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# Nutrition Assistance Application Using Deep Learning Algorithm

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***Abstract:*** Proper nutrition is crucial for maintaining good health. While nutrition apps exist to help people monitor their food intake and make healthier choices, they often require manual input and can be prone to errors. This paper proposes a real-time image-detecting nutrition value app that uses a deep learning convolutional neural network(CNN) algorithm to automatically analyze the nutritional content of food in real time.A three-layer CNN algorithm was developed to detect food objects and analyze their nutritional content, including calories, fat, and protein. The proposed web app model was tested using a dataset of 5025 food images with manually annotated nutritional values.The CNN model achieved an accuracy rate of 96% in detecting food images and predicting their nutritional content. The proposed app could provide real-time nutrition information for a variety of foods, including pre-packaged foods and restaurant meals.The proposed real-time image-based nutrition assistance app has the potential to help people make more informed food choices and improve their overall health. Further research is needed to refine the model and improve its accuracy, as well as to test its usability and effectiveness in a real-world setting.

**Keywords:** Nutrition, Calorie Intake, Food Packaging, Nutrition Labels, App-Based Nutrient Dashboard Systems, Deep Learning, CNN, Food Identification, Nutritional Value.

## 1. Introduction

In today's modern world, the pace of life is constantly changing, and so are the requirements of the human body's composition. With an abundance of consumables and prepared foods available to us, there has been a surge in health issues like obesity, caused by excessive calorie consumption. This has made it essential to develop a system that can influence people's eating habits and provide guidance towards a healthy lifestyle. By alerting users to the nutritional information of a food item and categorising it as healthy or unhealthy, such a system can help individuals establish their daily intake of calories from their diet.

However, the first step in achieving this goal is to determine the type of food, which requires predicting the image category (if the image is in the category of food or vegetable). To achieve this, a combination of deep learning techniques can be employed to recognise the image and determine the category based on it. This approach incorporates a wide range of segmentation and picture features, making it an effective tool for food recognition and promoting healthy living. In this article, we will delve deeper into the potential benefits of using deep learning techniques for food recognition and discuss how this technology can be used to combat obesity and improve overall health outcomes.

## 2. Literature Survey

Karan Parikh, et al,2018, (Health And Fitness Assistant) - This paper proposes a web app that uses machine learning algorithms to provide personalized diet and workout plans, as a cost-effective solution for those who cannot afford personal training. The app will create custom plans based on the user's preferences and recent activities, helping them achieve their fitness goals.

B.Prasanna Rani, et al, (2020)(Virtual Diet Assistant) –The proposes a virtual diet assistant system that uses machine learning and natural language processing to provide personalized dietary advice to users. The system analyzes user input and provides recommendations based on their individual needs and goals. The authors claim that their system can improve the effectiveness of diet plans and help individuals achieve their health goals.

Hammad Afzal, et al, 2018, (A Framework to Estimate the Nutritional Value of Food in Real Time Using DeepLearning Techniques) - The paper present

a mobile-based system that uses deep learning models and text analysis to estimate nutritional content from real-time images of meals for promoting healthy eating habits. The proposed system achieves a high classification rate of up to 85% on a dataset of 100 classes with 1000 images each and is implemented as a mobile app.

Chang Liu, Yu Cao, et al, 2017,(A New DeepLearning-based Food Recognition System for Dietary Assessment on An Edge Computing Service Infrastructure) –The paper proposes a new computer-aided food recognition system using deep learning and edge computing for accurate dietary assessment in weight loss interventions. The proposed system outperforms existing approaches in terms of food recognition accuracy, response time, and energy consumption, providing a promising solution for the field of health informatics.

Bojia Qiu, et al, 2020, (Deep Food: Food Image Analysis and Dietary Assessment via Deep Model) - The paper proposes a deep learning-based food recognition and dietary assessment system that analyzes food items from daily meal images, such as those captured by a smartphone. The system utilizes a three-step algorithm that accurately recognizes food items and generates dietary assessment reports based on their nutritional ingredients. The proposed system is evaluated using multiple food image datasets and achieves high recognition accuracy and efficiency.

Adrian Iftene, Nicoleta-Tatiana Trifan,et al, 2022, (Appetite-Nutritionist Assistant) - The paper discusses the Appetiteapplication,its main functionalities,and the motivation behind its development, which is the promotion of a healthy lifestyle and proper nutrition. The application likely includes features related to tracking and monitoring nutritional intake, providing personalized recommendations for healthy eating, and potentially using augmented reality. The paper also emphasizes the use of mobile applications and augmented reality for nutrition-related purposes.

DeepaBura, et al, 2020, (“Nutri-Mental” – An Android Application For Personal Health And Nutrition Management) - The paper “Nutri-Mental” describes the development of an Android application for personal health and nutrition management called “Nutri-Mental”. The application allows users to track their food intake and monitor their nutrient intake levels using an extensive food database with corresponding nutritional information. The paper discusses the features, design, and implementation of the application, as well as an evaluation of its performance and user experience.

Tejaskumar Patel,et al, 2019,( Deep Learning Based Food Image Recognition: A Survey) - The paper provides a comprehensive overview of the current state-of-the-art deep learning techniques used for recognizing food images, including various models such as CNNs, RNNs, and GANs. Additionally, it explores different datasets and their limitations, as well as the challenges in food image recognition and potential solutions to these challenges. Overall, this paper seems to be a useful resource for anyone interested in the field of food image recognition, including researchers and practitioners.

Kosin Chamnongthai, et al, 2018, (The Design and Implementation of an Ingredient Based Food Calorie Estimation System Using Nutrition Knowledge and Fusion of Brightness and Heat Information) - The paper proposes an ingredient-based food calorie estimation system that uses a combination of image processing techniques and nutrition knowledge to estimate the calorie content of food based on its ingredients and cooking method. The paper presents the methodology used to develop the system, its evaluation using a dataset of food images, and demonstrates promising results.

AaratiSurvase,et al, 2022, (Food Image Classification and Nutrition Detection Using CNN) - The paper proposes a system for food image classification and nutrition detection using CNN, which uses a pre-trained CNN model for feature extraction and classification of food images. The system is evaluated on a dataset consisting of 10 food categories and achieves a high accuracy rate.

Dr. Geetha V, Priyanka N, 2022,(Food Recognition Using Deep Convolutional Neural Network) -The paper presents a deep convolutional neural network (CNN) model for food recognition, which extracts food features using a pre-trained CNN model and classifies them using a softmax classifier. The proposed model is evaluated on a dataset of food images and achieves an accuracy rate of 80%, outperforming traditional machine learning algorithms.

## 3. Problem Definition

Problem: Nutrition assistants face several challenges in managing and tracking clients’ nutrition plans. The various factors to consider, such as dietary restrictions, personal preferences, and health goals, make it a time-consuming and daunting task to create personalized plans for each client. Additionally, keeping track of clients’ progress and updating their plans accordingly can be challenging and tedious. Communication with clients can also be difficult, with

clients often needing to wait for scheduled appointments to address concerns or questions, which can hinder their progress and motivation.

## 4. Existing System

Food analysis and diet planning systems face challenges due to the complexity and variability of different dishes, making it difficult to accurately recognize and detect food items in photos. Additionally, obtaining a diet plan through traditional methods can be time-consuming and inconvenient for users. However, emerging technologies such as mobile apps, web-based platforms, and wearable devices are working to address these challenges. These technologies use machine learning algorithms to analyze user data and provide personalized insights and suggestions, while physiological tracking can provide more accurate and personalized recommendations for diet and nutrition. Overall, these innovations are providing more effective and user-friendly solutions for food analysis and diet planning.

## 5. Proposed System

Sufficient nutrition and energy consumption, which can only be obtained through proper eating habits, are essential for maintaining a healthy existence. In addition to maintaining a good standard of living, a healthy diet helps people prevent chronic conditions including diabetes, high blood pressure, mental illness, asthma, and others. Obesity is one of the conditions brought on by over eating that is most common. When a person is obese, excess body fat accumulates to the point where it endangers their health. For the suggested system to recognise and locate food items from the input images, develop an automated nutrition analysis system. By locating possible locations and classifying them with deep neural networks, develop a three-step procedure specifically for detecting various foods in photographs. In the first stage, the automated system generates numerous regions of proposals using the provided photos. Then, it collects each region of thoughts by locating them in the original pictures, putting them on feature maps, and classifying them according to different food groups. Finally, by analysing the nutritional elements in the images, determine the food's calories, fat, carbs, and protein contents as well as its ingredients to generate a dietary evaluation report. The system's effectiveness and accuracy will also be increased by expanding the dataset to cover a larger variety of food types.

## MERITS

- Provide the nutrition content and ingredients of Multifoods
- Helps for fitness people to maintain and know the proteins and calories of the food
- Gives accurate results in real-time application

## 6.Proposed System of Architecture

The nutrition assistance web app using a CNN algorithm allows users to upload photos of their meals, which are analyzed using a convolutional neural network to identify and classify the different food items present. The app then provides personalized dietary recommendations based on the user's goals, preferences, and dietary restrictions. The user interface displays the recommendations, allowing users to take actionable steps to improve their nutrition.

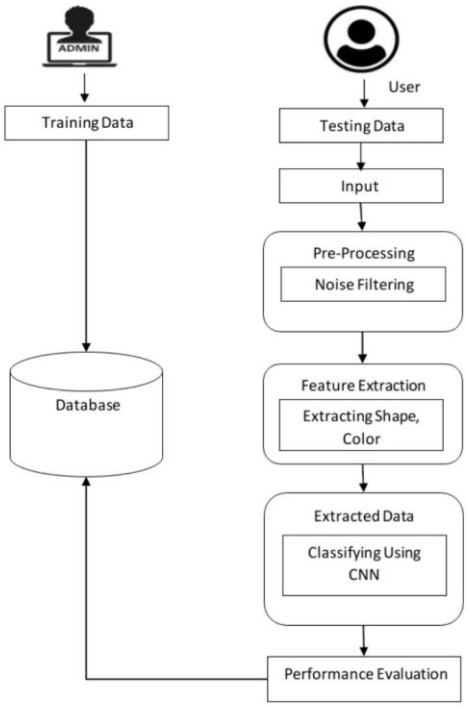


**Fig.1** Proposed System of Architecture

## 7. Methodology

CNNs represent feed-forward neural networks which encompass diverse combos of the convolutional layers, max pooling layers, and completely related layers and Take advantage of spatially neighborhood correlation by way of way of imposing a nearby connectivity pattern among neurons of adjacent layers. Convolutional layers alternate with max pooling layers mimicking the individual of complex and clean cells in mammalian seen cortex .A CNN includes one or extra pairs of convolution and max pooling layers and ultimately ends with completely related neural networks. The hierarchical structure of CNNs is steadily proved to

be the most efficient and successful manner to analyze visiblerepresentations.

The fundamental challenge in such visual tasks is to model the intra-class appearance and shape variation of objects. The hyper-spectral data with hundreds of spectral channels can be illustrated as 2D curves. We can see that the curve of every class has its own visual shape which is different from other classes, although it is relatively difficult to distinguish some classes with human eye (e.g., gravel and self-blocking bricks). We know that CNNs can accomplish competitive and even better performance than human being in some visual problems, and its capability inspires us to study the possibility of applying CNNs for classify the disease features. The CNN varies in how the convolutional and max pooling layers are realized and how the nets are trained. This network varies affording to the spectral channel size and the number of output classes of input lung data. In our proposed CNN structure, multiple features can be extracted from each original hyperspectral, and each feature has $n3$ dimensions

## 8. Modules Description

### *8.1 Upload Image*

In this module, the nutrition datasets should be uploaded as CSV files. Additionally, the information is kept in a database for later use. The dataset includes information on the calories, protein, fat, and food ingredient values of fruits and vegetables. These numbers are preserved as integer values and acquired from the Kaggle website.

### *8.2 Filtering Noise*

A median filter is a nonlinear technique widely used in image processing to get rid of "salt and pepper" noise. In the pre-processing stage of document analysis, document picture binarization is used to separate text in the foreground from the backdrop of the document. The succeeding document image processing tasks require a quick and precise binarizing approach.

### *8.3 Classification*

Classification is the process of dividing data into various categories. Here, a convolution neural network approach is employed to classify data. The user-uploaded food image will be compared to the food items in the system database. The specific food item will be recognized once the ideal match is discovered based on the qualities matched.

### *8.4 Nutrition Detection*

The food nutrition receives the image after the model has identified the food category or food type and extracts the food's nutritional data before sending it to the system. The system contrasts the nutritional information with the suggested dietary allowances. If the amount of a specific nutrient, let's say calories, exceeds the recommended dietary allowance, the user will receive a warning message to reduce nutrition intake. In that case, the user will see the food's nutritional value.

## 9. Data Training

The CNN algorithm for data training involves feeding the input images through multiple layers of convolution and pooling to extract features and reduce the dimensionality of the image. The output is then flattened and fed through a series of fully connected layers for classification.

During training, the weights of the CNN are adjusted to minimize the loss function between the predicted and actual labels. This process is repeated for multiple epochs until the CNN can accurately classify the images in the training set.

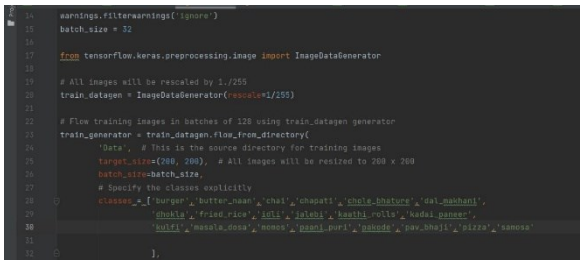


**Fig.2 Data** training using CNN algorithm.

The Image Data Generator class from Tensor Flow Keras to prepare the training data for a CNN model used in a nutrition assistance application. The ”batch_size” parameter is set to 32 to divide the data into batches, and the “train_datagen” object is created with the necessary preprocessing options such as rescaling.

The “flow_from_directory” method is used to generate batches of images from the specified directory with classes explicitly specified. By using this code as a starting point, developers can customize and optimize their CNN model for their specific nutrition assistance application using an appropriate dataset.

```
import tensorflow as tf

model = tf.keras.models.Sequential([
    # Note the input shape is the desired size of the image 200x 200 with 3 bytes color
    # The first convolution
    tf.keras.layers.Conv2D(16, (3,3), activation='relu', input_shape=(200, 200, 3)),
    tf.keras.layers.MaxPooling2D(2, 2),
    # The second convolution
    tf.keras.layers.Conv2D(32, (3,3), activation='relu'),
    tf.keras.layers.MaxPooling2D(2,2),
    # The third convolution
    tf.keras.layers.Conv2D(64, (3,3), activation='relu'),
    tf.keras.layers.MaxPooling2D(2,2),
    # The fourth convolution
    tf.keras.layers.Conv2D(64, (3,3), activation='relu'),
    tf.keras.layers.MaxPooling2D(2,2),
    # The fifth convolution
    tf.keras.layers.Conv2D(64, (3,3), activation='relu'),
    tf.keras.layers.MaxPooling2D(2,2),
    # Flatten the results to feed into a dense layer
    tf.keras.layers.Flatten(),
    # 128 neuron in the fully-connected layer
    tf.keras.layers.Dense(128, activation='relu'),
    # 5 output neurons for 5 classes with the softmax activation
    tf.keras.layers.Dense(20, activation='softmax')
])
```

**Fig.3** Data training using three layer of CNN algorithm.

Convolutional Neural Network (CNN) model using TensorFlow'sKeras API for a nutrition assistance application. The model uses several convolutional layers followed by max-pooling layers to reduce the dimensionality of the feature maps. The Dense layers are fully connected layers that perform classification, with the last layer using the soft max activation function to output the probabilities of the image belonging to each class. This CNN architecture is designed to accurately classify food images and provide recommendations for a healthy diet.

## 10. Results

### *10.1 Accuracy of Nutrition assistance application.*

Nutrition assistance application of accuracy level is 96%.

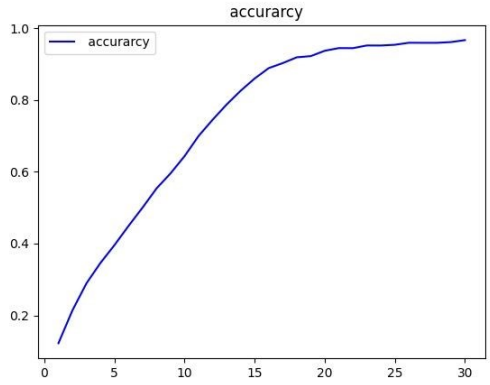


**Fig.4.** Accuracy of Nutrition Assistance Application

### *10.2 Loss of Nutrition assistance application.*

Nutrition assistance application of loss level 4%

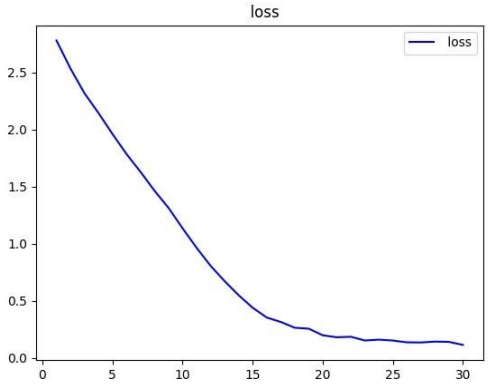


**Fig.5.** Loss of Nutrition Assistance Application

### *10.3 Predication Results.*

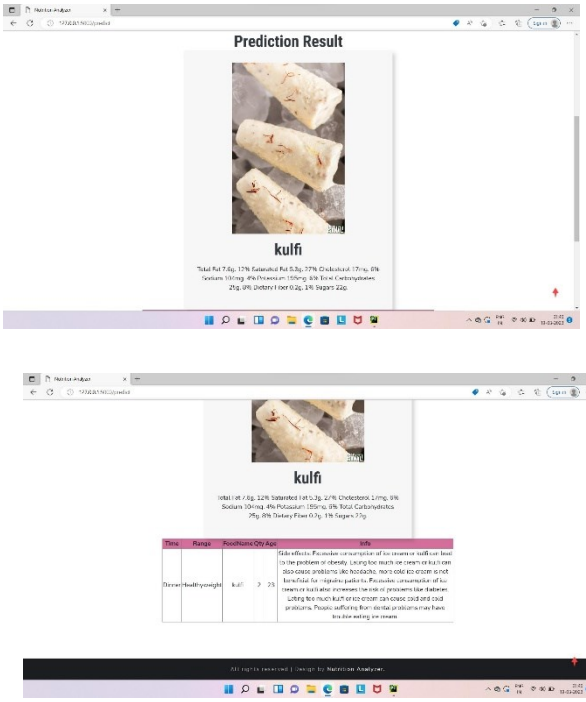


**Fig.6.** Predication Results.

Nutrition detection of real world images to given prediction results to images.

## 11. Future Work

A future enhancement for a nutrition assistant app using CNN could be the incorporation of real-time image recognition technology to analyse the nutritional content of meals. The app could provide users with a breakdown of calories, macronutrients, and micronutrients, and make personalized recommendations based on the user's dietary preferences and goals. Machine learning algorithms could also be used to learn from the user's food choices and provide personalized recommendations over time, helping users make more informed choices about their diet and improve their health.

## 12. Conclusion

This paper is Nutrition assistance application using CNN algorithm to automated food nutrition detection system that uses deep learning to categorize food images into various categories and estimate the quantity of nutrients in the food. The system uses a popular food dataset to categorize food photographs into the proper categories. The study suggests that the classification process can be improved by removing noise from the dataset and using a larger dataset with more classes and images per class. The model's weights can be stored and used to develop designs for calorie extraction, food categorization, and image classification, which can be used to create a web or mobile application that categorizes images and extracts calorie information from identified foods. Nutrition detection 96% accuracy to given the application.The system has potential applications in the field of nutrition and health, ethical concerns should be considered, and further research is needed to refine the system's accuracy.

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