

Abstract

In this project, we present a proof of concept for an efficient cooking assistant system which can automatically detect food and its caloric value from the images captured with a mobile phone camera using deep learning neural networks for image recognition as well as a question answering system based on the transcript of the food recipes.

The primary objective of this project is to provide people with an assistance tool for their daily based cooking experience as well as track their calories to promote proper diet which in turn ensures the person is healthy.

Methods

Data is collected initially from two datasets FOOD-101 and FOOD-20. FOOD-101 consists of 1000 images each of 101 food classes. Similarly, FOOD-20 consists of 100 images each of 20 Indian food classes. These two datasets are merged and preprocessed using different techniques such as data augmentation and image cropping. An Inception-V3 CNN model which has been pre-trained on ImageNet dataset is selected for the purpose of training on the merged dataset. Owing to constraints on computational power, we train this model on 10 food classes only of which 5 are Non-Indian food and the other 5 are Indian food. Then we take the saved keras model and convert it into a Tensorflow Lite model so that it can be deployed on a mobile application. The Recipe Box dataset is used to provide us the food recipes along with the cooking instructions. We then select a MobileBERT model pre-trained on SQUAD (Stanford Question Answering Dataset) 1.1 for the question answering system as it takes less storage and runs much faster than traditional BERT models. We then deploy both these models as mobile applications using Android Studio and the skeleton user interface provided by tensorflow. Table 1 shows the different food classes implemented in this application.

Datasets

- FOOD-101: It consists of 1000 images of 101 food classes each.
- FOOD-20: It consists of 100 images of 20 Indian food classes each.
- Merged Food Dataset: It consists of 1000 images of 121 food classes each of both Indian and Non-Indian origin.
- Recipe Box: It consists of 125,000 food recipes and cooking instructions scraped from different websites.

Introduction

Lack of proper exercise and improper diet is a major reason for the rise in obesity cases in today's fast paced world. Moreover the influence of the COVID-19 pandemic has been drastic and has led to a massive increase in obesity rates. According to NPR.org, this rise in obesity can be attributed to sedentary lifestyle, job loss and stress. Figure 1 portrays this fact.

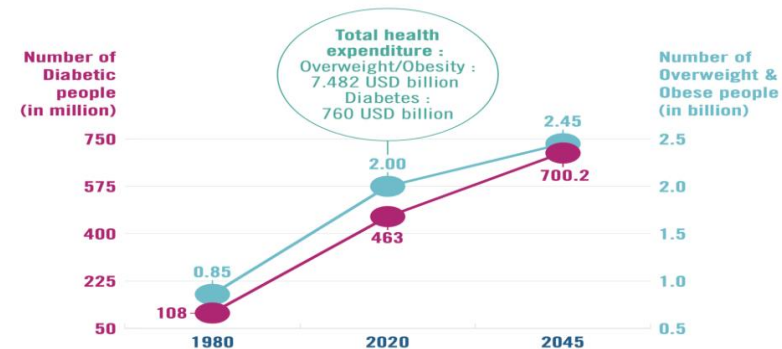


Figure 1

The solution for this issue is to make people aware about their nutritional consumption. This can be done with proper diet and keeping a track of calories consumed. However the present systems like “MyFitnessPal” and “Healthify-Me” require manual logging of food making it a tedious task leading to people quit tracking their consumption of calories. Additionally, existing recognition systems do not work on Indian food like Idli, Dosa and Biryani etc. Furthermore, there is a lack of systems which address the doubts people encounter while cooking food.

Demo and Results

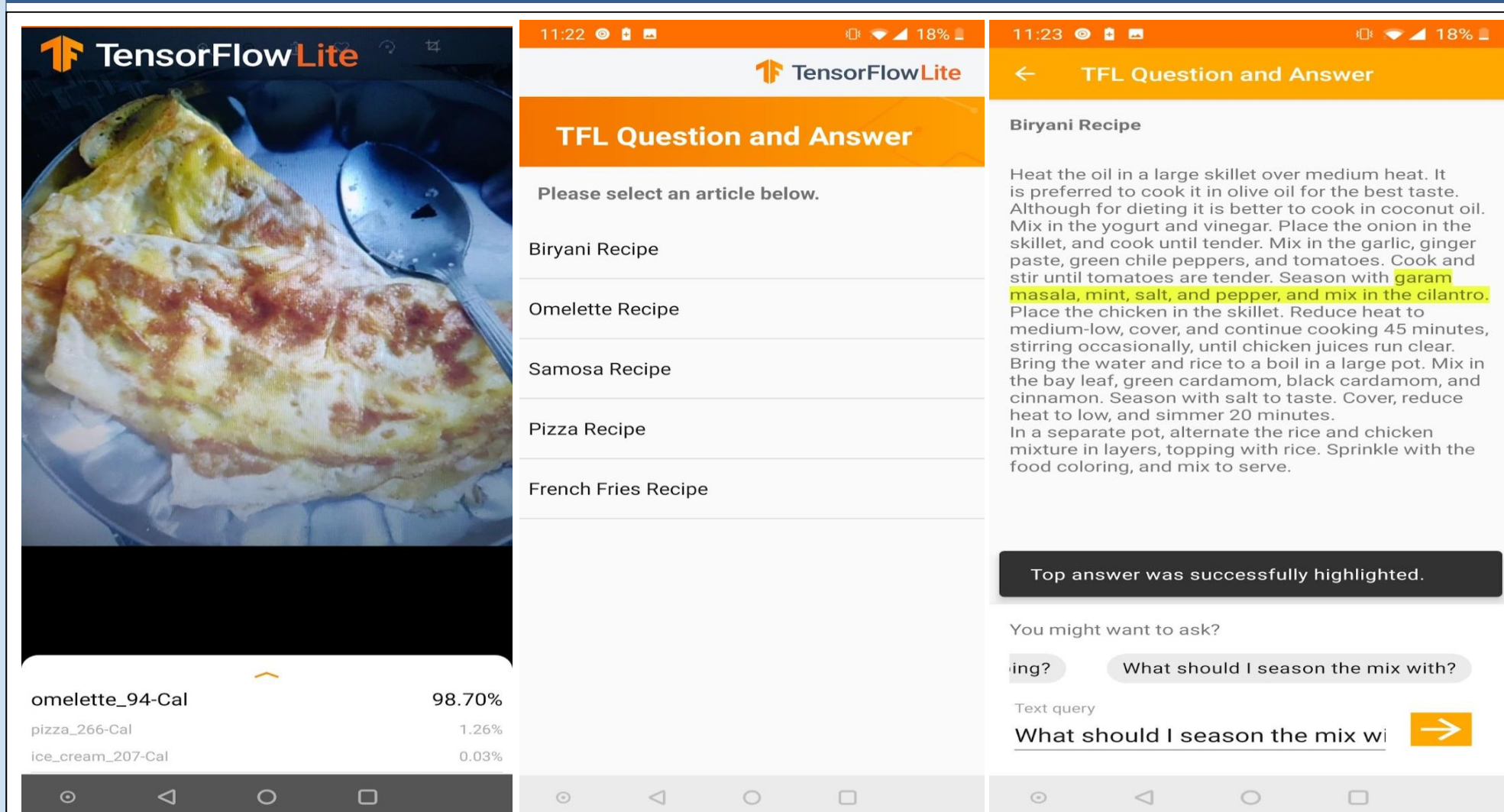


Figure 2 Food Recognition Application

Figure 3 Q&A App Menu Page

Figure 4 Q&A App Output

- The final output of the food recognition application shows the detected food with the confidence percentage of top-3 classes along with the estimated standard caloric value of the detected food, which is shown in Figure 2.
- Figure 3 displays the Main menu Page of the Question Answering Application, while the question based on the food transcript is typed and selected, the MobileBERT model decides the best answer and displays the answer by highlighting the text in yellow along with an audio output of that text using the speakers of the mobile phone as shown in figure 4.

Conclusions and Future Directions

- To conclude, both of the applications are performing very well and can be treated as a network which can assist the users in cooking as well as calorie tracking experience. Although these applications can be made much better for a much more enriching experience.
- Preserving the validation accuracy of the initial model and minimize the loss in accuracy when converting to a tensorflow lite model. We can also look into the possibility of using an API or cloud based deep learning model for better classification accuracy.
- With better computational resources we can easily scale this project to a broader dataset.
- We can develop a much more intuitive application with a better user interface as well as combining the features of both the applications into one application.

Contact Information

L.Satyajit
VIT-AP
Email:
satyajit.18bcd7143@vitap.ac.in
Phone: +918637013050

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