TITLE: AI POWERED NUTRITION ANALYZER

TEAM ID: PNT2022TMID03721

BATCH: B3-3M5E

TYPE: Web-Application

1. INTRODUCTION

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.).

Image classification is done by using Support Vector Machine(SVM) and Convolution Neural Network(CNN). The scalability of the solution is determined by the image of the food classified accurately, Social impact and customer satisfaction is maintained by friendly UI design and easy to operate.Mainly this business model increases the life span of the users. It provide healthy life.

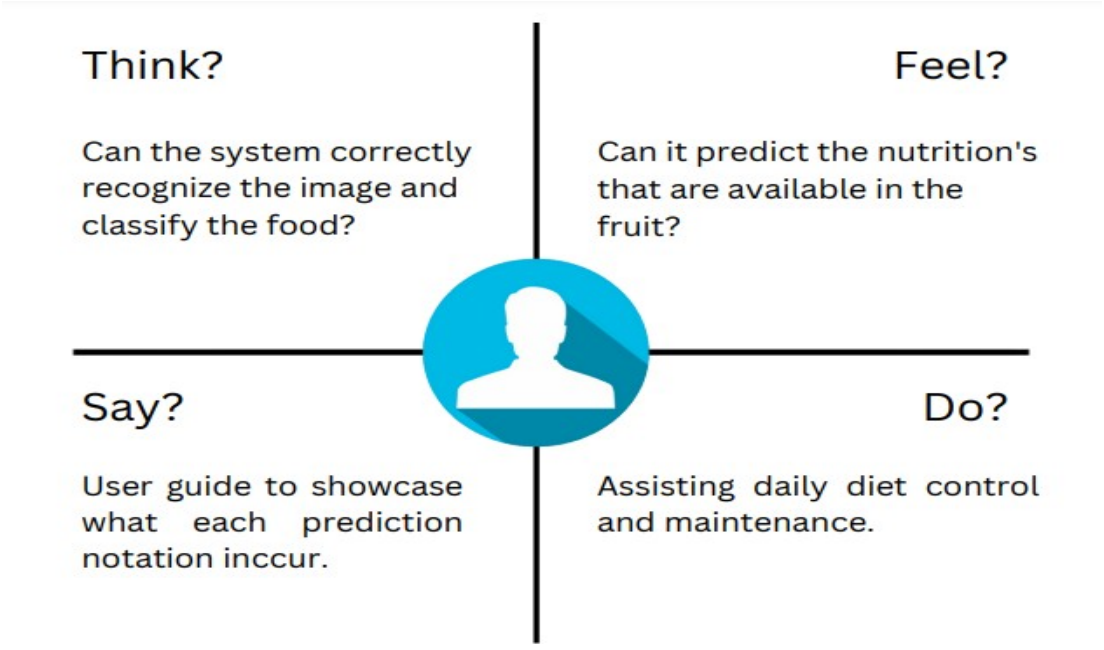
2. PROJECT OBJECTIVES:

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 WE KNOW ABOUT:

- 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.

3. EMPATHY MAP



4.TOOLS & LIBRARIES

In this topic we are going to see about tools and libraries that I am using to develop theproject.

No	Tools&LibraryName	Usage
1	Keras	We are using for deep learning tasks like creatingmodel, predicting the object etc.
2	tensorflow	TensorFlow can be used across a range of tasks but has a particular focus on training and inference of deep neural networks
3	Flask	It is classified as a microframework because it does not require particular tools or libraries. It has no database abstraction layer, form validation, or any other components where pre-existing third-party libraries provide common functions
4	scikitlearn	Simple and efficient tools for predictive data analysis · Accessible to everybody, and reusable in various contexts · Built on NumPy, SciPy, and matplotlib ·
5	Numpy	We are using it for the Image matrix handling.
6	Pandas	Pandas is an open-source library that is made mainly for working with relational or labeled data both easily and intuitively.

5. PROPOSED SOLUTION

S. No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	• The absence of balanced food and nutrition security leads to health problems such as diabetes, obesity, and malnutrition. • So we have to take adequate amounts of energy, proteins, vitamins, minerals, essential fats, micro and macronutrients. • This will done by using nutrition analyser app. • This app helps us to find the nutrition, vitamin and mineral content in the food.
2.	Idea / Solution description	• Image classification is done by using Support Vector Machine (SVM) and Convolutional Neural Network (CNN).
3.	Novelty / Uniqueness	• Convolutional Neural Network (CNN) and Support Vector Machine (SVM) is used in this system.
4.	Social Impact / Customer Satisfaction	• Friendly UI design and Easy to operate.
5.	Business Model (Revenue Model)	• It will increases the life span of the Users. It will provides the healthy life.
6.	Scalability of the Solution	• The scalability of the solution is how the image of the food is classified accurately.

6.ARCHITECTURE

Solution architecture is the process of developing solutions based on predefined processes, guidelines and best practices with the objective that the developed solution fits within the enterprise architecture in terms of information architecture, system portfolios, integration requirements and many more.

Solution architecture includes five main processes:

1.Identification of business goals and objectives;

2.Identification of system requirements;

3.Definition of information models and processes;

4.Selection and integration of technologies, tools, and platforms;

5.Development of project plans.

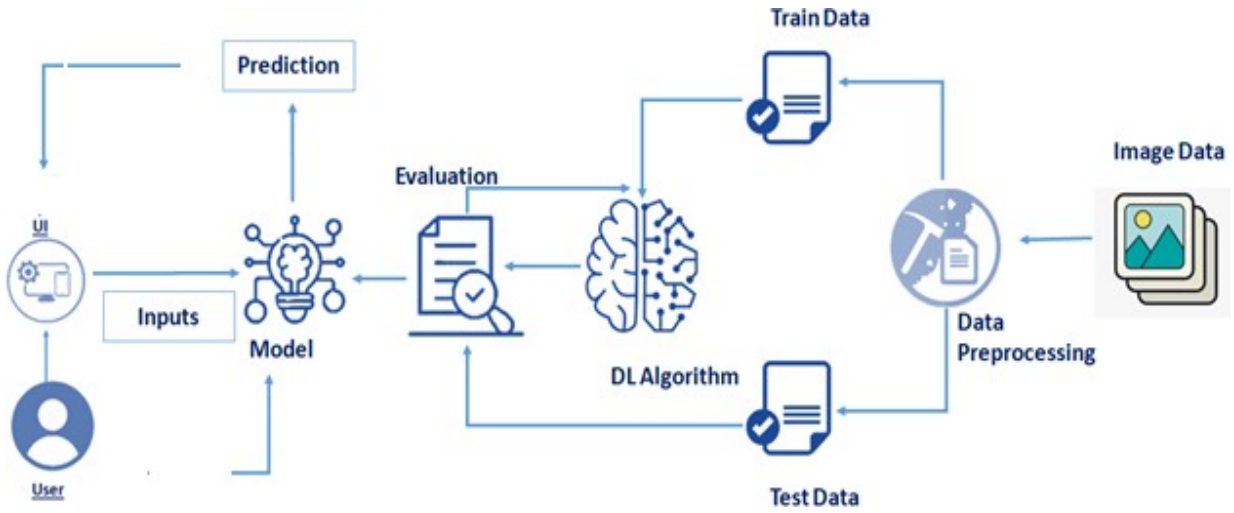
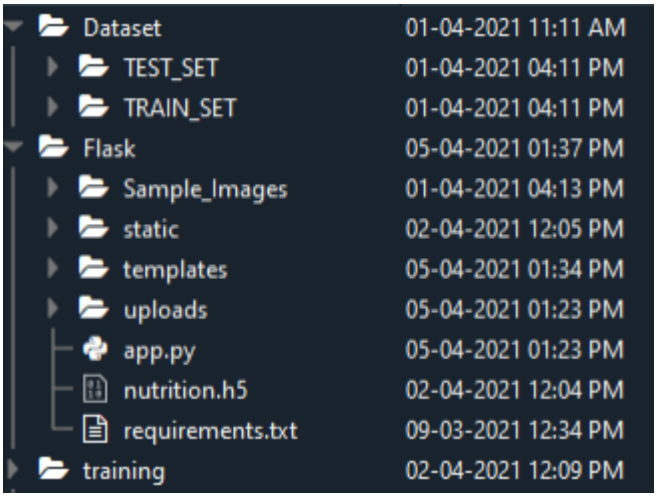


Figure 1. TECHNICAL ARCHITECTURE

7. PROJECT STRUCTURE



- Dataset folders contains the training and testing images for training our model We are building a Flask Application that needs HTML pages stored in the templates folder and a python script app.py for serverside scripting
- we need the model which is saved and the saved model in this content is a nutrition.h5
- templates folder contains home.html, image.html, imageprediction.html pages.
- Statis folder had the css and js files which are necessary for styling the html page and for executing the actions.
- Uploads folder will have the uploaded images(which are already tested).
- Sample_images will have the images which are used to test or upload.
- Training folder contains the trained model file.

8.WORK-FLOW

The user interacts with UI and gives the image 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 will classify the result and showcase it on the UI.

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

1. **DATA COLLECTION**
2. **DATA PREPROCESSING.**
3. **MODEL BUILDING**
4. **APPLICATION BUILDING**
5. **DEPLOYMENT**

8.1.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.

8.2. DATA PREPROCESSING

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

- Let us apply ImageDataGenerator functionality to Trainset and Testset . 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}

8.3. MODEL BUILDING

- The compilation is the final step in creating a model. Once the compilation is done, we can move on to the training phase. The loss function is used to find errors or deviations in the learning process. Keras requires loss function

during the model compilation process.

- Optimization is an important process that optimizes the input weights by comparing the prediction and the loss function. Here we are using adam optimizer

- Metrics are used to evaluate the performance of your model. It is similar to the loss function, but not used in the training process

- Now, let us train our model with our image dataset. The model is trained for 20 epochs and after every epoch, the current model state is saved if the model has the least loss encountered till that time. We can see that the training loss decreases in almost every epoch till 20 epochs and probably there is further scope to improve the model

- Evaluation is a 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.

8.4. APPLICATION BUILDING

- We use HTML to create the front-end part of the web page. Here, we have created 3 HTML pages- home.html, image.html, imageprediction.html, and 0.html.home.html displays the home page.image.html is used for uploading the image imageprediction.html will showcase the output

- The first step is usually importing the libraries that will be needed in the program. Importing the flask module into the project is mandatory. An object of the Flask class is our WSGI application. Flask constructor takes the name of the current module (__name__) as an argument Pickle library to

load the model file.

- The '/' URL is bound with the home.html function. Hence, when the home page of the webserver is opened in the browser, the HTML page is rendered. Whenever you enter the values from the HTML page the values can be retrieved using the POST Method.

- It will take the image request and we will be storing that image in our local system then we will convert the image into our required size and finally, we will be predicting the results with the help of our model which we trained and depending upon the class identified we will showcase the class name and its properties by rendering the respective html pages.

8.5. DEPLOYMENT

- Open the anaconda prompt from the start menu.
- Navigate to the folder where your app.py resides.
- Now type the "python app.py" command.
- It will show the local host where your app is running on http://127.0.0.1.5000/
- Copy that localhost URL and open that URL in the browser. It does navigate to where you can view your web page.
- Enter the values, click on the predict button and see the result/prediction on the web page.
- Click on classify button to see the results.

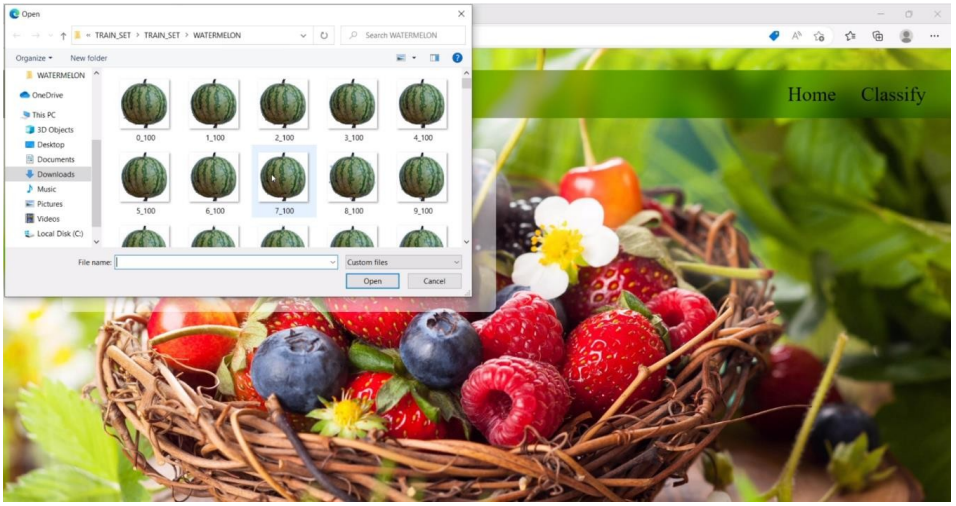
9. CODE

Code is open source and published into GitHub with read-me file.

https://github.com/IBM-EPBL/IBM-Project-23307-1659877727

10. OUTPUT

Some of the screenshots of project given below:


Open
TRAIN_SET > TRAIN_SET > WATERMELON
Search WATERMELON
Organize
New folder
WATERMELON
OneDrive
This PC
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
Local Disk (C:)
0_100
1_100
2_100
3_100
4_100
5_100
6_100
7_100
8_100
9_100
File name:
Custom files
Open
Cancel
Home
Classify


127.0.0.1:5000/image%201%20
Nutrition Image Analysis
Home
Classify
Upload Image to Classify
Classify


127.0.0.1:5000/predict
Nutrition Image Analysis
Home
Classify
Food Classified is: watermelon
Sodiumlevel:0
Sugarlevel:6.2
Fibrelevel:0.4
Servingsize:100.0
Fatlevel:0.1
Calories:30.3
Proteinlevel:0.6
Carbohydrates:7.4
Cholestrol:0

11. REFERENCE SURVEY TABULAR FORM

S. No.	Authors	Title	Methodology	ProS (Advantage)	Cons (Disadvantage)
1.	Muhammad Aslam, Inzamam Ul Haq, Muhammad Saad Rehan, Faheem Ali, Abdul Basit, Muhammad Iftikhar Khan, Muhammad Naeem Arbab (2021) (IEEE paper 1)	Health Analysis of Transformer Winding Insulation Through Thermal Monitoring and Fast Fourier Transform (FFT) Power Spectrum	Thermal monitoring, novel winding insulation model, thermal monitoring algorithm and installation of monitoring unit at 500 kv grid station.	The system assesses the power transformer's health status by tracking the hot-spot temperature and the transient incipient activities like partial discharges (PD) inside the winding insulation.	It requires oil and cellulose i.e., kraft paper to make the transformer so that the quality of the kraft paper must be as per the requirement.

2.	Yuita Arum Sari, Luthfi Maulana, Yusuf Gladiesnyah	Leftovers Nutrition Prediction for Augmenting Smart Nutrition Box	The dataset was taken using an SNB prototype combined with	The method was also embedded in SNB prototype to enhance the	The segmentation algorithm has drawbacks when
	Bihanda, Jaya Mahar Maligan, Nabila Nur'aini, Dhea Rahma Widyadhana (2020) (IEEE paper 2)	Prototype Feature Using Image Processing Approach and AFLE Algorithm	full of lighting inside the box. Each item of food was placed in the compartment of the white tray box.	estimation function.	applying in multiple conditions.
3.	Yongpan Zou ,Dan Wang,Schiong Hong,Rukhsana Ruby, Dian Zhang,Kaishun Wu (2020) (IEEE paper 3)	A Low-Cost Smart Glove System for Real-time Fitness Coaching	More specifically, iCoach, is a Smart fitness glove with commercial inertial measurement IMU including accelerometer, gyroscope, magnetometer	The detection of non-standard behaviors and quality assessment results are displayed on the user interface. The results can also be reported to users in the form of	The overall speed of repetition is too fast or too slow. The speed of outward and backward processes is not balanced. The

			embedded in its wrist band.	voice reminder.	repetitions are not stable with noticeable shakes.
4.	Zhao Zhao, Ali Arya, Rita Orji, Gerry Chan (2020) (IEEE paper 4)	Physical Activity Recommendation for Exergame Player Modeling using Machine Learning Approach.	The methodology was to use the questionnaire data to train a binary predictive model to predict whether the user would like a new type of exercise or not.	The feasibility of using the player model for personalizing PA, potential of using machine learning in building the recommender system for PA and the considerable effect in optimizing the system.	Sometimes it might not be realistic for some users to try those new Pas that our system recommended. The system did not look at the distance between PA with different perspectives.

5.	Asmabee Khan, Sachin Deshpande, Amiya K. Tripathy (2019) (IEEE paper 5)	Optimizing Nutrition using Machine Learning Algorithms -a Comparative Analysis	The background studies towards designing recommendation system using machine learning algorithms that lead to the design of nutrition based recommendation system.	An expert recommendation system is designed, which wills the user to assess their nutritional status and get a Web/App-based counseling from Nutritionists/Dietitian.	There must not be a lack of knowledge about proper nutrient-content diet to predict and form statistics.
6.	Jihyeon Kim, Uran Oh (2019) (IEEE paper 6)	Emo Wei: Emotion-Oriented Personalized Weight Management	To confirm the feasibility of monitoring emotion from personal logs	The paper provided design implications for future weight management	This field has not yet developed enough to grasp the situation, the

12. CONCLUSION

We developed a project which can identify the fruit images uploaded to the web application. The web application is built using deep learning, machine learning and using other technologies such as numpy, flask packages in python,