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FOOD RECOGNITION AND CALORIE ESTIMATION USING DEEP LEARNING

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Abstract: Obesity is becoming a major issue in everyone's life, In order to control this, one must ensure balanced diet, Intake of healthy food and consuming standard amount of calories per day is mandatory. So that food Recognition and Calorie Estimation are extremely important for overall well-being. This system, which allows end users to upload the food image and displays the estimated calories also nutrient values of that food image. The food Recognition is done by using Convolutional Neural Network (CNN) Model i.e. MobilenetV2. This is a user friendly system, where users can easily interact through the web browser.

Index Terms - Food Recognition, Calorie Estimation, CNN, MobileNetV2, Deep Learning, NLP.

I. INTRODUCTION

Food is a material that is mostly made up of protein, carbohydrates, fats, and other nutrients that are needed by the body to provide energy and support growth and other critical functions. It is the fuel that powers our bodies and allows us to carry out all our daily activities. But having a regular amount of calories is crucial. If they intake more calories than required they may face health problems like overweight or obesity in the future. Due this reason many are facing obesity issue. In terms of nutrition, calories refer to the energy that people obtain from their food. Understanding food and its nutritional value is crucial in pursuing health and well-being. Precise identification of food and calculation of calories can help people keep an eye on their food consumption and make educated decisions regarding their general health and nutrition. The popularity of deep learning has increased in the modern era due to its unmatched capacity to extract complex patterns and insights from large amounts of data. This paper concerns the development of the user friendly system that recognizes the food image through the popular deep learning algorithm which CNN model and also displaying of calorie estimated of the food image along with nutrient values of it.

II. LITERATURE SURVEY

FOOD CALORIE ESTIMATION AND BMI PREDICTION USING DEEP LEARNING [1]

In this paper, they built a system which gives calorie content of a food image and predict the BMI of an individual. Image processing technique is used to extract features from food image, CNN is used to estimate calorie content and to predict BMI machine learning algorithms such as Logistic regression and Random forest are used.

FOOD DETECTION AND CALORIE ESTIMATION [2]

This paper concerns the design model of food detection and calorie estimation using deep learning algorithm i.e. Convolution Neural Network, also explains the CNN layers.

FOOD CALORIE ESTIMATION USING CONVOLUTIONAL NEURAL NETWORK [3]

In this paper, the authors proposed a model for measuring calorie by using deep learning algorithm, for food detection or recognition is done by using multiple algorithms like CNN, Random forest, SVM to get better accuracy.

INDIAN FOOD CLASSIFICATION BASED ON NUTRIENTS AND CALORIE USING DEEP LEARNING [4]

In this paper the authors designed model which Takes food image as input and the output includes the corresponding calorie and nutrient data. For image recognition Inception V3 model is used and The Calories and Nutrition list dataset is created to anticipate the calorie and nutritional content of specific food items.

FOOD RECOGNITION AND CALORIE MEASUREMENT USING ARTIFICIAL INTELLIGENCE [5]

This paper presents overview of the technologies that are employed in food recognition and calorie measurement, also mentioned the algorithms how used in implementation for feature extraction i.e. SIFT, Gabor filter and Color histogram method.

SMART DIET DIARY: REAL-TIME MOBILE APPLICATION FOR FOOD RECOGNITION [6]

In this article, the authors proposed an easy to use mobile application called Smart Diet Diary, which uses deep learning to recognize a food item and calculate its nutritional value in terms of calorie count. They used a faster R-CNN for detecting foods and categorization.

CALORIFIC - FOOD RECOGNITION AND RECOMMENDATION IN MACHINE LEARNING PERSPECTIVE [7]

In this research paper the authors proposed a method, that it identify and display nutritional values of food image uploaded by end users, the Recognition done by the EfficientNetB0 model and a k-means clustering method is used to suggest an alternate food.

INDIAN FOOD IMAGE RECOGNITION WITH MOBILENETV2 [8]

In this paper, the authors proposed a system, where they used dataset consisting Indian food images of 12 different classes, the image recognition is done by using the CNN model, transfer learning model and calories are estimated are acquired from nutrition website and also by HSV method.

A FOOD RECOGNITION SYSTEM FOR CALORIE MEASUREMENT [9]

In this paper the authors proposed a System that uses images of food taken by user. Where the segmentation is done by using Fuzzy C Means Clustering, food detection done by Skull Stripping and categorization done by Support Vector Machine(SVM).

III. PROPOSED SYSTEM

The proposed system overview is that it allows the user to upload the image of the food and it display the calories, Macro Nutrient values of that food and also Recipes of that food image. The food recognition will be done by using CNN Model Architecture which is MobilenetV2. MobileNetV2 uses convolution layers to extract hierarchical features from input images. Different levels of abstraction are covered by these features, with simple edges and textures being the first, followed by more complex patterns like shapes and object parts. The knowledge gained from training on a large dataset can be leveraged by using MobileNetV2 as a pre-trained model. The calorie estimation and other nutrient values will be acquired through Ninja Nutrition API .Natural Language Processing is used for displaying the dishes based on the given input image. NLP techniques such as text preprocessing, feature extraction (using Count Vectorizer), and cosine similarity calculation are employed to analyze the textual information (ingredients) associated with dishes. This analysis enables the system to display dishes that closely match the user's input based on ingredient similarity.

IV. METHODOLOGY

Data Collection: The dataset is collected from kaggle, which is around 2GB datasize, contains images of 36 different classes of fruits and vegetables. And also made dataset of 6 varieties of breakfast they are: boiled egg, idli, poha, roti, vada, dosa.

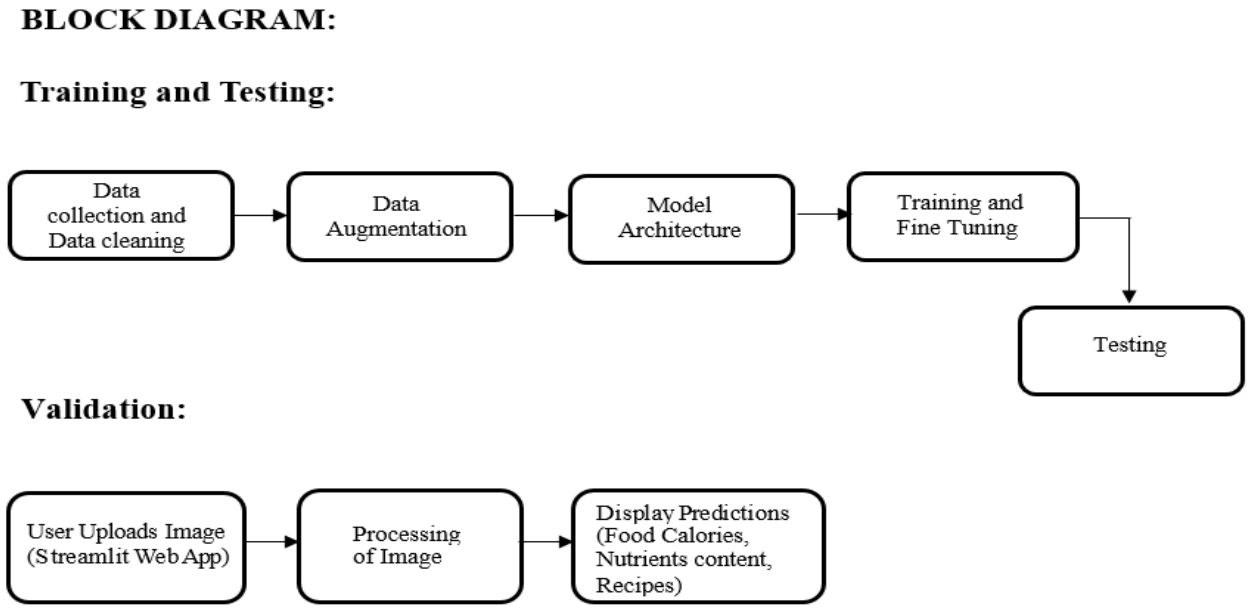

Fig 1.Block diagram of food recognition and calorie estimation using deep learning

Data Preprocessing and Data Augmentation: preprocessing prepare the images for input into the neural network model by ensuring uniformity in dimensions, converting them into a numerical format suitable for computation. Augmentation techniques include rotation, zoom, width and height shift, shear, and horizontal flip. The diversity of the training data is enhanced by these techniques, which leads to better generalization of the model.

Model Architecture:

We are using CNN architecture which is MobileNetV2. MobileNetV2's architecture consists of convolutional neural networks that aim to perform well on mobile devices. The first completely convolution layer in MobileNetV2's architecture has 32 filters, and it is followed by 19 residual bottleneck layers. Transfer learning is employed using the MobileNetV2 pre-trained model. This serves as the basis for feature extraction in the model. These features are then fed into additional layers (dense layers) to perform classification. The model is trained for 5 epochs with early stopping based on validation loss.

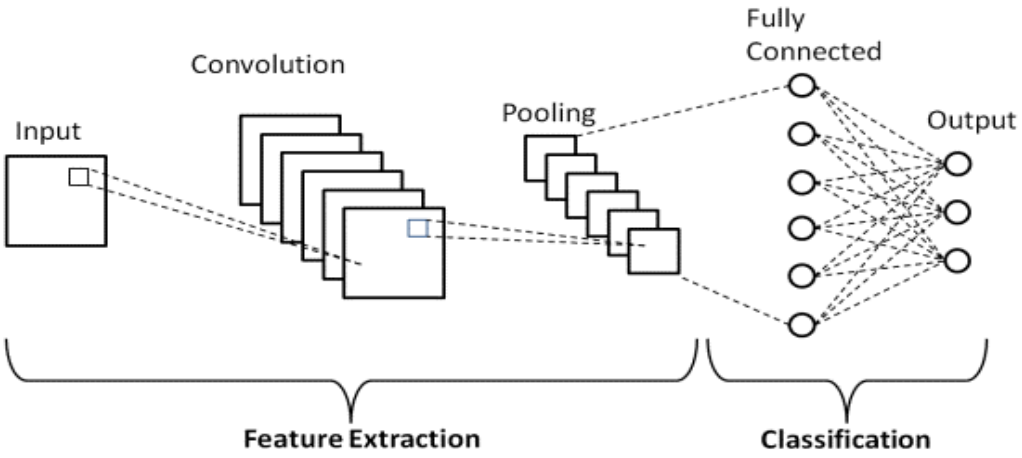

Fig 2. Basic architecture of CNN **[10]**

Streamlit App:

A Streamlit web application is created for the deployment of the model. Users can upload an image, and the model will predict whether the image contains a fruit or a vegetable and also name of that fruit or vegetable. This also fetches calorie information for the predicted food item using Ninja Nutrition API, which also includes macro nutrient information shown in a pie chart. **Natural Language Processing** is used for the dishes to be displayed based on user input. A dataset consisting of more than 1000 recipes is taken. This dataset serves as a reference for available dishes, and cosine similarity with user input is used to identify and recommend dishes that closely match the desired input based on ingredient similarity. The development of the code for this app, done in Visual Studio Code.

V. RESULTS

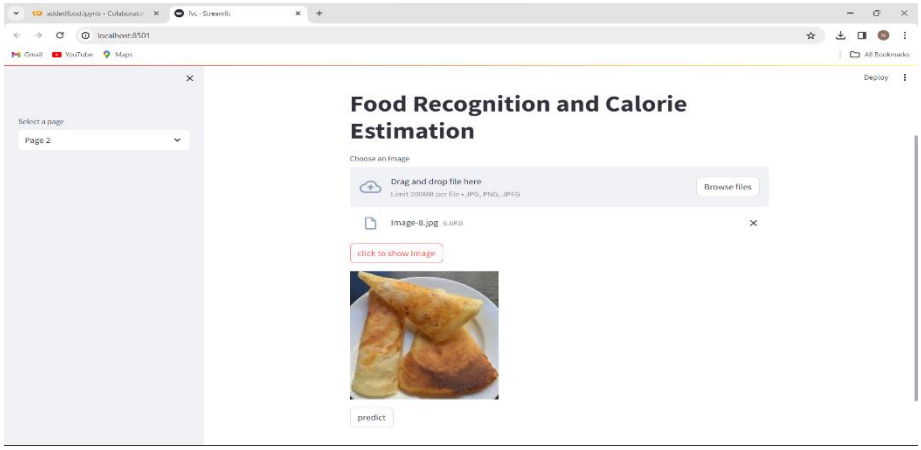

Fig3. The uploaded image i.e. Dosa

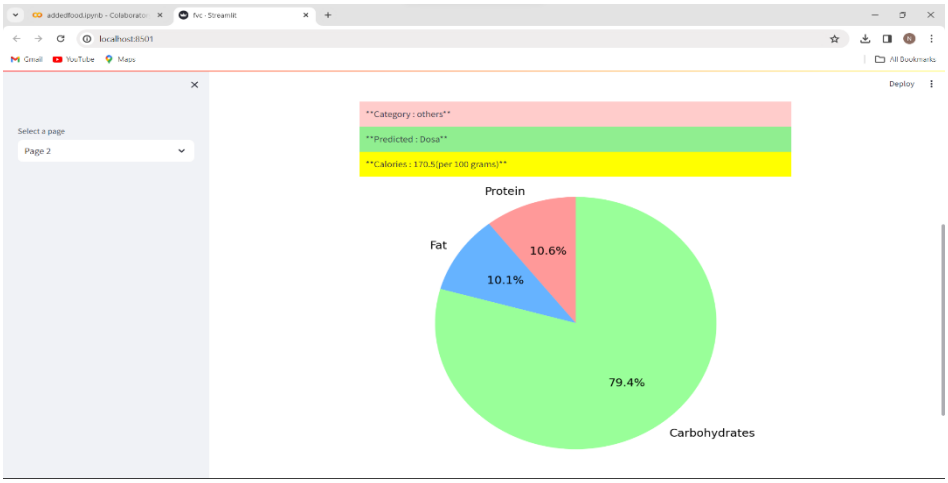

Fig 4. Recognized food name, category, calories, and macronutrients of Dosa

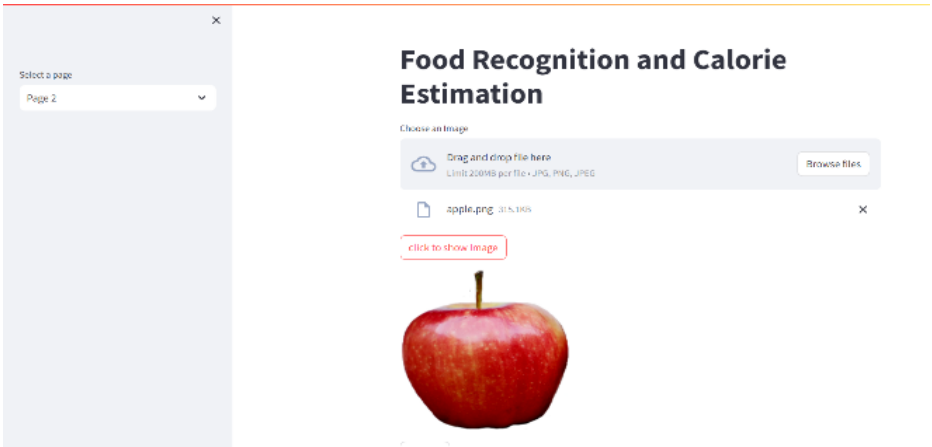

Fig 5. The uploaded image i.e. Apple

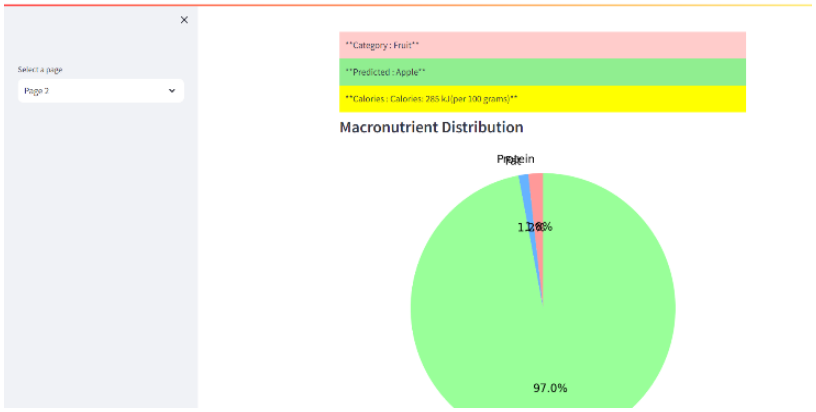

Fig 6. Recognized food name, category, calories, and macronutrients of apple

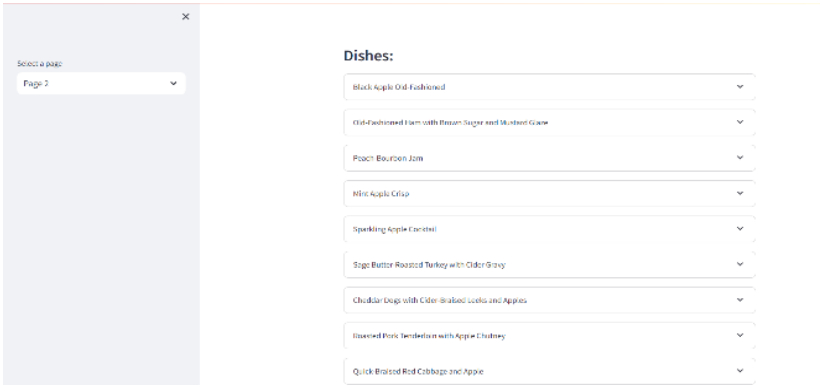

Fig 7. Dishes of apple

VI. CONCLUSION:

The proposed system encompasses the recent technologies, such as deep learning and NLP. The use of MobileNetV2 provides a scalable and effective solution for food detection, which is consistent with the rising demand from wellness and health-related applications. The calorie estimation can be improved in the future by accurately approximating volume.

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