Food Classification and Calorie Count using Deep Learning

*A Course Project Report Submitted in partial fulfillment of the course requirements for the award of grades in the subject of*

**Deep Learning**

by

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## *Certificate*

This is Certified that the project entitled **“Food Classification and Calorie Count using Deep Learning”** which is an experimental & Simulation work carried out by Swapnil Valvekar (2210030001) ,in partial fulfillment of the course requirements for the award of grades in the subject of **Deep Learning**, during the year **2024-2025**. The project has been approved as it satisfies the academic requirements.

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**Topic: Food Classification and Calorie Count using Deep Learning**

**1. Project Overview:**

The goal of this project is to develop an intelligent system that classifies food items from images and estimates their calorie content using deep learning techniques. The system will utilize Convolutional Neural Networks (CNNs) to recognize food items and a regression model to predict calorie values based on the identified food category.

**2. Key Concepts:**

* 1. **Convolutional Neural Networks (CNNs):**
* CNNs are a class of deep learning models specifically designed for image processing. They utilize convolutional layers to extract spatial hierarchies of features from images, making them highly effective for food classification tasks.

**CNN Functionality:**

* Extracts relevant features such as texture, shape, and colour from food images.
* Uses multiple layers, including convolutional, pooling, and fully connected layers, to improve accuracy.
* Outputs the predicted food category.

**2.2 Calorie Estimation:**

After classification, the calorie content of the food is estimated using a regression model. This model maps the identified food category to an approximate calorie count based on predefined nutritional data.

**3. Steps in Building the Project:**

**3.1 Dataset Preparation:**

* Use the Kaggle Food-101 dataset, which contains 101 food categories with 1,000 images per category.
* Perform preprocessing, including resizing, normalization, and augmentation, to improve generalization.

**3.2 Model Selection:**

* Use a pre-trained CNN model such as ResNet, VGG16, or MobileNet for food classification.
* Train a separate regression model to estimate calorie content based on classification results.

**3.3 Model Training and Evaluation:**

* Train the CNN model using labelled food images.
* Fine-tune hyperparameters such as learning rate, batch size, and number of epochs.
* Validate the model using a test dataset to measure accuracy and loss.

**3.4 Integration of Calorie Estimation:**

* Map classified food items to their calorie values using a lookup table or a trained regression model.
* Improve accuracy by incorporating portion size estimation.

**3.5 User Interface:**

* Develop a simple web or mobile interface allowing users to upload food images.
* Display classified food items along with estimated calorie values.

**4. Outcome of the Project:**

* **Accurate Food Classification:** The system will identify food items with high precision using CNNs.
* **Calorie Estimation:** Users will receive an estimate of the calorie content of their food based on recognized categories.
* **Efficient Processing:** The model will deliver real-time predictions with optimized computational efficiency.

**5. Challenges Faced:**

* **Dataset Availability:** Ensuring a comprehensive dataset that covers a wide variety of foods.
* **Calorie Estimation Accuracy:** Accounting for portion sizes and variations in preparation methods.
* **Model Overfitting:** Regularizing the model to prevent it from memorizing training data instead of generalizing well.

**6. Future Enhancements:**

* **Integration with a Nutrition Database:** Enhancing calorie estimation by pulling nutritional information from a verified database.
* **Multi-Food Recognition:** Improving the system to recognize multiple food items in a single image.
* **Portion Size Estimation:** Incorporating depth estimation techniques to improve calorie count accuracy.

**7. Conclusion:**

This project successfully implements a food classification and calorie estimation system using deep learning. By leveraging CNNs for classification and regression models for calorie prediction, the system provides accurate and efficient dietary analysis. Future improvements can further enhance accuracy and usability, making it a valuable tool for health-conscious users.

**8.Output:**





