NATIONAL UNIVERSITY OF MODERN LANGUAGES
ISLAMABAD

Computer Vision

Semester Project

Submitted to
Mr. Muhammad Waqar

Submitted By

Junaid Asif	BSAI-144
Syed Qasim Ali	BSAI-161
M. Khizar Baig	BSAI-156
Haris Nawaz	BSAI-158

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Food Recognition & Calorie Estimation Using Computer Vision

1. Introduction

In today's health-conscious world, monitoring calorie intake is essential but often neglected due to the manual effort involved. This project proposes a computer vision-based solution that enables users to **upload an image of food**, **automatically recognize the dish**, and **estimate its calories** using deep learning models and image processing.

The objective of this application is to **automate food recognition** using convolutional neural networks (CNNs) and to **map the predicted food class to an average calorie value** for health tracking purposes.

2. Problem Statement

Manual calorie tracking is time-consuming and inaccurate for many users. The need for a **convenient and automated tool** to identify food and estimate calories can help users maintain a healthier lifestyle. This project aims to solve that by developing a deep learning-based system that takes an image of food as input and returns the food name along with its calorie estimate.

3. Objectives

- Automatically recognize food from an image using a CNN model.
- Estimate calories based on the food class.
- Build a user-friendly Streamlit interface.
- Deploy a working prototype as a local application.

4. Methodology

4.1 Dataset

- **Dataset Used:** Food-101
- **Size:** 101,000 images across 101 categories.
- **Source:** Kaggle: https://www.kaggle.com/datasets/kmader/food41
- Data is divided into training and test sets (750 train / 250 test per class).

4.2 Data Preprocessing

- All images resized to **224×224**.
- Normalized pixel values to the range [0,1].
- Used **ImageDataGenerator** for rescaling and splitting the data.

4.3 Model Architecture

- **Transfer Learning Model:** MobileNetV2 (pretrained on ImageNet)

- **Final Layers Added:**
  - GlobalAveragePooling2D
  - Dense layer with Softmax (output: 101 classes)
- **Optimizer:** Adam
- **Loss Function:** Categorical Crossentropy

4.4 Training Environment

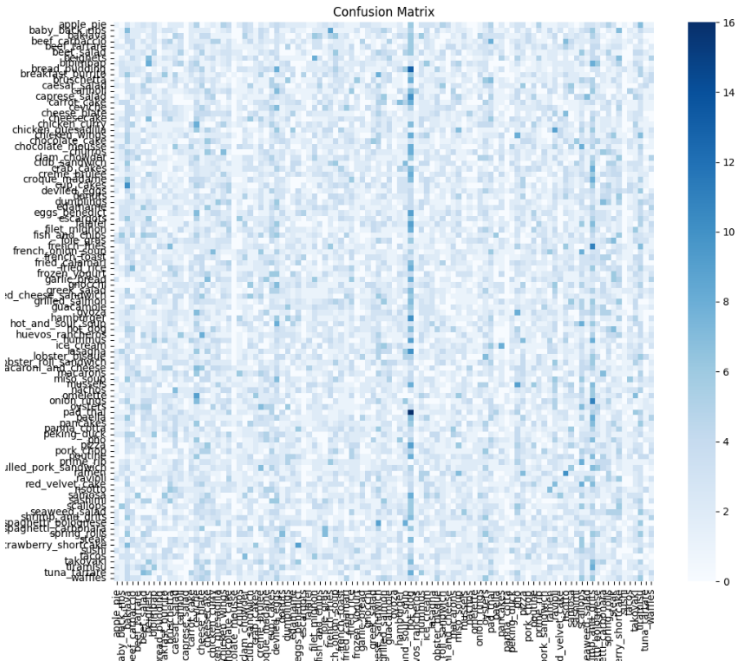
- Model trained using **Kaggle Notebook**.
- 5 epochs (can be increased for better accuracy).
- Model saved as food_model.h5 for deployment.

5. Evaluation

Metrics Used

- Accuracy
- Precision
- Recall
- F1-Score
- Confusion Matrix

Confusion Matrix



The model performs well on high-frequency classes like **pizza**, **burger**, and **sushi**. Some confusion is observed between visually similar classes like **spaghetti bolognese** and **spaghetti carbonara**.

6. Calorie Estimation

A CSV file calories.csv was manually created to map each of the 101 food categories to an average calorie per serving. For example:

Food	Calories
pizza	266
sushi	200
burger	354
apple_pie	296
...	...

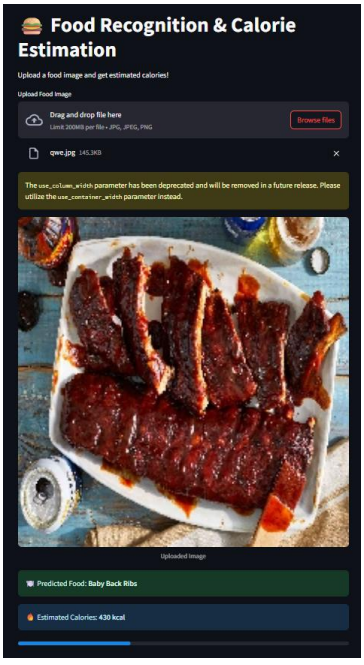
The app looks up the calorie value of the predicted food class and displays it to the user.

7. Deployment

Tool Used: Streamlit

Features:

- Upload image of food
- Predict food category using pretrained CNN
- Display calorie estimate



8. Future Work

- Extend calorie estimation to include **portion size** using bounding boxes or volume estimation.
- Add **multiple food item detection** per image.
- Add **nutrition facts** beyond just calories (protein, fat, carbs).

9. Conclusion

This project demonstrates how deep learning and computer vision can solve a real-world problem of food recognition and calorie estimation. The system is fast, user-friendly, and scalable. With further enhancements, it could be used in health apps, fitness trackers, or diet logging tools.