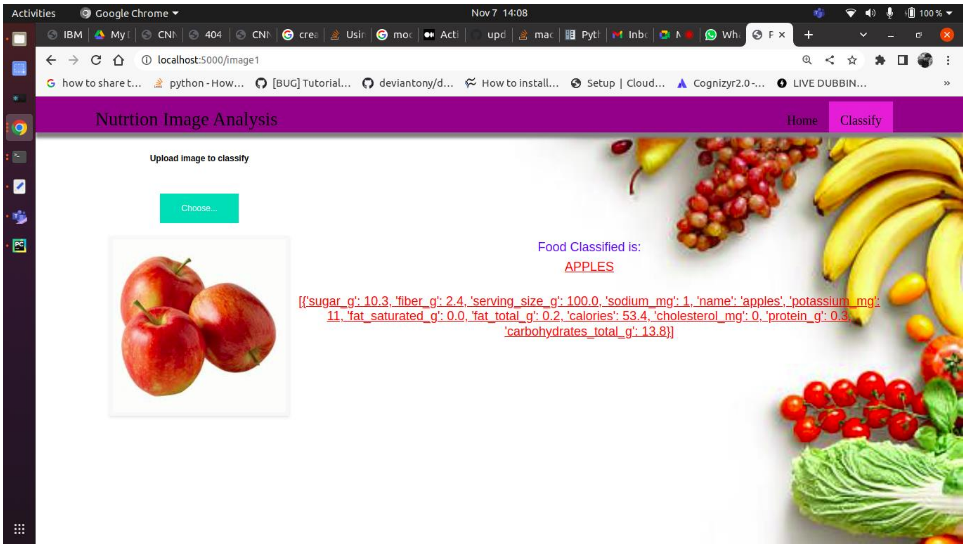
Nutrtion Image Analysis

Upload image to classify



Name	Size	Type	Modified
uploads			Yesterday
templates			Wed
static			Wed
Sample_Images			Wed





Nutrtion Image Analysis

Home Classify

Upload image to classify

Choose...

Food Classified is:

APPLES

[{'sugar_g': 10.3, 'fiber_g': 2.4, 'serving_size_g': 100.0, 'sodium_mg': 1, 'name': 'apples', 'potassium_mg': 11, 'fat_saturated_g': 0.0, 'fat_total_g': 0.2, 'calories': 53.4, 'cholesterol_mg': 0, 'protein_g': 0.3, 'carbohydrates_total_g': 13.8}]

GitHub
https://github.com/IBM-EPBL/IBM-Project-36622-1660296677.git
Demo link
https://drive.google.com/file/d/1OrhNWQrGRvELxHpIbcnIEjFQoqT-jKxF/view?usp=share_link