

AI-powered Nutrition Analyzer for Fitness Enthusiasts

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Project Report

1. INTRODUCTION:

1.1 Project Overview

Food is fundamental for human existence and has been the worry of numerous medical services shows. These day new dietary evaluation and sustenance examination instruments empower more chances to assist individuals with understanding their everyday dietary patterns, investigating nourishment designs and keep a solid eating routine. Wholesome investigation is the method involved with deciding the nourishing substance of food. An imperative piece of scientific science gives data about the compound organization, handling, quality control and pollution 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 color, 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

Neutrino conveys nourishment based information administrations and examination to its clients and needs to transform into a models from the advancement hypothesis as well as prescient examination to empower individualized information accumulation.

The application depends on Man-made consciousness to create custom information connected with brilliant calorie counter fueled by computer based intelligence. Their man-made consciousness learns a singular's

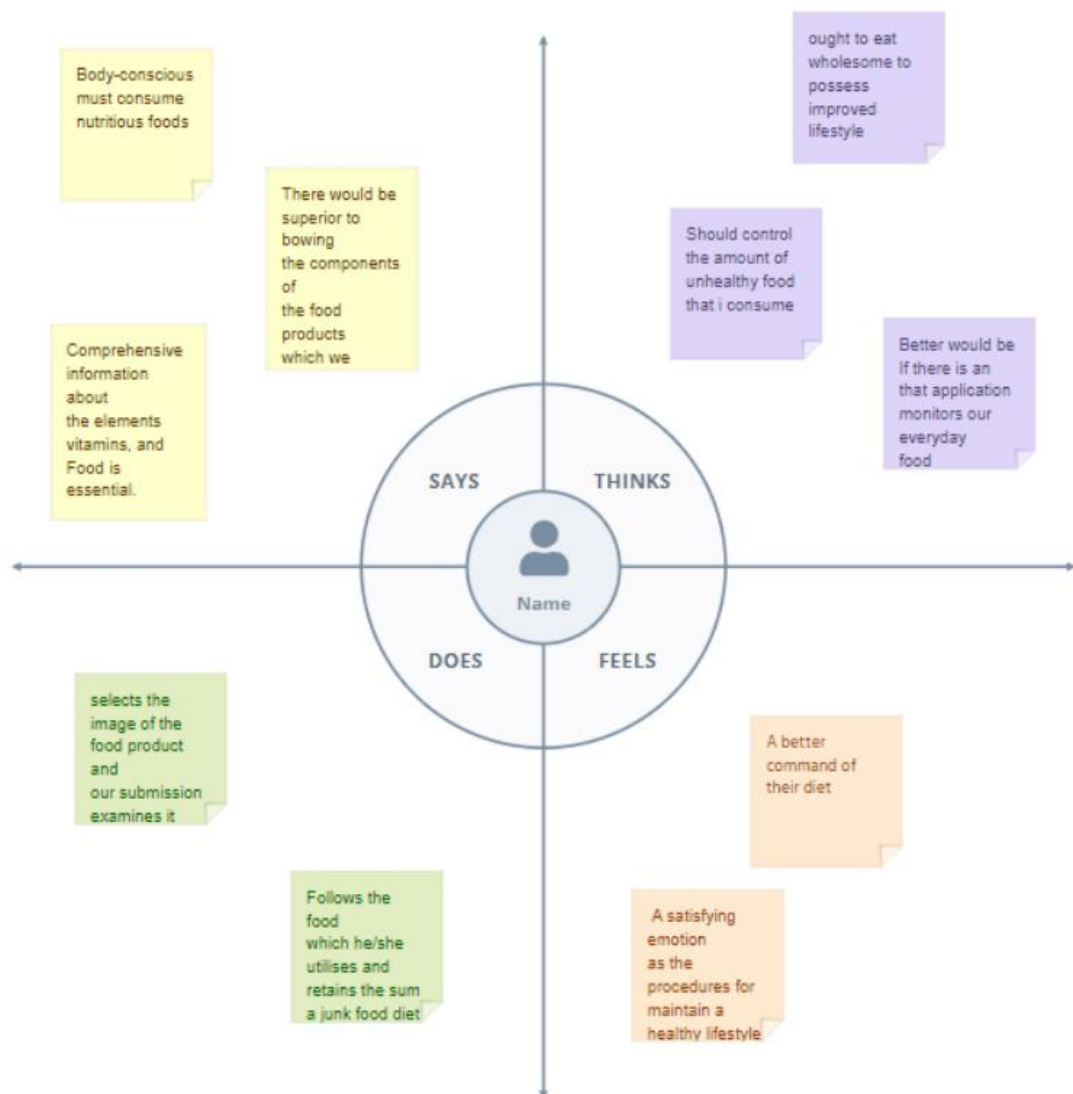
preferences, inclinations, and body type. This is all bundled in a far reaching nourishment and movement tracker driving wellspring of the nourishment related stage. The stage utilizes NLP and numerical.

2.3 Problem Statement Definition

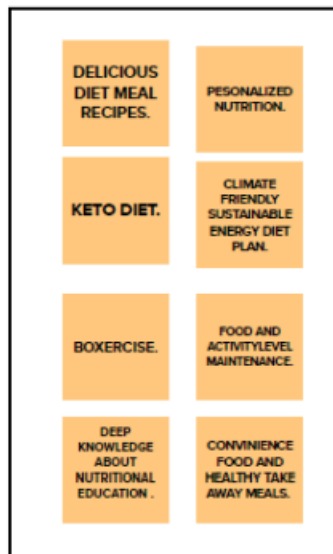
The main aim of the project is to building a model which is used for classifying the fruit depends on the different characteristics like colour, shape, texture etc. Here the user can capture the images of different fruits and then the image will be sent the trained model. The model analyses the image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

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



NUTRITIONAL



WORKOUT



PROGRAMS



3.2 Proposed Solution

S.No.	Parameter	Description
1.	ProblemStatement(Problem to be solved)	The main goal of the project is to build a model which is used for explaining the fruit depends on the different methods characteristics like colour, shape, texture etc.
2.	Idea/Solution description	Brand-new fruit implementing method called HPA-SLFN can be implemented for classification as it gives good results when compared to other techniques
3.	Novelty/Uniqueness	The type performance and accuracy for the analyses of image and detection rate of the nutrition based on the fruits is higher.
4.	Social Impact/Customer Satisfaction	Here the user can capture the images of different fruits and then the pictures will be sent to the trained model. The model analyses the image and detects the nutrition based on the fruits like (Sugar, Fibre, Protein, Calories, etc.) .

5.	BusinessModel(Revenue Model)	<ul style="list-style-type: none"> •Dataanalytics •Statistics methods •Future analysis
6.	ScalabilityoftheSolution	The model is scalable from the architecture and data set training perspective. We can train massive amounts of image data by converting them into .npy / .npz file formatwhich would facilitate easy storing,retrieving and processing.

3.4 Problem Solution fit

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem. It helps entrepreneurs, marketers and corporate innovators identify behavioral patterns

Purpose:

- Solve complex problems in a way that fits the state of your customers.
- Succeed faster and increase your solution adoption by tapping into existing mediums and channels of behavior.
- Sharpen your communication and marketing strategy with the right triggers and messaging.
- Increase touch-points with your company by finding the right problem-behavior fit and building trust by solving frequent annoyances, or urgent or costly problems.

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS Who is your customer? i.e. working parents of 0-5 y.o. kids Wellness Enthusiasts who like to lead healthy life and well balanced diet	6. CUSTOMER CONSTRAINTS CC What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices. Absence of wrong data information about food nutrition values. • Only thinking about leading healthy life without taking actions. • Not having individual assistant to monitor their daily nutritional intake	5. AVAILABLE SOLUTIONS AS Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking They can hire a personal Nutritionist. They can use apps. There are many apps like MyFitnessPal, Chromometer, Lifesum, etc.... which people resort to for good health.	Explore AS, differentiate
	2. JOBS-TO-BE-DONE / PROBLEMS J&P Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one, explore different sides. Individual physical exercise or yoga without prior knowledge may lead to muscle cramp. So can be tackled by use of animated guide videos for that.	9. PROBLEM ROOT CAUSE RC What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations. Due to fast paced lifestyle, Availability of low quality and nutrition less food, Improper diet plan, Lack of health related awareness, Emotional eating, not following strict timings	7. BEHAVIOUR BE What does your customer do to address the problem and get the job done? i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace) • Have a regular and enough sleep • Have an application to track their daily nutrition values. • Have a perfectly balanced diet plan	
Focus on J&P, tap into BE, understand RC	3. TRIGGERS TR What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news. To maintain good health and to regulate their eating and good intake of foods.	10. YOUR SOLUTION SL If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour. Creating a web application for users to track, monitor and maintain their health by performing specialized suggestions for each and every user.	8. CHANNELS of BEHAVIOUR CH 8.1 ONLINE: What kind of actions do customers take online? Extract online channels from #7 ONLINE: Taking advice from the nutrition expert and following fitness based online apps. OFFLINE: Working out regularly, and maintaining the regular activities as per the prescribed schedule	Focus on J&P, tap into BE, understand RC
Identify strong TR & EM	4. EMOTIONS: BEFORE/AFTER Before: People can't track their health details. People can't improve their health in proper manner After: Users can maintain and can improve their body fitness			Extract online & offline CH of BE

4. REQUIREMENT ANALYSIS

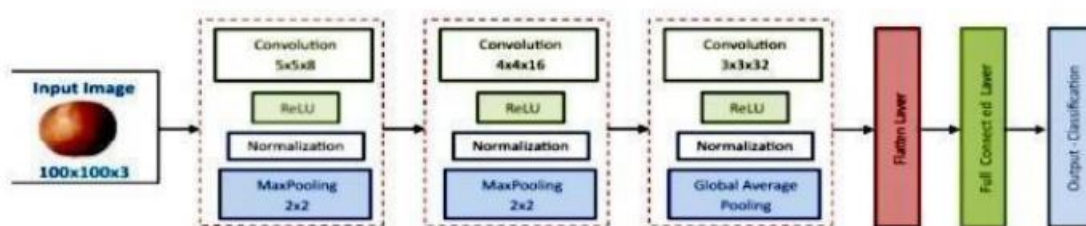
4.1 Functional requirement

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
- Nutrition is vital to the growth of the human body. Nutritional analysis guarantees that the meal meets the appropriate vitamin and mineral requirements, and the examination of nutrition in food aids in understanding the fat proportion, carbohydrate dilution, proteins, fiber, sugar, and so on. Another thing to keep in mind is not to exceed our daily calorie requirements
- 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.

- 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.)
- 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.
- 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.

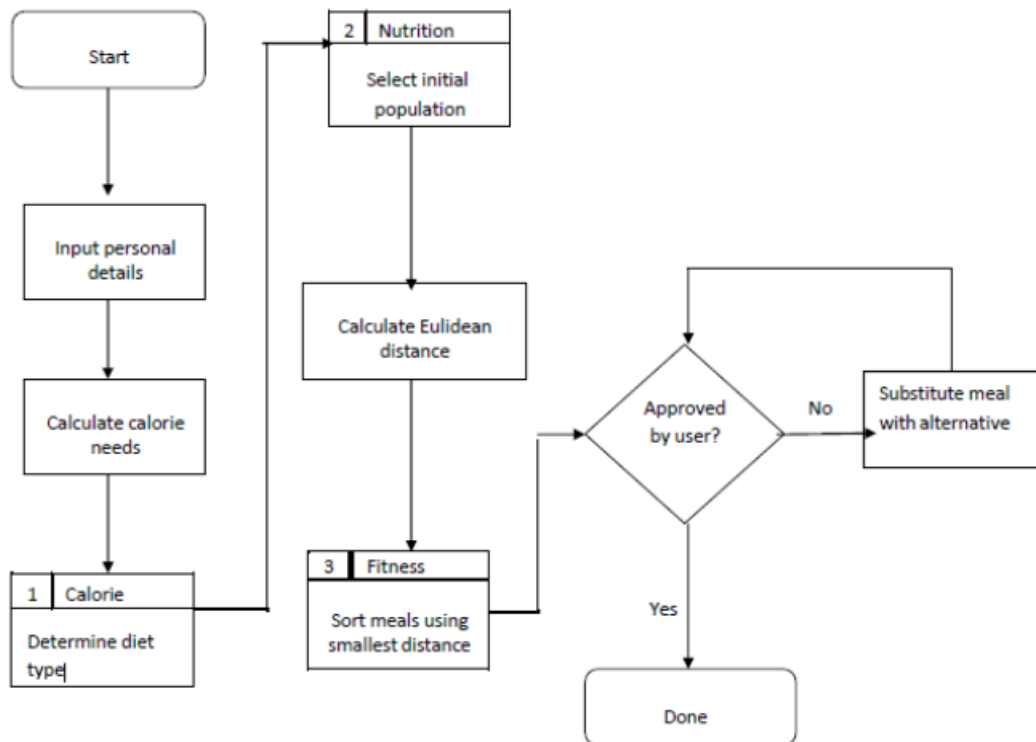
For Example:



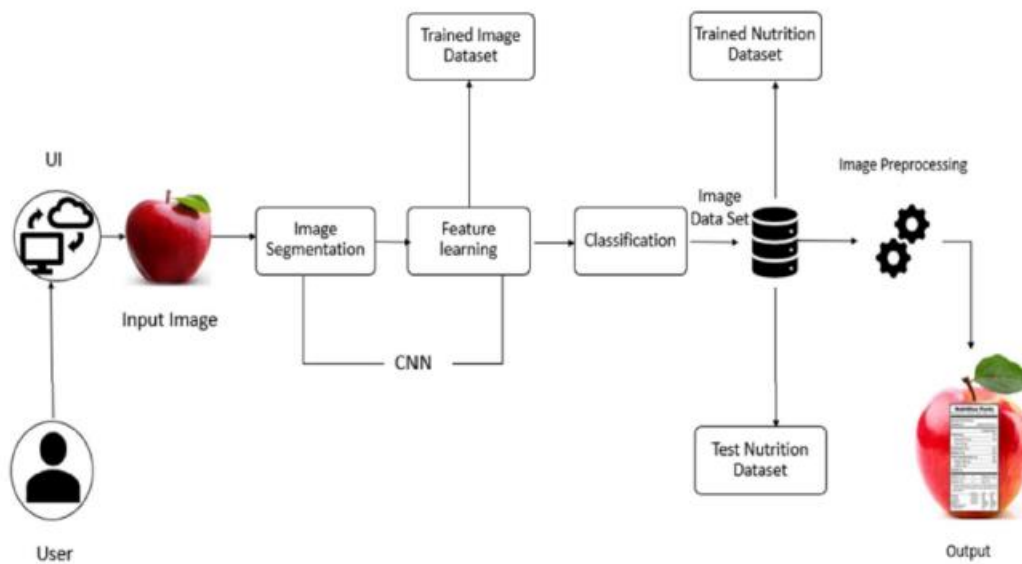
- The comparison of the proposed model with the conventional models shows that the results of this model are exceptionally good and promising to use in real-world applications.
- This sort of higher accuracy and precision will work to boost the machine’s general efficiency in fruit recognition more appropriately.
- A generic model for the dietary protein requirement (as with any nutrient) defines the requirement in terms of the needs of the organism, i.e. metabolic demands, and the dietary amount which will satisfy those needs, i.e. efficiency of utilization, thus: dietary requirement = metabolic demand/efficiency of utilization.

5. PROJECT DESIGN

5.1 Data Flow Diagrams



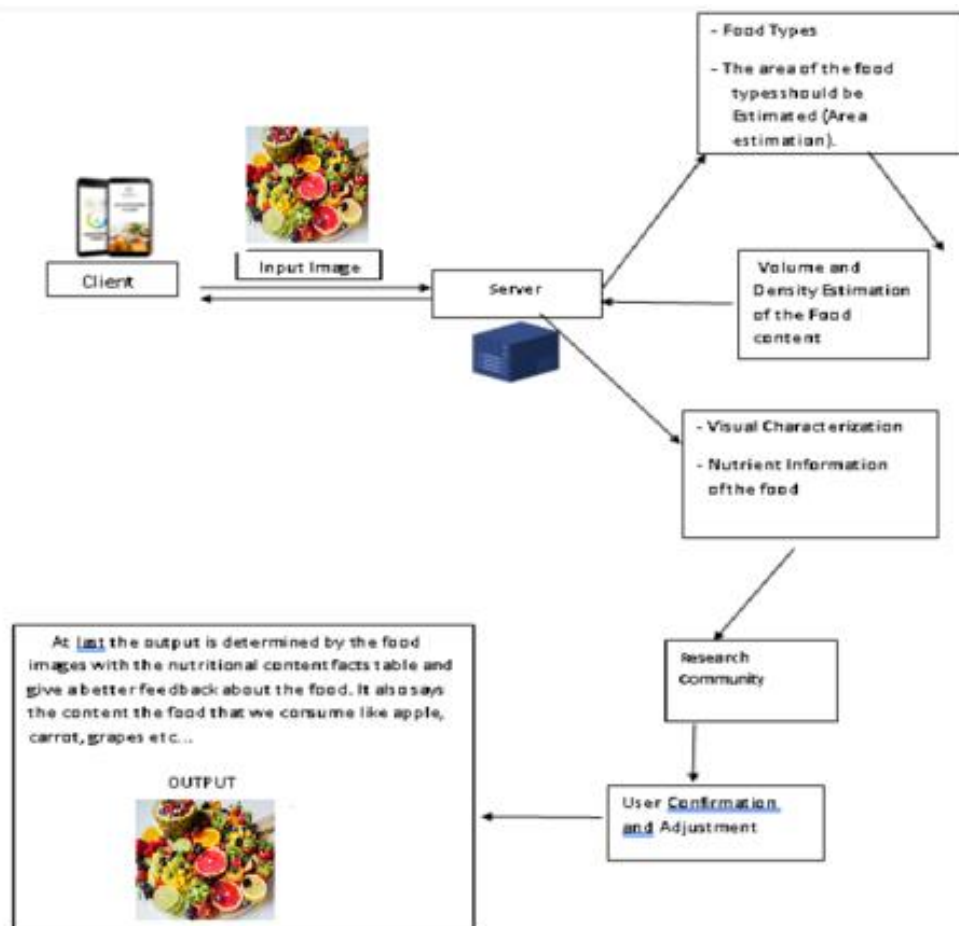
5.2 Solution & Technical Architecture



S.No	Component	Description	Technology
1.	App	User interacts with application for the prediction of Nutrition	Python, Java, HTML, SQLite, Android studio
2.	Database	Data Type, Configurations and data will be stored	MySQL, JS
3.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
4.	File Storage	File storage requirements	Cloud -- > drive
5.	Machine Learning Model	Purpose of Machine Learning Model	ANN, CNN, RNN
6.	Notification	Notification will be sent from the server	SendGrid

Application Characteristics

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Open-source frameworks used	SendGrid, Python, JQuery
2.	Security Implementations	Request authentication using encryption	Encryptions, SSL certs
3.	Scalable Architecture	The scalability of architecture consists of 3 tiers	Web Server – HTML, CSS ,Javascript Application Server – Python Flask Database Server – IBM Cloud
4.	Availability	Availability is increased by loads balancers in cloud VPS	IBM Cloud hosting
5.	Performance	The application is expected to handle up to 4000 predications per second	IBM Load Balance



6. CODING & SOLUTIONING (Explain the features added in the project along with code)

6.1 Feature 1

Data Collection

Collect images of different food items organized into subdirectories based on their respective names as shown in the project structure.

Create folders of types of food items that need to be recognized.

In this project, we have collected images of 5 types of food items apples, 'banana', 'orange', 'pineapple' and 'watermelon', they are saved in the respective subdirectories with their respective names.

For more accurate results we can collect images of high resolution and feed the model with more images. You can download the dataset used in this project using the link below.

Data Set: [LINK](#)

Note: For better accuracy train on more images

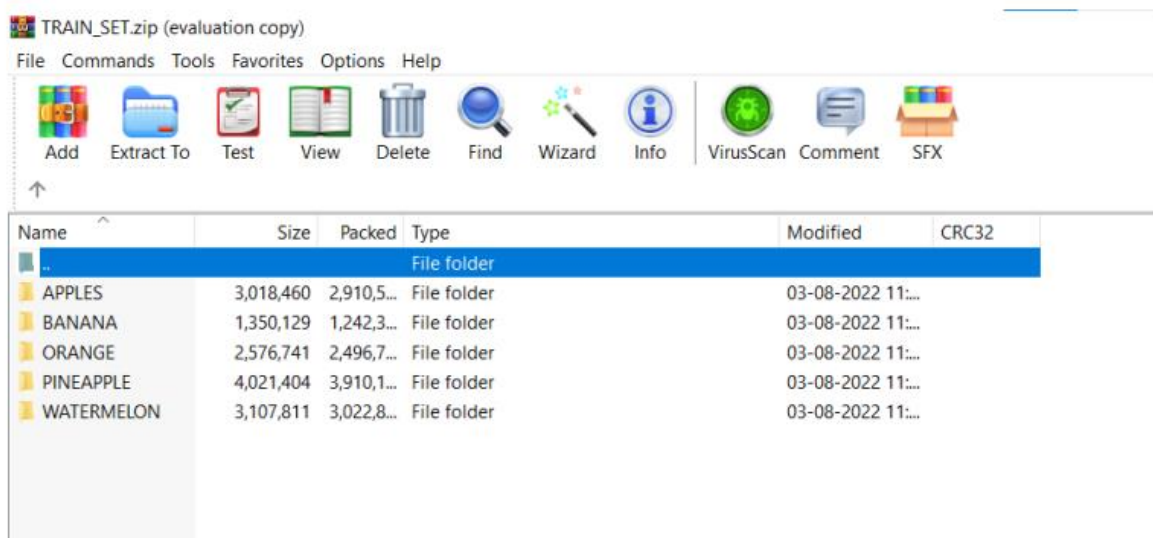


Image Preprocessing

```
In [1]: from keras.preprocessing.image import ImageDataGenerator

In [2]: train_datagen = ImageDataGenerator(rescale=1./255, shear_range=0.2, zoom_range=0.2, horizontal_flip=True)
test_datagen = ImageDataGenerator(rescale=1./255)

In [3]: x_train = train_datagen.flow_from_directory(
        r'C:\AI-powered Nutrition Analyzer for Fitness Enthusiasts', target_size=(64, 64), batch_size=5, color_mode='rgb', class_mode='sparse',
        x_test = test_datagen.flow_from_directory(r'C:\AI-powered Nutrition Analyzer for Fitness Enthusiasts', target_size=(64, 64), batch_size=5, color_mode='rgb', class_mode='sparse')
Found 4138 images belonging to 2 classes.
Found 4138 images belonging to 2 classes.

In [4]: print(x_train.class_indices)
{'APPLES': 0, 'BANANA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}

{'Rapid API Video': 0, 'TRAIN_SET-20221110T014135Z-001': 1}

Out[4]: {'APPLES': 0, 'BANANA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}

In [5]: print(x_test.class_indices)

{'Rapid API Video': 0, 'TRAIN_SET-20221110T014135Z-001': 1}

In [6]: from collections import Counter as c
c(x_train.labels)

Out[6]: Counter({1: 4138})



{'Rapid API Video': 0, 'TRAIN_SET-20221110T014135Z-001': 1}

In [6]: from collections import Counter as c
c(x_train.labels)

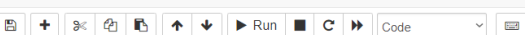










Out[6]: Counter({1: 4138})

In [8]: x_train = train_datagen.flow_from_directory(
        r'D:\IBM Assignment\Project Structure\Dataset\TRAIN_SET', target_size=(64, 64), batch_size=5, color_mode='rgb', class_mode='sparse',
        x_test = test_datagen.flow_from_directory(r'D:\IBM Assignment\Project Structure\Dataset\TEST_SET', target_size=(64, 64), batch_size=5, color_mode='rgb', class_mode='sparse')
Found 4138 images belonging to 5 classes.
```

Model Building:

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File Edit View Insert Cell Kernel Widgets Help Trusted Python 3 (ipykernel)

          Code 

```
In [1]: import numpy as np

In [2]: import tensorflow

In [3]: from tensorflow.keras.models import Sequential

In [4]: from tensorflow.keras import layers

In [5]: from tensorflow.keras.layers import Dense, Flatten

In [6]: from tensorflow.keras.layers import Conv2D, MaxPooling2D, Dropout

In [7]: from keras.preprocessing.image import ImageDataGenerator

In [8]: model=Sequential()

In [9]: classifier = Sequential()

In [10]: classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 3), activation='relu'))

In [11]: classifier.add(MaxPooling2D(pool_size=(2, 2)))

In [12]: classifier.add(Conv2D(32, (3, 3), activation='relu'))

In [13]: classifier.add(MaxPooling2D(pool_size=(2, 2)))
```

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```
In [14]: classifier.add(Flatten())

In [15]: classifier.add(Dense(units=128, activation='relu'))
classifier.add(Dense(units=5, activation='softmax'))

In [16]: classifier.summary()

Model: "sequential_1"
_____
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 (MaxPooling (None, 14, 14, 32)       0
2D)
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

In [17]: classifier.compile(optimizer='adam', loss='sparse_categorical_crossentropy', metrics=['accuracy'])

In [18]: classifier.save('nutrition.h5')
```

6.2 Feature 2

Project Structure - imageprediction.html

Project Structure: C:\Users\Evangeline Angel\PycharmProjects\imageprediction

Project: Flask

Sample_Images: Test_Image1.jpg, Test_Image2.jpg, Test_Image3.jpg, Test_Image4.jpg, Test_Image5.jpg, Test_Image11.jpg

Static: main.css, style.css

js: main.js

templates: 0.html, home.html, image.html

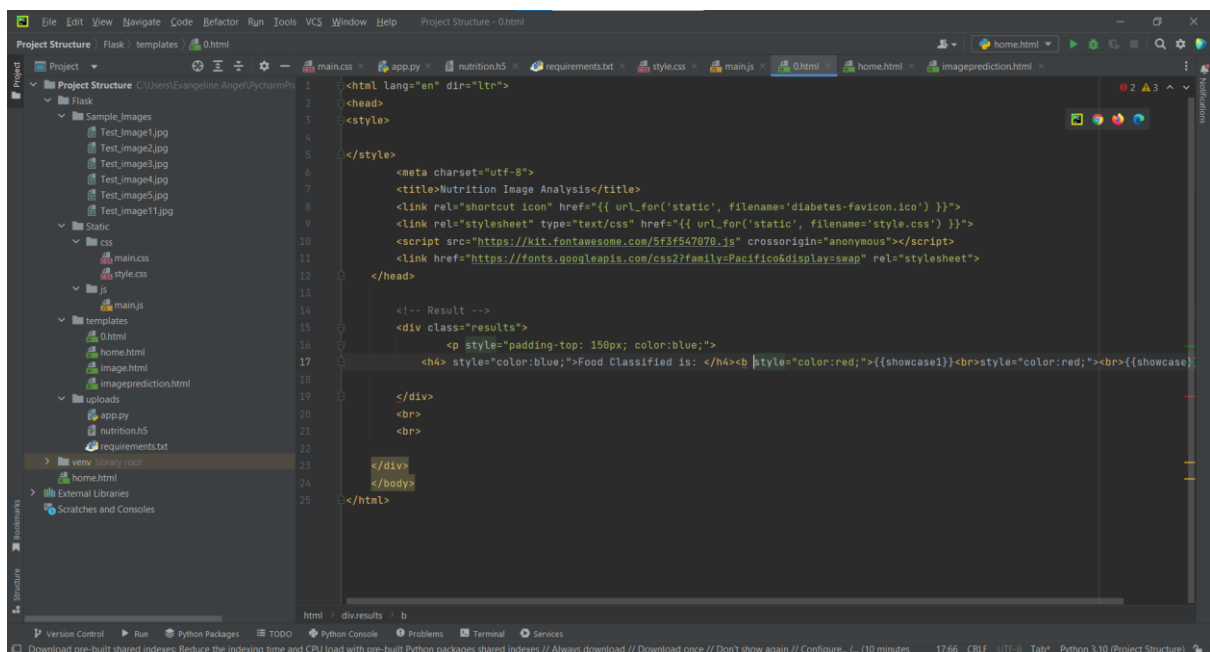
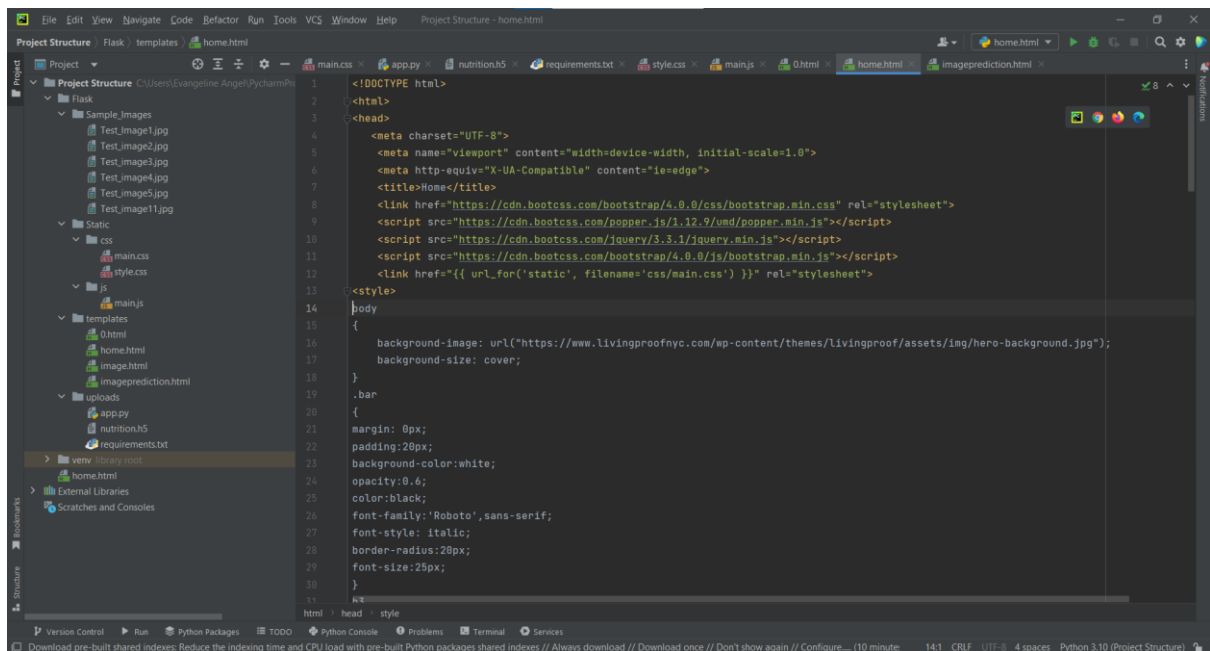
imageprediction.html

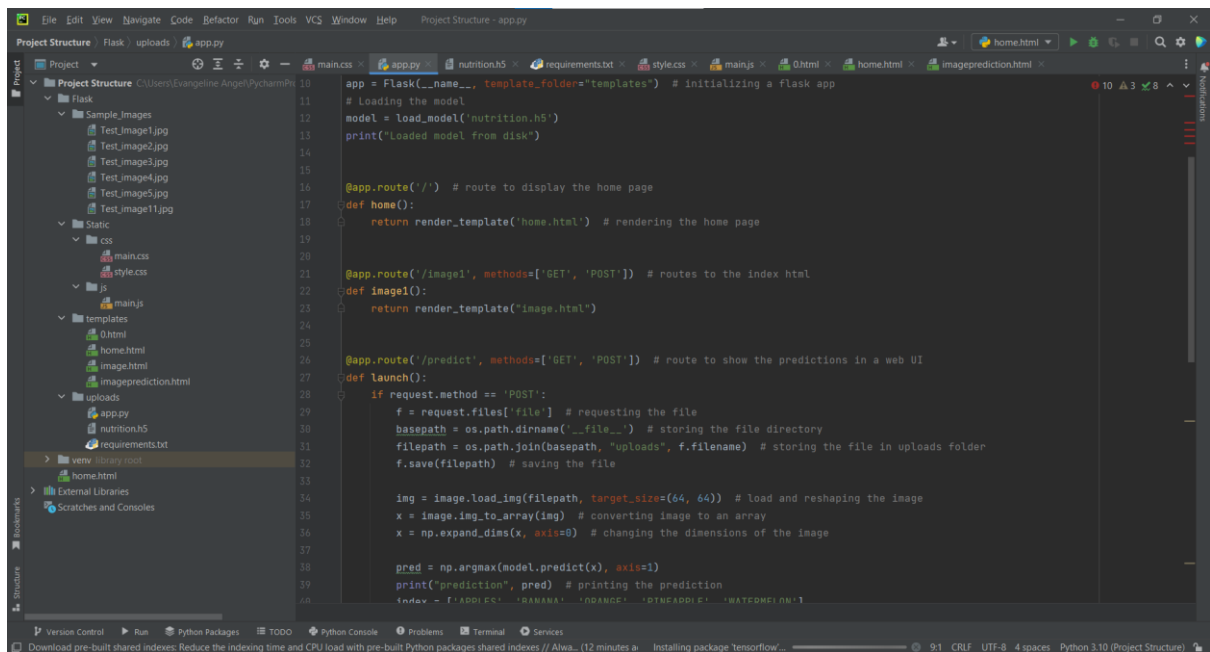
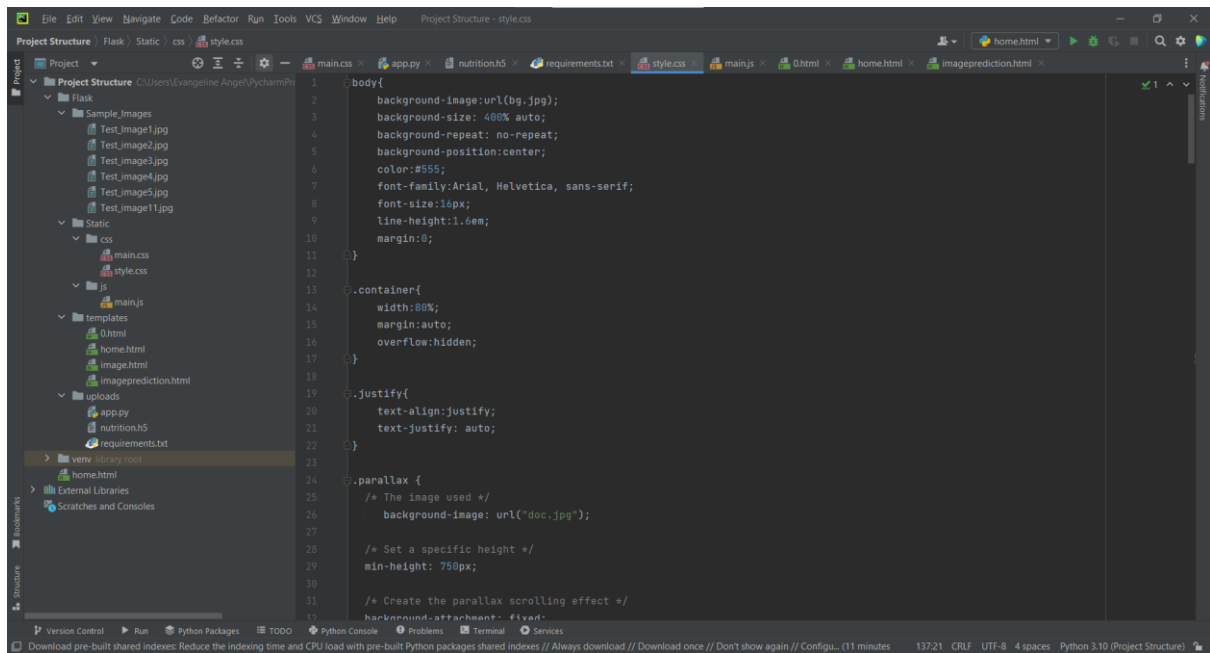
uploads: app.py, nutrition.h5, requirements.txt

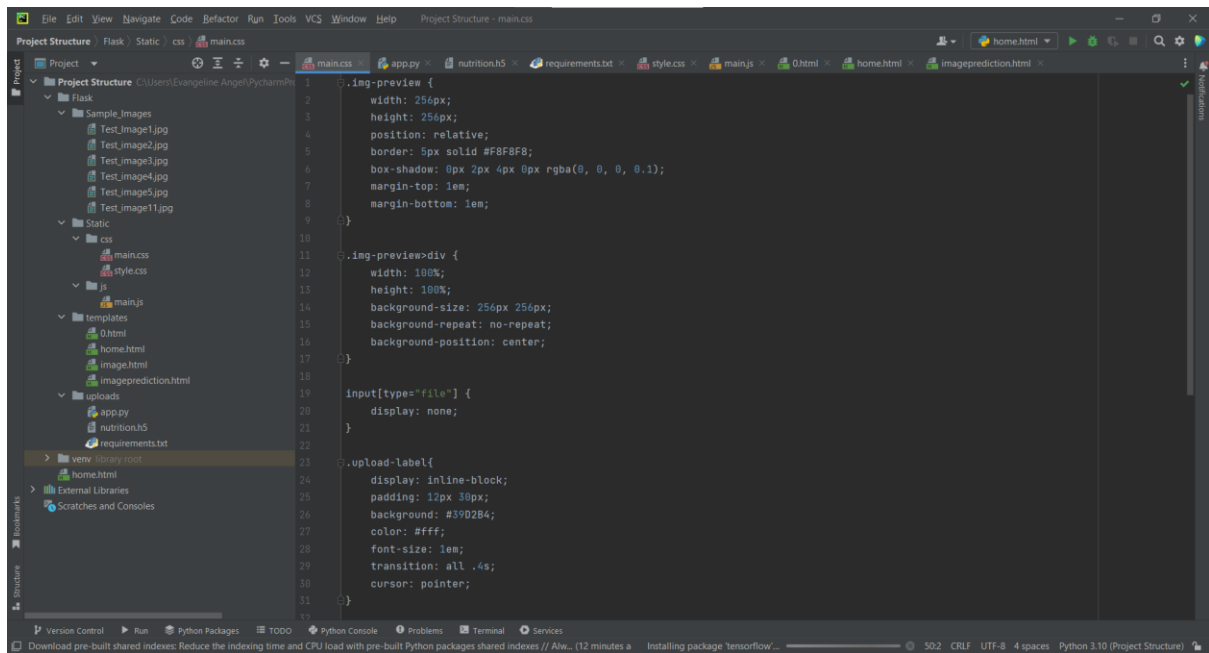
venv: library root, home.html

External Libraries: Scratchers and Consoles

```
1 <!DOCTYPE html>
2 <html>
3 <head>
4 <meta charset="UTF-8">
5 <meta name="viewport" content="width=device-width, initial-scale=1.0">
6 <meta http-equiv="X-UA-Compatible" content="ie=edge">
7 <title>Predict</title>
8 <link href="https://cdn.jsdelivr.net/npm/bootstrap@4.0.0/css/bootstrap.min.css" rel="stylesheet">
9 <script src="https://cdn.jsdelivr.net/npm/popper.js@1.12.0/umd/popper.min.js"></script>
10 <script src="https://cdn.jsdelivr.net/npm/jquery@3.3.1/jquery.min.js"></script>
11 <script src="https://cdn.jsdelivr.net/npm/bootstrap@4.0.0/js/bootstrap.min.js"></script>
12 <link href="{{ url_for('static', filename='css/main.css') }}" rel="stylesheet">
13 <style>
14 body
15 {
16     background-image: url("https://i.pinimg.com/originals/be/21/1a/be21ad5043a8d05757a3538bdd8f450.jpg");
17     background-size: cover;
18 }
19 .bar
20 {
21     margin: 0px;
22     padding: 20px;
23     background-color: white;
24     opacity: 0.6;
25     color: black;
26     font-family: 'Roboto', sans-serif;
27     font-style: italic;
28     border-radius: 20px;
29     font-size: 25px;
30 }
31 a
```

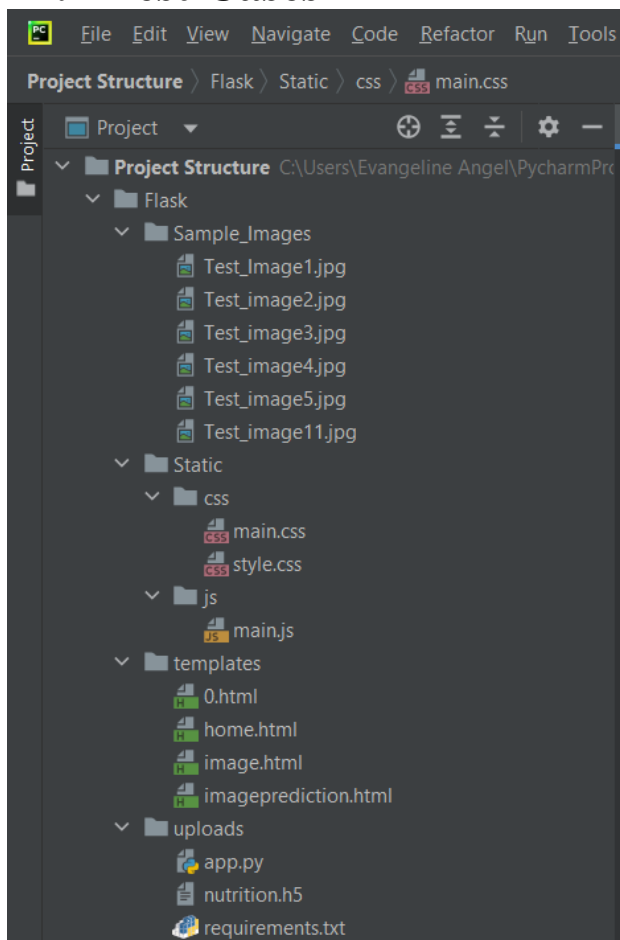






7. TESTING

7.1 Test Cases





7.2 User Acceptance Testing



8. RESULTS

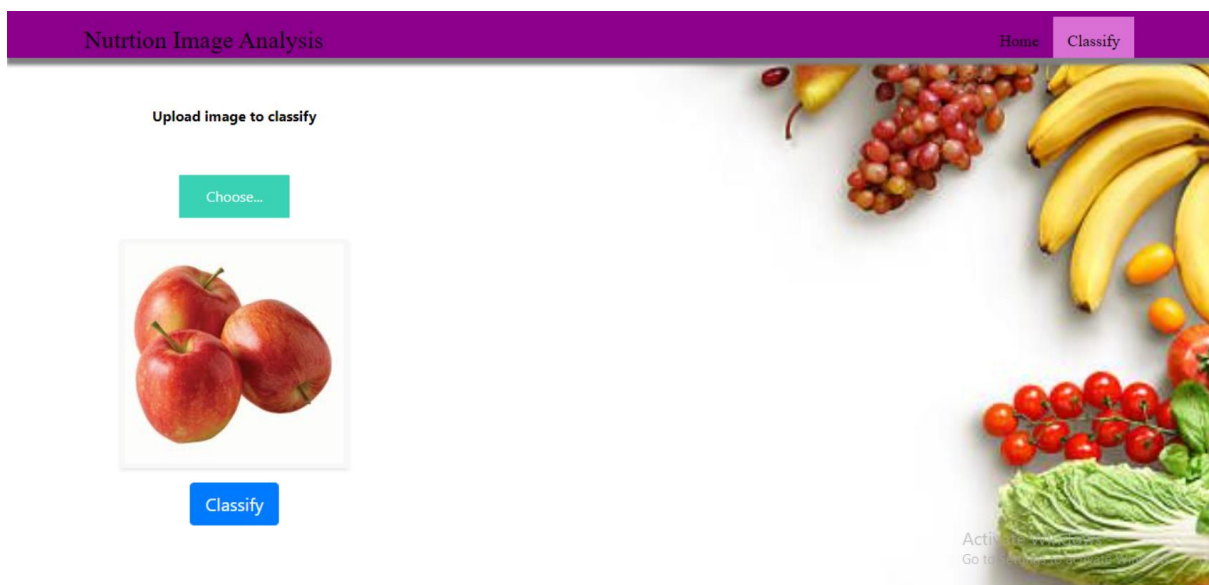
8.1 Performance Metrics

```

File Edit View Navigate Code Refactor Run Tools Git Window Help Flask - app.py
Project: app.py
Project: Flask Nutrition Image Analysis using CNN and RNN
  Sample_Images
    Test_Image1.jpg
    Test_Image2.jpg
Run: app
To enable them in other operations, rebuild TensorFlow with the appropriate compiler flags.
Loaded model from disk
* Restarting with stat
* Serving Flask app 'app' (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: on
2022-11-13 14:47:13.521039: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'cudart64_110.dll'; dlderror: cudart
2022-11-13 14:47:13.523308: I tensorflow/stream_executor/cuda/cudart_stub.cc:29] Ignore above cudart dlerror if you do not have a GPU set up on your machine.
Loaded model from disk
2022-11-13 15:03:52.074467: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'nvcuda.dll'; dlderror: nvcuda.dll
2022-11-13 15:03:52.769818: W tensorflow/stream_executor/cuda/cuda_driver.cc:269] failed call to cuInit: UNKNOWN ERROR (303)
2022-11-13 15:03:54.596275: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:169] retrieving CUDA diagnostic information for host: LAPTOP-E5IM4603
2022-11-13 15:03:54.619299: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:176] hostname: LAPTOP-E5IM4603
2022-11-13 15:03:57.062699: I tensorflow/core/platform/cpu_feature_guard.cc:142] This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
To enable them in other operations, rebuild TensorFlow with the appropriate compiler flags.
* Debugger is active!
* Debugger PIN: 589-305-535
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)

```

8.2 Output



9. CONCLUSION

- By the end of this project we will know fundamental concepts and techniques of Convolutional Neural Network.
- Gain abroad understanding of image data know how to build a web application using the Flask framework.
- Know how to pre-process data and know how to clean the data using different data preprocessing techniques.

10. FUTURE SCOPE

- Simulated intelligence is upsetting the wellbeing business.
- It is significantly utilized in further developing promoting and deals choices, man-made intelligence is currently likewise being utilized to Reshape individual propensities.
- In later we would rather not go to exercise center and do any eating regimens. By utilizing this nourishment wellness analyzer
- we can keep up with our eating regimen plans with practically no assistance from others and we can lead a cheerful and
- Solid existence with great riches.
- Simulated intelligence can undoubtedly follow wellbeing ways of behaving and dull activity examples and utilize the information to direct
- You towards your wellness process and diet plans .