

Project Report

| | |
|----------------------|---|
| Team Id | PNT2022TMID00560 |
| Project Title | AI-powered Nutrition Analyzer for Fitness Enthusiasts |

1. INTRODUCTION

1. Project Overview
2. Purpose

2. LITERATURE SURVEY

1. Existing problem
2. References
3. Problem Statement Definition

3. IDEATION & PROPOSED SOLUTION

1. Empathy Map Canvas
2. Ideation & Brainstorming
3. Proposed Solution
4. Problem Solution fit

4. REQUIREMENT ANALYSIS

1. Functional requirement
2. Non-Functional requirements

5. PROJECT DESIGN

1. Data Flow Diagrams
2. Solution & Technical Architecture
3. User Stories

6. PROJECT PLANNING & SCHEDULING

1. Sprint Planning & Estimation
2. Sprint Delivery Schedule
3. Reports from JIRA

7. CODING & SOLUTIONING

1. Feature 1
2. Feature 2

8. TESTING

1. Test Cases
2. User Acceptance Testing

9. RESULTS

1. Performance Metrics

10.ADVANTAGES & DISADVANTAGES

11.CONCLUSION

12.FUTURE SCOPE 13. APPENDIX Source Code

GitHub & Project Demo Link

1. INTRODUCTION

The most crucial factor in living a healthy life is eating a balanced, healthy diet. It supports healthy outcomes, aging, normal growth, and the growth of a sense of well-being. Additionally, it lowers the chance of developing cardiac and heart disorders and aids in maintaining a healthy body weight. Age, way of life, culture, gender, and a host of other factors all affect a balanced diet. Therefore, there is a need for nutritionists that can analyze each and every person based on their unique culinary culture and way of life. Artificial intelligence fills a requirement in the current, developing society for identity and nutrition studies. When a huge amount of data is required for structuring and integrating the metabolomics, AI algorithms will help forecast the complicated non-linear relationships in fitness related data sets. Every person needs to be aware of how many calories they are consuming in their fruits because society as a whole is becoming more diet concerned. It encourages better digestion and helps you feel full on less food. One can become more aware of their food choices by making a few minor adjustments to their eating routine. This analyser will give users an assistant that will advise them on what to eat, how much to consume, and all of the fruit's calories and nutrients. Additionally, it aids in lowering birth weight, malnutrition, and other issues.

1.1. PROJECT OVERVIEW

The idea is to ensure that the food has an optimal requirement of vitamins and minerals wherein the examination of nutrition in food helps in understanding about the fat proportion, carbohydrates dilution, proteins, fiber, sugar, etc. And thereafter the appropriate presence of nutritional value assists in fulfilling the compliance regulations matched by the national and international bodies. Food nutritional analysis is a compulsory requirement for food products manufacturing industries as it's a necessary complaint for the products to get launched. Thus have the scanning of the food product's nutritional value and be rest assured.

1.2. PURPOSE

The purpose of nutritional assessment, however, is to define a patient's nutritional status, to define clinically relevant malnutrition and to monitor changes in nutritional status.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

A Study of Calorie Estimation in Pictures of Food by Jun Zhou, Dane Bell, Sabrina Nusrat, Melanie Hingle, Mihai Surdeanu, Stephen Kobourov findings offer fresh knowledge on the method for estimating calories from food photographs, which may be used to improve analysis and software development. As a function of respondent characteristics and food features, their study aims to assess the accuracy of crowdsourced annotations of calorie content in food photographs as well as to identify and quantify sources of bias and noise. They distributed a custom-made webpage that conducts an online test and encouraged adult social media users to offer calorie estimates for 20 food photos (for which actual calorie data were known). The pictures were chosen to show different meal varieties and energy densities. Participants might have disclosed their height, weight, and gender. The identical data was also annotated by five nutrition specialists to serve as a basis for comparison. Using linear mixed effects models with participant and image index as random variables, they investigated estimated accuracy on the basis of competence, demographic information, and meal quality. They also looked at the benefit of combining estimates from different sources. [1] An analysis of calorie estimation accuracy by Hannah Mixon and Matthew E. Davis is obesity monitoring and controlling by understanding the risk factors of every individual. Understanding risk factors is crucial to comprehend the role that individual differences in cognitive abilities play in the nutritional decision-making process, from the assessment of calories to the influence of any cognitive biases or miscalculations that may occur. In the current study, researchers looked into how dietary aspects like limited eating and cognitive factors like cognitive reflection and numeracy affect biases and miscalculations about calories. Additionally, it primarily focuses on packaged goods and calculates risk and calories for them. [2] Popular Nutrition-Related Mobile Apps: A Feature Assessment by Rodrigo Zenun Franco, Rosalind Fallaize, Julie A Lovegrove, Faustina Hwang is a model proposed in 2016, is to examine and contrast the approaches and technologies used by the most widely used nutrition apps for dietary assessment and user feedback. 13 apps in total were deemed popular enough to be included in the analysis. Nine applications included a food diary function for prospectively documenting food intake. There were barcode scanners and text search capabilities for food selection. Selection of the portion size was only textual (ie, without images or icons). All nine of these apps have the ability to gather data on physical activity (PA) through wearable integrations, self-report, or GPS tracking. Their work mainly concentrated on achieving a healthy energy balance between dietary intake and PA. None of these nine applications provided elements specifically linked to meal plans and coaching for motivation. The remaining four of the 13 apps, however, concentrated on these prospects without including food diaries. Another cutting-edge feature of one app, Fat Secret, allowed users to communicate with medical experts, and S Health offered a nutrient balance score. [3] Artificial Intelligence Applications in Nutrition and Dietetics is a model that provides the advantages and disadvantages. Both dieticians and clients should track dietary assessments of individuals when assessing nutritional status. Artificial intelligence applications are becoming more prevalent in the fields of dietetics and nutrition, according to observations. For instance, the food consumption logs, which are assessed

by photographing the meals ingested, are helpful in determining the nutritional status. These smartphone-shot images demonstrate how useful and adaptable the application is. The dietician can follow the suggested diet plan using these apps, and the clients can take responsibility for their own diet adaption. In order to lower the danger in this approach, hospitalized patients' usual food consumption must be closely monitored. [4]

2.2 REFERENCES

- [1] A Study of Calorie Estimation in Pictures of Food by Jun Zhou, Dane Bell, Sabrina Nusrat, Melanie Hingle, Mihai Surdeanu, Stephen Kobourov
- [2] An analysis of calorie estimation accuracy by Hannah Mixon and Matthew E. Davis
- [3] Popular Nutrition-Related Mobile Apps: A Feature Assessment by Rodrigo Zenun Franco, Rosalind Fallaize, Julie A Lovegrove, Faustina Hwang
- [4] Artificial Intelligence Applications in Nutrition and Dietetics is a model provides the advantages and disadvantages

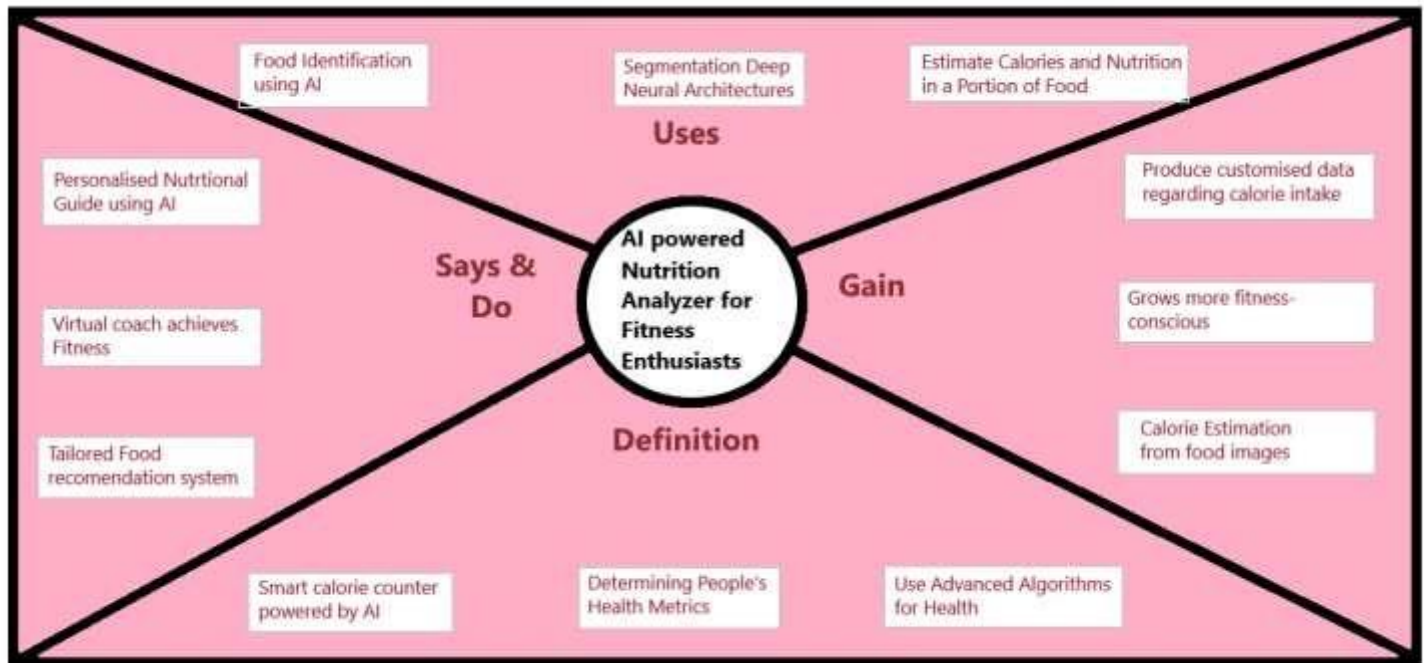
2.3 PROBLEM STATEMENT

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.

To accomplish this, we have to complete all the activities and tasks listed below

- Data Collection.
 - Collect the dataset or Create the dataset
- Data Preprocessing.
- Import the ImageDataGenerator library
- Configure ImageDataGenerator class
- ApplyImageDataGenerator functionality to Train Set and Test Set
- Model Building
 - Import the model building Libraries
 - Initializing the model
 - Adding Input Layer
 - Adding Hidden Layer
 - Adding Output Layer

- Configure the Learning Process
- Training and testing the model
- Save the Model
- Application Building
 - Create an HTML file



- Build Python Code

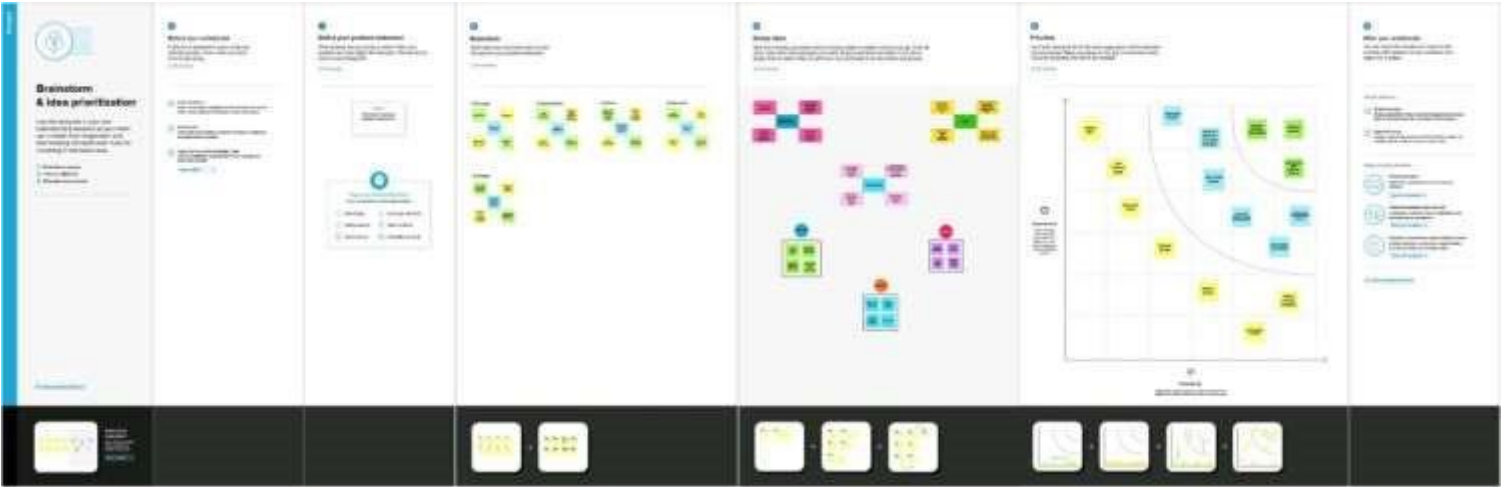
3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and attitudes. It is a useful tool to help teams better understand their users.

Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

3.2 IDEATION & BRAINSTORMING



3.3 PROPOSED SOLUTION

| S.No. | Parameter | Description |
|-------|---------------------------------------|---|
| 1. | Problem Statement (Problem solved) | A nutrition analyser with AI powered fruit classifier based on the features to provide nutritional values like fiber, vitamins, minerals etc to Fitness Ethusiasts. |
| 2. | Idea / Solution description | Creating web interface application to monitor and track health condition and helping the people to improve their health condition. |
| 3. | Novelty / Uniqueness | Artificial Intelligence offers unparalleled opportunities of progress and applications in nutrition. There remain gaps to address to potentialize this emerging field |

| | | |
|----|---|---|
| 4. | Social Impact / Customer Satisfaction | The relationship between an individual's social, psychological, and cultural environment and his or her nutritional status is one of both cause and effect. With use of this application one can keep track of how much nutrients they can balance in their diet. |
|----|---|---|

| | | |
|----|-----------------------------------|--|
| 5. | Business Model (Revenue Model) | Offering monthly or yearly subscription for premium features. Monetizing data from the application. |
| 6. | Scalability of the Solution | For now the nutrition analyser is limited to mostly fruits only, which can be scaled to other foods, Implementing in mobile app. |

3.4 PROBLEM SOLUTION FIT

| | | | | |
|-------------------------|--|---|---|---|
| Define CL, RL into CL | <div>1. CUSTOMER SEGMENT(S)CS</div> <div>Who is your customer?</div> <div>customers who need to keep track of their diet and exercise regime, take expert advice and connect to other fitness enthusiasts</div> | <div>6. CUSTOMER LIMITATIONSCL</div> <div>EG. BUDGET, DEVICES</div> <div>What limits your customers to act when problem occurs?</div> <div>1.This application will be supported by all devices 2.this app is able to map its users nutritional patterns and needs. 3.it will monitor the progress</div> | <div>5. AVAILABLE SOLUTIONSAS</div> <div>PLUS & MINUS</div> <div>Which solutions are available to the customer when he/she is facing the problem? What had he/she tried in the past?</div> <div>Pluses & minuses 1.The system plans offer its customer and fitness enthusiasts many beauty tips options that can help them reach their goals. 2.Users will be able to order food as per their diet plan</div> | Explore AS, differentiate |
| | <div>2. PROBLEMS / PAINS + ITS FREQUENCYPR</div> <div>Which problem do you solve for your customer? There could be more than one, explore different sides.</div> <div>1.It wants to help millions of customers achieve their goals by Engaging with nutritionists and other health experts empowered with artificial intelligence. 2.It solves health problems such as fitness problem, inappropriate diet, mental problems etc. 3.The main objective of this work to recommend a diet to different individual for their health problems</div> | <div>9. PROBLEM ROOT / CAUSERC</div> <div>What is the root of every problem from the list?</div> <div>1.customer don't know where to start for the balanced diet. 2.they lack the information about health problems 3.Not following the guidance properly</div> | <div>7. BEHAVIOR + ITS INTENSITYBE</div> <div>What does your customer do about / around / directly or indirectly related to the problem?</div> <div>1.Make sure customers takes the balanced diet that gives your body the nutrients it needs to function correctly. 2.it will Build Activity into customer daily routine for health balance</div> | Focus on PR, tap into RL, understand RC |
| Identify strong TR & EM | <div>3. TRIGGERS TO ACTTR</div> <div>What triggers customer to act?</div> <div>customer should know their process for their fitness goal</div> | <div>10. YOUR SOLUTIONSL</div> <div>1. To Consider your Fitness Goal 2.To Create a balanced routine 3. To Build Activity into your daily routine 4. Start slowly and build up gradually and Listen to your body 5. Will monitor your progress</div> | <div>8. CHANNELS of BEHAVIORCH</div> <div>ONLINE</div> <div>Extract channels from Behavior block</div> <div>The model analyses the image and detect the nutrition based on the fruits like {Sugar, Fibre, Protein, Calories, etc.}.</div> <div>OFFLINE</div> <div>Extract channels from Behavior block and use for customer development</div> <div>The customer can capture the images of different fruits and then the image will be sent the trained model which will analyse nutrition</div> | Extract online & offline CH of BE |

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

AI-Powered Nutrition Analyzer for Fitness Enthusiasts

Function Requirements

| FR. No | Functional Requirement | Sub Requirement |
|--------|------------------------|--|
| FR-1 | User Registration | Registration through Form |
| FR-2 | User Confirmation | Confirmation via Email |
| FR-3 | User Profile | Filling the profile page after logging in |
| FR-4 | Scan the Image | Capture the images of the fruits or food |
| FR-5 | Data Processing | Provide the nutrition contents of the food |

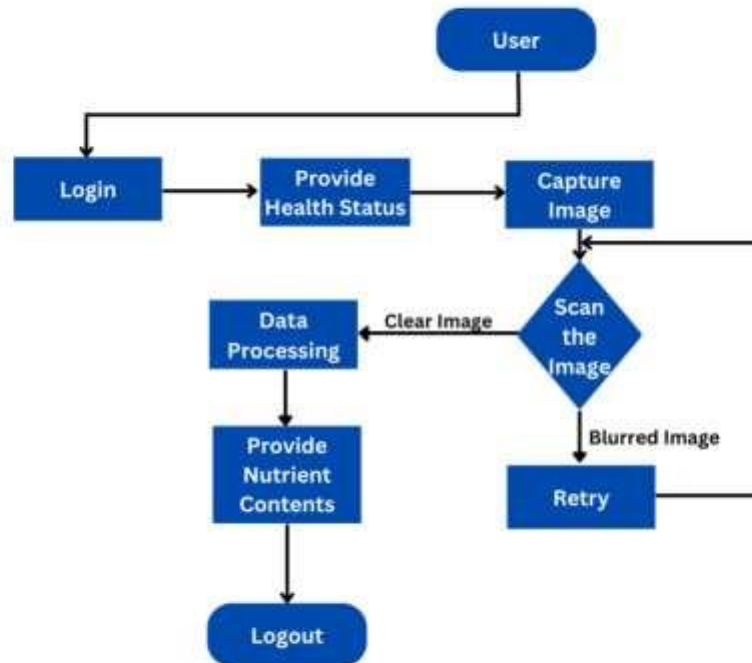
Non-Functional Requirement

| NFR. No | Non-Functional Requirement | Description |
|---------|----------------------------|-------------|
|---------|----------------------------|-------------|

| | | |
|-------|--------------|--|
| NFR-1 | Usability | The system allows the user to perform the tasks easily and efficiently and effectively |
| NFR-2 | Security | Assuring all data inside the system or parts will be protected against malware attacks or unauthorized attacks |
| NFR-3 | Reliability | The website does not recover from failure quickly , it takes time as the application is running in single server |
| NFR-4 | Performance | Response time and Net processing time is fast |
| NFR-5 | Availability | The system will be available up to 95% of the time |
| NFR-6 | Scalability | The website is scalable |

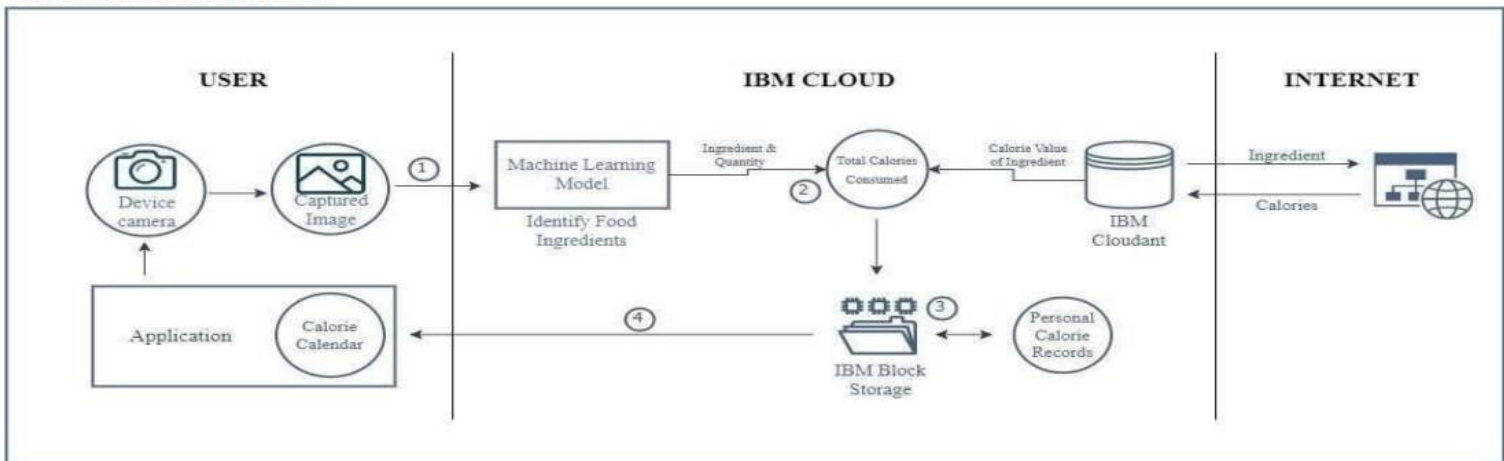
5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS



5.2 SOLUTION & TECHNICAL ARCHITECTURE

Technical Architecture:



5.3 USER STORIES

| USER TYPE | FUNCTIONAL REQUIREMENTS | USER STORY NUMBER | USER STORY/TASK | ACCEPTANCE CRITERIA | PRIORITY | RELEASE |
|-----------|-------------------------|-------------------|---------------------------|---------------------------|----------|----------|
| Customer | Registration | USN-1 | As a user, I can register | I can access my account / | High | Sprint-1 |

| | | | | | | |
|--|------------------|-------|---|---|------|----------|
| | | | for the application by entering my Name, Age, Gender, E-mail, password, and confirming my password. | dashboard | | |
| | | USN-2 | As a user, I will receive a confirmation email once I have registered for the application. | I can receive confirmation email & click confirm. | High | Sprint-1 |
| | Profile Updating | USN-3 | As a user, I have to enter my height, weight and daily activity details | I can update these information on Dashboard. | High | Sprint-1 |

| | | | | | | |
|--|-------|-------|---|-------------------------------------|------|----------|
| | Login | USN-4 | As a user, I can login to the application by entering Email and password. | I can access my account/ dashboard. | High | Sprint-1 |
|--|-------|-------|---|-------------------------------------|------|----------|

| | | | | | | |
|-----------------|-------------------------|-------|---|--|--------|----------|
| | Dashboard | USN-5 | As a user, I can login to the application by entering Email and password. | I can get the nutritional value of that particular meal. | High | Sprint-2 |
| | | USN-6 | As a user, I can track my daily calorie intake. | I can access my account/ Dashboard | Medium | Sprint-2 |
| Applic ation | Maintain Application | USN-7 | Maintaining details for users. | I can access the database. | High | Sprint-3 |

6. PROJECT PLANNING & SCHEDULING

6.1. SPRINT PLANNING & ESTIMATION

| SPRINT | FUNCTIONAL REQUIREMENT | USER STORY NO | USER STORY/TASK | STORY POINTS | PRIORITY | TEAM MEMBERS |
|--------|---------------------------|---------------------|--|-----------------|----------|-------------------------|
| 1 | Data Collection | USN-1 | Dataset - Collecting images of food items apples , banana, orange, pineapple, watermelon for analysis | 5 | High | Somnath M Shrinath S |
| 1 | Image Processing | USN-2 | Image data augmentation - Increasing the amount of data by generating new data points from existing data | 4 | Medium | Shyam raj k Sathya S |

| | | | | | | |
|---|----------------------|-------|---|---|--------|-------------------------|
| 2 | Image Processing | USN-3 | Image Data Generator Class - Used for getting the input of the original data | 4 | Medium | Somnath M Shrinath S |
| 1 | Image Processing | USN-4 | Applying image data generator functionality to train set and test set | 4 | Medium | Shyam raj K Sathya S |
| 2 | Model Phasing | USN-5 | Defining the model architecture - Building the model using deep learning approach and adding CNN layers | 4 | Medium | Somnath M Shrinath S |
| | | | | | | |
| 2 | Model phasing | USN-6 | Training , saving, testing and predicting the model | 5 | High | Shrinath S Somnath M |
| 2 | Recognise fruit type | USN-7 | Data base creation for the input classes | 4 | High | Shrinath S Somnath M |
| 2 | Development Phase | USN-8 | User database creation - It contains the details of users | 2 | Medium | Somnath M Shrinath S |
| 2 | Development Phase | USN-9 | Home page creation - It shows options of the application | 2 | Low | Shyamraj K Sathya S |

| | | | | | | |
|---|-------------------|--------|--|---|--------|-------------------------|
| 2 | Development Phase | USN-10 | Login and registration page creation - User can register and login through gmail with Id and password | 2 | low | Shrinath S Somnath m |
| 3 | Development Phase | USN-11 | Dashboard creation – Dashboard contains the information of user profile and features of the application | 2 | low | Shyamraj K Sathya S |
| 3 | Development Phase | USN-12 | User Input Page Creation - It is for the user to feed the input images | 4 | Medium | Shrinath S Somnath M |
| 3 | | USN-13 | Analysis and prediction page creation - It shows the prediction of given user input | 4 | Medium | Shyamraj K Sathya S |
| 3 | Application Phase | USN-14 | Creation of about us, feedback and rating page – It shows application history and feedback page to users | 4 | Medium | Shrinath S Somnath M |
| 3 | Application Phase | USN-15 | Building the python code and importing the flask module into the Project | 6 | High | Shrinath S Somnath M |

| | | | | | | |
|---|-------------------|--------|--|---|--------|-------------------------|
| 4 | Application Phase | USN-16 | Create the Flask application and loading the model | 5 | High | Shrinath S Somnath M |
| 4 | Application Phase | USN-17 | API integration - Connecting front end and back end and perform routing and run the application | 5 | High | Shrinath S Somnath M |
| 4 | Deployment phase | USN-18 | Cloud deployment – Deployment of application by using IBM cloud | 4 | High | Somnath M Shrinath S |
| 4 | Testing Phase | USN-19 | Functional testing – Checking usability and accessibility | 3 | Medium | Shrinath S Somnath M |
| 4 | | USN-20 | Non Functional testing – Checking scalability and performance of the application | 3 | Medium | Shyam raj K Sathya S |

6.2. SPRINT DELIVERY SCHEDULE

| SPRINT | TOTAL STORY POINTS | DURATION | SPRINT START DATE | SPRINT END DATE | STORY POINTS COMPLETED | SPRINT RELEASE DATE |
|--------|--------------------|----------|-------------------|-----------------|------------------------|---------------------|
| 1 | 20 | 6 Days | 24 Oct 2022 | 29 Oct 2022 | 17 | 29 Oct 2022 |

| | | | | | | |
|---|----|--------|-------------|-------------|----|-------------|
| 2 | 20 | 6 Days | 31 Oct 2022 | 05 Nov 2022 | 20 | 5 Nov 2022 |
| 3 | 20 | 6 Days | 07 Nov 2022 | 12 Nov 2022 | 20 | 12 Nov 2022 |
| 4 | 20 | 6 Days | 14 Nov 2022 | 19 Nov 2022 | 20 | 19 Nov 2022 |

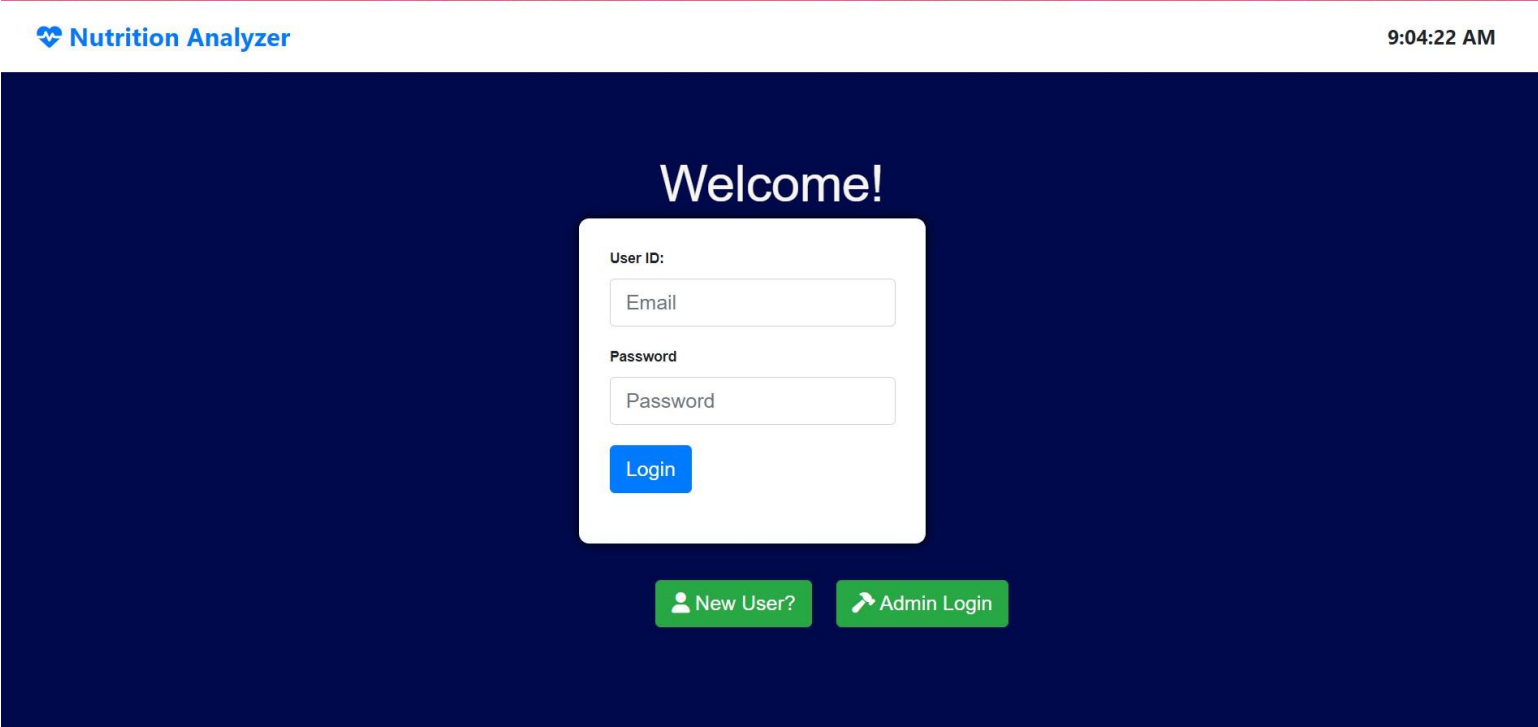
6.3 REPORTS FROM JIRA



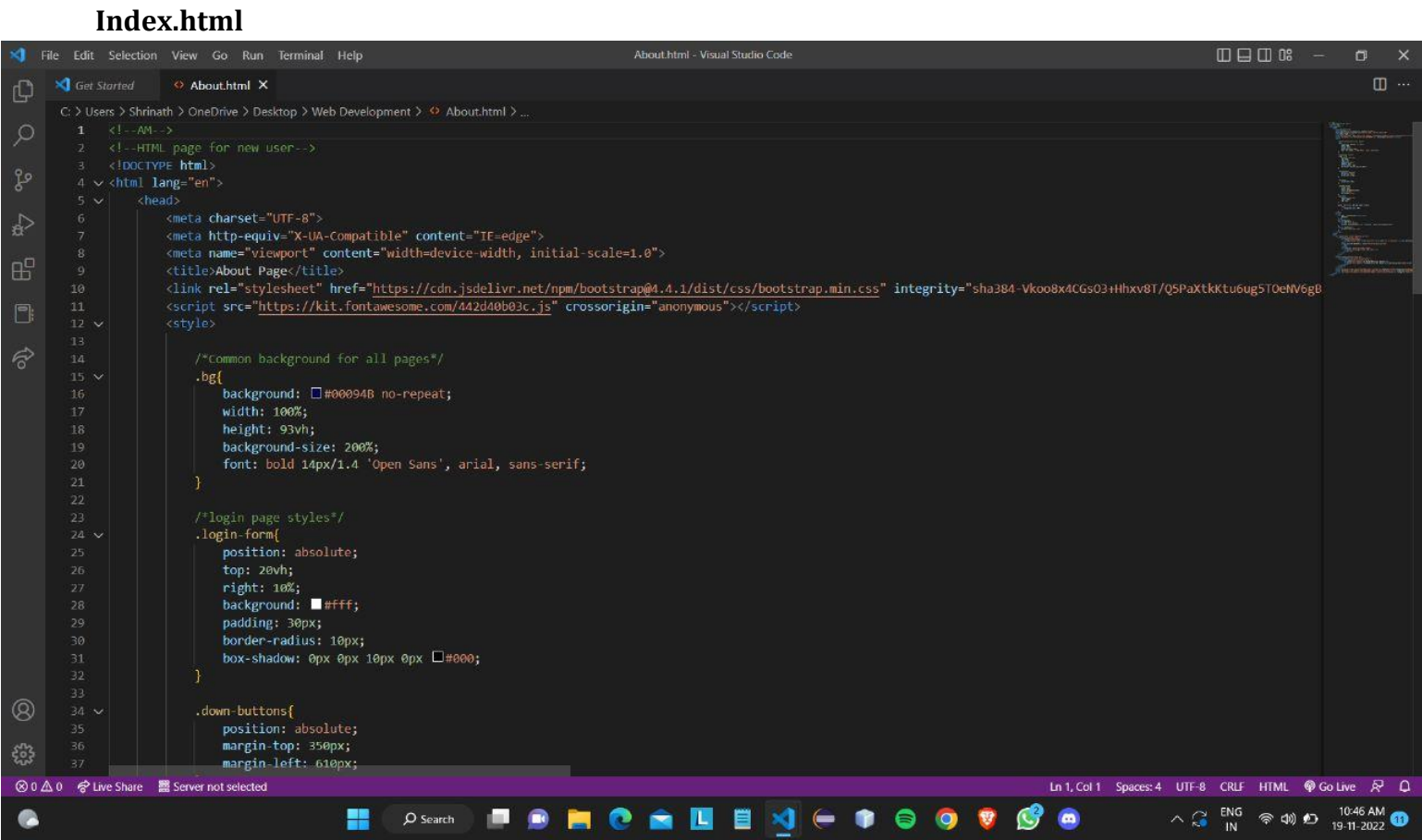
7. CODING & SOLUTIONING

7.1 FEATURE 1

Home.html



Feature 2



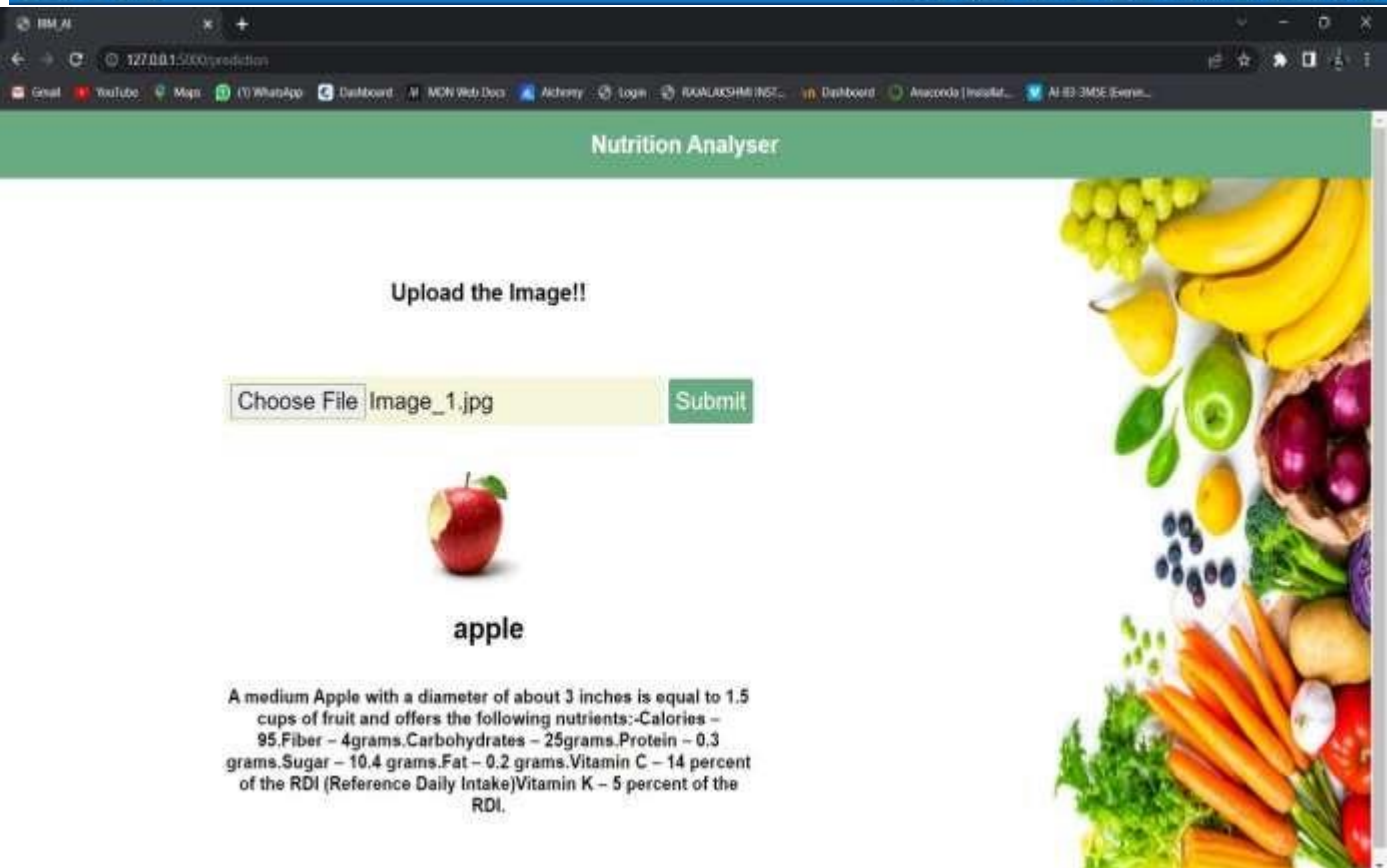
App.py

```
File Edit Selection View Go Run Terminal Help
app.py - Python Analyzer - Visual Studio Code

NUTRITION_ANALYSER
├── __pycache__
├── env
├── images
├── static
├── templates
├── test
├── train
├── app.py
├── DataSetup
├── Fruits_Nutrition.hs
├── fruits.hs
├── nutrition.hs
└── upload_images.py

app.py
1 from flask import Flask, render_template, url_for, request
2 import numpy as np
3 import os
4 import tensorflow as tf
5 from keras.models import load_model
6 from keras.preprocessing import image
7 from keras.utils import load_img, img_to_array
8 import requests
9 from bs4 import BeautifulSoup
10
11 print(tf.__version__)
12
13 APP_ROOT = os.path.dirname(os.path.abspath(__file__))
14
15 model = load_model('Fruits_Nutrition.hs')
16
17 class_name = {0: 'apple', 1: 'banana', 2: 'beetroot', 3: 'bell pepper', 4: 'cabbage', 5: 'capsicum', 6: 'carrot', 7:
18               19: 'mango', 20: 'onion', 21: 'orange', 22: 'paprika', 23: 'pear', 24: 'peas', 25: 'pineapple', 26: 'pomegra
19
20
21 app = Flask(__name__)
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
```

```
2022-11-18 15:27:56.203618: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'nvidia.dll'; dlerror: nvidia.dll not found
2022-11-18 15:27:56.263389: W tensorflow/stream_executor/cuda/cuda_driver.cc:263] failed call to cuInit: UNKNOWN ERROR (303)
2022-11-18 15:27:56.279651: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:169] retrieving CUDA diagnostic information for host: DESKTOP-9F0F88L
2022-11-18 15:27:56.280522: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:176] hostname: DESKTOP-9F0F88L
2022-11-18 15:27:56.283897: I tensorflow/core/platform/cpu_feature_guard.cc:193] This TensorFlow binary is optimized with oneAPI Deep Neural Network Library (oneDNN) to use
the following CPU instructions in performance-critical operations: AVX AVX2
to enable them in other operations, rebuild TensorFlow with the appropriate compiler flags.
* Debug mode: off
WARNING: This is a development server. Do not use it in a production deployment, use a production WSGI server instead.
* Running on http://127.0.0.1:5000
Press CTRL+C to quit
```



Data Collection

Download the dataset using the above given link

Unzipping the dataset

```
!unzip          '/content/Dataset.zip'          inflating:
Dataset/TRAIN_SET/PINEAPPLE/33_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/34_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/35_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/36_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/37_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/38_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/39_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/40_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/41_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/42_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/43_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/44_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/45_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/46_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/47_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/48_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/49_100.jpg inflating:
Dataset/TRAIN_SET/PINEAPPLE/4_100.jpg
```

Image ProProcessing

```
Importing the ImageDataGenerator Library import numpy as np
import tensorflow as tf 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
```

```
Config ImageDataGenerator Class train_datagen = ImageDataGenerator(rescale =
1./255,shear_range=0.2, zoom_range=0.2, horizontal_flip= True)
test_datagen = ImageDataGenerator(rescale = 1./255)
```

Applying Image DataGenerator Functionality To Trainset And Testset

```
#Applying Image DataGenerator Functionality To Trainset And Testset x_train =
train_datagen.flow_from_directory(r'/content/drive/MyDrive/DataSet-
IBM/TRAIN_SET', target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')
```

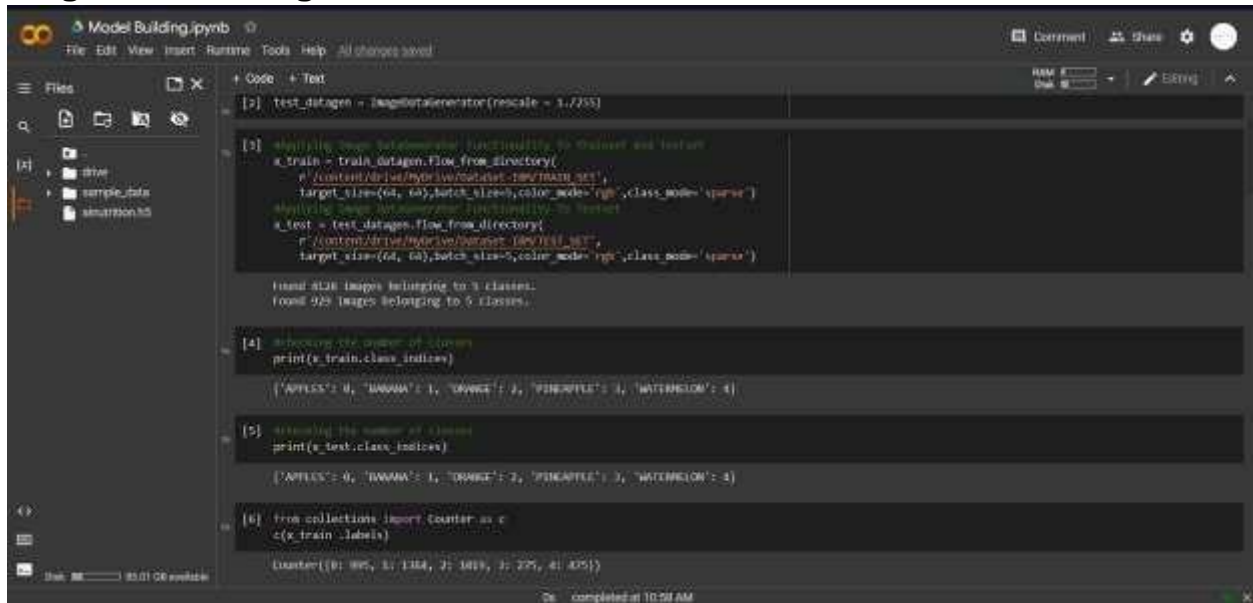
```
#Applying Image DataGenerator Functionality To Testset
```

```
x_test = test_datagen.flow_from_directory( r'/content/drive/MyDrive/DataSet-
```


IBM/TEST_SET', target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')

```
Found 4128 images belonging to 5 classes.  
Found 929 images belonging to 5 classes.
```

Image PreProcessing



```
[2] test_datagen = ImageDataGenerator(rescale = 1./255)  
  
[3] # applying same data generator functionality to dataset and test set  
x_train = train_datagen.flow_from_directory(  
    r'/content/drive/MyDrive/colab-tf/train_set',  
    target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')  
# applying same data generator functionality to test set  
x_test = test_datagen.flow_from_directory(  
    r'/content/drive/MyDrive/colab-tf/TEST_SET',  
    target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')  
  
Found 4128 images belonging to 5 classes.  
Found 929 images belonging to 5 classes.  
  
[4] # checking the number of classes  
print(x_train.class_indices)  
  
{'APPLE': 0, 'BANANA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}  
  
[5] # checking the number of classes  
print(x_test.class_indices)  
  
{'APPLE': 0, 'BANANA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}  
  
[6] from collections import Counter as c  
c(x_train.labels)  
  
Counter({0: 895, 1: 1384, 2: 1419, 3: 275, 4: 455})
```

Model Creation

Importing libraries import numpy as np import tensorflow as tf 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

Initializing the Model

```
model = Sequential()
```

Adding CNN Layers

```
classifier = Sequential()
```

```
# First convolution layer and pooling classifier.add(Conv2D(32, (3, 3),  
input_shape=(64, 64, 3), activation='relu'))
```

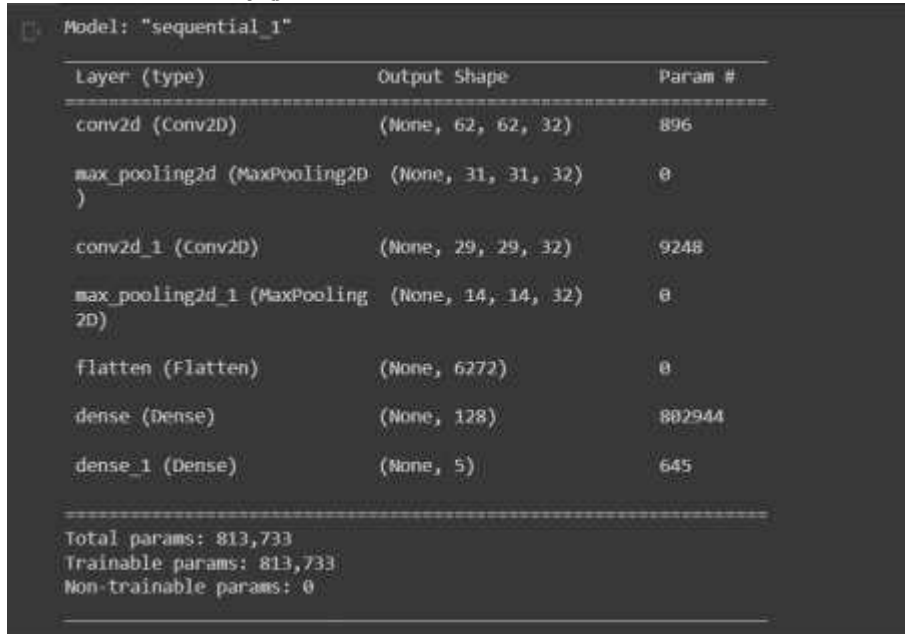
```
classifier.add(MaxPooling2D(pool_size=(2, 2))) # Second convolution layer  
and pooling classifier.add(Conv2D(32, (3, 3), activation='relu'))
```

```
# input_shape is going to be the pooled feature maps from the previous convolution layer  
classifier.add(MaxPooling2D(pool_size=(2, 2)))
```

```
# Flattening the layers classifier.add(Flatten())
```

Adding Dense Layers classifier.add(Dense(units=128,
activation='relu')) classifier.add(Dense(units=5,
activation='softmax'))

classifier.summary()



| Layer (type) | Output Shape | Param # |
|--------------------------------|--------------------|---------|
| conv2d (Conv2D) | (None, 62, 62, 32) | 896 |
| max_pooling2d (MaxPooling2D) | (None, 31, 31, 32) | 0 |
| conv2d_1 (Conv2D) | (None, 29, 29, 32) | 9248 |
| max_pooling2d_1 (MaxPooling2D) | (None, 14, 14, 32) | 0 |
| Flatten (Flatten) | (None, 6272) | 0 |
| dense (Dense) | (None, 128) | 802944 |
| dense_1 (Dense) | (None, 5) | 645 |

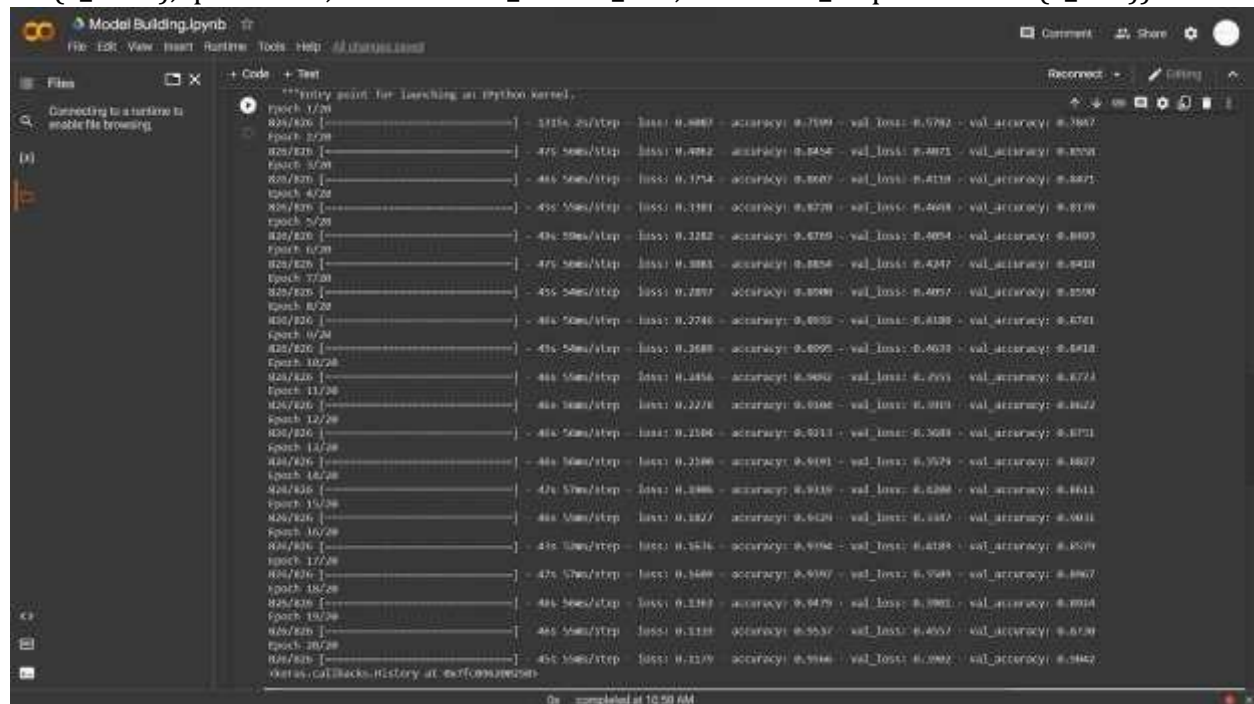
| |
|---------------------------|
| Total params: 813,733 |
| Trainable params: 813,733 |
| Non-trainable params: 0 |

Configure the Learning Process

Compiling the CNN

categorical_crossentropy for more than 2
classifier.compile(optimizer='adam',
loss='sparse_categorical_crossentropy', metrics=['accuracy'])

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))



Save the Model

classifier.save('ainutrition.h5')

8. TESTING

8.1 TEST CASES & USER ACCEPTANCE TESTING

Test the Model

```

#Predict the results from
tensorflow.keras.models import load_model from
keras.preprocessing import image from
keras_preprocessing.image import load_img
model = load_model("ainutrition.h5")
  
```

from tensorflow.keras.utils import img_to_array

#loading of the image

img = load_img(r'/content/drive/MyDrive/DataSet-

IBM/TEST_SET/ORANGE/n07749192_1251.jpg', grayscale=False, target_size= (64,64))

```
#image to array x = img_to_array(img)
#changing the shape 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 107ms/step
array([2])
```

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

```
'ORANGE'
```

```
print(result) if result
== 'APPLES':
```

```
print("One serving, or one medium apple, provides about 95 calories, 0 gram fat, 1 gram
protein, 25 grams carbohydrate, 19 grams sugar (naturally occurring), and 3 grams fiber.") elif
result == 'BANANA':
```

```
print("One serving, or one medium ripe banana, provides about 110 calories, 0 gram fat, 1
gram protein, 28 grams carbohydrate, 15 grams sugar (naturally occurring), 3 grams fiber,
and 450 mg potassium.") elif result == 'ORANGE':
```

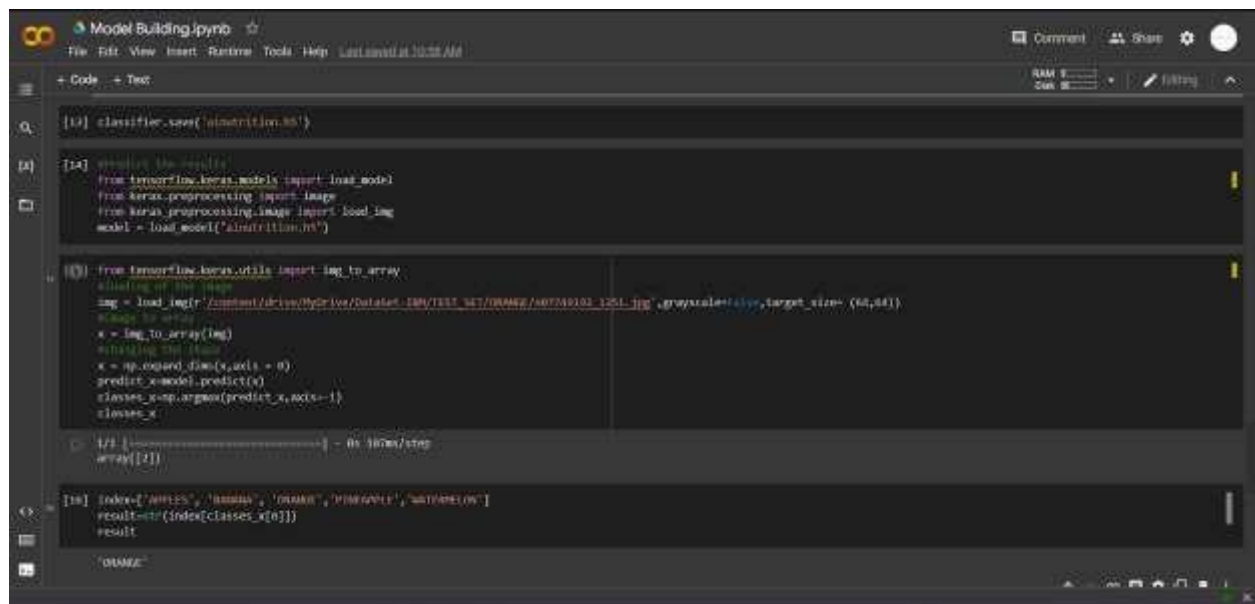
```
print("60 calories, No fat or sodium, 3 grams of fiber, 12 grams of sugar, 1 gram of protein,
14 micrograms of vitamin A, 70 milligrams of vitamin C, 6% of your daily recommended
amount of calcium.") elif result == 'PINEAPPLE':
```

```
print("Calories: 83, Fat: 1.7 grams, Protein: 1 gram, Carbs: 21.6 grams, Fiber: 2.3 grams,
Vitamin C: 88% of the Daily Value (DV), Manganese: 109% of the DV, Vitamin B6: 11% of
the DV.") elif result == 'WATERMELON':
```

```
print("Calories: 46, Carbs: 11.5 grams, Fiber: 0.6 grams, Sugar: 9.4 grams, Protein: 0.9
grams, Fat: 0.2 grams, Vitamin A: 5% of the Daily Value (DV), Vitamin C: 14% of the DV.")
```

```
ORANGE
60 calories, no fat or sodium, 3 grams of fiber, 12 grams of sugar, 1 gram of protein, 14 micrograms of vitamin A, 70 milligrams of vitamin C, 6% of your daily recommended amount
```

Model Building



```
[12] classifier.save('classification.h5')

[14] #evaluating the results
from tensorflow.keras.models import load_model
from keras.preprocessing import image
from keras.preprocessing.image import load_img
model = load_model('classification.h5')

[15] from tensorflow.keras.utils import img_to_array
#loading the image
img = load_img('content/drive/MyDrive/Datasets/DM/TEST_SET/ORANGE/407749192_1251.jpg', grayscale=False, target_size=(64,64))
#image to array
x = img_to_array(img)
#adjusting the shape
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 10ms/step
array([1])

[16] index=[ 'apple', 'banana', 'orange', 'pineapple', 'watermelon']
result=chr(index[classes_x[0]])
result

'ORANGE'
```

Webpage

Know Your Food Calorie

Know live food calories & nutrition information from a single food image

Choose File

407749192_1251.jpg

Submit

Instructions:

Limitations

- The image size must be under 1024KB.
- The image format must be in JPEG, JPG or PNG.

Do's

- Center the food on the picture.
- Upload squared images, meaning that height and width are the same.

Dont's

- Blurry images.
- Images that include multiple food items.



9. RESULTS

9.1 PERFORMANCE METRICS

```
loss: 0.2104 - accuracy: 0.9213 - val_loss: 0.3689 - val_accuracy: 0.8751
loss: 0.2100 - accuracy: 0.9191 - val_loss: 0.3579 - val_accuracy: 0.8827
loss: 0.1906 - accuracy: 0.9319 - val_loss: 0.4280 - val_accuracy: 0.8611
loss: 0.1827 - accuracy: 0.9329 - val_loss: 0.3347 - val_accuracy: 0.9031
loss: 0.1636 - accuracy: 0.9394 - val_loss: 0.4189 - val_accuracy: 0.8579
loss: 0.1609 - accuracy: 0.9397 - val_loss: 0.3509 - val_accuracy: 0.8967
loss: 0.1363 - accuracy: 0.9479 - val_loss: 0.3901 - val_accuracy: 0.8924
loss: 0.1339 - accuracy: 0.9537 - val_loss: 0.4557 - val_accuracy: 0.8730
loss: 0.1179 - accuracy: 0.9566 - val_loss: 0.3902 - val_accuracy: 0.9042
```

10. ADVANTAGES & DISADVANTAGES

Advantages :

- Easily detect and Estimate the food nutrition
- Most Accurate

- Flexible Model which can give maximized outcome
- No Specific Requirements needed to implement the model

Disadvantages :

- Training model is a time consuming process.
- Change in uploading image size or format will throw error

11. CONCLUSION

Thus we have constructed a model that can identify the fruit variety and it can analyze its nutrition by advanced AI techniques and CNN Algorithm, then the Prediction model is checked. Then the entire model is deployed to the IBM Cloud account that we have created with the studies we have done.

12. FUTURE SCOPE

- It can be developed as a Web or Android Application.
- In future Alternate Advanced technologies can be Implemented.
- The Identification and tracking system can be implemented if possible

13. APPENDIX Source**Code:**

Github : <https://github.com/IBM-EPBL/IBM-Project-9249-1658989420>