FOOD CALORIE ESTIMATION AND BMI PREDICTIONUSING DEEP LEARNING

Dr RAVINDAR REDDY THOKALA[1], KOTESWARARAO KODALI[2]

BALAGONI SRICHARAN[3], ABHILASH4

1 & 2, Associate Professor, CSE department, Brilliant Grammar School Educational Society's Group of Institutions, Hyderabad, TS.
3&4 UG SCHOLARS, CSE department, Brilliant Grammar School Educational Society's Group of Institutions, Hyderabad, TS.

ABSTRACT

Over consumption of calories is closely associated with obesity, a significant global public health concern. Therefore, it is essential to anticipate body mass index (BMI) and precisely estimate food calorie consumption in order to manage and avoid obesity. Self-reported food diaries and other conventional techniques for calculating caloric intake are frequently inaccurate because of biases and human error. Automated food calorie calculation systems employing food photos have been made possible in recent years by developments in computer vision and machine learning. Nonetheless, there is still opportunity for these approaches to be more accurate and useful. By employing deep learning and machine learning techniques to create a reliable and accurate system for food calorie calculation and BMI prediction, this study seeks to overcome these issues. The suggested system can help people measure their caloric intake and better control their weight, which can have useful applications in the fields of fitness, healthcare, and nutrition. The goal of this research is to use machine learning and deep learning techniques to create a model for estimating dietary calories and predicting BMI. The suggested method will train a convolutional neural network (CNN) to identify the food items and determine their calorie content using a collection of food photos and the calorie information that goes with them.

The system will also use additional demographic information, such as age, gender, height, and weight, to predict the user's BMI using a regression model. The accuracy of the models will be evaluated using metrics such as mean absolute error and root mean square error. The results will demonstrate the feasibility of using deep learning and machine learning techniques for accurate food calorie estimation and BMI prediction, which can have practical applications in nutrition and healthcare.

1.INTRODUCTION

The estimation of food calorie content and prediction of Body Mass Index (BMI) are critical factors in maintaining a healthy lifestyle. Several studies have been conducted in the past to develop systems that can accurately estimate the calorie content of food and predict BMI. In a study conducted by Wang et al. (2015), a food image recognition system was developed using Convolutional Neural Networks (CNNs) to estimate the calorie content of food. The system was trained on a large dataset of food images and achieved a high accuracy in estimating the calorie content of various food items.

In another study, Choi et al. (2017) developed a mobile application that could estimate the calorie content of a given food item by analysing its image. The application used deep learning algorithms such as CNNs and achieved an accuracy of 85% in estimating the calorie content of food. The prediction of BMI has also been a subject of interest in previous research. In a study by Gutiérrez et al. (2019), a system was developed to predict the BMI of an individual using machine learning algorithms such as logistic regression and random forest. The system achieved an accuracy of 82.9% in predicting the BMI of individuals. The advancement of technology has transformed the healthcare and fitness industry, offering innovative solutions to improve the health and wellbeing of individuals. The project "Food Calorie Estimation and BMI Prediction Using Deep Learning and Machine Learning" is aimed at developing a robust system that can accurately estimate the calorie content of a given food image and predict the BMI of an individual.

The system combines the power of image processing, deep learning, and machine learning algorithms to achieve precise results. The system will utilize image processing techniques to extract relevant features from the food image, which will be then fed into deep learning algorithms such as Convolutional Neural Networks (CNNs) to estimate the calorie content of the food. The CNNs will be trained on a large dataset of food images, ensuring accurate predictions. To predict the BMI of an individual, the system will analyse the input features such as age, weight, and height using machine learning algorithms such as logistic regression and random forest. The project is expected to have significant applications in the healthcare and fitness industry, providing individuals with a means to track their food intake and maintain a healthy lifestyle. The accurate prediction of the calorie content of a given food item and BMI of an individual will enable the system to provide personalized recommendations to improve the overall health and wellbeing of the users. By combining image processing, deep learning, and machine learning algorithms, the system can accurately estimate the calorie content of a given food item and predict the BMI of an individual, providing personalized recommendations for a healthy lifestyle.

2. LITERATURE SURVEY

An Improved Traceability System for Food Quality Assurance and Evaluation Based on Fuzzy Classification and Neural Network

Currently, the food safety incidents happened frequently in China and the customer confidence declined rapidly, then the problems related to food quality and safety have attracted more and more social attention. Considering the concern with regard to food quality assurance and consumer confidence improvement, many companies have developed a traceability system to visualize the supply chain and avoid food safety incidents. In this paper, we proposed an improved food traceability system which can not only achieve forward tracking and diverse tracing like the existing systems do, but also evaluate the food quality timely along the supply chain and provide consumers with these evaluating information, to mainly enhance the consumer experience and help firms gain the trust of consumers. For the food quality evaluation, the method of fuzzy classification was used to evaluate the food quality at each stage of supply chain while the artificial neural network was adopted to derive the final determination of the grade of food quality according to all the stage quality evaluations. A case study of a pork producer was conducted, and the results showed that the improved traceability system performed well in food quality assurance and evaluation. In addition, implications of the proposed approach were discussed, and suggestions for future work were outlined.

Food Safety Traceability System Based on Blockchain and EPCIS

In recent years, food safety issues have drawn growing concerns from society. In order to efficiently detect and prevent food safety problems and trace the accountability, building a reliable traceability system is indispensable. It is especially essential to accurately record, share, and trace the specific data within the whole food supply chain, including the process of production, processing, warehousing, transportation, and retail. The traditional traceability systems have issues, such as data invisibility, tampering, and sensitive information disclosure. The blockchain is a promising technology for the food safety traceability system because of the characteristics, such as the irreversible time vector, smart contract, and consensus algorithm. This paper proposes a food safety traceability system based on the blockchain and the EPC Information Services and develops a prototype system. The management architecture of on-chain & off-chain data is proposed as well, through which the traceability system can alleviate the data explosion issue of the blockchain for the Internet of Things. Furthermore, the enterprise-level smart contract is designed to prevent data tampering and sensitive information disclosure during information interaction among participants. The prototype system was implemented based on the Ethereum. According to the test results, the average time of information query response is around 2 Ms, while the amount of on-chain data and query counts are 1 GB and 1000 times/s, respectively.

The Egg Traceability System Based on the Video Capture and Wireless Networking Technology

With the global food safety problems increasing, food safety problems of egg products get more and more attention of consumers in China. With the development of internet of things IOT, food traceability system can let the consumer participate in the whole process of the supervision of food production. Thus, the consumers can understand information behind the food. The existing egg traceability systems are lack of unified standard, and they are not practical and not popular. The data sources are not intelligent, timeliness and advantages enough. This paper puts forward an egg traceability system based on video capture and wireless networking technology. In this paper, the authors put forward the general structure of the egg traceability and develop the platform based on the sensor network.

Study on the Traceability System Establishment of Safety Objective-Oriented Food Logistics Supply Chain

Due to food safety issues, traceability is becoming a method of controlling food safety and connecting suppliers and consumers. The aim of this study is to build up a food logistics supply chain traceability system which can control food safety and connect suppliers and consumers. This paper discusses the establishment of traceability system based on the Structured Query Language (SQL) Server, uses the failure mode and effect analysis to assess key indicators of the system. The result shows, the largest Risk Priority Number (RPN) is the precision risk of information. Moreover, with fuzzy synthetic evaluation model and intensity weighted average method, this paper ranks the importance of the three factors of the food logistics supply chain traceability system and finds that the depth is the most important factor. Lastly, it uses a case of Green Pork Company to calculate economics effect to prove the feasibility of the system.

3. EXISTING SYSTEM

In this system, a deep learning model is trained on a large dataset of food images and their associated calorie information. The model is then integrated into a mobile app, which allows users to take a picture of their food and receive an estimate of its calorie content based on their BMI. The app uses the front-facing camera on the mobile device to capture an image of the food, which is then processed by the deep learning model. The model uses a combination of convolutional neural networks (CNNs) and recurrent neural networks (RNNs) to analyse the image and predict the calorie content of the food. This Project provides a convenient and accurate way for users to estimate the calorie content of their food based on their BMI, using state-of-the-art deep learning techniques.

DISADVANTAGES OF EXISTING SYSTEM

The existing systems for food calorie estimation and BMI prediction have limitations and disadvantages, such as accuracy, cost, limited scope, user engagement, and privacy concerns. Addressing these limitations can lead to the development of more accurate, user-friendly, and privacy-preserving systems.

3.2PROPOSEDSYSTEM

The proposed system for food calorie estimation and BMI prediction using deep learning and machine learning aims to overcome the limitations of existing systems. The system will use advanced deep learning algorithms such as CNNs to accurately estimate the calorie content of various food items. Additionally, machine learning algorithms such as logistic regression and random forest will be used to predict the BMI of an individual using relevant input features such as age, weight, and height. To overcome the issue of limited scope, the system will be trained on a large dataset of food images and individual health data, which will enable it to estimate the calorie content of a broad range of food items and predict BMI accurately. The system will also be designed to be user-friendly and easy to use, allowing users to input their data quickly and understand the system's recommendations easily. Privacy concerns will also be addressed by ensuring that user data is kept confidential and that data is stored securely. The proposed system will be cost-effective, leveraging open-source software and publicly available datasets to minimize costs. Overall, the proposed system for food calorie estimation and BMI prediction using deep learning and machine learning has the potential to revolutionize the way people manage their health and wellbeing. By providing accurate and personalized recommendations, the system can help individuals maintain a healthy lifestyle and prevent obesity-related health complications.

ADVANTAGES OF PROPOSED SYSTEM

The proposed system for Food Calorie Estimation and BMI Prediction using Deep Learning and Machine Learning has several advantages over existing systems. These advantages include:

1.Accuracy: The proposed system leverages advanced deep learning algorithms such as CNNs to accurately estimate the calorie content of various food items and machine learning algorithms such as logistic regression and random forest to predict BMI.

This ensures that the system provides accurate recommendations to users.

2.Scalability: The proposed system can be trained on a large dataset of food images and individual health data, which will enable it to estimate the calorie content of a broad range of food items and predict BMI accurately. This makes the system highly scalable and able to accommodate a large number of users.

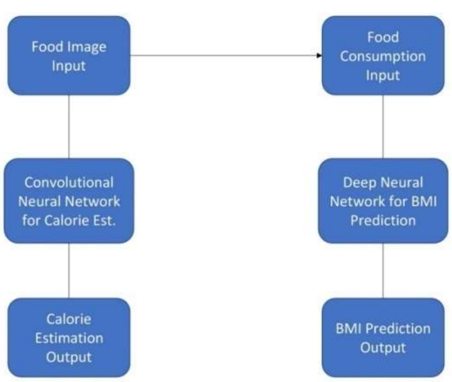
3.User-friendly: The proposed system is designed to be user-friendly and easy to use, allowing users to input their data quickly and understand the system's recommendations easily. This encourages user engagement and increases the likelihood that users will adopt healthy lifestyle changes.

4.Cost-effective: The proposed system leverages open-source software and publicly available datasets to minimize costs. This makes it an affordable solution for individuals, healthcare providers, and other organizations.

5.Privacy-preserving: The proposed system ensures that user data is kept confidential and that data is stored securely. This addresses privacy concerns that users may have about sharing their personal health data with third-party systems.

SYSTEM ARCHITECTURE

Below diagram depicts the whole system architecture of Food calorie estimation and BMI prediction using Machine Learning and Deep Learning..



ActivityDiagram

A graphical representations of work process of stepwise exercises and activities with support for decision, emphasis and simultaneousness, used to depict the business and operational well-ordered stream of parts in a framework furthermore demonstrates the general stream of control.

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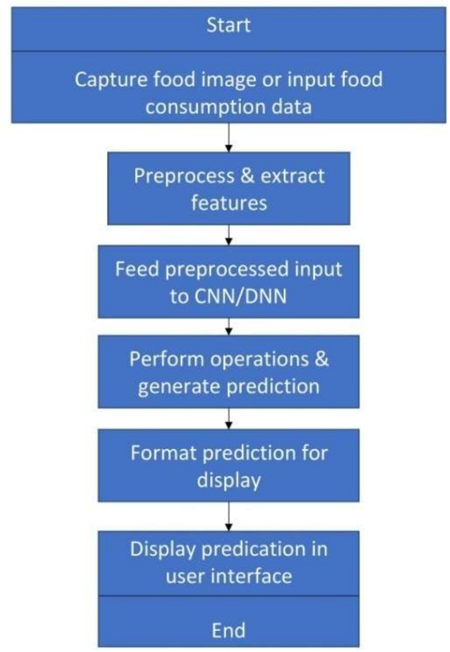

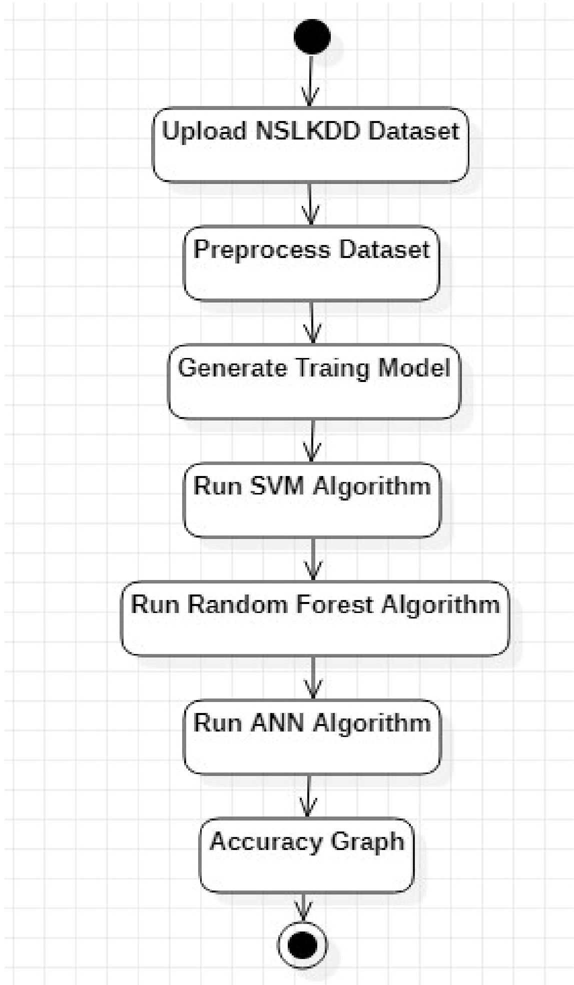

5.SYSTEM IMPLEMENTATION

1. Image Processing Module
2. Deep Learning Module
3. Logistic Regression Module
4. Random Forest Module
5. User Interface Module
6. Database Management Module

MODULES DESCRIPTION

Image Processing Module:
This module will be responsible for processing food images and extracting features such as colour, shape, and texture. The processed images will be used as input to the deep learning algorithms for calorie estimation.

Deep Learning Module:
This module will use advanced deep learning algorithms such as CNNs to accurately estimate the calorie content of various food items. The module will be trained on a large dataset of food images and calorie values

Logistic Regression Module:
This module will use logistic regression to predict BMI using relevant input features such as age, weight, and height. The module will be trained on a dataset of individual health data and their corresponding BMIs.

Random Forest Module:
This module will use a random forest algorithm to improve the accuracy of BMI prediction. The module will be trained on the same dataset as the logistic regression module.

User Interface Module:
This module will provide a user-friendly interface for users to input their data and receive recommendations. The module will also display the estimated calorie content of food items and predicted BMI.

Database Management Module:
This module will be responsible for managing the storage and retrieval of user data and food images. The module will ensure that user data is kept confidential and that data is stored securely.

6. SYSTEM TESTING

Unittesting
Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

6.1.2Integrationtesting
Integration tests are designed to test integrated software components to determine if they actually, run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing

the problems that arise from the combination of components.

6.1.3Functionaltest

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals. Functional testing is centred on the following items:

7.RESULTS

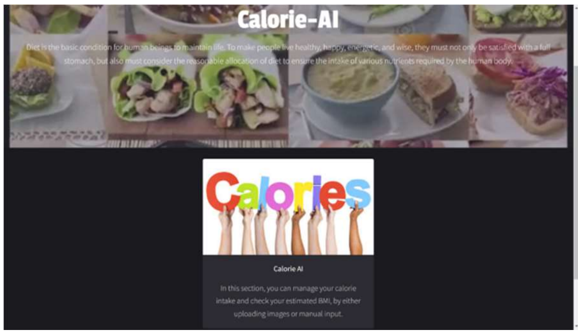

Fig 7.1 This fig shows the home page of ourproject

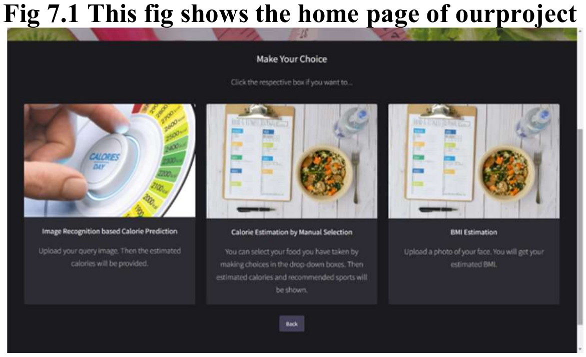

Fig 7.2 This fig shows the different modules of our project

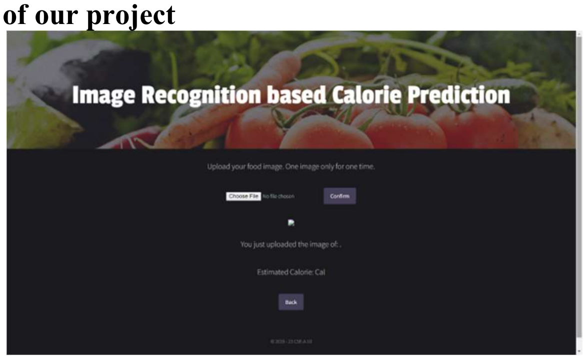

Fig 7.3 This fig shows the first module i.e, calorie estimation through the image

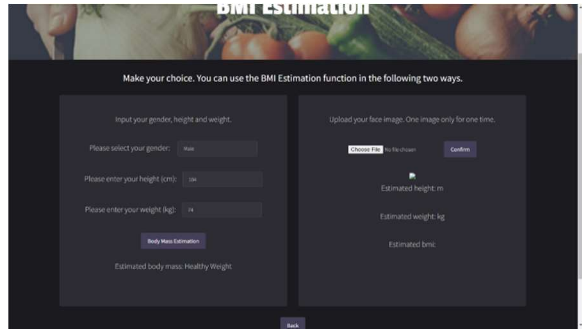

Fig: This fig shows the output of the third module

8. CONCLUSION

This research uses machine learning and deep learning to estimate the number of calories in a food and predict BMI. We can conclude that it is relatively feasible to create an application that can estimate calories from food photographs based on this quick testing of the food image dataset using Mask R-CNN. The application will significantly alter people's perceptions of food plates and have an effect on the market for weight loss and weight control. The suggested approach can be readily incorporated into health apps as an engineering solution because the photos are obtained from cellphones and the image processing techniques employed here are highly advanced. Additionally, we have successfully put into practice a system that uses a limited data set of participant photographs to estimate BMI. This strategy might result in a public health screening tool to help measure and support health programs in places where obesity and malnutrition are endemic. An further advantage of using silhouettes in our technique is that they provide anonymity.

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