AI NUTRITION ADVISOR FOR FITNESS ENTHUSIASTS: MAKING EVERY BYTE COUNT

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Abstract - Food is a need for human existence, and medical conferences have addressed this issue frequently. With the aid of contemporary dietary evaluation and nutrition analysis tools, customers have more opportunities to learn about their eating habits, study nutrition trends, and maintain a healthy diet. Nutritional analysis is used to determine a food's nutritional worth. Analytical chemistry plays a critical role in providing information on the chemical composition, processing, quality control, and contamination of food. The project's main objective is to create a classification system for fruits based on their different characteristics, including color, shape, and texture. Here, users may capture images of different fruits, which are then uploaded and analyzed by a trained algorithm. The program looks at the image and calculates the fruit's nutrient composition, including its sugar, fiber, protein, and calorie content. To predict the nutritional content, the Convolutional Neural Network technology is used as a classification method.

Index Terms – Deep Learning Technique, CNN(Convolutional Neural Network)

Introduction

This project is more than just a digital tool; it's a comprehensive solution designed to empower fitness enthusiasts to make informed dietary choices. By harnessing the capabilities of AI and machine learning, the AI Nutrition Advisor considers a multitude of factors, including an individual's fitness objectives, dietary preferences, and restrictions, to deliver tailored nutritional recommendations. It doesn't stop there; it also adapts to changing goals and provides real-time feedback, making it a dynamic and invaluable companion on the journey to fitness and well-being. In this endeavor, we delve into the heart of nutrition science, exploring the intricacies of dietary analysis and meal planning. We examine the significance of data integration from fitness tracking devices, dietary logs, and other sources to ensure recommendations remain current and aligned with an individual's progress. The AI Nutrition Advisor represents a convergence of the latest advancements in technology and the timeless wisdom of nutrition, aimed at enhancing not only fitness outcomes but also overall health and well-being. This project's journey is one of empowerment, efficiency, health improvement, and customization. It's about making every bite count and transforming dietary choices into a precision instrument for achieving fitness goals.

I. OBJECTIVES

• This project aims at building an application that automatically estimates food attributes such as ingredients and nutritional value by classifying the input image of food and also calculating the BMI rate of the registered user.

• This method employs a deep learning model (CNN) for accurate food identification and Food APIs to give the nutritional value of the identified food.

II. PROBLEM DEFINITION

The problem revolves around the creation of an AI-driven Nutrition Advisor that provides tailored dietary recommendations to fitness enthusiasts, taking into account their unique goals, dietary preferences, and restrictions. In a world increasingly focused on health and fitness, individuals often seek personalized and science-based nutrition guidance to optimize their diet for their fitness goals. Many fitness enthusiasts face challenges in understanding and maintaining a balanced and effective diet, leading to suboptimal results or even health issues. To address this, we aim to develop an AI-powered Nutrition Advisor dedicated to fitness enthusiasts, helping them make informed dietary choices to achieve their fitness objectives.

III. RELATED WORK

Nareen O, et.al,…[1] Proposed evaluation of weight reduction therapy has been shown in the literature to greatly benefit from an accurate dietary assessment. The majority of contemporary nutritional evaluation techniques, however, rely on memory. Current computer-based food identification system development for accurate food evaluation is now possible via rich Cloud services and complete mobile devices. Addressing the issue of food detection and identification in images of various foods. The issue is worsened by the wide range of food products with low interand large intra-class differences and the scant information in a single image. By outlining the general application of numerous fusion-trained classifiers, it is possible to improve the identification and recognition of traits gleaned from different deep models. This essay 2 investigated numerous methods for identifying foods. Food identification is a challenging challenge since food products are presented; sometimes, they are different within the same group a sort of issue with categorizing fine-grained pictures as the identification of food pair-wise local characteristics that take advantage of eight specific food ingredients' positional relationships. The proposed multi-food image recognition system that detects first food recognizes color, texture, gradient, and SIFT extracted by several detectors using multiple kernel learning regions. The food is divided into 300 blocks, and five classes are further classified, such as staple, main dish, side dish, fruit, and non-food from each block's extract color and DCT coefficients. Food identification and quantity estimation are part of the TADA dietary evaluation system.

Yao Liu, et.al,…[2] For the food sector, it is important to establish tools and processes for quickly and accurately identifying and analyzing food quality and safety goods. Traditional methods for machine learning Based on handcrafted traits, typically perform poorly since they have a limited capacity to describe complex culinary properties. The convolutional neural network (CNN), which is the most widely used architecture of deep learning and has been increasingly used for the detection and analysis of complex food matrices, has recently emerged as an efficient and viable method for feature extraction. Goals and strategy: The current review introduces multi-feature aggregation techniques, 1-D, 2-D, and 3-D CNN models for feature extraction, and the structure of CNN. CNN's uses as a depth feature. With the improvement of the quality of life, people are increasingly conscious of high-quality and safe food products in daily life, therefore the development of methods for reliably detecting and analyzing food quality and safety is important for the industry. With the unique advantages of strong feature learning and good generalization ability, CNN is potential and attractive for effective and efficient analysis of complex food matrices. CNN can not only automatically locate important features, but can also obtain unparalleled performance under challenging conditions such as complex background, and different resolutions and orientations of the images. Despite the advantages of CNN in the provision of better performance, there still remain numerous challenges to its applications in the food domain.

Rizwan Khan, et.al,…[3] In order to prevent foodborne illness and harm, food must be properly prepared, transported, and stored. Food products may encounter a variety of health risks from farm to factory and factory to fork. Food safety is therefore essential from a financial and moral standpoint. The consequences of not complying with food safety regulations are diverse.) The demand for precise, rapid, and neutral quality assessments of these qualities in food products is increasing as dietary requirements and high-quality standards are demanded more frequently. To accomplish these goals, computer vision offers an automated, non-destructive, and cost-effective method. Its usefulness for fruit and vegetable assessment and classification has been proven by a significant body of research. It highlights the key elements of image processing technology and provides an overview of the most recent developments in the food industry. Public health is consistently and significantly burdened by foodborne illnesses. After more than a century Large-scale changes in food production, distribution, and regulations were pushed and fed into macro social pressures like population growth, urbanization, and

globalization. Compared to other economic sectors, the food industry and distribution network, in particular, have created huge amounts of data in recent years. To increase the safety of the food supply, several types of data were imaginatively examined at various points along the agricultural value chain. For instance, toxic contaminations on farmlands were forecasted in preharvest, field, and weather forecasts; in the retail setting, contactless audits and record-keeping were carried out for 1.4 million months; and observations of Hindawi Journal of Food Quality Volume.

Laura Maria König, et. al,…[4] Dietrelated health risk factors and eating habits can both be modified with the help of nutrition apps. Although they might slow the rising rates of overweight and obesity, they haven't yet been widely adopted. Therefore, comprehensive understanding of The development of design recommendations targeted at promoting adoption and sustained use of nutrition apps requires an understanding of the factors encouraging and discouraging (long-term) app use. The literature on obstacles to and enablers of the use of nutrition apps across disciplines, as well as empirical 3 qualitative and quantitative studies with current, former, and non-users of nutrition apps, has been synthesised in this systematic review. PsychINFO, PSYNDEX, PsycArticles, PubMed, Web of Science, and SPORTDiscus were among the six databases used in a comprehensive literature search that also included backward and forward citation searches. The anticipated data extraction procedure, the inclusion and exclusion criteria, and the search strategy were all registered in advance. All empirical qualitative and quantitative publications in German or English that focused on adolescents (aged 13–18) or adults who were either present, former or non-users of nutrition apps were eligible for inclusion. Individual barriers and facilitators were extracted and put into categories based on a qualitative content analysis. Multiple factors influencing participation with mobile weight reduction and weight maintenance therapies have been discovered by two systematic evaluations. These elements include social support, customisation, ease of use, entertainment, and the availability of tools like self-monitoring, prompts, and feedback. Dhanamjayulu, et.al,…[5] The usable information on human faces can be used to determine an individual's age, gender, weight, etc. Body mass index (BMI) and weight are two of these biometrics that are reliable predictors of health. Based on recent health science studies, this work proposes a regression approach based on the 50-layer Residual network architecture to investigate ways to identify malnourished individuals and obese individuals by evaluating body weight and BMI from facial photos. Multi-task Cascaded Convolutional Neural Networks have been used for face detection. A method is developed to assess BMI, age, and gender using real-time photographs of human faces. Obesity and malnutrition are frequently identified with the aid of BMI. The estimation of height, weight, and BMI using automated methods was done in earlier publications. Today's social networks, like Facebook, Instagram, and Snapchat, contain a variety of functions, including the trading of images, looking for a job, dating, and blogging. More and more people around the world are capturing their lives with digital cameras and publishing the records as images or videos on social media networks. The proposed method is useful in establishing the relation between the characteristics of the human face and the body, such as body height and weight the suggested technique to detect malnourished and overweight children from human faces. The proposed system does not require the full body real image of a person. Face detection is done with the Multi-task Cascaded Convolution Neural Networks on pictures with single/multiple faces. BMI, age, and gender are estimated from a person’s face using residual neural networks. The problems of BMI, age, and gender estimation are posed as three separate regression pattern classification problems in the dataset of facial images taken from the internet along with their metadata containing information like gender, age, and BMI.

IV. BACKGROUND OF THE WORK

For humans to survive, food is necessary. To better understand their eating habits and trends, many nowadays would want to record everything they consume each day. New nutrition evaluation methods based on contemporary methodologies provide up a new universe of possibilities for comprehending culinary tradition, examining dietary habits, directing daily recipes, and enhancing health. Recent developments in the fields of computer vision and deep learning are revolutionizing the way they analyze food data in the current system. Food-related images are typically challenging to identify and sluggish to detect due to the enormous number of food products and the ineffectiveness of the detection algorithm. Obtaining a diet plan is also entirely manual. People often had to wait a very long time when they visited their dietician to learn about the recommended diet plan. Receiving a diet plan as a result is quite inconvenient for users. From the perspective of the end user, this is not efficient.

V. PROPOSED WORK

Sufficient nutrition and energy consumption, which can only be obtained via 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 overeating 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 recognize and find food items from the input pictures, develop an automated nutrition analysis system. By 4 locating promising locations and classifying them with deep neural networks, a three-step approach for specifically recognizing various meals in images may be developed. In the initial stage, the automated system generates various regions of proposals using the provided photos. Then, it collects each region of ideas by locating them in the original pictures, displaying them on feature maps, and categorizing them into different food categories. Finally, by examining the nutritional elements in the images, determine the quantities of calories, fat, carbs, and protein to create a dietary evaluation report.

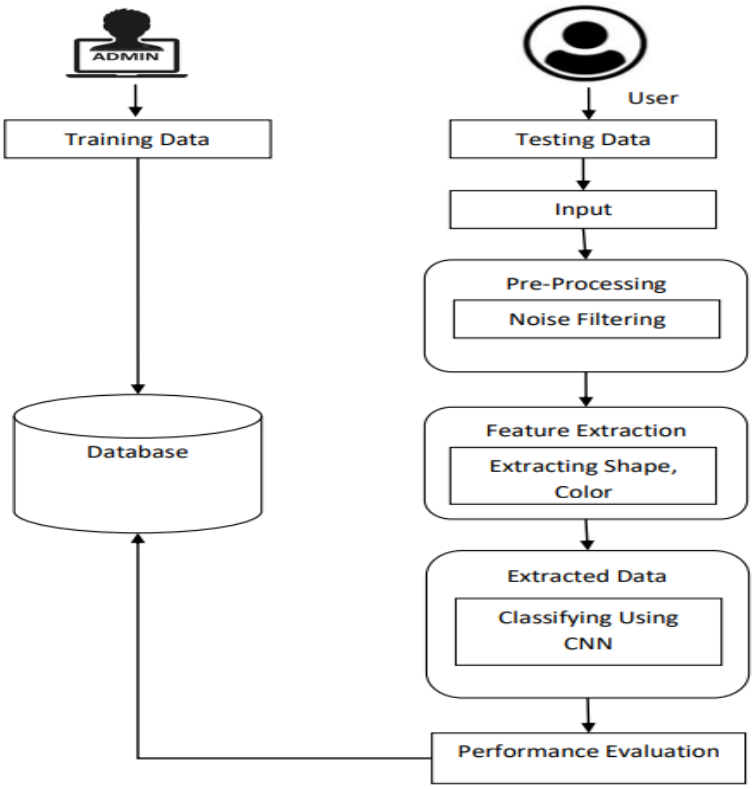

Fig 1: Proposed Architecture

UPLOAD IMAGE

Upload the nutrition datasets in this module. Additionally, the information is kept in a database for later use. The collection includes statistics on calories, protein, fat, carbs, vitamins, and cholesterol for fruits and vegetables. These numbers are preserved as integer values and acquired from the Kaggle website.

FILTERING NOISE

Filtering techniques minimize image noise so that the nutrients of the fruits or vegetables may be determined. The filter's objective is to eliminate the noise that spoils pictures. It is supported by a statistical analysis. The frequency response of a filter is designed typically. To decrease "salt and pepper" noise, filtering is a popular nonlinear image processing approach. When noise reduction and edge preservation are top concerns, a median filter is preferred over convolution.

CLASSIFICATION

The user-uploaded food image will be compared to the food items in the system database for the features collected in the feature extraction stage in the classification process. The specific food item will be recognised after the ideal match is discovered based on the qualities matched. The detected food item's name will be displayed over the food. Here, a convolution neural network approach is employed to classify data.

NUTRITION DETECTION

The image is sent to the food nutrition API once the model has identified the food category or food type, which extracts the food's nutritional data and provides it to the system. The system contrasts the nutritional information with the dietary allowance guidelines. If the user's intake of a certain nutrient—let's say calories—exceeds the recommended dietary allotment, a warning message advising them to lower their intake will be shown. If not, the user will be able to view the food's nutritional value.

METHODOLOGY

CONVOLUTIONAL NEURAL NETWORK:

- CNN feed-forward neural network is represented by combining the fully related convolutional layers and max.
- This takes advantage of spatial local correlation by enforcing the patterns of local connectivity between the adjacent layers of neurons.
- The complicated characters of the convolutional layers and easy cells in the mammalian visible cortex are mimicked and exchanged with max-pooling layers
- The forward and backward phases are repeated from some epochs. In each epoch, the following occurs:
- The inputs are propagated from the input to the output layer.
- The network error is calculated.
- The error is propagated from the output layer to the input layer.

VI. CONCLUSIONS

This research study suggests a technique for an automated food nutrition detection system that can estimate the quantity of nutrients in food. As of now, the computer can classify the meal into one of the several categories provided in the dataset. The classification made use of the popular food dataset. Using a deep learning method, the food photographs were categorized into the proper groups

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