Indian Food Image Classification Using Transfer Learning

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Abstract— **Classification has been facilitated by the advancements in deep learning, coupled with the accessibility of larger datasets and enhanced computational capabilities. Among the various techniques, the convolutional neural network stands out as the predominant and widely adopted method for image classification in recent times. This project focuses on classifying images from an Indian food dataset using a range of transfer learning approaches.**

The significance of food in human life cannot be overstated, as it serves as a crucial source of essential nutrients. It is imperative for individuals to be mindful of their dietary choices to maintain a healthy lifestyle. Consequently, food classification plays a pivotal role in promoting overall well-being.

In contrast to conventional approaches that involve building models from scratch, this project leverages pre-trained models. This not only reduces computational overhead and costs but also leads to improved outcomes. The dataset comprises 20 classes of Indian food, with 500 images allocated to each class for training and validation.

Keywords: **- Classification, Deep learning, larger datasets, Computational resources, Convolutional neural network, Image classification, Transfer learning, Indian food dataset**

I. INTRODUCTION

The task at hand revolves around the classification of Indian food images, employing the powerful technique of transfer learning. With the ever-increasing availability of computational resources and expansive datasets, classification tasks have seen significant advancements, especially in the domain of image recognition. Among these methods, transfer learning has emerged as a widely utilized approach for leveraging pre-trained models to address specific classification tasks.

Indian cuisine holds a distinctive place in culinary culture, offering a diverse array of flavours, ingredients, and dishes. Recognizing and classifying these foods through automated image analysis presents valuable applications, not only for culinary enthusiasts but also for nutritional assessment and dietary planning. This project focuses on harnessing the potential of transfer learning to accurately categorize Indian dishes, streamlining the process and potentially yielding superior results.

By capitalizing on pre-existing models, we aim to circumvent the need for building classification models from the ground up, consequently saving valuable computation time and resources. The dataset under consideration encompasses a diverse range of Indian food items, comprising a total of 20 classes, each containing 500 images. This extensive dataset serves as the cornerstone for training and validating the classification models, ensuring robust and reliable performance.

II. PROBLEM STATEMENT

The Indian Food Classification application is the application that will be hosted. So, a user or visitor can visit the application check for the recipes by using image processing. The main purpose of project is to find out food Recipe by using Image Processing. We take input as an image and give output as Name, Ingredients as well as Process of Recipe

III. LITERATURE SURVEY

The literature survey delves into various approaches in automated food image classification and recognition, leveraging deep learning techniques for diverse applications. Studies explore the utilization of convolutional neural networks (CNNs) such as SqueezeNet, VGG-16, Google InceptionV3, and even deep generative adversarial networks (GANs) for this purpose. These approaches demonstrate significant advancements in food classification accuracy, with techniques like transfer learning and fusion learning playing crucial roles. Additionally, there's a focus on addressing challenges such as limited training data and the need for extensive labelling, leading to the development of more efficient and cost-effective recognition systems.

IV. PROPOSED SYSTEM

The Indian Food Dataset. The dataset considered for our study is the Indian Food dataset. It contains 20 different classes of food and each class has 500 sample im- ages. The dataset inherently comes with a lot of noise since there are images in which there is more than one food item.

Image preprocessing the dataset contains 20 different classes of food images. Each class of image is divided into training and testing images wherein 400 images from each class are considered as training samples and the remaining 100 samples as test samples. Overall, there are 8000 training samples and 2000 test samples. The training set images are fed to the CNN model and validation is made using the test dataset.

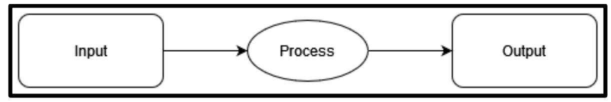
Training the CNN classifier using pretrained models the greater part of the Computer Vision Problems doesn't have exceptionally huge datasets (10,000 images - 50,000 images). In transfer learning early layers will detects edges, middle layers detect the shapes and the last layers will detect some high-level data features. These transfer learning models are useful in many computers vision and image classification problem.

Validation and Testing - Once the model is trained using the train dataset (the sample of data used to fit the model) then validated using validation dataset (The sample of data used to provide an unbiased evaluation of a model fit on the training dataset while tuning model hyper parameters.) and finally tested using the test dataset.

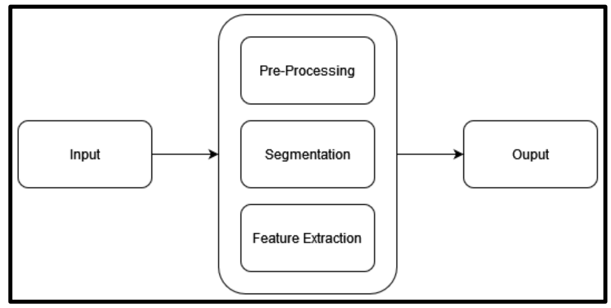
Calories extraction of the classified image. Finally, our classifier can be used to estimate the calorific content of the classified food from the internet. Suitable python or any scripts can be used to perform web scraping to fetch the nutrition facts for the classified image from the web and provide it to the user.

V.DESIGN

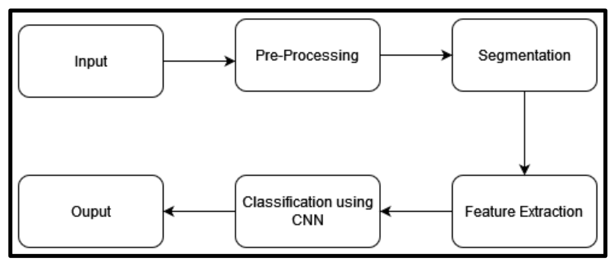
A. Data flow diagram



The Level 0 DFD represents the main components of the System.



The Level 1 DFD provides a more detailed view of the key components of the System.



Level 2 DFD

B. UML Diagrams 1. Use case diagram

The provided image depicts a sequence diagram illustrating the potential workflow of a food image classification system. In this system, users interact by providing food images (step 2), which are then pre-processed (step 3) and segmented (step 4) before being classified via a Convolutional Neural Network (CNN).

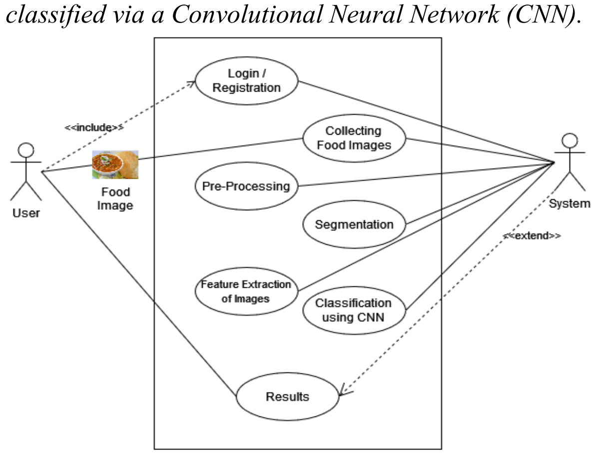


Fig. Use Case Diagram

2. Activity Diagram

Activity diagrams illustrate the workflow of the whole system.

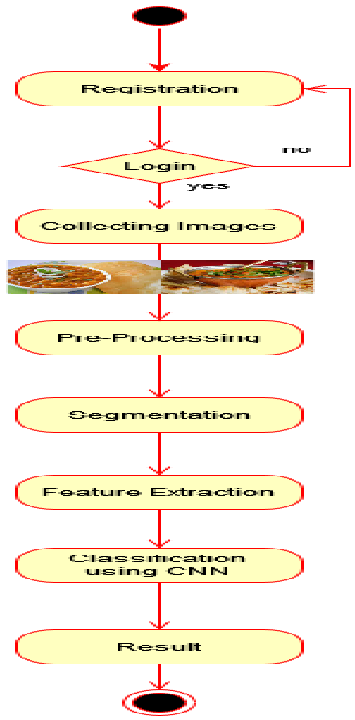


Fig. Activity Diagram

Sequence Diagram

The series of interactions between the user and the system during the user interaction with system.

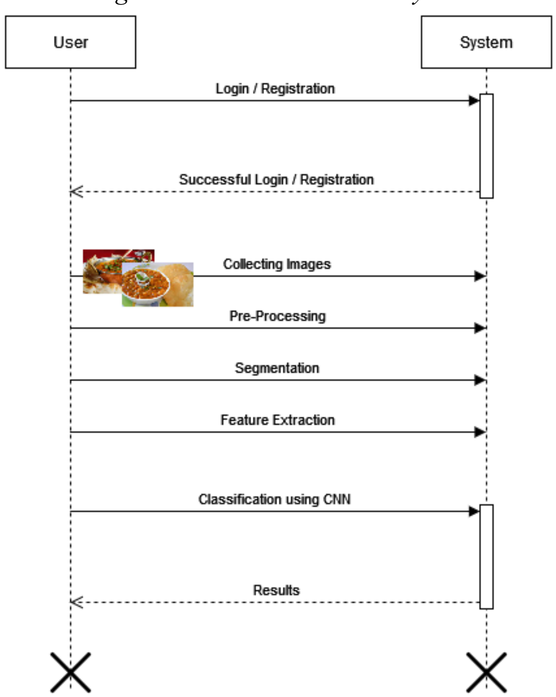


Fig. Sequence Diagram

3. Class Diagram

The class diagram gives the detail view of the systems classes and their association with each other. This user interaction could involve users providing food images to the system for various purposes, such as recipe suggestions, dietary analysis, or food logging. By understanding these interactions and user needs, the research aims to develop and improve food image classification systems for a variety of user-centric applications. This approach aligns with the growing interest in leveraging technology for personalized dietary management and food-related tasks.

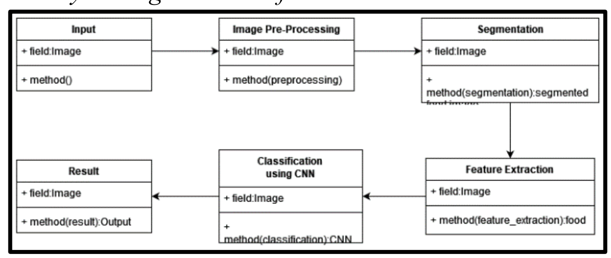


Fig. Class Diagram

V. IMPLEMENTATION

Implementing a food image classification system involves harnessing several techniques. First, a diverse dataset of labelled food images is acquired and then pre-processed for consistency through techniques like resizing and colour normalization. Next, a machine learning model, often a Convolutional Neural Network (CNN), is chosen and trained. Training involves feeding the pre-processed images and their labels to the model, allowing it to learn features that distinguish between food categories. This process iteratively adjusts the model's internal parameters to improve classification accuracy. Finally, the model's performance is evaluated on a separate testing set to ensure it generalizes well to unseen data. The trained model can then be deployed in various applications, like dietary tracking or recipe recommendation tools. Techniques like transfer learning and data augmentation can further improve the model's performance and robustness.

VI. CONCLUSION

In this proposed system, the Convolutional Neural Network, a Deep learning technique is used to classify the food images in to their respective classes. The dataset considered is the Indian food dataset and train dataset using CNN algorithm. Indian food image classification system, classify the which type of food and recipe and also to automatically analyses the dietary and calorie information.

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