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Machine Learning based Nutritional assistant using Convolution-al Neural Network

Nutri AI – Nutrition and Diet App

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Abstract : The nutrition assistant system proposed in the study is a technology-based solution to help individuals make healthier dietary choices. The system uses advanced machine learning techniques, specifically a convolution-al neural network (CNN), to accurately identify food items from images taken by the user's smartphone camera. The CNN model was trained on a large dataset of food images to ensure accurate identification of food items. The diet plan application integrated with the CNN model allows users to set their health goals and dietary preferences, such as vegetarian or gluten-free diets. Based on this information, the system provides personalized dietary recommendations and meal plans that meet the user's nutritional needs. The system not only identifies food items but also estimates portion sizes of the foods in the image, which is used to provide more accurate nutrient content information and track the user's daily caloric intake. The user study conducted to evaluate the system found that the system helped users make healthier food choices and understand their nutritional needs. The system's ability to provide personalized dietary recommendations was particularly valued by participants, who reported that it helped them better understand their nutritional needs and make more informed food choices. Overall, the nutrition assistant system has the potential to prevent diet-related health issues by providing tailored dietary recommendations that are specific to each individual's health goals and dietary preferences.

Index Terms **– Nutritional Assistant, Diet planning, Machine learning, Neural Network.**

I. INTRODUCTION

Artificial intelligence (AI) refers to the ability of machines or computer systems to perform tasks that would normally require human intelligence, such as understanding natural language, recognizing images, and making decisions. AI is a rapidly growing field with many applications, including robotics, healthcare, finance, and transportation.

One subfield of AI is machine learning (ML), which involves training computer systems to automatically improve their performance on a specific task based on data input. ML algorithms can identify patterns and make predictions based on large amounts of data, making it a powerful tool in many industries. One popular form of ML is deep learning, which uses neural networks to simulate the way the human brain works.

The new era of technology is characterized by the increasing use of AI and ML in various industries, as well as the development of new technologies that rely on these techniques. For example, self-driving cars, virtual assistants, and chat-bots all rely on AI and ML to function.

In healthcare, AI and ML are being used to improve medical diagnoses and develop personalized treatment plans. In finance, AI and ML are used for fraud detection and credit risk analysis. In transportation, AI and ML are being used to optimize traffic patterns and reduce accidents.

As these technologies continue to evolve and improve, they have the potential to revolutionize the way we live and work. However, it is important to also consider the ethical implications of AI and ML, such as data privacy and bias, to ensure that these technologies are being used in a responsible and equitable manner. The evolution of new technologies has been a driving force in human progress throughout history. From the development of fire and the wheel to the invention of the internet and artificial intelligence, technological advancements have continually reshaped the way we live and work.

One of the most significant drivers of technological evolution is the increasing availability of computing power. As computing power has become cheaper and more accessible, it has enabled the development of increasingly complex and sophisticated technologies.

Another important factor is the rise of interconnectedness and the internet. The internet has enabled unprecedented levels of collaboration and knowledge sharing, allowing new technologies to spread rapidly and accelerate the pace of innovation.

Technological evolution has also been driven by a number of key inventions and breakthroughs, such as the invention of the transistor, the development of the graphical user interface, and the creation of the World Wide Web.

Today, we are seeing the emergence of new technologies that are poised to revolutionize the way we live and work once again. These include technologies like 5G networks, autonomous vehicles, and the Internet of Things (IoT), as well as advancements in artificial intelligence and machine learning.

As these new technologies continue to evolve and mature, they are likely to bring about significant changes in many aspects of our lives, from how we communicate and work to how we travel and access healthcare. It is an exciting time to be alive, and the future promises to be full of even more incredible technological advancements. Machine learning has been increasingly used in food analysis and nutrition assistance in recent years, offering new insights into the composition of food and the nutritional needs of individuals.

One key area where machine learning is being used is in the analysis of food data, such as ingredient lists, nutritional labels, and recipes. By training machine learning models on large datasets of food data, researchers and nutritionists can gain a better understanding of the composition of different foods, the interactions between different nutrients, and the effects of food on health and disease.

In addition to food analysis, machine learning is also being used to develop personalized nutrition plans and dietary recommendations. By analyzing data on an individual's age, gender, weight, activity level, and health status, machine learning algorithms can generate customized nutrition plans that are tailored to each person's unique needs and goals. Machine learning is also being used in the development of new food products, such as plant-based alternatives to meat and dairy. By training machine learning models on large datasets of food properties and characteristics, researchers can identify new combinations of ingredients and optimize formulations to create new and innovative food products.

Overall, the use of machine learning in food analysis and nutrition assistance is helping to advance our understanding of nutrition and health, and to create new opportunities for personalized nutrition and food product development.

II. NEED OF THE STUDY

People can lead healthy lives by eating a balanced, nutritious diet. In the modern world, we cannot say for sure which foods are safe to eat and which cannot; similarly, we cannot say for sure which foods are nutritious and which are not. Food products all across the world have the nutritional facts label printed on them, and they are all displayed similarly. These nutritional facts include information on some of the main nutrients, such as carbs, protein, and others, that are contained in the food product.

The average person finds it difficult to understand these nutrition fact labels. These nutritional information may be understood by individuals who are diligent about their diet, such as those who routinely exercise and diet, trainers, and nutritionists, but not by the average person. The purpose of this project effort is to categorize these food products into five levels of healthiness ranging from very healthy to highly dangerous in order to make this information more easily available. A sequential sequence of data retrieval, data cleaning, data labeling, and supervised learning is used to accomplish this.

III. RESEARCH METHODOLOGY

3.1 Existing System

Along with identifying various kinds of fruits and vegetables, the approach also provides per serving calories for each meal that is recognized in a single image. In order to achieve this, we will ask the user to input a food image. To identify this food item, the SVM algorithm is employed. The next step uses morphological features from OpenCV to do image segmentation. The volume of the food is calculated after segmentation. After then, formulas are used to calculate the food's calories. A user may become very perplexed if there are several comparable apps available. Simple consumers find it difficult to use complex apps, which are not useful for all smartphone users. The accuracy of the nutritional information provided by existing nutritional assistant apps can vary widely. Some apps rely on user-generated content, which can be unreliable and inconsistent. Others may use outdated or inaccurate data. Some nutritional assistant apps lack features that encourage user engagement and motivation, which can lead to low usage and ultimately, poor results. Some nutritional assistant apps do not allow users to customize their goals or recommendations based on their individual needs, preferences, or dietary restrictions.

3.2 Proposed System

The goal of the project was to create a prototype system that could accurately detect and classify food images based on their attributes. To achieve this goal, the project used a pre-training model that was modified and trained with a large dataset of food images to improve its accuracy. The prototype system had three primary software components: a modified CNN model training module for classification purposes, a text data training module for attribute estimation models, and a display module. The CNN model was used to classify the food images based on their visual characteristics, while the text data training module was used to estimate the attributes of the food based on textual information provided by the user. The display module was used to show the results of the image and attribute classification to the user. To improve the accuracy of the categorization, the project experimented with a variety of food categories, each with thousands of photos. This helped to ensure that the pre-training model was trained on a diverse range of food images, which could improve its ability to accurately classify food images that it had not seen before.

3.3 Block Diagram

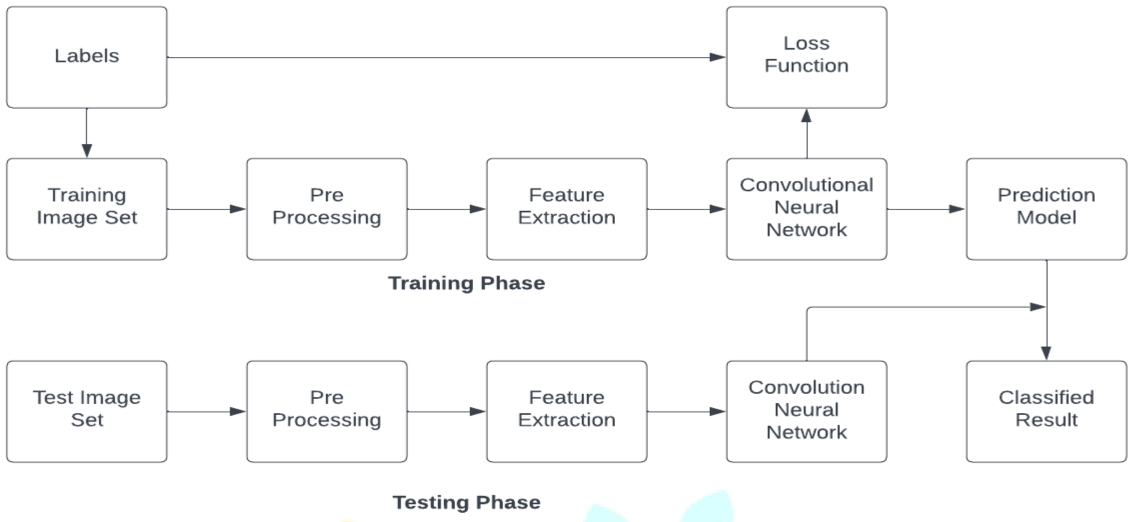

Fig 3.1 Block Diagram

3.4 Working Principle

3.4.1 Dataset Pre-Processing

Images are enhanced and resized during data per-processing since each image in the dataset varies depending on its size, making image scaling necessary for data training. Image enhancement techniques include gray scale conversion and histogram equalization.

3.4.2 Classification

The dataset is unbalanced; high accuracy indicates that it is biased towards the class and includes more image samples. The proposed model's predictions on the test dataset are displayed in the confusion matrix, which is also used to determine how many photos were mistakenly categorized. The rows and columns, respectively, represent the true class and expected class.

3.4.3 Training and Testing

The CNN training model is developed utilizing modified architecture following data pre-processing. Hyper parameter tweaking is used to maximize the model's accuracy. The dataset, the model file, and the classification test picture are prepared; during classification, the model file is used to do CNN prediction; and the outcome is classified.

3.4.4 Methodology

Step 1 Involves importing the necessary libraries (tensor flow, pickle, and keras).
Step 2 Involves building a sequential model that forms the layers sequentially.
Step 3 Involves importing convolution layers using TensorFlow's conv function.
Step 4: Apply necessary activation, such as relu and softmax, and adjust in accordance with attained precision.
Step 5: Apply a thick coating

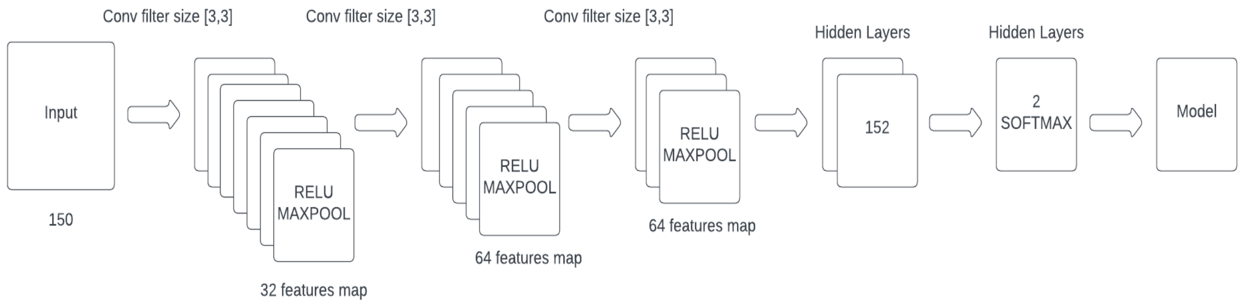

Fig 3.2 ER Diagram

IV. RESULTS AND DISCUSSION

4.1 The CNN model's training results

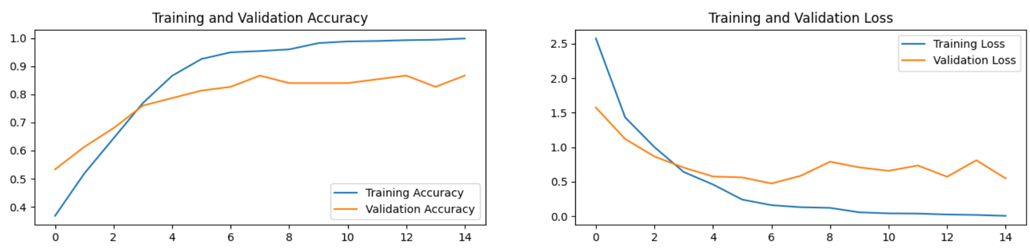

Fig 4.1 An illustration of the CNN model's improvisation by lowering the loss percentage and enhancing the model's effectiveness and accuracy

Fig 4.1 displays the comparison of the training stages where the loss % is reduced and the accuracy percentage is improved using the CNN model. The model is fed batches of training data and adjusting its parameters to minimize the loss function, which measures the difference between the predicted output and the true output. As the model trained for more epochs, it continued to make small adjustments to the parameters to further minimize the loss function, which led to a reduction in the lost percentage.

4.2 The User Interface

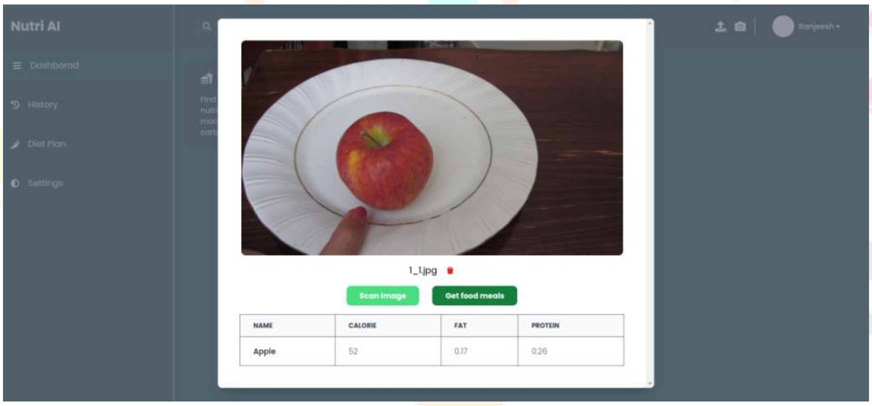

Fig 4.2 An illustration of the identification of calorie, fat and protein of a fruit

Fig 4.2 displays the interface which has a user login and registration form at the top, where users can log in and keep their information after being authenticated. After logging in they may search for meals based on calories, fat, protein, and geographies. There is a section dedicated to diet plans where users can sign up to receive notifications about suggested food diets or personalized diet plans. And the diet plan can also be shared from a remote place. Also, the interface offers the choice of uploading the image or capturing a real-time image from the camera and sending it to the back-end powered by a flash server. The back-end server gets the client's image, analyzes it, and then runs the image through the model to find the food.

REFERENCES

[1] Boshra Alshujaa,Fatima AlNuaimi,Wathiq Mansoor,Shadi Atalla,"Comparison of Food Calorie Measurement Using Image Processing and Machine Learning Techniques",2022 5th International Conference on Signal Processing and Information Security (ICSPIS).

[2] V Balaji Kasyap,N. Jayapandian,"Food Calorie Estimation using Convolutional Neural Network",2021 3rd International Conference on Signal Processing and Communication (ICPSC)

[3] Pramod B. Deshmukh,Vishakha A. Metre,Rahul Y. Pawar,"Caloriemeter: Food Calorie Estimation using Machine Learning",2021 International Conference on Emerging Smart Computing and Informatics (ESCI).

[4] Haoyu Hu,Zihao Zhang,Yulin Song,"Image Based Food Calories Estimation Using Various Models of Machine Learning",2020 5th International Conference on Mechanical Control and Computer Engineering (ICMCCE)

[5] Rutuja Rewane,P. M. Chouragade,"Food Recognition and Health Monitoring System for Recommending Daily Calorie Intake",2019 IEEE International Conference on Electrical Computer and Communication Technologies (ICECCT)

[6] I. Kovalskys, M. Fisberg, G. Gomez, R. G. Pareja, M. C. Yepez-Garcia, L. Y. Cortes-Sanabria, et al., "Energy intake and food sources of eight latin american countries: results from the latin american study of nutrition and health (elans)", Public Health Nutr., vol. 21, no. 14, 2018.

[7] Asta Tarute, Shahrokh Nikou and Rimantas Gatautis, "Mobile application driven consumer engagement", Telematics and Informatics, vol. 34, no. 4, pp. 145-156, January 2017.

[8] Shurouq Hijazi, Alex Page, Burak Kantarci and Tolga Soyata, "Machine Learning in Cardiac Health Monitoring and Decision Support", Computer, vol. 49, no. 11, pp. 38-48, Nov. 2016.

[9] G. Agapito, B. Calabrese, P. H. Guzzi, M. Cannataro, M. Simeoni, I. Caré, et al., "DIETOS: A recommender system for adaptive diet monitoring and personalized food suggestion", 2016 IEEE 12th International Conference on Wireless and Mobile Computing Networking and Communications (WiMob), 17-19 Oct. 2016.

[10] Yurong Zhong, "The analysis of cases based on decision tree", 2016 7th IEEE International Conference on Software Engineering and Service Science (ICSESS), Aug. 2016.
[11] Steven S Coughlin, Mary Whitehead, Joyce Q Sheats, Jeff Mastromonico, Dale Hardy and Selina A Smith, "Smartphone applications for promoting healthy diet and nutrition: a literature review", Jacobs journal of food and nutrition, vol. 2, no. 3, pp. 021, 2015.
[12] Shreya B. Ahire and Harmeet Kaur Khanuja, "A Personalized Framework for Health Care Recommendation", International Conference on Computing Communication Control and Automation, 26-27 Feb. 2015.
[13] Mechelle Gittens, Reco King, Curtis Gittens and Adrian Als, "Post-diagnosis management of diabetes through a mobile health consultation application", 16th International Conference on e-Health Networking Applications and Services (Healthcom), pp. 152-157, 2014.
[14] Bruno M Silva, Ivo M Lopes, Joel JPC Rodrigues and Pradeep Ray, "SapoFitness: A mobile health application for dietary evaluation", 13th International Conference on e-Health Networking Applications and Services, pp. 375-380, 2011.
[15] L. Zepeda and D. Deal, "Think before you eat: photographic food diaries as intervention tools to change dietary decision making and attitudes", International Journal of Consumer Studies, vol. 32, no. 6, pp. 692-698, 2008.