AI-powered Nutrition Analyzer for Fitness Enthusiasts

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CHAPTER 1

INTRODUCTION

ABSTRACT:

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 analysisis the process of determining the nutritional content of food. It is avital part of analytical chemistry that provides information about the chemical composition, processing, quality control and contamination of food.

PROJECT DESCRIPTION

The main aim of the project is to build 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, Fiber, Protein, Calories,etc.).

TECHNOLOGIES USED:

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

PROJECT FLOW:

The user interacts with the UI (User Interface) and give theimage as input. Then the input image is then pass to our flask application, And finally with the help of the model which we build we willclassify the result and showcase it on the UI..

CHAPTER 2

LITERATURE SURVEY:

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 aid 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. If this limit is surpassed, we may become fat.

Neutrino: Artificial Intelligence Nutrition App. As the name implies, the app provides nutrition-based analytics and data to its customers and is quickly becoming a prominent platform for offering AI fitness services. It deploys predictive analysis for personalized data compilation using mathematical and

natural language processing (NLP) models.

Furthermore, it shares nutrition-related data with its partners via SDK and API integrationto improve its services and product offerings. It Is an Israelbasedfirm created in 2011 that allows pregnant women to customize their body's nutritional requirements. This software collaborated with IBM's natural language capability to provide 24-hour assistance and dietary recommendations. MyFitnessPal App creates a daily food diary for you by recognizing the food from photos you shoot. 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. It does a pretty good job, although its estimate can be a bit unpredictable. It also needs a network connection, which is something to think about when eating out.

RESULT AND DISCUSSION:

This model will be useful for every category peopleirrespective of age and gender. Using this model we'll know the exact amount of nutritional content in the food we have which is very useful asit isvery important to take care of one's health

CHAPTER 3

IDEATION AND PROPOSED SOLTUION

Customer Problem Statement :

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, analytical chemistry that provides information about the chemical composition, processing, quality control and contamination of food.

The main aim of the project is to build 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, Fiber, Protein, Calories,etc.).

The user interacts with the UI (User Interface) and give theimage as input. Then the input image is then pass to our flask application, And finally with the help of the model which we build we willclassify the result and showcase it on the UI.

I am	**Mr.X**	**Mr.X , fruits, food,etc.**
I'm trying to	**Have nutritious food**	**Sugar,Protein,Carbs,Fat.etc.**
but	**I'm unable to analyze**	**Lack of analyzing capacity**
because	**I don't know the nutrition values**	**Don't know how to analyze with AI, lack of knowledge in AI.**

which makes me feel	**Lazy about choosing right food**	**Can't analyze due to unknown facts about the nutrition values.**

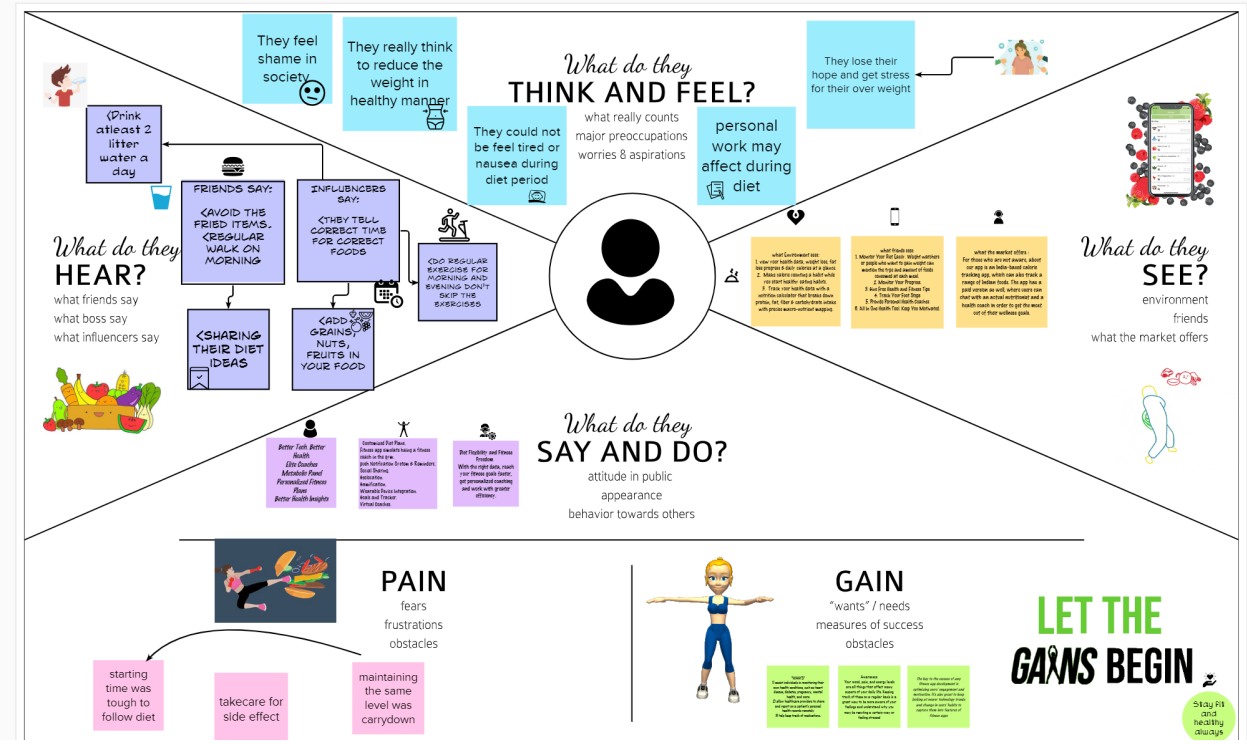
Problem Statement (PS)	**I am (Customer)**	**I'm trying to**	**But**	**Because**	**Which makes me feel**
PS-1	X	**Have nutritious food**	**Have nutritious food**	**Have nutritious food**	**Have nutritious food**
PS-2	Y	**Have nutritious food**	**Have nutritious food**	**Have nutritious food**	**Have nutritious food**

Empathy Map Canvas:

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes.

It is a useful tool to helps teams better understand their users.

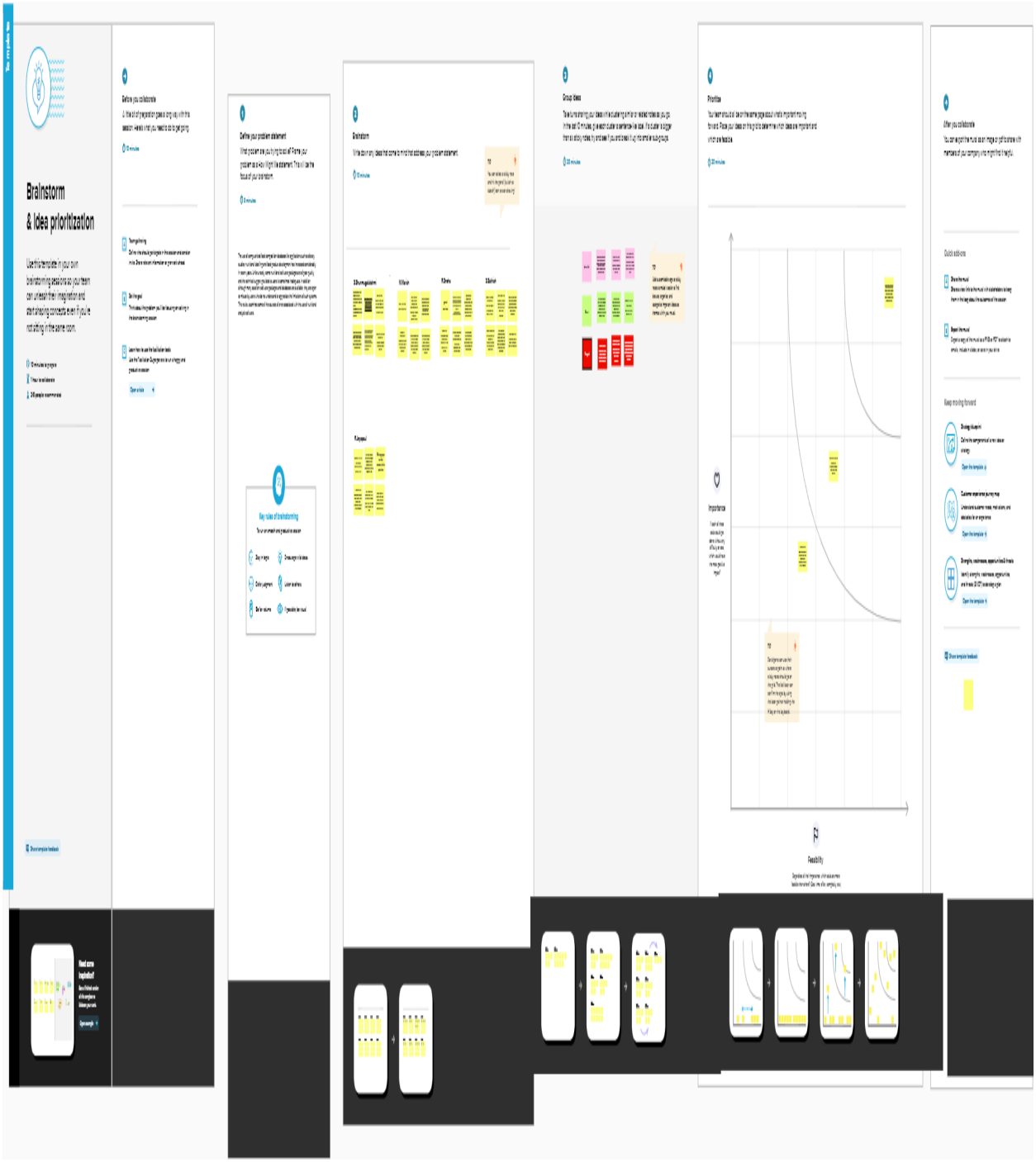
Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



Brainstorm & Idea Prioritization

The main aim of the project is to build a model which is used for identifying the fruit depends on the different characteristics like colour, shape, texture etc using image processing. Here the user can capture the images of different fruits and then the image will be analysed with the trained model. The model analyses the image and lists out the nutrients present in the fruit like sugar, vitamins, minerals, protein etc

Team Gathering, Collaboration and Select the Problem Statement


Brainstorm
& idea prioritization
Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.
Before you collaborate
Define your problem statement
Brainstorm
Group ideas
Prioritize
After you collaborate
Key rules of brainstorming
Importance
Feasibility

Problem Statement:

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.

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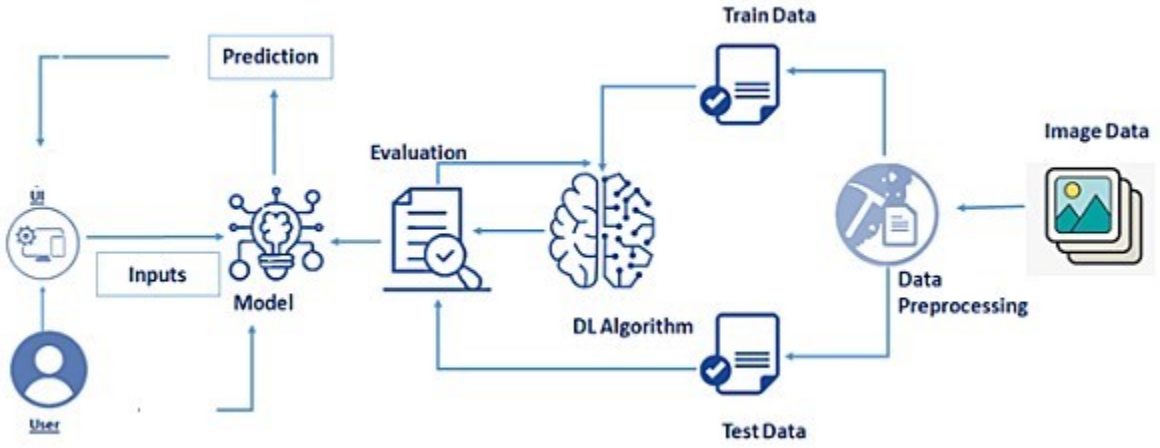
I am	The fitness Analyst, who is in need of an assistance to I'm trying to Use the recent technologies to check the nutrition of fruits and choose my consumption based on it.
But	I am unaware of the existing technology that can help me to guess the nutrition of various fruits for the given input.
Because	I don't want to make any wrong decision about nutrition.

Solution Architecture:

1. The main aim of the project is to build a model which is used for identifying the fruit depends on the different characteristics like colour, shape, texture etc using image processing. Here the user can capture the images of different fruits and then the image will be analysed with the trained model. The model analyses the image and lists out the nutrients present in the fruit like sugar, vitamins, minerals, protein etc


Train Data
Prediction
Image Data
Evaluation
UI
Inputs
Model
DL Algorithm
Data
Preprocessing
User
Test Data

CHAPTER 4

REQUIREMENT ANALYSIS

Functional Requirements:
Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form,IBM CLOUD
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Upload Image of the food	Existing image should be uploaded in the web api
FR-4	Get the results declared by the analyzer	View data

Non-functional Requirements:
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Used many times for several food images
NFR-2	Security	Only registered users can access
NFR-3	Reliability	Always reliable since the model sis running in the IBM cloud
NFR-4	Performance	High performance
NFR-5	Availability	Always available in Cloud
NFR-6	Scalability	High

CHAPTER 5

PROJECT DESIGN

Data Flow Diagrams:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

Sprint	**Functional Requirement (Epic)**	**Task**	**Team Members**
Sprint-1	Solution Design	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.	Shunmugalakshmi ,Sneha, Jeyapaul
Sprint-2	Development	We'll go through all the basics of ***diet*** and ***nutrition app development*** as well as must-have features and useful tools	Sneha,Sathish,Marish
Sprint-3	Testing	Goal of this research was the development, validation, and reliability ***testing*** of the ***app*** quality evaluation	Sathish,Marish,Jeyapaul
Sprint-4	Project Close	Good nutrition promotes not only better physical health and reduced susceptibility to disease, but has also been demonstrated to contribute to cognitive development and academic success. Left to their own devices, children will not automatically select healthy foods.	Shunmugalakshmi,Jeyapaul,Marish

Project Chart:

Sprint	Sprint Start Date	Sprint End Date
Sprint-1	24 Oct 2022	29 Oct 2022
Sprint-2	31 Oct 2022	05 Nov 2022
Sprint-3	07 Nov 2022	12 Nov 2022
Sprint-4	14 Nov 2022	19 Nov 2022

Milestone:

We discussed all the aspects of Health & Fitness applications. Straight from the different app ideas, must have features, ways to monetize the app, and the Cost of app development we covered it all.

As discussed earlier, there are few existing apps that are doing well. However, they are a few cons that those apps have. To succeed you must study these cons and come up with an app which can resolve all those issues.

To achieve all this, you would require the help of a mobile application development firm that can deliver it in minimal cost. Permits comprise a pool of talented professionals who would deliver all your requirements with their top-notch skills combined with our cutting-edge technology.

Activity List:

In Project Planning is an important task to scheduling the phrase of the project to the team member. In this Activity can shows the various activities are allocated and done by the team members. In Project , we can split into the four step of phrases are

Phrase 1: Information Collection and Requirement analysis

Phrase 2: Project Planning and Developing the modules

Phrase 3: Implementing the High accuracy deep learning algorithm to perform

Phrase 4: Deploying the model on Cloud and Testing the model and UI performance

CHAPTER 7

CODING AND SOLUTION

Coding:

```
!conda install --yes keras
```

Collecting package metadata (current_repodata.json): ...working... done

Solving environment: ...working... done

All requested packages already installed.

Retrieving notices: ...working... done

In [28]:

```
!conda install --yes tensorflow
```

Collecting package metadata (current_repodata.json): ...working... done

Solving environment: ...working... done

All requested packages already installed.

Retrieving notices: ...working... done

In [29]:

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

In [30]:

```
train_datagen=ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizo
nt al_flip=True)
```

In [31]:

```
test_datagen=ImageDataGenerator(rescale=1./255)
```

In [32]:

```
x_train=train_datagen.flow_from_directory(r'C:\Users\HARIHARAN\PycharmProjects\AI
Analyzer for fitness enthusiasts\TRAIN_SET',target_size=(64,
64),batch_size=5,color_mode='rgb',class_mode='sparse')
```

Found 2626 images belonging to 5 classes.

In [33]:

```
x_test=test_datagen.flow_from_directory(r'C:\Users\HARIHARAN\PycharmProjects\AI
```

```
Analyzer for fitness enthusiasts\TEST_SET',target_size=(64,
64),batch_size=5,color_mode='rgb',class_mode='sparse')
```

```
Found 1055 images belonging to 5 classes.
```

In [34]:
```
print(x_train.class_indices)
```

```
{'APPLES': 0, 'BANANA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}
```

In [35]:
```
print(x_test.class_indices)
```

```
{'APPLES': 0, 'BANANA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}
```

In [36]:
```
from collections import Counter as cc(x_train.labels)
```

Out[36]:
```
Counter({0: 606, 1: 445, 2: 479, 3: 621, 4: 475})
```

In [37]:
```
import numpy as np
```

In [38]:
```
import tensorflow
```

In [39]:
```
from tensorflow.keras.models import Sequential
```

In [40]:
```
from tensorflow.keras import layers
```

In [41]:
```
from tensorflow.keras.layers import Dense,Flatten
```

In [42]:
```
from tensorflow.keras.layers import Conv2D,MaxPooling2D,Dropout
```

In [43]:
```
from keras.preprocessing.image import ImageDataGenerator
```

In [44]:
```
model=Sequential()
```

In [45]:
```
classifier=Sequential()
```

In [46]:
```
classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64 ,3), activation='relu'))
```

In [47]:

```
classifier.add(MaxPooling2D(pool_size=(2, 2)))
```

In [48]:

```
classifier.add(Conv2D(32, (3, 3), activation='relu'))
```

In [ ]:

In [49]:

```
classifier.add(Flatten())
```

In [50]:

```
classifier.add(Dense(units=128, activation='relu'))
```

In [51]:

```
classifier.add(Dense(units=5, activation='softmax'))
```

In [52]:

```
classifier.summary()
```

```
Model: "sequential_3"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_2 (Conv2D)            (None, 62, 62, 32)        896

max_pooling2d_1 (MaxPooling  (None, 31, 31, 32)        0
2D)

conv2d_3 (Conv2D)            (None, 29, 29, 32)        9248

flatten_1 (Flatten)          (None, 26912)             0

dense_2 (Dense)              (None, 128)               3444864

dense_3 (Dense)              (None, 5)                 645

=================================================================
```

Total params: 3,455,653

Trainable params: 3,455,653

Non-trainable params: 0

_____

In [54]:

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

In [55]:

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

In [56]:

```
from tensorflow.keras.models import load_model
```

In [58]:

```
from keras.preprocessing import image model = load_model("nutrition.h5")
```

In [1]:

```
from flask import Flask,render_template,request
```

In [2]:

```
import os
```

In [3]:

```
import numpy as np
```

In [4]:

```
from tensorflow.keras.models import load_model
```

In [5]:

```
from tensorflow.keras.preprocessing import image
```

In [6]:

```
import requests
```

In [7]:

```
app= Flask(__name__,template_folder="templates")
```

In [8]:

```
model=load_model('nutrition.h5')
```

In [9]:

```
print("Loaded model from disk")
```

Loaded model from disk

In [11]:

```
@app.route('/')def home():
    return render_template('homepage.html')
```

In [12]:

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

In [14]:

```
@app.route('/predict',methods=['GET','POST'])def launch():
    if request.method=='POST':
        f=request.files['file']
        basepath=os.path.dirname('__file__')
        filepath=os.path.join(basepath,"uploads",f.filename)
        f.save(filepath)

        img=image.load_img(filepath,target_size=(64,64))
        x=image.img_to_array(img)
        x=np.expand_dims(x,axis=0)

        pred=np.argmax(model.predict(x), axis=1)
        print("prediction",pred)
        index=['APPLES','BANANA','ORANGE','PINEAPPLE','WATERMELON']
        result=str(index[pred[0]])
        x=result
        print(x)
        result=nutrition(result)
        print(result)
        return render_template("0.html",showcase=(result),showcase1=(x))
```

In [15]:

```
def nutrition(index):
    url = "https://calorieninjas.p.rapidapi.com/v1/nutrition"
    querystring = {"query":index}
    headers = {
```

```
    'X-RapidAPI-Key': 'daaf576556msh5fcbc747e5cb27cp14bd10jsn07d05ab509ae',
    'X-RapidAPI-Host': 'calorieninjas.p.rapidapi.com'
    }
    response = requests.request("GET",url,headers=headers, params=querystring)
    print(response.text)
    return response.json()['items']
```

In [ ]:

```
if __name__ == "__main__":
    app.run(debug=False)
```

CHAPTER 8

TESTING

Test case	ID Feature Type	Component	Test Scenario	Expected Result	Actual Result	Status
CT_001	*Code testing*	*Jupyter notebook*	*Code test initial run*	*Run the imported libraries and initialize the code properly*	*Verified*	*PASS*
CT_002	*Code testing*	*Registering the cloud*	*Create cloud and new asset creation*	*New asset created*	*Verified*	*PASS*
CT_003	*Data set loading*	*Load the data set in the cloud by specifying the directory*	*Dataset load*	*Loading the data set*	*Verified*	*PASS*
MT_001	*Model training*	*Image upload*	*Image upload and classify*	*Loading the image and classify*	*Verified*	*PASS*
MT_002	*Model training*	*Image classification*	*Checks and classifies the image loaded*	*Classification*	*Verified*	*PASS*
MT_003	*Model training*	*Image classification*	*Checks and classifies the image loaded*	*Classification*	*Verified*	*PASS*
MT_004	*Model training*	*Image classification*	*Checks and classifies the image loaded*	*Classification*	*Verified*	*PASS*

CHAPTER 9

ADVANTAGES:

1. Providing a food intake analysis
2. Setting nutrition goals
3. Providing educational reports
4. Managing patient or client weight changes
5. Creating diet records
6. Easy, do-it-yourself nutrition labeling
7. Recipe and formula creation
8. Quick creation and editing of food labels
9. An extensive ingredient database
10. Nutrition food label compliance
11. Food label imports from many different countries and regions
12. Diet analysis and tracking
13. Meal planning and menu creation
14. Multiple reporting styles

DISADVANTAGES:

1. Need to train many data sets

   Sometimes images cannot be classified as expected

2. More technical skills required

3. AI ,ML concepts working must be understood prior.

CHAPTER 10

FUTURE SCOPE:

By this project we can integrate it with smart devices for the real time data of the nutrition when scanned ,we can either direct the data with cloud service such as AWS kinesis and do all the processing in the cloud.

We can convert the application into a mobile app so that it is easily accessible for android and ios users along with nutrition details we can also add the health benefits for fruits and vegitables which are scanned .

CHAPTER 11

CONCLUSION:

Artificial intelligence (AI) is a rapidly evolving area that offers unparalleled opportunities of progress and applications in many healthcare fields. In this review, we provide an overview of the main and latest applications of AI in nutrition research and identify gaps to address to potentialize this emerging field. AI algorithms may help better understand and predict the complex and non-linear interactions between nutrition-related data and health outcomes, particularly when large amounts of data need to be structured and integrated, such as in metabolomics. AI-based approaches, including image recognition, may also improve dietary assessment by maximizing efficiency and addressing systematic and random errors associated with self-reported measurements of dietary intakes. Finally, AI applications can extract, structure and analyze large amounts of data from social media platforms to better understand dietary behaviours and perceptions among the population. In summary, AI-based approaches will likely improve and advance nutrition research as well as help explore new applications. However, further research is needed to identify areas where AI does deliver added value compared with traditional approaches, and other areas where AI is simply not likely to advance the field. Technology is all about updates and we hope our idea will make some vital changes and receive positive reponse thank you

CHAPTER 11

PROJECT FILES :*https://github.com/IBM-EPBL/IBM-Project-45745-1660732038*

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FOR FITNESS ENTHUSIASTS
IBM PROJECT