AI-POWERED NUTRITION ANALYZER FOR FITENESS ENTHUSIASTS

PROJECT REPORT
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Submitted by

D.SRILAKSHMI (810419106010)

K.ADILAKSHMI (810419106026)

E.SWATHI (810419106034)

S.SIVASANGARI (810419106046)

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DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE,(AUTONOMOUS)

PERAMBALUR – 621212

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ABSTRACT

Nowadays, standard intake of healthy food is necessary for keeping a balanced diet to avoid obesity in the human body. In this paper, we present a novel system based on machine learning that automatically performs accurate classification of food images and estimates food attributes. This paper proposes a deep learning model consisting ofa convolution neural network that classifies food into specific categories in the trainingpart of the prototype system. The main purpose of the proposed method is to improve the accuracy of the pre-training model. The paper designs a prototype system based onthe client server model. The client sends an image detection request and processes it on the server side. We implemented three classifier SVM ,ANN,CNN for compare the improved accuracy of system. Including a pre-trained CNN model training module for classification purposes, a text data training module for attribute estimation models, anda server-side module. We experimented with a variety of food categories, each containing thousands of images, and through machine learning training to achieve higher classification accuracy.

1. INTRODUCTION

1.1 Project Overview

Technology Assisted Dietary Assessment (TADA) has been one of Purdue EPICS' most valuable insights for mounting nutrition intervention programs. With the growing concern about obesity, the need to accurately measure food intake has become imperative. For example, dietary assessment among adolescents is problematic as this group has irregular eating patterns and less enthusiasm for recording food intake. Preliminary studies among adolescents suggest that the innovative use of technology may improve the accuracy of dietary information from young people. Recognition of emerging advancements in technology, e.g., higher resolution pictures, improved memory capacity, faster processors, allow these devices to process information not previously possible.

Our goal is to develop, implement, and evaluate a mobile device food record (MDFR) that will translate to an accurate account of daily food and nutrient intake among adolescents and adults. Our first steps include further development of our pilot mobile computing device to include digital images, a nutrient database, and image processing for identification and quantification of food consumption. Mobile computing devices provide a unique vehicle for collecting dietary information that reduces burden on record keepers. Images of food can be marked with a variety of input methods that link the item for image processing and analysis to estimate the amount of food. Imagesbefore and after foods are eaten can estimate the amount of food consumed

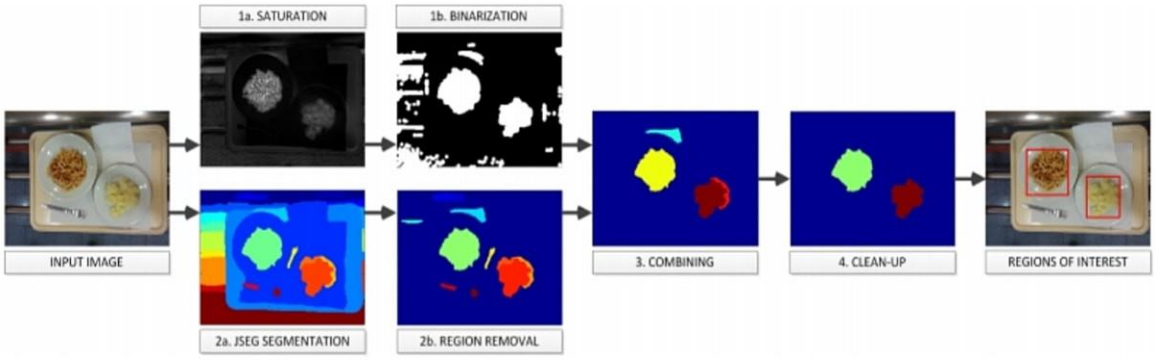

Figure 1: food recognition recognition

Our goal is to develop, implement, and evaluate a mobile device food record (mdFR) that will translate to an accurate account of daily food and nutrient intake among adolescents and adults. Our first steps include further development of our pilot mobile computing device to include digital images, a nutrient database, and image processing for identification and quantification of food consumption. Mobile computing devices provide a unique vehicle for collecting dietary information that reduces burden on recordkeepers. Images of food can be marked with a variety of input methods that link the item for image processing and analysis to estimate the amount of food. Images before and after foods are eaten can estimate the amount of food consumed

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.).

2. LITERATURE SURVEY

2.1 Existing problem

In the short term, poor nutrition can contribute to stress, tiredness and ou capacity to work, and over time, it can contribute to the risk of developing some illnesses and other health problems such as: being overweight or obese.Tooth decay ,high blood pressure. There are now strong links between low intakes of particular nutrients and the risk of developing chronic disease including some cancers, heart disease, diabetes, osteoporosis and depression. During pregnancy, insufficient nutrient intake can have long-term health implications for the health of the child.

2.2 References

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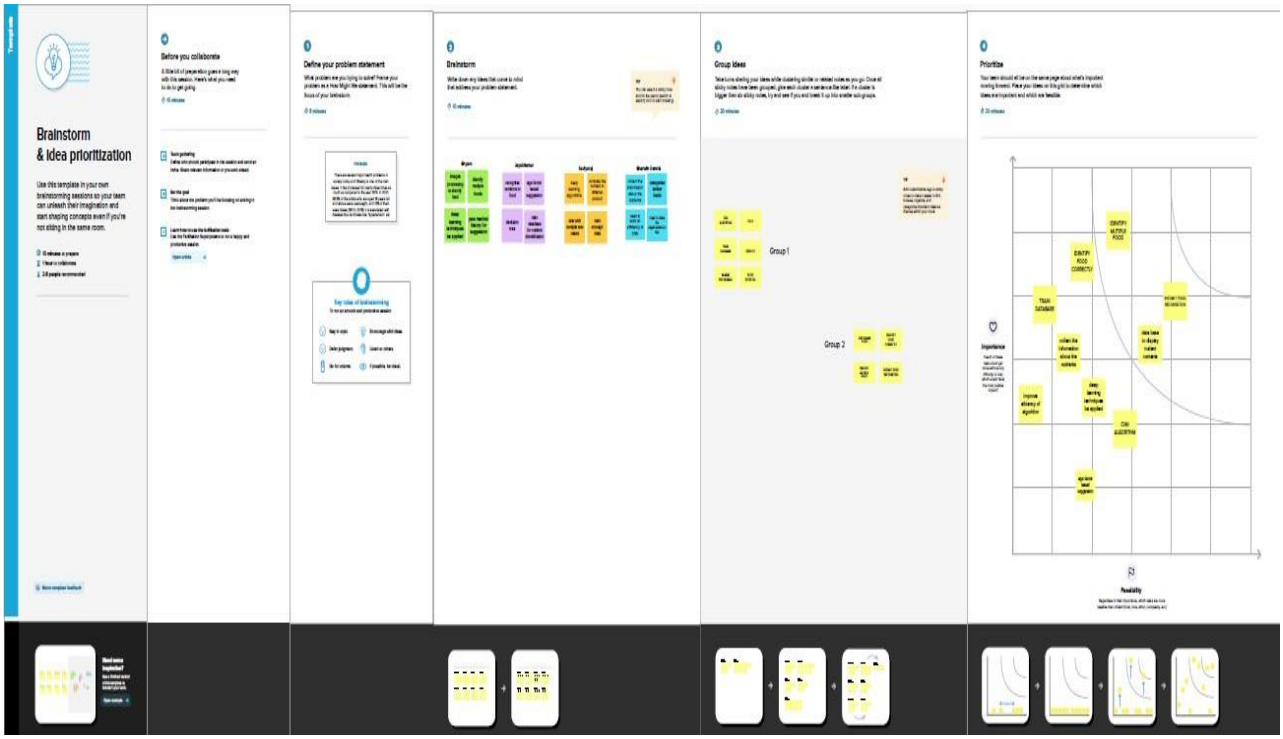
2.3 Problem Statement Definition

The amount of physical activity you need depends on your individual fitness goals and your current fitness level. It’s important to start within your abilities and listen to your body’s cues in terms of pain and injury. Obesity is a common health issue that is defined by having a high percentage of body fat. Being overweight or obese increases your chances of dying from hypertension, coronary heart disease, sleep apnea, and endometrial, breast, prostate, and colon cancers. Junk foods are high in calorie but low in nutrition value and lead to an excess metabolic weight leading to obesity. An obese individual is prone to life-threatening diseases which are not only limited to cholesterolor diabetes but also can cause stoke and NCDs. Overtraining may wear down the immune system. It Increases cardiovascular stress.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

3.2 Ideation & Brainstorming



3.3 Proposed Solution

Project team shall fill the following information in the proposed solution template.

S.NO.	Parameter	Description
1.	Problem Statement (Problem to be solved)	The inability of most apps to correctly calculate the nutritional value of the MD is a main reason for consumers ultimately rejecting calorie intake and meal-tracking apps.
2.	Idea / Solution description	Milestones are important for losing weight, soallow users to set and beat goals to make their achievements visible to them.
3.	Novelty / Uniqueness	Giving an individual food and health scheduling. According to their health, body conditions.
4.	Social Impact / Customer Satisfaction	To lose extra weight, To take control over eating habits & lose weight, To get professional advice, To discover food ingredients fast.
5.	Business Model (Revenue	It is available for customers for free and it is easy

	Model)	to use anywhere , anytime in any country.
6.	Scalability of the Solution	This analyzing tool uses artificial intelligence to measure food products' quantitative and qualitative properties without harming them.

3.4 Problem Solution Fit

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

1. It will generate the diet plan as well as monitor the user's health to classify the category of the disease and to create the diet plan. It will also reduce the cost of consulting the person nutritionist.

The task of food detection/classification is not easy as it seems. All possible options related to the given Image.

* Image classification, object detection, segmentation, face recognition. Classification of crystal structure using a convolutional neural network.

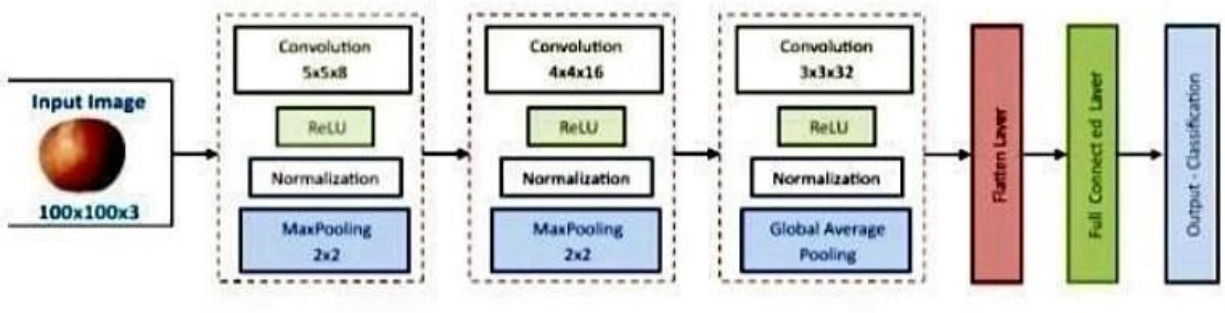
* Computer-Assisted Nutritional Recognize Food Images – In order to solve this issue, a brand-new Convolutional Neural Network (CNN)- based food picture identification system was created, as described in this study. We utilized our suggested strategy on two sets of actual food picture data.

2. Here the user can capture the images of different fruits and then the image will be sent to the trained model. The model analyzes the image and detects the nutrition based on the fruits like (Sugar, Fiber, Protein, Calories, etc.)

3. The Ultimate Workout at Home Solution This fitness AI software is designed with personalized training regimens for each individual. It began as "gym only software," but has now improved its system to satisfy "at home fitness" expectations.

4. You take a picture, dial in data such as whether you are eating breakfast or lunch and add a quick text label, and the app estimates the calorie content.This software collaborated with IBM's natural language capability to provide 24-hour assistance and dietary recommendations.

For Example:



5.The comparison of the proposed model with the conventional

models shows that the results of this model are exceptionally good and promising to use in real-world applications. This sort of higher accuracy and precision will work to boost the machine's general efficiency in fruit recognition more appropriately.

6.A generic model for the dietary protein requirement (as with any nutrient) defines the requirement in terms of the needs of the organism.

7.Metabolic demands, and the dietary amount which will satisfy those needs, i.e. efficiency of utilization, thus: dietary requirement = metabolic demand/efficiency of utilization.

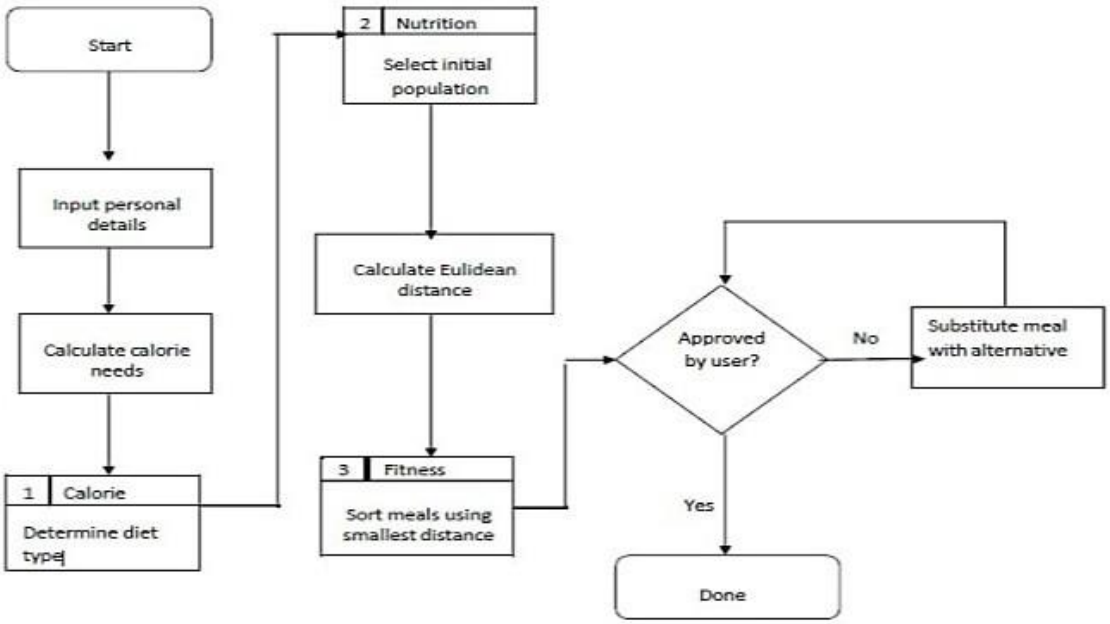
4.2 Non-functional Requirements:

Following are the non-functional requirements of the proposed solution

FR.NO	Non-Functional Requirement	Description
NFR-1	**Usability**	Easy to use with interactive User Interface
NFR-2	**Security**	User can access only their personal information
NFR-3	**Reliability**	The average time of failure shall be 7 days or 1month
NFR-4	**Performance**	The result has to be shown within 5 sec
NFR-5	**Availability**	The dietician shall be available to users 24 hours a day or 7 days of a week
NFR-6	**Scalability**	Supports various food items

5. PROJECT DESIGN

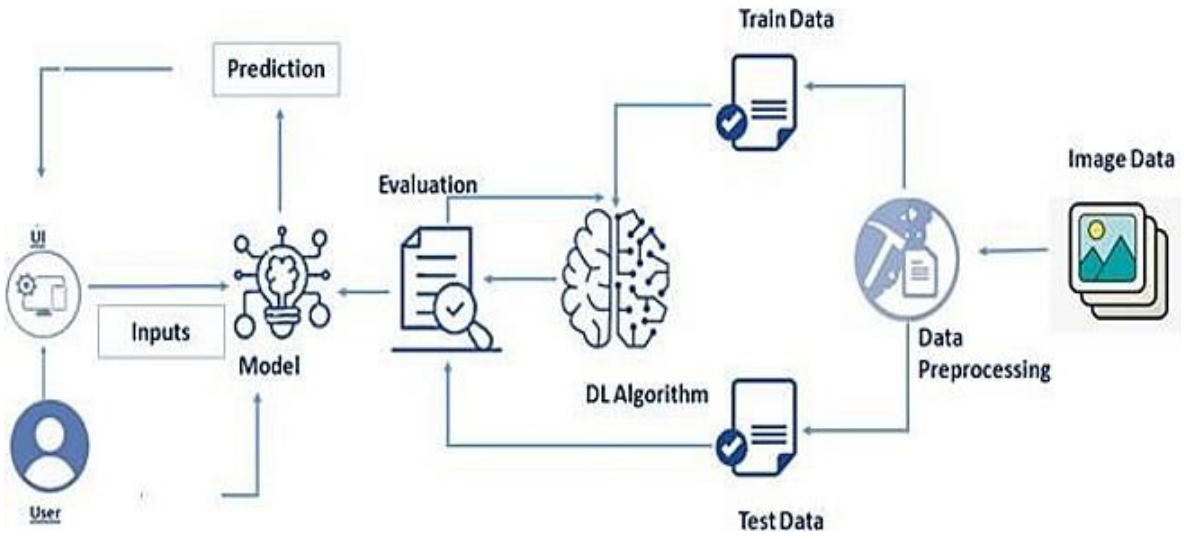
5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture

- Nowadays new dietary assessment and nutrition analysis tools enablemore opportunities to help people understand their daily eating habits,exploring nutrition patterns andmaintain ahealthydiet.
- Nutritional analysis is the process of determining the nutritional contentoffood.
- The main aim of the project is to building a model which is used forclassifying the fruit depends on the different characteristics like colour,shape,texture etc.
- Food is essential for human life and has been the concern of manyhealthcareconventions.

It is a vital part of analytical chemistry that provides information aboutthe chemical composition, processing, quality control and contaminationof food.



5.3 User Stories :

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	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
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail	I can register and acces the dashboard with gmail	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	I can login using my email and password	High	Sprint-1
	Dashboard	USN-6	As a user I can upload food image as input	I can use my camera or my files to upload image	Medium	Sprint-1
		USN-7	As a user I can give my diet details and with that app provides nutrients recommendation	I can enter my information and allow app to access details	High	Sprint-2
Customer (Web user)	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
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail	I can register and access the dashboard with gmail	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	I can login using my email and password	High	Sprint-1
	Dashboard	USN-6	As a user I can upload food image as input	I can use my camera or my files to upload image	High	Sprint-1

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	Download Food Nutrition Dataset	4	High	Nandhini .E Selvanayaki.S
Sprint-1	Image Preprocessing	USN-2	Importing The Dataset into Workspace	1	Low	Saranya.p Nandhini.E
Sprint-1		USN-3	Handling Missing Data	3	Medium	Kamali.R
Sprint-1		USN-4	Feature Scaling	3	Low	Saranya.P
Sprint-1		USN-5	Data Visualization	4	High	Kurin Firathos.S
Sprint-1		USN-6	Spitting the Data into the Train and Test	4	Medium	Kamali.R
Sprint-1		USN-7	Creating A Dataset with Sliding Windows	4	Medium	Kurin Firathos.S
Sprint-2	Model Building	USN-8	Importing The Model Building Libraries	1	Medium	Nandhini.E
Sprint-2		USN-9	Initializing The Model	3	High	Kamali.R Kurin Firathos.S
Sprint-2		USN-10	Adding LSTM Layers	2	Medium	Saranya.P Selvanayaki.S
Sprint-2		USN-11	Adding Output Layers	3	High	Saranya.P Nandhini.E
Sprint	**Functional Requirement (Epic)**	**User Story Number**	**User Story / Task**	**Story Points**	**Priority**	**Team Members**
Sprint-2		USN-12	Configure The Learning Process	2	Low	Kamali.R Kurin Firathos.S
Sprint-2		USN-13	Train The Model	2	Medium	Kamali.R Nandhini.E
Sprint-2		USN-14	Model Evaluation	1	Medium	Selvanayaki.S
Sprint-2		USN-15	Save The Model	2	Medium	Kamali.R Saranya.P
Sprint-2		USN-16	Test The Model	3	High	Kamali.R Kurin Firathos.S

Sprint-3	Application Building	USN-17	Create An HTML File	4	Medium	Nandhini.E Selvanayaki.S
Sprint-3		USN-18	Build Python Code	4	High	Kamali.R Kurin Firathos.S
Sprint-3		USN-19	Creating our Flask application and loading our model by using load_model method	4	Medium	Saranya.p Nandhini.E
Sprint-3		USN-20	Routing to HTML page	4	High	Selvanayaki.S
Sprint-3		USN-21	Run the application	2	Medium	Kamali.R Kurin Firathos.S
Sprint-4	Train The Model On IBM	USN-21	Register For IBM Cloud	4	Medium	Nandhini.E Selvanayaki.S
Sprint-4		USN-22	Train The ML Model On IBM	8	High	Kamali.R Kurin Firathos.S
Sprint-4		USN-23	Integrate Flask with Scoring End Point	8	High	Kamali.R Kurin Firathos.S

6.2 Sprint Delivery Schedule

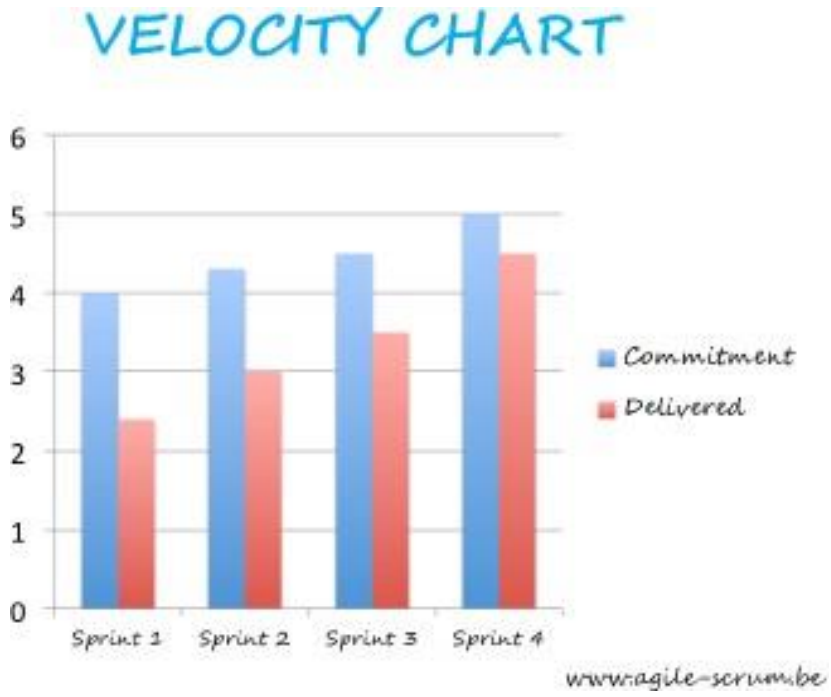
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	2 Nov 2022	2 Nov 2022	20	06 Nov 2022
Sprint-2	20	6 Days	08 Nov 2022	09 Nov 2022	20	10 Nov 2022
Sprint-3	20	6 Days	11 Nov 2022	12 Nov 2022	20	13 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	17 Nov 2022

6.3 Reports from JIRA

Velocity:

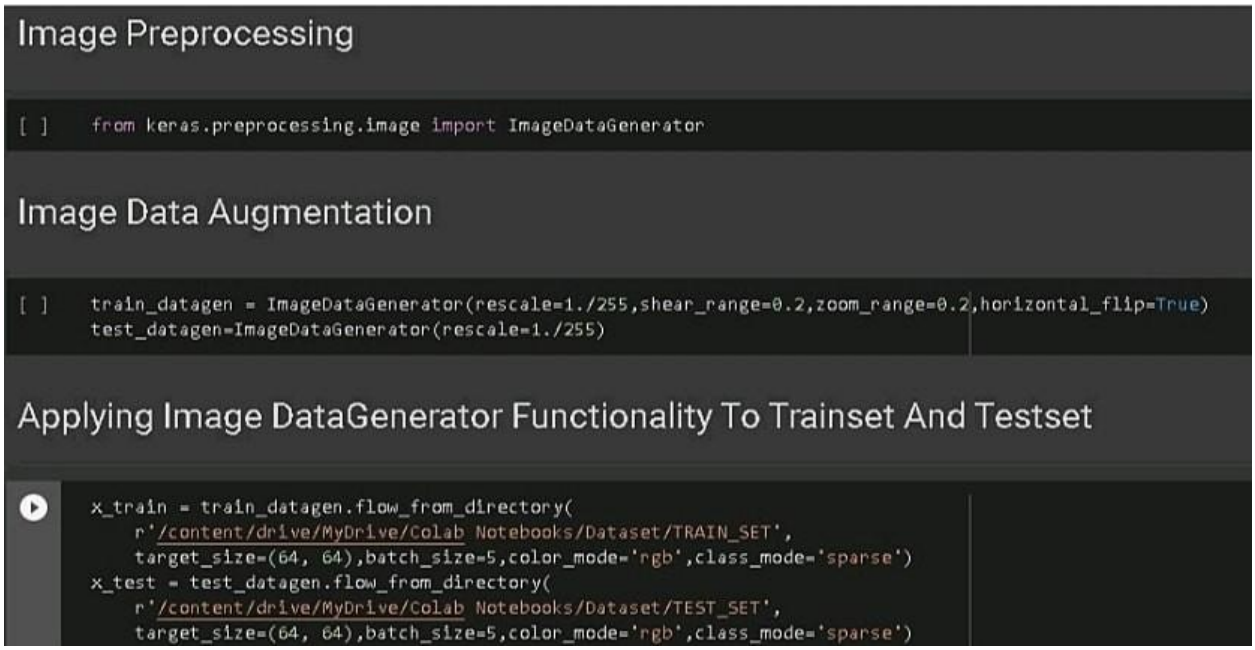
Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$



7. CODING & SOLUTIONING (Explain the features added in the projectalong with code)

a. Feature 1



3. Adding CNN Layers

```
[ ]   classifier = Sequential()
      classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 3), activation='relu'))
      classifier.add(MaxPooling2D(pool_size=(2, 2)))
      classifier.add(Conv2D(32, (3, 3), activation='relu'))
      classifier.add(MaxPooling2D(pool_size=(2, 2)))
      classifier.add(Flatten())
```

4. Adding Dense Layers

```
[ ]   classifier.add(Dense(units=128, activation='relu'))
      classifier.add(Dense(units=5, activation='softmax'))
```

```
      classifier.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                 Output Shape              Param #
=================================================================
 conv2d (Conv2D)              (None, 62, 62, 32)        896
```

5. Configure The Learning Process

```
[ ]   classifier.compile(optimizer='adam', loss='sparse_categorical_crossentropy', metrics=['accuracy'])
```

6. Train The Model

```
[ ]   classifier.fit_generator(generator=x_train,steps_per_epoch = len(x_train),epochs=20, validation_data=x_test,validation_steps = len(x_test))
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Pl

Epoch 1/20
494/824 [==========>.....] - ETA: 6:52 - loss: 0.7194 - accuracy: 0.7174
```

7. Saving The Model

```
[ ]   classifier.save('nutrition.h5')
```

8. Testing The Model

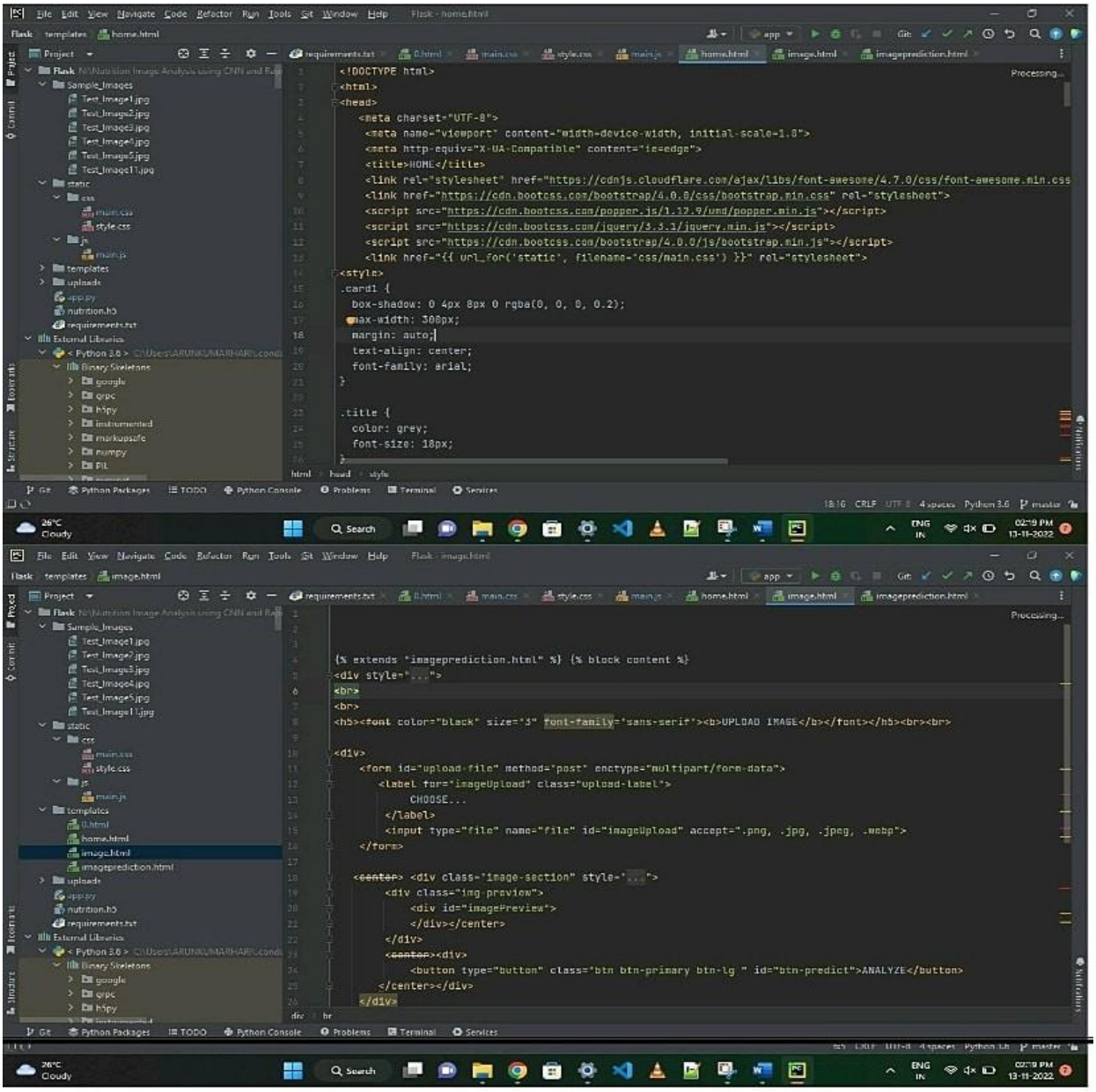
```
[ ]  from tensorflow.keras.models import load_model
     from keras.preprocessing import image
     model = load_model("nutrition.h5")
```

```
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
model = load_model("nutrition.h5")
img = image.load_img(r'/content/drive/MyDrive/Colab Notebooks/Sample_Images/Test_Image1.jpg',grayscale=False,target_size= (64,64))
x = img_to_array(img)
x = np.expand_dims(x,axis = 0)
predict_x=model.predict(x)
classes_x=np.argmax(predict_x,axis=-1)
classes_x
```

```
1/1 [==============================] - 0s 62ms/step
array([0])
```

```
[ ]  index=['APPLES', 'BANANA', 'ORANGE','PINEAPPLE','WATERMELON']
     result=str(index[classes_x[0]])
     result
```

b. Feature 2

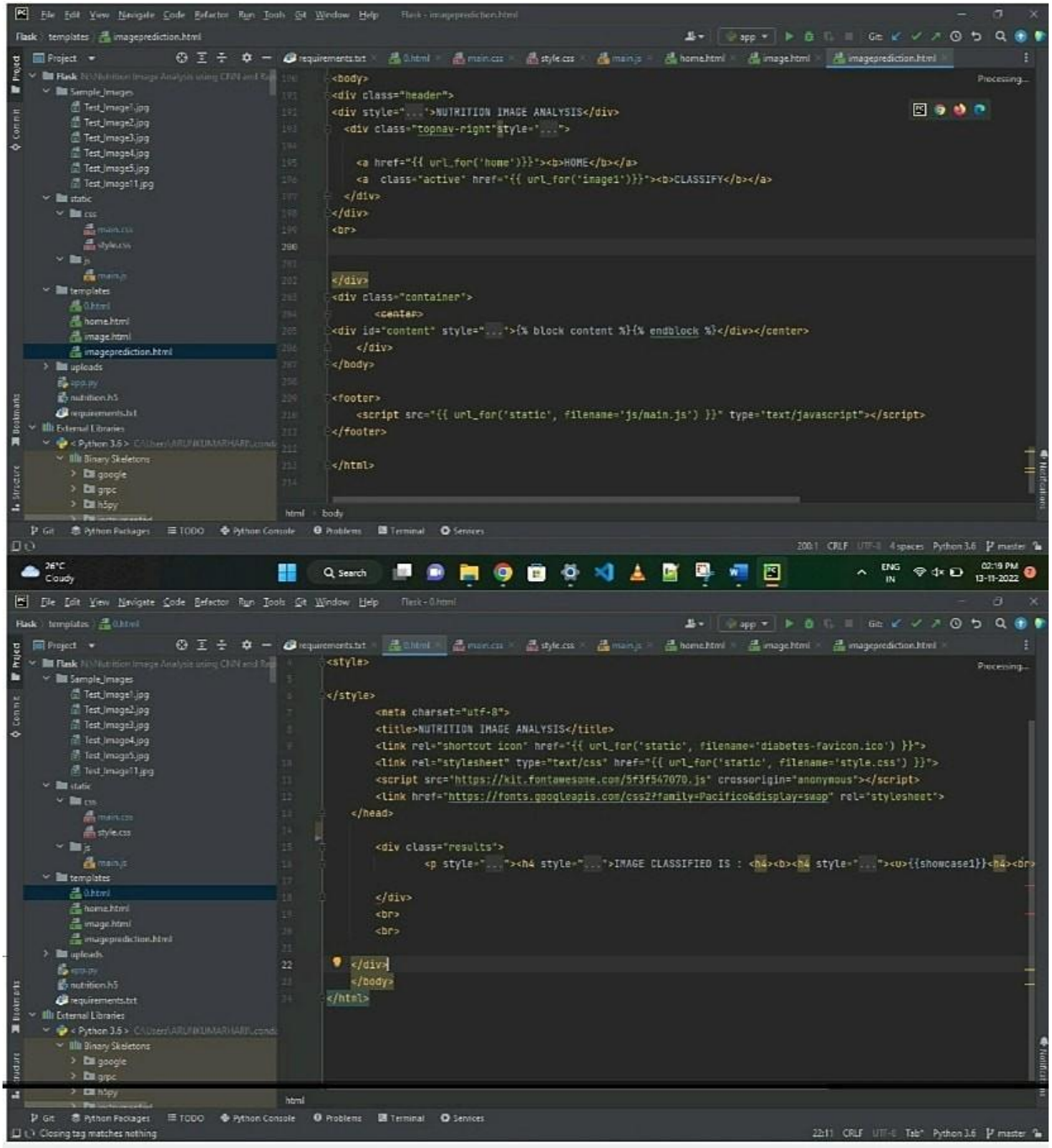

home.html
<!DOCTYPE html>
<html>
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<meta http-equiv="X-UA-Compatible" content="ie=edge">
<title>HOME</title>
<link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css
<link href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css" rel="stylesheet">
<script src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.js"></script>
<script src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script>
<script src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js"></script>
<link href="{{ url_for('static', filename='css/main.css') }}" rel="stylesheet">
<style>
.card1 {
box-shadow: 0 4px 8px 0 rgba(0, 0, 0, 0.2);
max-width: 300px;
margin: auto;
text-align: center;
font-family: arial;
}
.title {
color: grey;
font-size: 18px;
}
image.html
{% extends "imageprediction.html" %} {% block content %}

<h5>UPLOAD IMAGE</h5>

<form id="upload-file" method="post" enctype="multipart/form-data">
<label for="imageUpload" class="upload-label">
CHOOSE...
</label>
<input type="file" name="file" id="imageUpload" accept=".png, .jpg, .jpeg, .webp">
</form>

<button type="button" class="btn btn-primary btn-lg " id="btn-predict">ANALYZE</button>

Python Packages
TODO
Python Console
Problems
Terminal
Services
26°C
Cloudy
Search
ENG
IN
02:19 PM
13-11-2022


File Edit View Navigate Code Refactor Run Tools Git Window Help
imageprediction.html
<body>

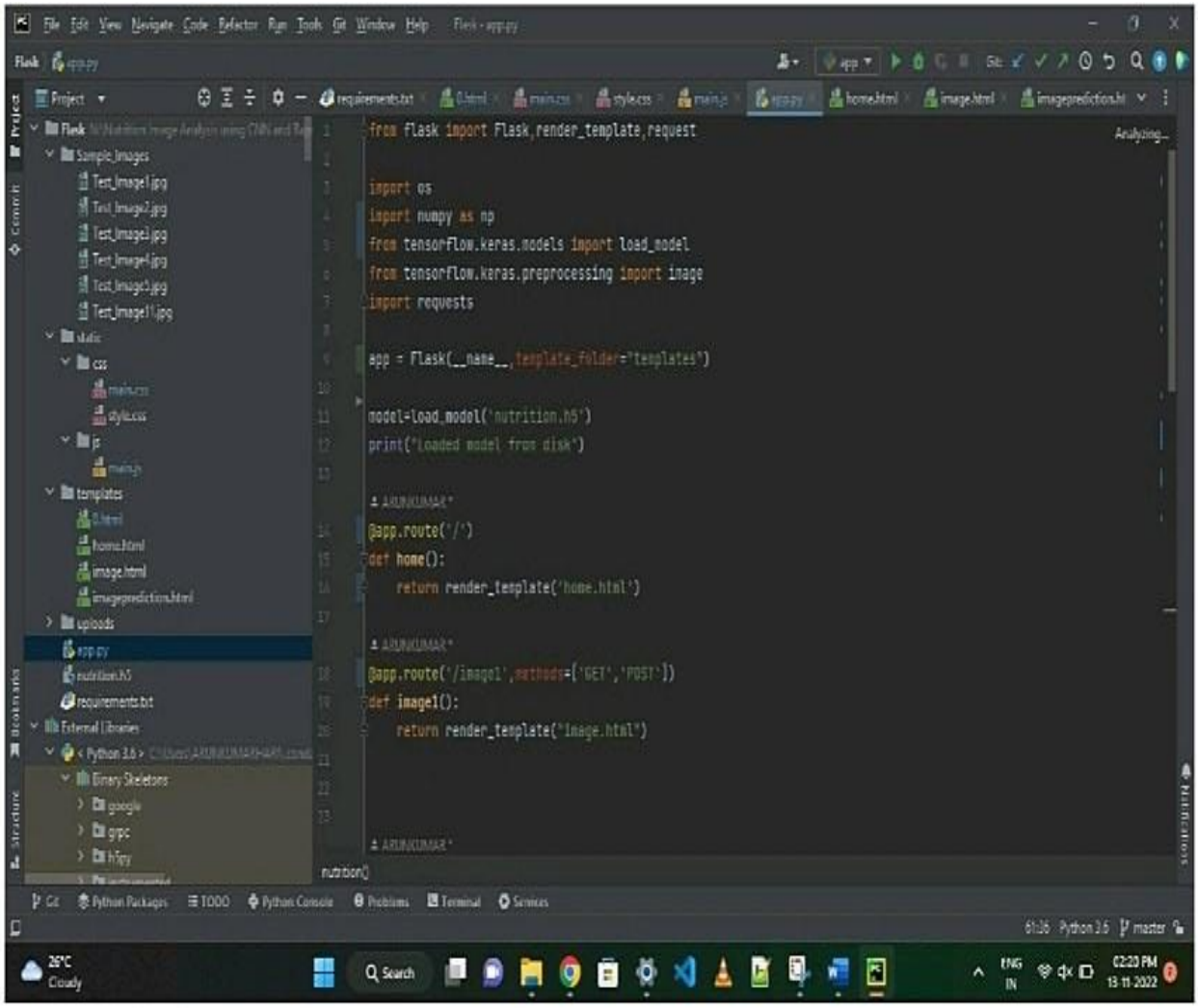
NUTRITION IMAGE ANALYSIS
<div class="topnav-right"style="...">
HOME
CLASSIFY

{% block content %}{% endblock %}

</body>
<footer>
<script src="{{ url_for('static', filename='js/main.js') }}" type='text/javascript"></script>
</footer>
</html>
26°C
Cloudy
Search
ENG
IN
02:19 PM
13-11-2022
0.html
<style>
</style>
<meta charset="utf-8">
<title>NUTRITION IMAGE ANALYSIS</title>
<link rel="shortcut icon" href="{{ url_for('static', filename='diabetes-favicon.ico') }}">
<link rel="stylesheet" type="text/css" href="{{ url_for('static', filename='style.css') }}">
<script src="https://kit.fontawesome.com/5f3f547070.js" crossorigin="anonymous"></script>
<link href="https://fonts.googleapis.com/css2?family=Pacifico&display=swap" rel="stylesheet">
</head>

<p style="..."><h4 style="...">IMAGE CLASSIFIED IS : <h4><h4 style="..."><u>{{showcase1}}<h4>

</body>
</html>
Closing tag matches nothing


File Edit View Navigate Code Refactor Run Tools Git Window Help Flask - app.py
Flask app.py
Project
requirements.txt 0.html main.css style.css main.js app.py home.html image.html imageprediction.ht
Flask
Sample_Images
Test_Image1.jpg
Test_Image2.jpg
Test_Image3.jpg
Test_Image4.jpg
Test_Image5.jpg
Test_Image11.jpg
static
css
main.css
style.css
js
main.js
templates
0.html
home.html
image.html
imageprediction.html
uploads
app.py
nutrition.h5
requirements.txt
External Libraries
Python 3.6
Binary Skeletons
google
grpc
h5py
from flask import Flask,render_template,request
Analyzing...
import os
import numpy as np
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import requests
app = Flask(__name__,template_folder="templates")
model=load_model('nutrition.h5')
print("Loaded model from disk")
ARUNKUMAR
@app.route('/')
def home():
return render_template('home.html')
ARUNKUMAR
@app.route('/image1',methods=['GET','POST'])
def image1():
return render_template("image.html")
ARUNKUMAR
nutrition()
Git Python Packages TODO Python Console Problems Terminal Services
61:26 Python 3.6 master
26°C Cloudy
Search
ENG IN
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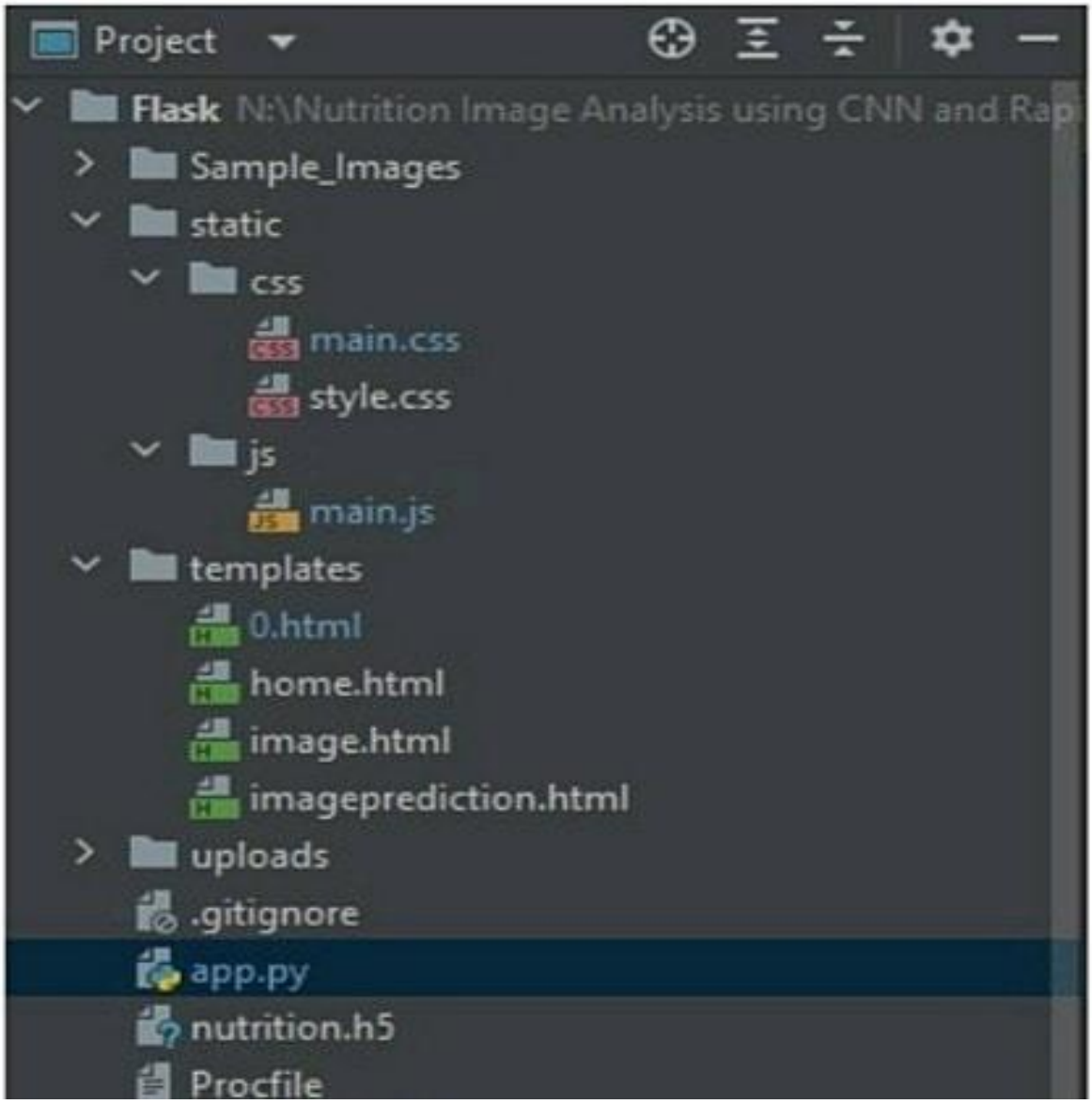
8.TESTING

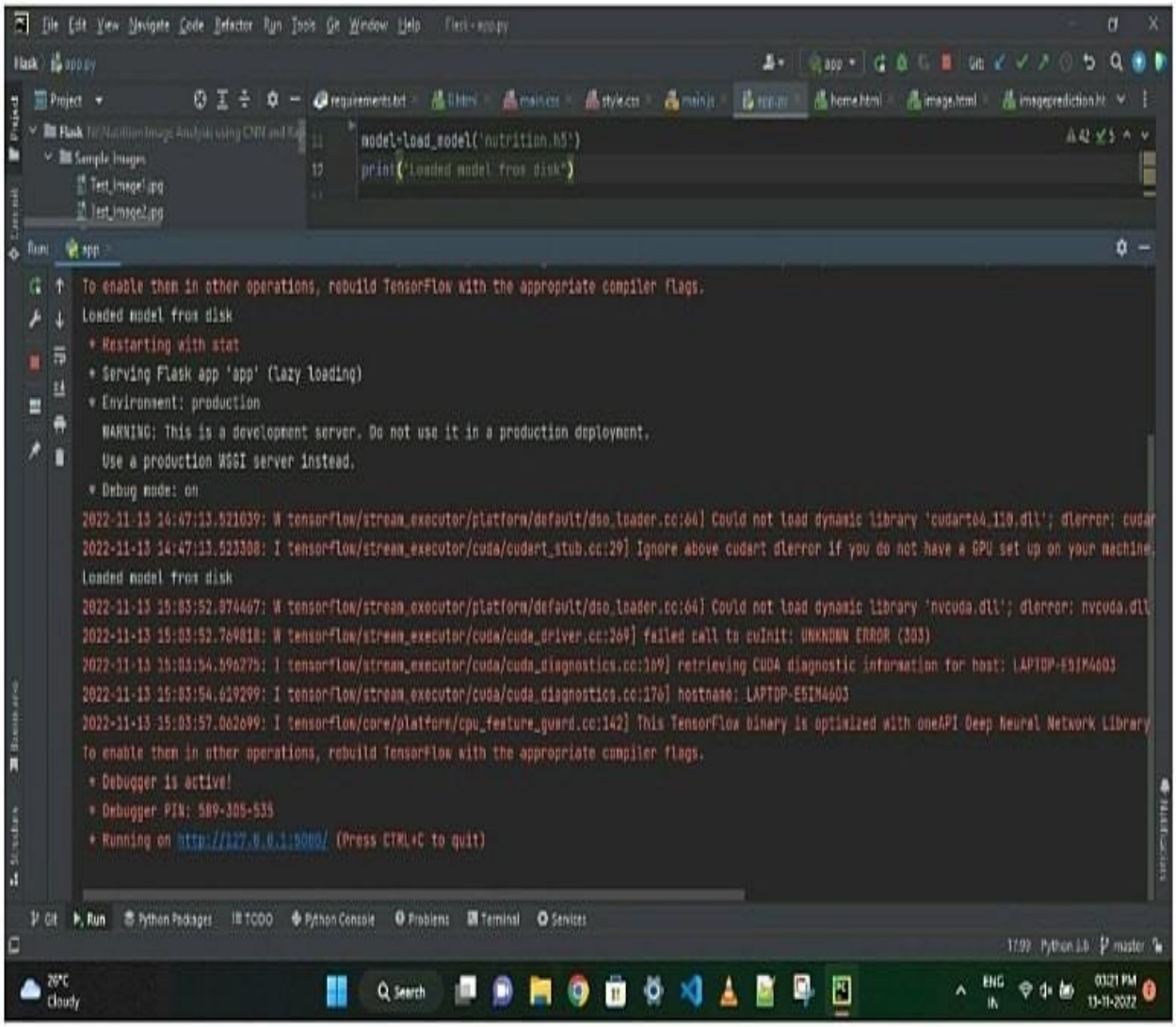
a. Test Cases



b. user Acceptance Testing

9. RESULTS

a. Performance Metrics



10.**ADVANTAGES & DISADVANTAGES**

Advantages:

- 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.
- No need of doctor consultation.
- Increase user satisfaction – more accurate training and diet recommendations help users to achieve their fitness goals faster.
- With the help of artificial intelligence, it easily helps to track user's health behaviours and repetitive exercise patterns.

Disadvantages:

- being overweight or obese.
- tooth decay.
- high blood pressure.
- high cholesterol.
- heart disease and stroke.
- type-2 diabetes.
- osteoporosis.
- some cancers.

10.CONCLUSION

Thus powered nutrition analyzer for fitness enthusiasts good nutrition promotes not only better physical healthy and reduced susceptibility to disease, but has also been demonstrated to contribute to cognitive development and academic success. Left to their own devices, children will not automatically select healthy food. A balance diet and appropriate meal timings are important for healthy body and mind. Most countries nowadays implement health education program in schools which include feeding to students, vitamin and mineral supplementation.

11.FUTURE SCOPE

AI is revolutionizing the health industry. It is majorly used in improving marketingand sales decisions, AI is now also being used to reshape individual habits. In future wedon't want to go to gym and do any diets. By using this nutrition fitness analyzer we can maintain our diet plans without any help from others and we can lead a happy and healthy life with good wealth.AI can easily track health behaviors and repetitive exercisepatterns and use the data to guide you towards your fitness journey and diet plans.

12. APPENDIX

Source Code

```
import os
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
import cv2
from tqdm import tqdm
from PIL import Image
import io

import tensorflow as tf
from tensorflow.keras.preprocessing.image import ImageDataGeneratorfrom
sklearn.utils import shuffle


from sklearn.model_selection import train_test_split
from tensorflow.keras.applications import EfficientNetB2
from keras.layers import GlobalAveragePooling2D, Dropout, Dense
from keras.models import Model
from tensorflow.keras.callbacks import EarlyStopping, ReduceLROnPlateau,
TensorBoard, ModelCheckpoint
from sklearn.metrics import classification_report, confusion_matrix
from IPython.display import display, clear_output
import ipywidgets as widgets
```

```
from google.colab import drive
drive.mount('/content/drive')
```

%Directory setting

```
fpath = '/content/drive/My Drive/nutrion analysis/new dataset'random_seed
= 42

categories = os.listdir(fpath)
categories = categories[:20]
print("List of categories = ",categories,"\n\nNo. of categories = ", len(categories))
% image loading and labeling
def load_images_and_labels(categories):
  img_lst=[]
  labels=[]
  for index, category in enumerate(categories):
    for image_name in os.listdir(fpath+"/"+category):
      img = cv2.imread(fpath+"/"+category+"/"+image_name)img
      = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)

      img_array = Image.fromarray(img, 'RGB')
```

```
        #resize image to 227 x 227 because the input image resolution for AlexNet is 227
x 227
        resized_img = img_array.resize((227, 227))

        img_lst.append(np.array(resized_img))

        labels.append(index)
    return img_lst, labels

images, labels = load_images_and_labels(categories)
print("No. of images loaded = ",len(images),"\nNo. of labels loaded = ",len(labels))
print(type(images),type(labels))
```

%model summary

```
model=Sequential()

#1 conv layer
model.add(Conv2D(filters=96,kernel_size=(11,11),strides=(4,4),padding="valid",activatio
n="relu",input_shape=(227,227,3)))

#1 max pool layer
model.add(MaxPooling2D(pool_size=(3,3),strides=(2,2)))

model.add(BatchNormalization())

#2 conv layer
model.add(Conv2D(filters=256,kernel_size=(5,5),strides=(1,1),padding="valid",activation
="relu"))

#2 max pool layer
model.add(MaxPooling2D(pool_size=(3,3),strides=(2,2)))
```

```
model.add(BatchNormalization())

#3 conv layer
model.add(Conv2D(filters=384,kernel_size=(3,3),strides=(1,1),padding="valid",activation
="relu"))

#4 conv layer
model.add(Conv2D(filters=384,kernel_size=(3,3),strides=(1,1),padding="valid",activation
="relu"))

#5 conv layer
model.add(Conv2D(filters=256,kernel_size=(3,3),strides=(1,1),padding="valid",activation
="relu"))

#3 max pool layer
model.add(MaxPooling2D(pool_size=(3,3),strides=(2,2)))

model.add(BatchNormalization())


model.add(Flatten())

#1 dense layer
model.add(Dense(4096,input_shape=(227,227,3),activation="relu"))

model.add(Dropout(0.4))

model.add(BatchNormalization())

#2 dense layer
model.add(Dense(4096,activation="relu"))

model.add(Dropout(0.4))
```

```
model.add(BatchNormalization())

#3 dense layer
model.add(Dense(1000,activation="relu"))

model.add(Dropout(0.4))

model.add(BatchNormalization())

#output layer
model.add(Dense(20,activation="softmax"))

model.summary()
```
% compile CNN model and accuracy

```
model.compile(optimizer="adam", loss="sparse_categorical_crossentropy",
metrics=["accuracy"])
```
%train the model

```
model.fit(x_train, y_train, epochs=100)
```
%model save

```
model_name = 'trained_model.h5'
model.save(model_name, save_format='h5')
```

%loss accuracy

```
loss, accuracy = model.evaluate(x_test, y_test)

print(loss,accuracy)
```

GitHub Link

https://github.com/IBM-EPBL/IBM-Project-14919-1659591999

Project Demo Link

https://drive.google.com/file/d/1OD74Fe3Lh0M4aKlDiv9kjg--HzmNyr7F/view?usp=drivesdk

or

https://youtu.be/CLaOS8BLCPA