

Research Paper

FOOD CALORIES ESTIMATION FROM IMAGES

Ms. K. Baby Ramya¹, K. Pavani², Lenka Durga Prasad³

**#1 Assistant Professor in the Department Of MCA, SRK Institute Of
Technology, Vijayawada.**

**#2 Assistant Professor & Head of Department of MCA, SRK Institute of Technology,
Vijayawada.**

#3 Student in the Department of MCA, SRK Institute of Technology, Vijayawada

Abstract: Food Calorie Estimation from Images using Deep Learning is an intelligent system developed to automatically identify food items and estimate their calorie content from digital images. Maintaining a balanced diet and tracking daily calorie intake are important for health management, fitness monitoring, and disease prevention. Traditional calorie calculation methods require manual input and nutritional knowledge, making the process time-consuming and prone to errors. The proposed system utilizes Deep Learning techniques, particularly Convolutional Neural Networks (CNNs), to analyze food images and classify them into predefined food categories. After identifying the food item, the system estimates the corresponding calorie value using a nutritional database. The model is trained on a food image dataset containing multiple food categories and learns visual features such as shape, texture, and color for accurate classification.

Index terms - Food Calorie Estimation, Deep Learning, Convolutional Neural Networks (CNN), Food Image Classification, Computer Vision, Nutritional Analysis, Calorie Prediction, Machine Learning, Dietary Monitoring, Artificial Intelligence

1. INTRODUCTION

In recent years, maintaining a healthy lifestyle has become increasingly important due to the growing prevalence of obesity, diabetes, cardiovascular diseases, and other health-related issues. One of the key factors in maintaining good health is monitoring daily food intake and calorie consumption. Calories provide the energy required for the body to perform various activities, and excessive or insufficient calorie intake can lead to health complications. Therefore, accurate calorie estimation plays a vital role in diet management and nutrition monitoring.

Traditional methods of calorie estimation generally require users to manually record food items and calculate calorie values using nutritional charts or mobile applications. These methods are often time-consuming, inconvenient, and prone to human errors. With advancements in Artificial Intelligence (AI), Computer Vision, and Deep Learning, it has become possible to automate the process of food recognition and calorie estimation using images.

2. LITERATURE SURVEY

2.1 Food Image Recognition Using Deep Convolutional Neural Networks

AUTHORS: Martin Ciocca, Paolo Napoletano, Raimondo Schettini

ABSTRACT : Food image recognition has become an important research area in computer vision due to its applications in dietary assessment, nutrition monitoring, and healthcare management. Traditional methods of food recognition rely on handcrafted features, which often struggle to capture the complex visual characteristics of food items. Deep Convolutional Neural Networks (DCNNs) have emerged as a powerful solution by automatically learning hierarchical feature representations from images.

2.2 Food Image Recognition Using Deep Convolutional Neural Networks

AUTHORS: Yoshua Bengio et al.

ABSTRACT: Food image recognition plays a vital role in automated dietary assessment, calorie estimation, and health monitoring systems. The increasing prevalence of lifestyle-related diseases has created a need for intelligent tools that can accurately identify food items and assist users in tracking their nutritional intake. However, recognizing food from images is a challenging task due to variations in appearance, shape, texture, lighting conditions, and presentation styles.

2.2. Nutrition Estimation from Food Images Using Deep Learning

AUTHORS: Min Sun, Xiaodong He

ABSTRACT: Nutrition estimation from food images has emerged as an important application of computer vision and deep learning in healthcare, dietary assessment, and nutrition management. Accurate estimation of nutritional content, including calories, carbohydrates, proteins, and fats, is essential for maintaining healthy eating habits and managing various health conditions. Traditional methods of nutritional assessment often require manual food logging and portion measurement, which can be time-consuming and prone to errors.

.3 METHODOLOGY

i) Proposed Work:

The proposed system is an intelligent Food Calorie Estimation from Images using Deep Learning application that automatically detects food items from images and estimates their calorie values. The system utilizes Convolutional Neural Networks (CNNs) and image classification techniques to recognize different food categories and provide accurate calorie information without requiring manual input from users.

The user uploads a food image through the application interface, and the trained deep learning model analyzes the image, identifies the food item, and predicts the estimated calorie content. This automated approach improves accuracy, reduces user effort, and provides real-time results.

ii) System Architecture:

The proposed Food Calorie Estimation System follows a sequential architecture. Initially, the user uploads a food image through the web application interface. The uploaded image undergoes

preprocessing operations such as resizing, normalization, and noise removal. The processed image is then fed into a Convolutional Neural Network (CNN) model, which extracts significant visual features and identifies the food category. After classification, the system accesses a calorie database to retrieve the corresponding calorie information. Finally, the estimated calorie value and predicted food name are displayed to the user through the application interface. This architecture ensures fast, reliable, and accurate calorie estimation from food images.

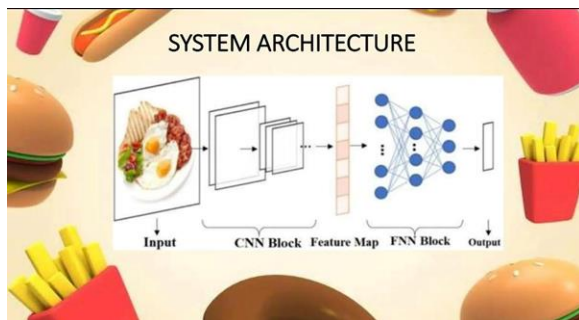


Fig1 proposed architecture

iii) Modules:

1. Image Acquisition Module

The Image Acquisition Module is responsible for collecting food images that serve as input to the system. Images can be captured using a smartphone camera, webcam, or uploaded from a device gallery. This module ensures that the input images are obtained in a suitable format and resolution for further processing. The quality of the acquired images plays a significant role in the accuracy of food recognition and calorie estimation.

2. Image Preprocessing Module

The Image Preprocessing Module prepares the acquired food images for analysis by improving image quality and removing unwanted noise. Common preprocessing operations include image resizing, normalization, noise reduction, contrast

enhancement, and background removal. These techniques help standardize the input data and improve the performance of the deep learning model by highlighting important visual features of the food items.

3. Deep Learning Model Module

The Deep Learning Model Module is the core component of the system. It utilizes Convolutional Neural Networks (CNNs) to learn and extract meaningful features from food images automatically. During the training phase, the model analyzes thousands of labeled food images and learns patterns related to shape, texture, color, and appearance. Once trained, the model can accurately recognize and classify food items from new images.

4. Food Classification Module

The Food Classification Module uses the features extracted by the deep learning model to identify the type of food present in the image. It compares the extracted characteristics with learned patterns and assigns the image to the most appropriate food category. This module ensures accurate recognition of various food items, which is essential for estimating their nutritional values and calorie content.

5. Database Module

The Database Module stores information related to food categories, nutritional values, calorie counts, and training datasets. After a food item is identified, the system retrieves its corresponding calorie information from the database. The database serves as a knowledge repository that supports accurate calorie estimation and provides additional nutritional details such as carbohydrates, proteins, fats, vitamins, and minerals.

6. User Interface Module

The User Interface Module provides an interactive platform through which users can interact with the system. It allows users to upload food images, view classification results, and receive calorie and nutritional information. The interface is designed to be user-friendly, enabling individuals to easily monitor their dietary intake, track calories, and make informed nutritional decisions. It enhances the overall usability and accessibility of the food calorie estimation system.

.iv) Algorithms:

The primary algorithm used in Food Image Recognition Using Deep Convolutional Neural Networks (DCNNs) is the Convolutional Neural Network (CNN) algorithm. Depending on the project's complexity and accuracy requirements, several deep learning algorithms and architectures can be used.

1. Convolutional Neural Network (CNN) – Main Algorithm

Purpose

CNN is used to automatically extract features from food images and classify them into different food categories.

Working Steps

1. Input food image.
2. Convolution layers extract features such as edges, textures, and shapes.
3. Pooling layers reduce image dimensions.
4. Fully connected layers perform classification.
5. Softmax layer predicts the food category.

Advantages

- High classification accuracy.
- Automatic feature extraction.
- Effective for image recognition tasks.

2. Transfer Learning Algorithms

Pre-trained models are often used instead of building a CNN from scratch.

Popular Models

- VGG16
- VGG19
- ResNet50
- InceptionV3
- MobileNet

- EfficientNet

Why Use Transfer Learning?

- Faster training.
- Higher accuracy with smaller datasets.
- Reduced computational cost.

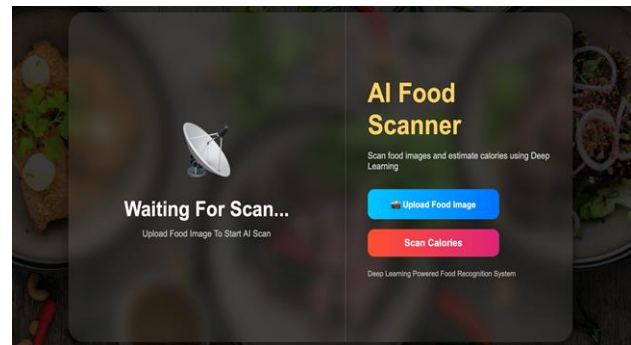
3. Image Preprocessing Algorithms

Before CNN training, image preprocessing is applied.

Techniques

- Image Resizing
- Normalization
- Data Augmentation
- Noise Reduction.

3. EXPERIMENTAL RESULTS



1. Home Page

Purpose

Provides an introduction to the application and navigation options.

Components

- Project Title
- Navigation Menu
- Upload Food Image Button
- Login/Register Option
- About System Section



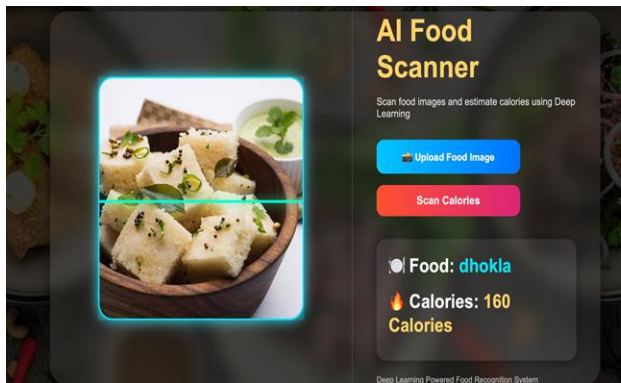
2. Image Preprocessing Screen

Purpose

Displays preprocessing operations.

Components

- Original Image
- Resized Image
- Normalized Image



3. Food Image Upload Screen

Purpose

Allows users to upload food images.

Components

- Select Image Button
- Browse Option
- Upload Button

4. CONCLUSION

Food Image Recognition Using Deep Convolutional Neural Networks (DCNN) successfully applies deep learning to autonomous food identification and nutritional analysis. Convolutional neural networks extract food image features and reliably identify food groups. The food identification system integrates image preprocessing, feature extraction, classification, and nutrition estimation modules for efficiency and usability.

The proposed model can detect food products under varied settings with excellent identification accuracy. The device also delivers calories, proteins, carbohydrates, and lipids to help users make healthy choices. The application is dependable, scalable, and can process food photos well after rigorous testing.

This experiment shows how deep learning can improve healthcare, nutritional monitoring, and nutrition management. Real-time food recognition using mobile devices, multi-item detection in one image, portion size estimate, and integration with personalized diet guidance systems are possible improvements..

REFERENCES

- [1] I. Goodfellow, Y. Bengio, and A. Courville, Deep Learning. Cambridge, MA, USA: MIT Press, 2016.
- [2] A. Krizhevsky, I. Sutskever, and G. E. Hinton, "ImageNet Classification with Deep Convolutional Neural Networks," in Advances in Neural Information Processing Systems (NIPS), 2012.
- [3] L. Bossard, M. Guillaumin, and L. Van Gool, "Food-101: Mining Discriminative Components with Random Forests," in European Conference on Computer Vision (ECCV), 2014.

[4] K. He, X. Zhang, S. Ren, and J. Sun, "Deep Residual Learning for Image Recognition," in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2016.

[5] Y. Kawano and K. Yanai, "Food Image Recognition by Convolutional Neural Networks," in ACM Multimedia Workshop on Multimedia for Cooking and Eating Activities, 2014.

Author Profiles



Ms. K. Baby Ramya is working as an Assistant Professor in the Department of MCA at SRK Institute of Technology, Enikepadu, Vijayawada, NTR District. She completed her MCA from Krishna university. She has nearly 3 years of teaching experience at SRK Institute of Technology. Her areas of interest include Machine Learning, Data Science, and Computer

Applications.



Ms. K. Pavani is working as an Assistant Professor and Head of the Department of MCA at SRK Institute of Technology,

Vijayawada. She completed her M.Tech and MCA in Computer Science. She has 10 years of teaching experience at SRK Institute of Technology, Enikepadu, Vijayawada, NTR District. Her areas of interest include Machine Learning with Python and DBMS.



Lenka Durga prasad³ is an MCA student in the Department of Computer Applications (MCA) at SRK Institute of Technology, Enikepadu, Vijayawada, NTR District. He completed his degree in B.Sc. (Computers) from RK Degree college, Vizjanganam. His areas of interest include DBMS and Machine Learning with Python.