

AI POWERED NUTRITION ANALYZER FOR FITNESS ENTHUSIASTS

DOMAIN : ARTIFICIAL INTELLIGENCE

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PROJECT REPORT

submitted by

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ABSTRACT:

Literature has indicated that accurate dietary assessment is very important for assessing the effectiveness of fitness. However, most of the existing dietary assessment methods rely on memory. With the help of pervasive mobile devices and rich cloud services, it is now possible to develop new computer-aided food recognition system for accurate dietary assessment. However, enabling this future Internet of Things-based dietary assessment imposes several fundamental challenges on algorithm development and system design. In this paper, we set to address these issues from the following two aspects: (1) to develop novel Artificial Intelligence-based visual food recognition algorithms to achieve the best-in-class recognition accuracy; (2) to design a food recognition system employing service computing paradigm to overcome some inherent problems. As the world grows more fitness-conscious with passing time, the demand for technological solutions to cater to this burgeoning demand is diversifying. Lately, a number of startups in India and worldwide are using predictive analytics artificial intelligence and natural language processing to help scores of fitness enthusiasts to track and monitor their nutrition and calorie intake. In India, this global trend has had a positive impact on scores of startups and websites catering to this segment. AI and its various subsets have been leveraged by these platforms to identify the calorie intake and also to make food recommendations for a healthy diet. In most cases, what we see is that these platforms act as a data repository where while providing real-time information to its users, it also makes available to numerous clients who work in this field for a determined rate. In this article, we take a look at the top AI-based online platforms which make use of AI and other deep learning technologies to provide a real-time update about nutrition intake.

Index Terms— Mobile Applications, Object Recognition, Artificial Intelligence, Food Recognition

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1.INTRODUCTION

The pace with which the world is growing it is often seen that we tend to ignore our health and later suffer the grave consequences. Wise men say that health is wealth and to emphasize this important prospect of life we are developing software that allows the user to keep a track of their diet and provide them with the best solutions that adjust with their day to day life. Nutritional intake is the basis for human growth and health, and the intake of different types of nutrients and micronutrients can affect health. Most diseases are inextricably linked to diet. Diabetes, cardiovascular diseases (hypertension, hyperlipidemia), gout, peptic ulcers, and gastroenteritis are all diet-related diseases that are increasing in prevalence every year, while the age group of those suffering from these diseases is gradually decreasing. The development of the Internet has made it possible to conduct online nutrition surveys through large-scale food and nutrition databases linked to automated dietary records, and there are now a growing number of software, platforms, and applications for nutrition surveys.

The term “artificial intelligence” was first proposed in 1955 by the American computer scientist John McCarthy (1927–2011) in the proposal of a research project, which was carried out the following year at Dartmouth College in Hanover, New Hampshire. Artificial intelligence (AI) as a branch of computer science, the purpose of which is to imitate thought processes, learning abilities and knowledge management, finds more and more applications in experimental and clinical medicine. In recent decades, there has been an expansion of AI applications in medicine and biomedical sciences. The possibilities of artificial intelligence in the field of medical diagnostics, risk prediction and support of therapeutic techniques are growing rapidly. Thanks to the use of AI in ophthalmological [3], radiological [4] and cardiac [5] diagnostics, measurable clinical benefits have been obtained. AI was used in research on new pharmaceuticals [6]. The development of AI also provides new opportunities for research on nutrients and medical sensing technology.

1.1.OBJECTIVES

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.

BY THE END OF THIS PROJECT YOU WILL

- Know fundamental concepts and techniques of Convolutional Neural Network
- Gain a broad understanding of image data.
- Know how to pre-process/clean the data using different data preprocessing techniques.
- Know how to build a web application using the Flask Framework

TECHNOLOGIES USED:

Python, CNN, IBM Cloud, IBM Watson, IBM Cloudant DB, Deep Learning, Python Flask

1.2.LITERATURE SURVEY

1.PROJECT TITLE:Approximate estimation of the nutritions of consumed food by Deep Learning

AUTHOR: Ibrahim Berkan Aydilek.

YEAR: 2017

DESCRIPTION:

Controlled intake of nutrition is recommended as a condition for being a healthy individual. Knowing and monitoring how much food is consumed during the day, following the calorie and nutrition of these foods helps to control healthy nutrition. • In this study, an attempt was made to approximate the nutrition of the food at the image level using the Foodpictures dataset that contain nutrient images. The food pattern is one of the modifiable factors for improving lifestyle and disease prevention. It is known that changes in diet have an effect on the evolution of chronic noncommunicable diseases (CNCD) of high prevalence, such as obesity, depression, anxiety, type 2 diabetes, and cardiovascular diseases. In order to prevent the CNCD, changing eating habits is strongly recommended. In addition, physical fitness, through systematized physical activities or that increase daily caloric expenditure, also contributes to the prevention of CNCD. Precision medicine, or precise health, is an approach for disease treatment and prevention that considers individual variability in genes, environment, and lifestyle. The applying of precision medicine has been broadly improved by the recent development of the large-scale biologic database, powerful methods for characterizing patients, and the use of high and smart technology. It is important to consider the computational tools for analyzing large data sets and, in this way, health-care providers will depend on electronic clinical decision support to quickly make appropriate treatment decisions. Computer systems that have a certain degree of intelligence and human/expert independence to infer about the preexisting data, in order to support the decision, could be useful, since the data generated require rapid and reliable analysis from a large number of variables.

2.PROJECT TITLE: Validation of a deep learning system for the full automation of bite and meal duration analysis of experimental meal videos.

AUTHOR: D Konstantinidis, K Di Mitropoulos, B Longleat.

YEAR: 2020

DESCRIPTION:

Eating behavior can have an important effect on, and be correlated with, obesity and eating disorders. To remedy the latter a novel “Rapid Automatic Bite Detection” (RABiD) algorithm that extracts and processes skeletal features from videos was trained in a video meal dataset (59 individuals; 85 meals; three different foods) to automatically measure meal duration. The association between nutrition and health has been repeatedly established by the field of nutrition science and evidence-based practices. Nevertheless, inadequate nutrition is still prevalent among Filipino households. As a response to this public health issue, a nutrition system called Virtual Dietitian (VD) was conceived. Through a mixed-methods approach, VD was beta tested via a user study and System Usability Scale (SUS) by six information technology experts and six registered dietitians. Participants performed the standardized tasks with a mean of 85% completion rate and 106.2 seconds, and graded SUS with a mean score of 83.4 (excellent). Albeit the prototype successfully exhibited the potential of VD as a nutrition system, qualitative feedback from experts revealed some modifications that are needed to accomplish before going to the next phase of the study.

3.PROJECT TITLE: Health fitness exercise eating healthy.

AUTHOR: Dana Sullivan Kilroy.

YEAR: 2019

DESCRIPTION:

Learn about the importance of healthy breakfasts, workout snacks and meal plans. This will help prevent any stomach discomfort during exercise. The association between nutrition and health has been repeatedly established by the field of nutrition science and evidence-based practices. Nevertheless, inadequate nutrition is still prevalent among Filipino households. As a response to this public health issue, a nutrition system called Virtual Dietitian (VD) was conceived. Through a mixed-methods approach, VD was beta tested via a user study and System Usability Scale (SUS) by six information technology experts and six registered dietitians. Participants performed the standardized tasks with a mean of 85% completion rate and 106.2 seconds, and graded SUS with a mean score of 83.4 (excellent). Albeit the prototype successfully exhibited the potential of VD as a nutrition system, qualitative feedback from experts revealed some modifications that are needed to accomplish before going to the next phase of the study. Healthcare professionals delivered their feedback on the correctness of processes and meal plan generation while the information technology experts pointed out the deficiencies of VD from the technical perspective (e.g., web standards, layout and design, functionality, navigation, usability).

4.PROJECT TITLE: Feeling good the future of the wellness market.

AUTHOR: Shaun Callaghan.

YEAR: 2021

DESCRIPTION:

Since views of wellness are constantly evolving, companies must understand the market from a consumer perspective. Meanwhile, other mindfulness and fitness apps have expanded into “sleep casts” or moved into personalized health coaching and disease management to promote better health outcomes. Artificial intelligence (AI) is among the major emerging research areas and industrial application fields. An important area of its application is in the preventive healthcare domain, in which appropriate dietary intake reporting is critical in assessing nutrient content. The traditional dietary assessment is cumbersome in terms of dish accuracy and time-consuming. The recent technology in computer vision with automatic recognition of dishes has the potential to support better dietary assessment. However, due to the wide variety of available foods, especially local dishes, improvements in food recognition are needed. In this research, we proposed an AI-based multiple-dish food recognition model using the EfficientDet deep learning (DL) model. The designed model was developed taking into consideration three types of meals, namely single-dish, mixed-dish, and multiple-dish, from local Taiwanese cuisine. The results demonstrate high mean average precision (mAP) = 0.92 considering 87 types of dishes. With high recognition performance, the proposed model has the potential for a promising solution to enhancing dish reporting. Our future work includes further improving the performance of the algorithms and integrating our system into a real-world mobile and cloud-computing-based system to enhance the accuracy of current dietary intake reporting tasks.

5.PROJECT TITLE: Best foods to eat when you're exercising more, according to dietitians.

AUTHOR: Karla Walsh

YEAR:2021

DESCRIPTION:

Boost muscle growth and limit the muscle protein breakdown. Otherwise, listen to your hunger and fullness cues. According to an article published in Harvard Health Letter, eating breakfast regularly has been linked to a lower risk of obesity, diabetes, and heart disease. Starting your day with a healthy meal can help replenish your blood sugar, which your body needs to power your muscles and brain.

Eating a healthy breakfast is especially important on days when exercise is on your agenda. Skipping breakfast can leave you feeling lightheaded or lethargic while you're working out.

Choosing the right kind of breakfast is crucial. Too many people rely on simple carbohydrates to start their day. A plain white bagel or doughnut won't keep you feeling full for long.

In comparison, a fiber- and protein-rich breakfast may fend off hunger pangs for longer and provide the energy you need to keep your exercise going.

2.DESCRPTION OF THE EXISTING SYSTEM

2.1.GENERAL:

An online application having artificial intelligence about humannutritional needs and diets. The user registers them on the app by providing An online application having artificial intelligence about human the essential details like name, email, phone number, weight, height, medical history and eating habits. After registering, the user gets a choice to select the package and further can proceed to the payment process. Based on the personal and medical details, the user gets well- constructed diet plans along with light exercises that must be followed in the routine for better health. An e-mail or message notification is sent to the customer as soon as the payment is processed.

2.2.METHEDOLOGY:

The app uses AI and image classification technology to identify the food correctly and accurately and also calculated the amount the calories just from the picture. Their proprietary API, called Food AI API has been trained to identify cuisines from across the world, thus making it the most culturally diverse food identification system in the world. Further, by connecting the API with diverse data sets, the food which is automatically recognised by the platform is paired with detailed nutrition information.

2.3.EXPLANATION

An intelligent agent for setting up diet plans based on the inputs provided by the user. The system creates a meal plan in accordance with a person's lifestyle and health requirements. The online artificial dietitian is a system having artificial intelligence about human diets.

Due to the modern lifestyle, carefree attitude and being materialistic, people are taking their health and diet otherwise. These days people tend to suffer from numerous health disorders and fitness problems majorly due to an unbalanced diet. In the present scenario, there is a trade-off between health, wealth and time. Many a time, they are ignorant about the right nutrient value for a healthy being. Therefore, to facilitate them with a proper diet chart along with light exercises according to their lifestyle and cope up with their busy schedule, a need for software emerges that can provide diet consultancies to the people at their preferred time and mobile phones without having to visit a dietitian. The prime objective of the software 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.

2.4.PROBLEM IDENTIFIED

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 the 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. What makes this App better over existing artificial dieticians is the added functionality that the registered users can have direct conversations through messages with a certified dietician(s) to get the best of our services. Moreover, it will keep a track of past inputs and data of the user and put forth the diet plan after considering the user's history.

3. DESCRIPTION OF PROPOSED SYSTEM

3.1. GENERAL:

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.

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.,)

3.2.METHODOLOGY ANDSYSTEM ARCHITECTURE:

Our food recognition system employs visual sensors to capture food images as the source data. Due to the recent advances of electronics, visual sensors are now available in many Internet-of-Things(IoT) devices, such as smart phones. To simplify the design, we utilized the camera on smartphones for visual sensing. Besides the smartphone, for sensing and image capturing, the recognition is done in a collaborative manner between the edge device (e.g., smartphone) and servers (e.g., servers in the cloud). As shown in Figure, our system includes end user layer (left most of Figure), edge layer (middle of Figure 1), and cloud layer (right most of Figure), together form a three-layer service delivery model. In our proposed system, data and computation are kept close to end users at the edge of network. Also, the end user's device can passively record the geological location. Hence, the system could provide low latency, reduced energy consumption, and location-awareness for end users. The computations are distributed throughout the network, including both the edge devices and servers in the cloud. Please note, in our system recognition is done in a collaborative manner.

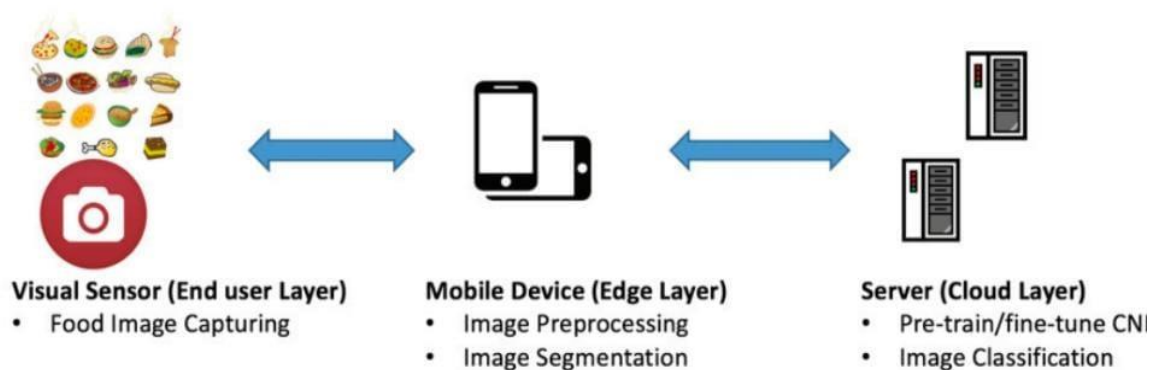


Figure 3.1:overview architecture

3.2.1.SOLUTION ARCHITECTURE:

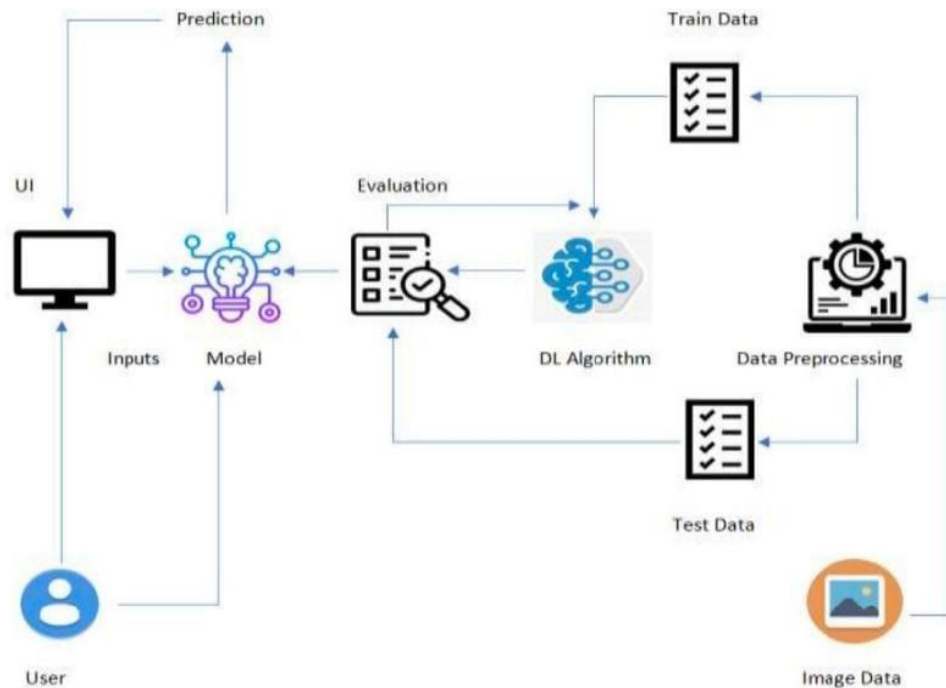


Figure 3.2. solution architecture

3.2.2.TECHNICAL ARCHITECTURE:

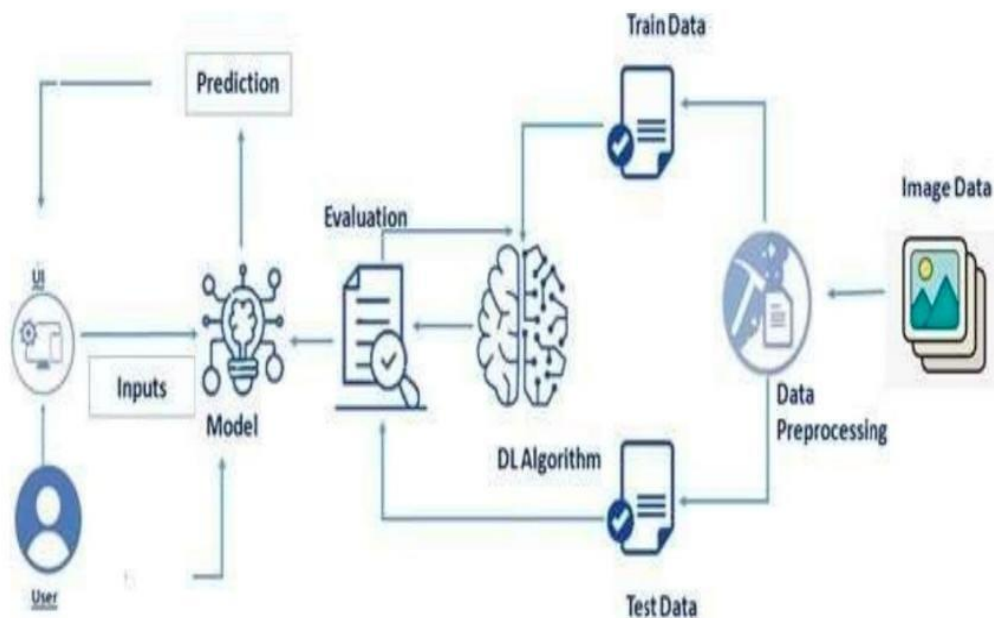


Figure 3.3. Technical architecture

3.3.MODULE EXPLANATION:

Once the food images are captured, we will conduct two types of computations at mobile device in the Front-end Component (FC) (a.k.a., Edge Layer): image pre-pro-cessing and image segmentation. The main objective of the first computation (image pre-processing) is to identify if the image being captured is blurry or not. While many cameras on mobile devices have features such as optical zoom or auto focusing, in real-world practice, when users take the pictures of food, they may have very limited time to do so due to their busy schedule and their photo taking action may be interrupted by other matters. Hence, the chances of device shaking and other interruptions while taking pictures are high. An automatic image blurry detection algorithm running at the mobile device is needed to give a real-time alarm to reminder user to re-take the picture if the image is blurry. We define an out-of-focus image as blurry image. Our goal is to develop a light weight and effective blurry image detection algorithms running at the mobile device. In literature, image restoration has been proposed to handle blurry im-ages. Unfortunately, these existing methods are not appli-cable to our case because these techniques need a reference image to compute the quality of the test image. In our ap-plications, we may only have test images. Followed our previous research , we propose a simple-feature(such as “edginess” of the image) and threshold-based method to divide the images captured into two groups (i.e., the clear image group and the blurry image group). The “edginess” of the image is defined as the number of edge pixels (e.g., detected by Sobel operator) divided by the total number of image pixels. The rationale behind this method is that the percentage of edge pixels for clear image (with clear object of interests) is much higher than the percentage of edge pixels for blurry image. In our previous research , we also noticed that there are different patterns between the frequency spectrums of clear image and blurry image. The Fourier spectrum of a blurry image usually shows prominent components along the certain degree (e.g., 45 degree) directions that correspond to the cornersof the image.

3.4 PROBLEM IDENTIFIED:

Ideal situation:

Ideally, a Nutrition Analyzer is available which will help people in assisting the nutrition analysis and help them in maintaining good health.

Reality:

Currently there is no ideal nutrition analyzer is available. Those which are available, fails to satisfy the needs of the people. Some are not personalized while some are very complicated to be accessed by everyone. Hence, there is no Nutrition analyzer to guide and assist people.

Consequences:

People tend to consume food without the knowledge of nutrition content of the food. This results in nutrition imbalance leading to nutrition deficiencies and diseases.

Proposal:

Our project of Nutrition Analyzer for Fitness Enthusiasts Focus on Developing a simple Nutrition Analyzer which is capable of analyze the nutrition in the food by giving the picture of the food. This is achieved by Artificial Intelligence with Python, Deep learning ,CNN etc..

4. SYSTEM REQUIEREMENTS

4.1. HARDWARE REQUIREMENTS:

The user must have a smartphone for installation of the app.

4.2. SOFTWARE REQUIREMENT:

- Python
- CNN
- IBM Cloud
- IBM Watson
- IBM Cloudant DB
- Deep learning
- Python flask

5. IDEATION AND PROPOSED SOLUTION

5.1. EMPATHY MAP CANVAS:

▼ [Sign up for updates](#)

- units like (Sugar, Fibre, Protein, Calories, etc.).

This is a textbox...



5.2. PROPOSED SOLUTION:

S.No.	Parameter	Descripti on
1.	Problem Statement (Problem to be solved)	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.
2.	Idea / Solution description	The idea 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.
3.	Novelty / Uniqueness	Here the user can capture the images of different fruits and then the image 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.).
4.	Social Impact / Customer Satisfaction	This project is very helpful to People. Everyone Maintaining their own diet, to manage the time.
5.	Business Model (Revenue Model)	By using this system, the users can predict and analyze the picture of the fruits and foods. In which it results to the visualizing the description of the foods taken as input.
6.	Scalability of the Solution	By implementing this system, the people can efficiently and effectively to gain knowledge about the fitness.They want and they wish to use at anytime. This system can also be integrated with the future technologies.

5.3. SOLUTION FIT TEMPLATE:

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS <ul style="list-style-type: none"> Healthy Eaters Sports Persons 	6. CUSTOMER CONSTRAINTS CC <ul style="list-style-type: none"> Internet Facility Spending Time 	5. AVAILABLE SOLUTIONS AS <p>To detect the nutrition based on fruits like Sugar, Fibre, Protein, Calories, etc. to make the users conscious about their foods.</p>	Explore AS, differentiate
	2. JOBS-TO-BE-DONE / PROBLEMS J&P <ul style="list-style-type: none"> Incorrect Details Low quality image leads to wrong prediction of nutrients 	9. PROBLEM ROOT CAUSE RC <ul style="list-style-type: none"> Busy Schedule Laziness 	7. BEHAVIOUR BE <ul style="list-style-type: none"> Consulting Doctors Maintaining their own diet 	
Identify TR & strong EM	3. TRIGGERS TR <p>Through advertisements, neighbors or through social media</p>	10. YOUR SOLUTION <p>To track the health care plan of an individual. To track the calories in the food by uploading images. To suggest food based on their health conditions.</p>	8. CHANNELS OF BEHAVIOUR <p>ONLINE:</p> <ul style="list-style-type: none"> Through Social Media Channel Advertisements <p>OFFLINE:</p> <ul style="list-style-type: none"> Suggests neighbors Through pamphlets 	Identify TR & strong EM
	4. EMOTIONS: BEFORE / AFTER <p>Before: Unhealthy, Confused After: Healthy, Confident</p>			

Figure 5.2. solution fit template

6. REQUIREMENT ANALYSIS

6.1. FUNCTIONAL REQUIREMENTS

Following are the functional requirements of the proposed system.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Gmail or using phone number
FR-2	User Confirmation	Confirmation on Gmail or using phone number
FR-3	User Details	Registration through form
FR-4	Server Calculation	Calculating user details Example: Height, Weight, Age
FR-5	Calculate information from Server	Based on the given information they calculate their nutrition level
FR-6	Server notification	Based on the nutrition level server provide notification like intake of food and water

6.2. NON-FUNCTIONAL REQUIREMENTS:

Following are the non-functional requirements of the proposed system.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	To maintain your health
NFR-2	Security	User details will be secure from server side

NFR-3	Reliability	Trusted details from server
NFR-4	Performance	Better performance comparing to other apps
NFR-5	Availability	Available on email and chatbot
NFR-6	Scalability	Every Customer must get Healthy Life and ProperDiet Maintenance based on the Healthy Measureand Calorie prediction.

7. PROJECT DESIGN

7.1. DATAFLOW DIAGRAM:

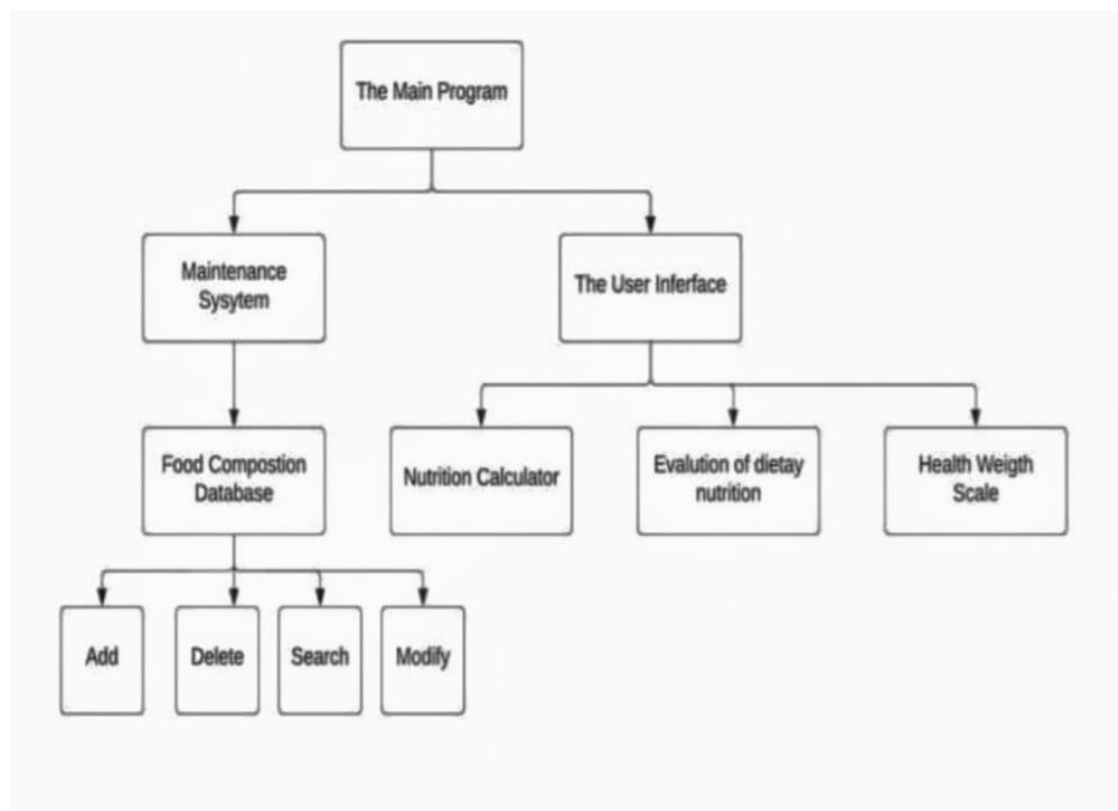


Figure 7.1. dataflow diagram(1)

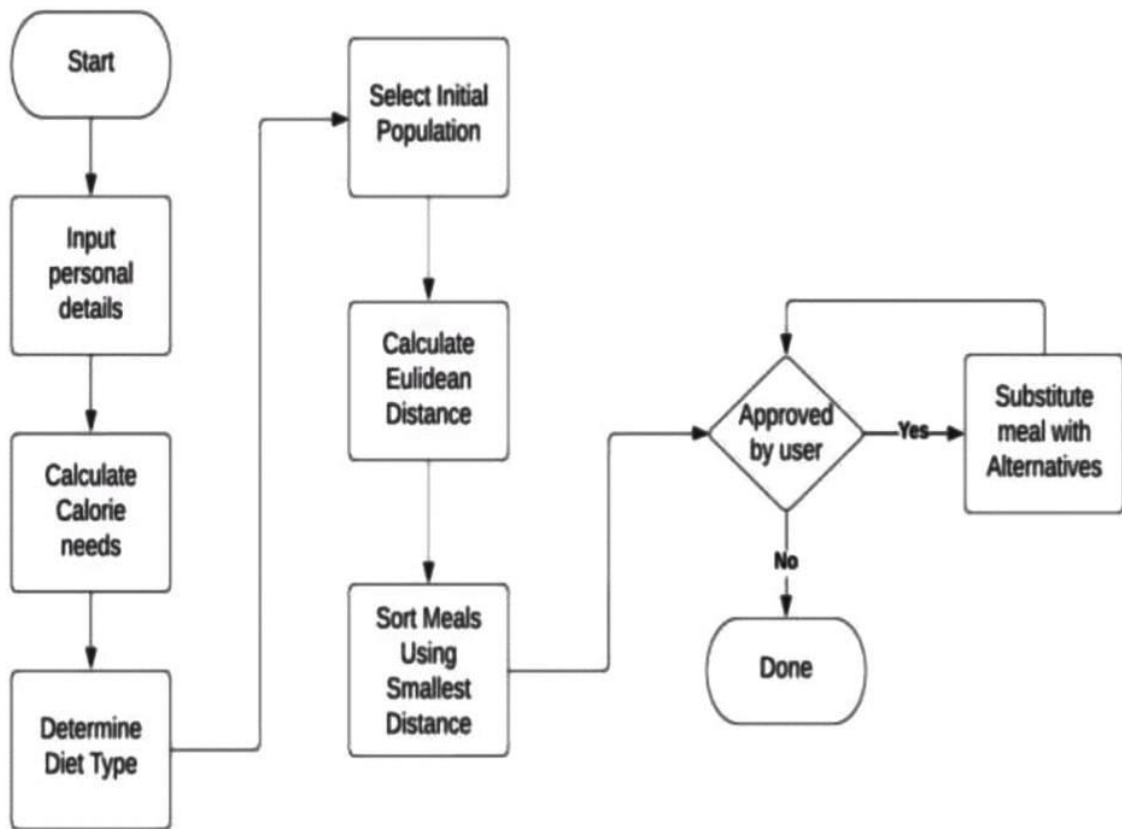


Figure 7.2. dataflow diagram (2)

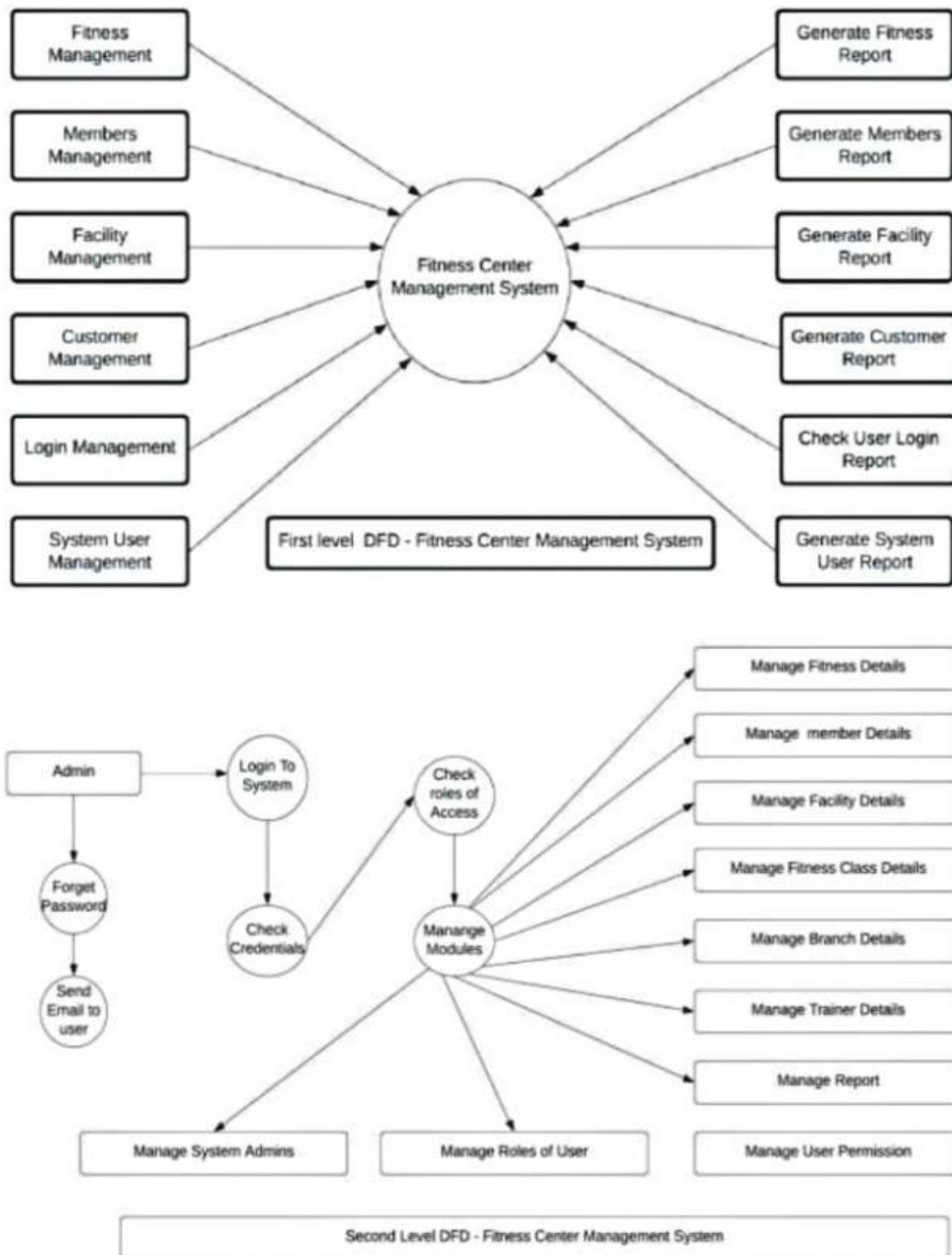


Figure 7.3. data flow diagram (3)

8.IMPLEMENTATION AND RESULTS

8.1.SCREENSHOTS:

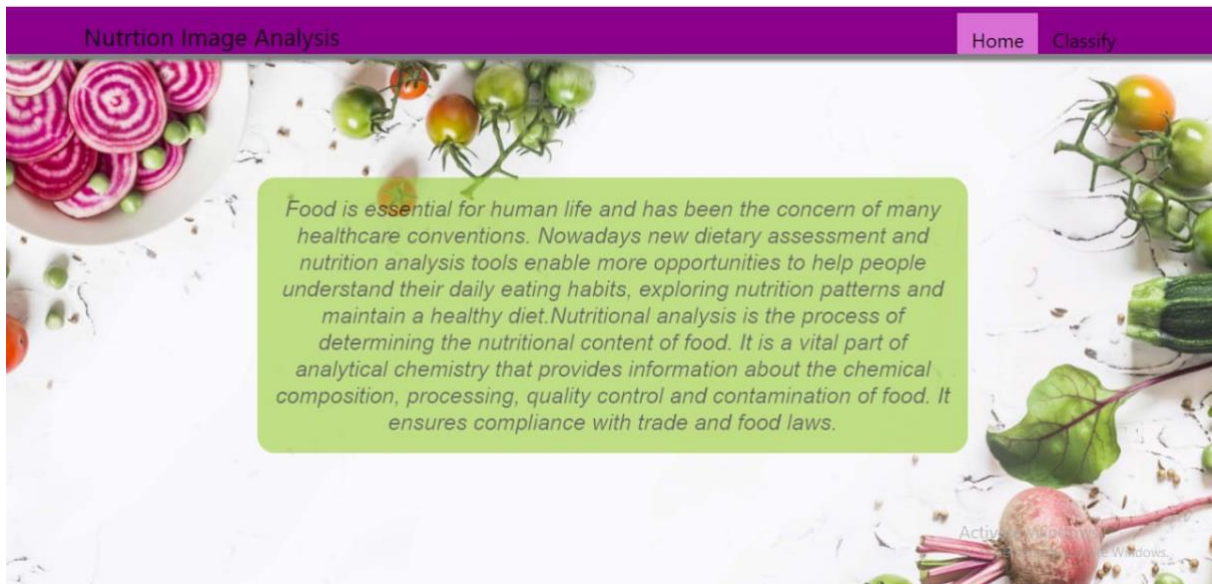


Figure 8.1. application home page

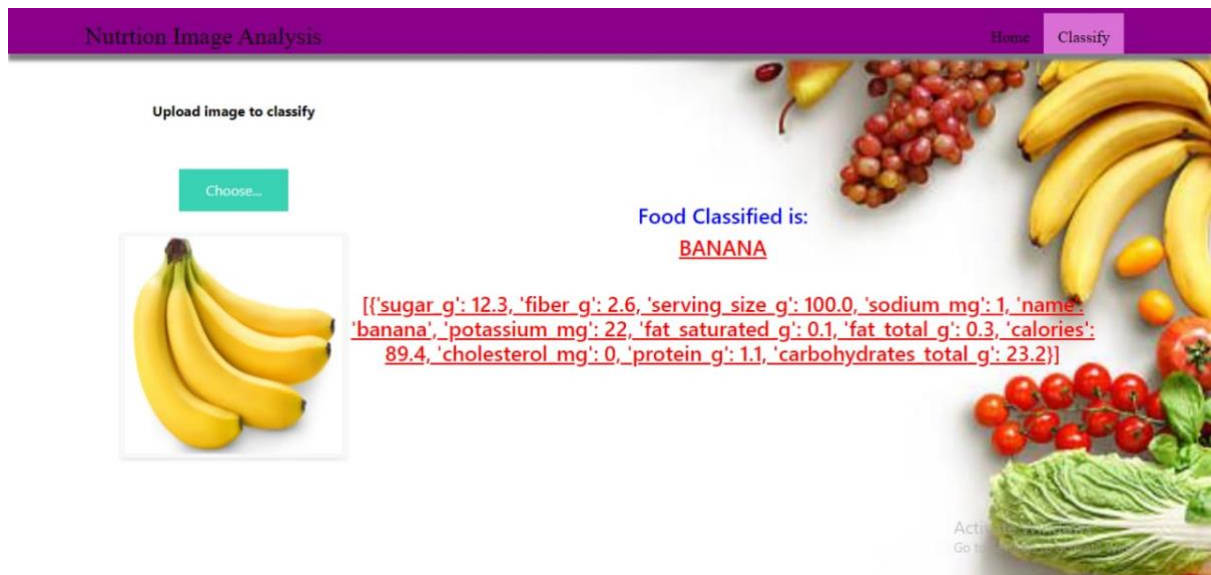


Figure 8.2.nutrition image analysis(banana)



Figure 8.3.nutrition image analysis(pineapple)



Figure 8.4.Nutrition image analysis(apple)

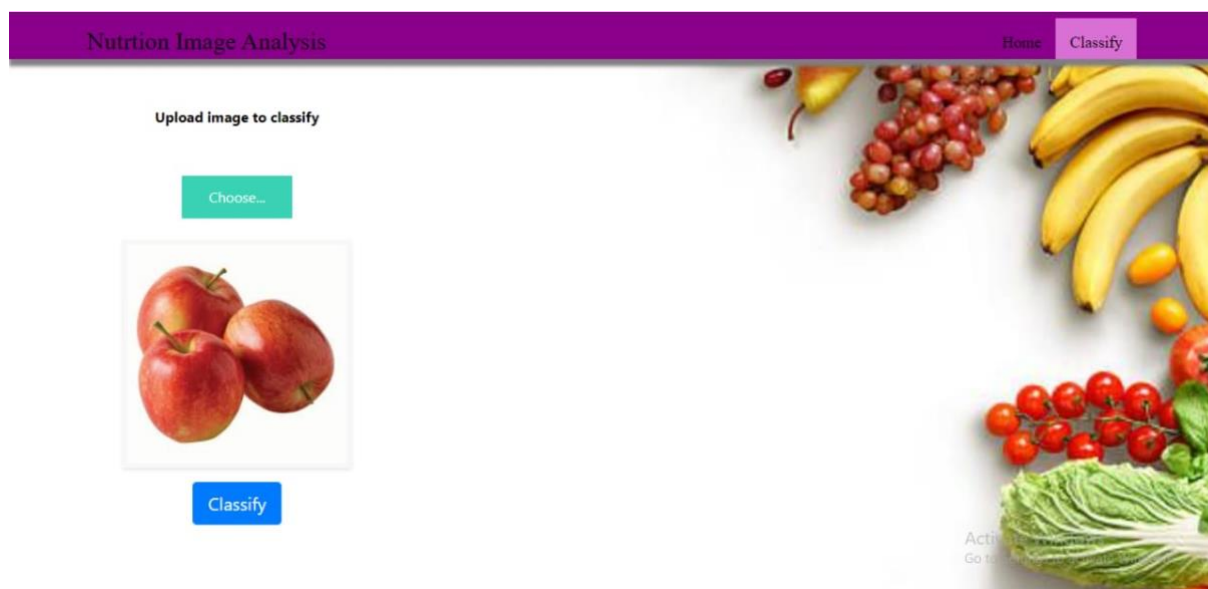


Figure 8.5. classification

8.2. CODING AND SOLUTIONING:

8.2.1. Import the ImageGenerator Library

Image data augmentation is technique that can be used to artificially expand the size of the training dataset by creating modified versions of images in the dataset.

The keras deep learning neural network library provides the capability to fit the models using image data augmentations via the ImageGenerator class. Let us import the ImageGenerator class from keras.

```
from keras.preprocessing.image import ImageDataGenerator
```

8.2.2. Configure ImageDataGenerator class

ImageDataGenerator class is instantiated and the configuration for the types of data augmentation. There are five main types of data augmentation techniques for image data; specifically:

Image shifts via the width_shift_range and height_shift_range arguments. The image flips via the horizontal_flip and vertical_flip arguments.

Image rotations via the rotation_range argument

Image brightness via the brightness_range argument.

Image zoom via the zoom_range argument.

An instance of the ImageDataGenerator class can be constructed for train and test.

```
train_datagen= ImageDataGenerator(rescale=1./255,shear_range=0
.2,zoom_range=0.2,horizontal_flip=True)
test_datagen=ImageDataGenerator(rescale=1./255)
```

8.2.3. Apply image datagenerator functionality to trainset and testset

Apply Image DataGenerator Functionality To Trainset And Testset
 Let us apply ImageDataGenerator functionality to Trainset and Testset by using the following code
 For Training set using flow_from_directory function.

This function will return batches of images from the subdirectories 'apples', 'banana', 'orange', 'pineapple', 'watermelon' together with labels 0 to 4 {'apples': 0, 'banana': 1, 'orange': 2, 'pineapple': 3, 'watermelon': 4}

```
x_train=train_datagen.flow_from_directory(
    r'/content/drive/MyDrive/TRAIN_SET',target_size=(64,64),ba
tch_size=5,color_mode='rgb',class_mode='sparse'
)

x_test=test_datagen.flow_from_directory(
    r'/content/drive/MyDrive/TRAIN_SET',target_size=(64,64),ba
tch_size=5,color_mode='rgb',class_mode='sparse'
)
```

```
print(x_train.class_indices)
print(x_test.class_indices)
from collections import Counter as c
c(x_train .labels)
```

8.2.4. Initializing the model

Keras has 2 ways to define a neural network:

- Sequential
- Function API

The Sequential class is used to define linear initializations of network layers which then, collectively, constitute a model. In our example below, we will use the Sequential constructor to create a model, which will then have layers added to it using the add() method.

```
model = models.Sequential()
```

8.2.5. Compiling the model and Fitting the model

```
#Compiling the model
model.compile(optimizer='adam',
              loss=tf.keras.losses.SparseCategoricalCrossentropy
                (from_logits=True),
              metrics=['accuracy'])
#Fitting the model
history = model.fit(train_images, train_labels, epochs=10,
                    validation_data=(test_images, test_labels))
```

8.2.6. Test the model

Evaluation is the process during the development of the model to check whether the model is the best fit for the given problem and corresponding data.

Load the saved model using load_model.

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

9. ADVANTAGES AND DISADVANTAGES

9.1. ADVANTAGES:

Yet people consume foods, not nutrients, so it is helpful to view food or meal as more than just a set of nutrients that impact our health. Some weight loss diets have assigned a negative connotation to certain nutrients, such as low fat or low carbohydrate diets. This can create a view that a specific nutrient is bad, regardless of the role it plays when foods containing that nutrient are consumed as a part of a healthy, balanced diet. This model helps in analysing a nutrition in the food.

9.2. DISADVANTAGES:

Like anything, there are always drawbacks. In some cases the predicting algorithm may give the wrong output.

10.SOURCE CODE:

```
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')
@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 launches():
    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))
import http.client
conn = http.client.HTTPSConnection("calorieninjas.p.rapidapi.com")
headers = {
'X-RapidAPI-Key':
"e5805fbf62mshf8d7308c0600c2dp197087jsn93407e3cce35",
'X-RapidAPI-Host': "calorieninjas.p.rapidapi.com"
}
conn.request("GET", "/v1/nutrition?query=Pineapple", headers=headers)
res = conn.getresponse()
data = res.read()
print(data.decode("utf-8"))
import requests
url = "https://calorieninjas.p.rapidapi.com/v1/nutrition"
querystring = {"query":"Pineapple"}
headers = {
"X-RapidAPI-Key":
"e5805fbf62mshf8d7308c0600c2dp197087jsn93407e3cce35",
"X-RapidAPI-Host": "calorieninjas.p.rapidapi.com"
}
response = requests.request("GET", url, headers=headers, params=querystring)
print(response.text)
if __name__ == "__main__":
# running the app
app.run(debug=False).

```

11. CONCLUSION

11.1. CONCLUSION:

In this paper, we aimed to develop a practical deep learning based food recognition system for dietary assessment within the edge computing service infrastructure. The key technique innovation in this paper includes: the new deep learning-based food image recognition algorithms and the proposed real-time food recognition system employing edge computing service paradigm. Our experimental results on two challenging data sets using our proposed approach have demonstrated that our system has achieved the three major objectives: (1) it outperforms the results from all existing approaches in terms of recognition accuracy; (2) it develops a real-time system whose response time is close to the minimal of existing techniques; and (3) it saves the energy by keep the energy consumption equivalent to the minimum of the existing approaches. In the future, we plan to continue improving performance of the algorithms (in terms of detection accuracy) and system (in terms of response time and energy consumption). We also plan to integrate our system into a real-world mobile devices and edge/cloud computing-based system to enhance the accuracy of current measurements of dietary caloric intake estimate. As our research is related to the biomedical field, much larger data sets are needed to provide convincing evidence to verify the efficacy and effectiveness of our proposed system. Backed by several major federal grants from NSF and NIH, we are in the process of collaborating with UMass Medical School and the University of Tennessee, College of Medicine to deploy our system in the realworld clinical practice.

11.2. FUTURE ENHANCEMENT:

People are increasingly turning to technology to help them with wellness and fitness problems. Many fitness apps, gym management software, gadgets, and wearables are entering the market and creating all the buzz.

In fact, a recent report by Research N Reports revealed that the value of the global fitness technology market is estimated to grow from \$17.9 billion in 2019 to \$62.1 billion by 2025. You may not realize, but every year, artificial intelligence (AI) is assimilating deeper into our lifestyle.

AI In Fitness

It shouldn't come as a surprise when I say that artificial intelligence has become an indispensable part of the fitness industry.

Whether or not your health club uses AI, but AI is revolutionizing the health industry. From improving marketing and sales decisions, AI is now also being used to reshape individual habits. For instance, AI can easily track health behaviors and repetitive exercise patterns and use the data to guide you towards your fitness journey.

How AI Can Benefit The Fitness Industry

The benefits of AI in fitness is enormous. Here are a few of the latest trends in the fitness industry.

1.AI-Based Personal Trainer

The next big thing in the fitness industry will be AI-based personal trainer.

What does it even mean? In simple terms, apps driven by artificial intelligence to help you achieve your fitness goals. These apps are so

designed that they can offer personalized fitness and lifestyle plans. These apps are powered by AI that helps tailor individual fitness plans based on your goals, eating habits, current fitness level, data from wearable devices, and much more.

Not only that, but you would also find apps that can check your workout form and correct you, just like a trainer would do. You will need to use your phone's camera, and you can have a one-on-one setting and get real-time feedback on your workout posture.

For instance, if you are doing a squat, it will correct you if you are extending your knees too far, or your legs are placed too close.

2. Smarter Fitness Wearables

Another trending application of AI in fitness is that it is making your wearable devices smarter.

This Apple Watch or Fitbit, which you might already use, is moving towards more than just collecting data. They are now being tuned to detect your irregular heartbeats that might lead to a stroke or detect signs of diabetes. In fact, these wearables will soon be able to connect with your electronic medical reports to give you a complete view of your profile.

These smart wearables are so designed that it can keep records of how you have improved or the time you have spent exercising. You can easily share these data with your coaches using the devices. Soon enough, the gym will act as a virtual assistant, whereby it will be able to provide even more specific instructions to its members. For instance, it can guide you on the number of reps you need to perform.

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Github ID: <https://github.com/IBM-EPBL/IBM-Project-53074-1661313387>

DemoLink:

<https://drive.google.com/file/d/1W01H4hS6nXYGC83YkvV6nvlzpCqc5r4N/view?usp=drivesdk>