Introduction

Abstract

In the 21st century, the availability of food options has significantly increased, making it challenging for individuals to monitor their food intake effectively. This trend has led to a growing number of people who are seeking to become more mindful of what they eat to maintain their health and well-being. Despite their best efforts, many of these health-conscious individuals struggle to maintain their new habits due to the arduous nature of their methods.

That's why, our team 'Tidbit' is offering an easy-to-use calorie-tracking mobile application. Now, users can capture their food pick and get notified about the nutritional data instantly.

Usability Problem

One challenge that health-conscious individuals often encounter is the difficulty of accurately assessing the nutritional value of foods they consume. Diet-conscious individuals may struggle to estimate the ingredients that make up certain foods, as well as to predict the overall calorie count. This can lead to a lack of confidence in the accuracy of their dietary tracking and may hinder their progress toward their health goals.

In modern times, individuals lead busy, structured lives, leaving them with little time to spare. As such, many opt to use mobile applications to help them stay mindful of their nutritional intake. However, even with the assistance of these apps, the daily task of inputting nutritional information requires a significant amount of effort and time from the individual.

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Related Work

As obesity rates are rising around the world and healthcare education is spreading widely, tracking calorie intake has attracted enormous attention from more and more people. Thus, there are an increasing number of solutions in the market that enable users to track their calorie intake. In this section, we will review some existing solutions available both in the market and in the literature.

1. **Existing Solutions**

The early appearance of calorie tracking requires journaling, in which the users have to measure the portions of everything in the meal, calculate the calorie, and log it in a journal. This traditional way has inherent downsides as it requires a lot of work, and is hard to keep track in the journal. As we enter the digital era, there is rapid growth in the development of mobile applications, and companies start to see opportunities in releasing healthcare applications. Some notable examples of manual tracking apps are Calory, MyFitnessPal, and Lose It. They provide users with a comprehensive database of foods and nutritional information, allowing them to manually log their food intake and track their calories. These apps also offer features such as goal setting, progress tracking, and social support to help users achieve their health and fitness goals. However, these applications usually hide useful features behind a paywall and suffer from inherent drawbacks such as being time-consuming and high levels of commitment from users.

Figure 1. Calory application

In recent years, with the emergence and innovations in state-of-the-art Artificial Intelligence models, companies and researchers are now focusing on their applications in the healthcare field. Some recent automated tracking tools are Cronometer, LogMeal API, and SmartPlate. Cronometer utilizes food's barcode

and its enormous database to log users' calorie intake. LogMeal API and SmartPlate use image recognition technology to identify the type and amount of food on the plate and provide users with their calorie intake. Although these solutions have proven to be effective in tracking users' calorie intake, they still face some limitations. For instance, Cronometer does not provide much fitness information, LogMeal API requires a kiosk to measure the food's weight, and SmartPlate still has low accuracy.

Figure 2. LogMeal Kiosk

2. **Literature Review**

   The early research on the problem focuses on the benefits of tracking calorie intake, the challenges associated with it, and the literature survey on calorie-tracking solutions. Unsurprisingly, tracking calorie intake is an effective way to achieve weight loss goals. Burke et al. [1] showed that users with food-tracking journals lost more weight than those who did not. Evert et al. [2] found that tracking food intake resulted in better blood glucose and lower hemoglobin A1c levels. However, tracking calorie intake can be challenging due to the user's circumstances. Black et al. [3] showed that low-income individuals faced barriers to tracking their food intake, such as a lack of access to healthy foods and limited time for food preparation.

In recent approaches related to tracking calorie intake, Machine Learning models are rising as a dominant force when it comes to computing the users' calorie intake efficiently. To automatically capture the foods' calories, image processing and recognition are required. Redmon et al. [5] transformed the computer vision field with their YOLO architecture innovation, which achieves state-of-the-art on both accuracy and efficiency, enabling the camera to recognize objects in real time. Pouladzadeh et al. [4] suggested an assistive calorie measurement system aimed at supporting patients and healthcare providers in managing health conditions related to diet. Amol et al. [6] proposed a web-based application for estimating fruit calories and improving individuals' utilization propensities for wellness.

Reference

[1] Burke LE, Wang J, Sevick MA. Self-monitoring in weight loss: a systematic review of the literature. J Am Diet Assoc. 2011 Jan;111(1):92-102. doi: 10.1016/j.jada.2010.10.008. PMID: 21185970; PMCID: PMC3268700.

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[6] Amol, A. Todarwal, Sharma Smriti, Bharambe Rishikesh, Gladson Roy, and S. Varma. "Fruit Classification and Calories Measurement using Machine Learning and

Deep Learning.” (2021).

Proposed Solution

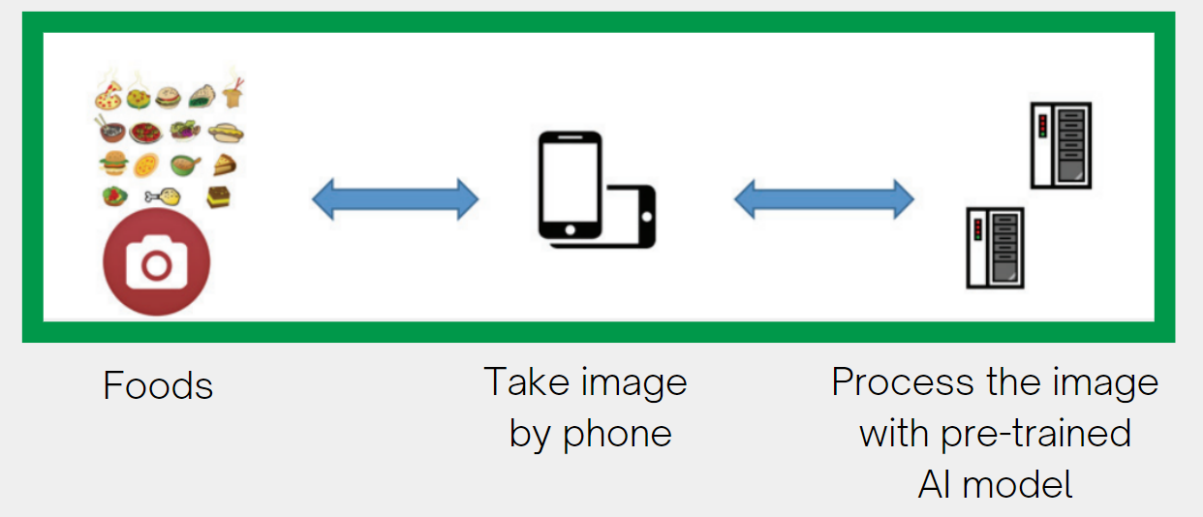

Figure 1. Application Framework

As we discussed in the previous section, the main usability problem of existing applications is having to manually enter the information about the meal and the calories of each food, and low accuracy. Therefore, in this section, we propose a mobile application that will detect the meal from an instantaneously captured picture and then estimate the calories of each item there using computer vision and machine learning techniques.

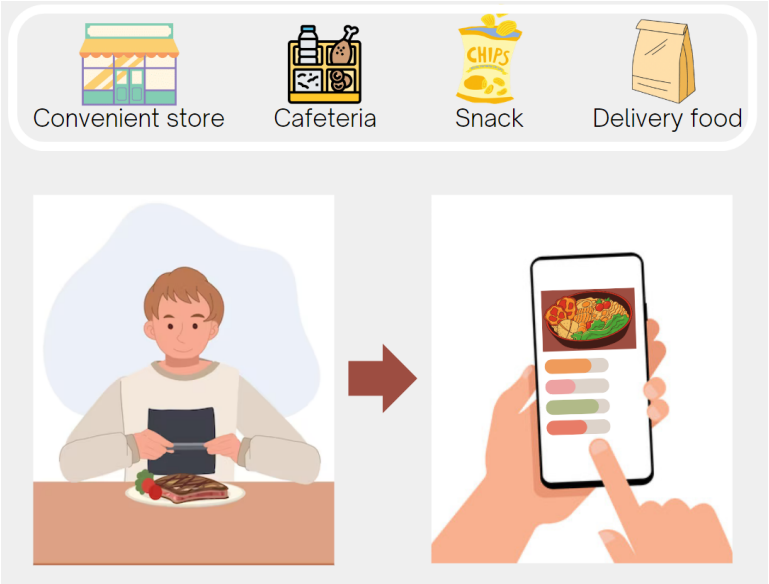

Figure 2. Usage scenario

The app should be user-friendly and provides a simple way for users to log their food and drinks by taking a photo of their meal or snack. The app will then use image recognition algorithms to identify the different types of foods and drinks, estimate their portion sizes, and provide an accurate calorie count. To accurately obtain food types and estimate the calories, we will utilize the state-of-the-art YOLO architecture, which can efficiently categorize objects in real-time, which boosts the response speed of our app.

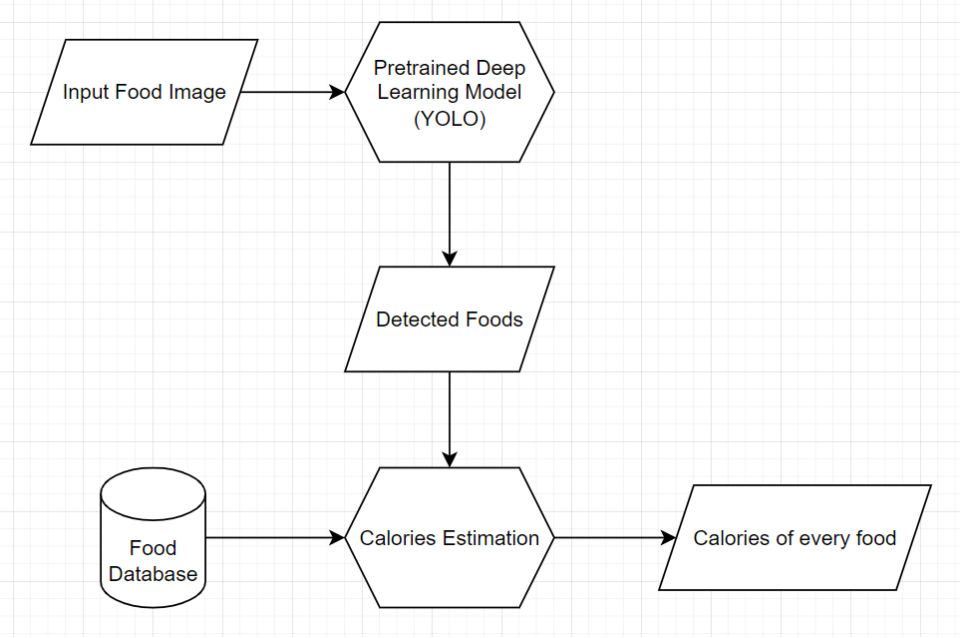

Figure 3. Flowchart of our Deep Learning Framework

To have a better understanding of our application workflow, please refer to Figure 3. Firstly, the user will take an image of the food, and it will be sent to the backend, which contains a pre-trained Deep Learning Model that will process that image and produce the annotated information about each type of food. Along with such information, we will make queries to a food database to estimate each food type's portion size. The result will then be sent back to the user's device, where it will be displayed along with the calorie count for each food item. The user can then review and confirm the accuracy of the information and make any necessary adjustments. Once the user has confirmed the information, the calorie count for each food item will be added to the user's daily intake summary. The user can review their daily summary at any time to see their total calorie intake for the day and track their progress toward their goals.

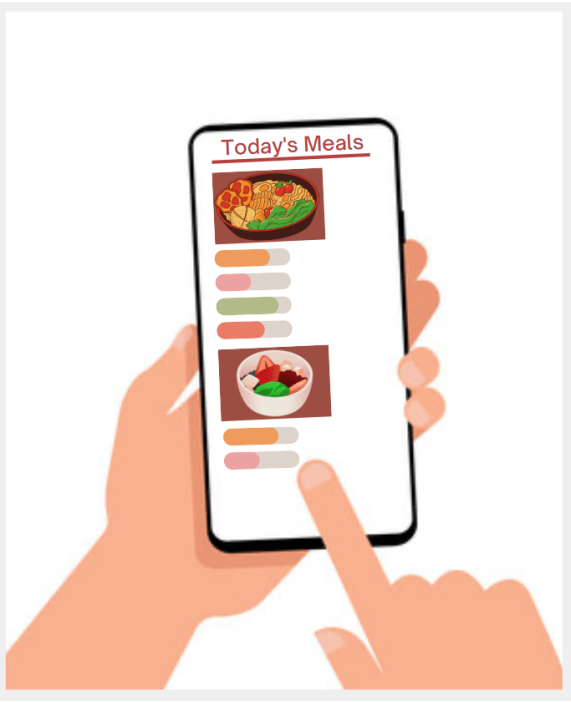

Figure 4. Food history in one day

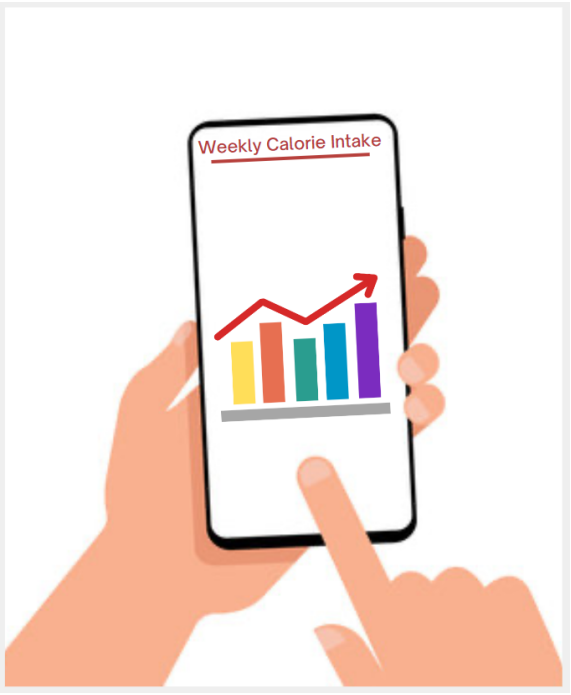

Figure 5. Weekly calorie intake

Overall, our application workflow is designed to provide a seamless, efficient, and accurate way for users to track their calorie intake and improve their health. By leveraging advanced technology and machine learning algorithms, we aim to deliver users the power to make informed and healthy food choices in a simple and accessible way.