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# Personalized Android Application for Food Identification and Calorie Count Visualization

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***Abstract***— Regular measurement and maintenance of calorie count of body is very essential and important for healthy living. Calorie count of body changes with change occurring in weight and height measurement. High body calories is a way to many diseases and disorders. Proper calorie count and nutritional value can be maintained by intake of healthy food. Keeping the knowledge of calories and nutritional value of each food item is a difficult task. Use of the emerging and rapidly growing smart phone technology for health maintenance can proved to be a great combination with outstanding results. The paper describes the system developed for food identification and calorie recognition, which also shows whether the given fruits and vegetables are fresh or not. Users can use the system with the help of developed android application on their smart phones. The system is trained and tested on the set of different food images to calculate its efficiency and accuracy. The results obtained proved that the system is accurate in recognizing the food item and showing its calorie contents. Also, the android application set the BMI value and depending on that give the daily calorie limit, which can be maintained by consuming the healthy food.

***Keywords***— Calorie Count, Segmentation, Feature Extraction, Classification, Health Monitoring

## I. INTRODUCTION

Increased obesity give rise to number of disorders and sometimes depression also. Factors which are responsible for causing obesity are mainly reduction in the amount of physical movements of body, some genetic inherited factors, and the most important one is improper diet, which includes excessive food intake as well as improper calorie consumption and nutrient intake. To keep that precious body healthy and fit many alternatives are available such as taking some supplements, injections and a large amount of medicinal products. But all these products have huge number of consequences on the body and these effects can prove so fatal that it may even lead to death. If not reduced in appropriate time, these excessive body fats can be more destructive and dangerous.

Many people have mind-set that obese and fat people eat less and still gain weight. But, this concept is totally wrong and also not supported by many medical experts. The fact is, obese people need more energy as compared to the normal people because their most of the energy is spent to maintain the extra mass on their body, which is useless. Many times, when body fats cross the level of saturation in the body, it needs to be removed with the help of surgery, which proves too costly to the patient. The obesity rate is more in females as compared to males due to pregnancy, child birth and uneven mensuration cycles.

People are constantly looking for ways to improve their health and one approach that could be taken in addition to exercising is managing daily calorie intake. The use of android devices has been tremendously increased in the past decade. These mobile devices are being carried with people every time and everywhere. So, the use of emerging digital technologies is done to develop a system to identify food item and determine its calorie count, and providing the result to the users on these handheld android devices.

Calorie count normally depends on the BMI index, which is the measure of height and weight of the body. High calorie food leads to deposition of fats in the body. For this, the correct identification of the food item along with its contents is very important, before purchasing it from the market. The developed system helps to identify the food item along with its calorie contents and also shows whether it is fresh or not. Because, if the food item is not fresh, it's nutritional value nearly becomes zero and it can have harmful effects on body.

## II. RELATED WORK

The work in [1], is a wearable system for food monitoring based on the concept of augmented reality. The use of RIS is

 

done for identification of the given food item by the user and then the nutrient content information will be visualized on the screen laid upon the food item. The paper [2], is also based on the same concept. It is an application developed for android devices to display the food nutritional components on its image. To make people more caretaking about their health, the work [3] design a food recognition application for android devices. In the dietary management system [4], the calorie values are calculated by using segmentation, feature extraction and classification. Researchers [15], proposed a mobile food identification system for estimating calorie count and nutrition value of food and also for recording user's eating habits.

The system [5], have used the technique called Naïve Bayes in a cloud based system to track the food intake of users and keeping watch on their calorie count . The study [6], determines the use of crowdsourcing technique in the personalized mobile applications for reducing fats on the body. In the paper [13], authors introduced a nutrition intake monitoring system which is based on wearable, mobile wireless enabled necklace featuring on embedded piezoelectric sensor. The work [26], presents the use of deep learning for classification of food ingredients and also for multi-classification of food items. The work [27], gives a system for automatic food recognition, which makes use of Neural Networks for the purpose of feature extraction. The recommender system [8], called as Diet Organizer System give recommendations about the nutritional contents in food along with the nutrients one should intake to both the healthy users as well as the users affected by some kind of diseases or disorders.

## III. METHODOLOGY

The developed system for food identification and calorie recommendation consist of two modules:

*A. Admin module*

Admin of the system is given all the rights over the system. All the operations such as managing dataset, managing users are managed by the admin. Also, all the phases involved in the processing of the food image is visible to the admin. The admin module consists of following phases:

*a)* *Training the dataset with uploaded images:*The training data consists of set of images to train the developed system. Training the system is making the system learn to process information and perform the required operations. In training phase, the system uses iterative steps to process the image, which helps to identify the features, shapes and other details of the image. Here, total 200 images of different food items with 5 to 6 images of each food item are uploaded to make the training dataset, which includes images of both fresh and not fresh food items.

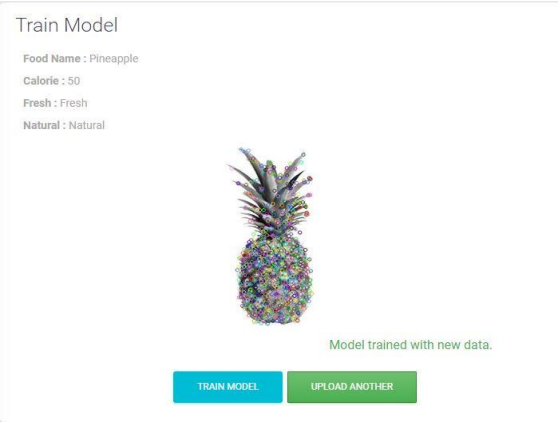


Figure 1. Training Dataset

*b)* *Greyscale Conversion:*The input food image provided by users is in RGB format. The image in RGB format is first converted to greyscale image. The reasons to convert coloured image into greyscale before processing are, elimination of noise due to unnecessary colours, requirement of less space to store the image, easy to work with, and easy feature detection from the image.


Figure 2. Greyscale Conversion

*c)* *Segmentation:*Segmenting the image means partitioning the pixels into different groups called as segments. The pixels in one segment resemble similar properties and differ from pixels in other segments. Segmentation also helps to separate out the important details such as features of image, shape, texture information from the other unnecessary information present in the image. The use of Mean Shift Based Fuzzy C-Means technique is done to separate out the main food item along its edges and boundaries from the other background details. The greyscale image is provided as input to give a segmented image as output.

 

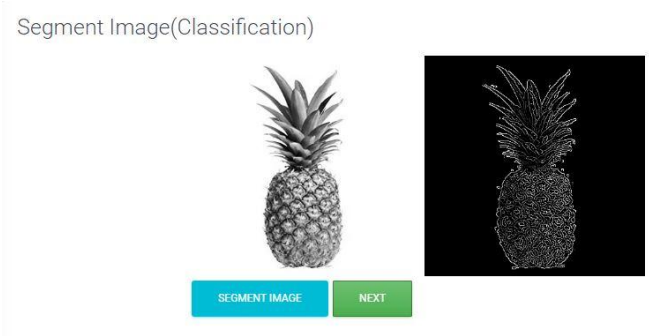


Figure 3. Segmentation

*d) Histogram Calculation:* The distribution of intensity values on the given axis in the graphical format is termed as histogram of the image. The greyscale image is generally 8-bits in size and therefore the total pixel values present are 256, which are distributed according to their intensity values. The greyscale image is provided as input and depending upon the different intensities of grey colour a histogram is plotted on x-axis and y-axis of the plane.

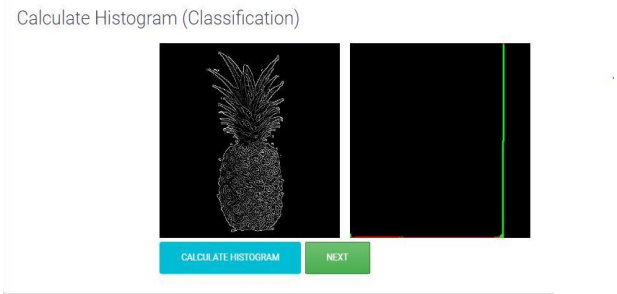


Figure 4. Histogram Calculation

*e) Feature Extraction:* Feature extraction is the process of extracting the details of the image which helps in distinguishing one food image from another. The distinguishing factors such as shape, texture, colour, edges, boundaries of food item helps in differentiating one food item from another. The Fast Scale Invariant Feature Transform technique has been used to extract the features and characteristics from the given food image. The process helps in deriving new features from the original feature set. This helps in achieving better accuracy for the classification phase which, mainly depends upon the extracted features.


Figure 5. Feature Extraction

*f) Classification:* The classification process consists of different decision theories for the identification of the food item. Here, the classification phase has used the Convolutional Neural Network for classification of food images into different classes. The classification technique use the distinct features obtained from the previous phase to classify the food images into different classes. Training set of images is used to create different training classes based on the extracted features and after that testing set of images is used to classify and recognize the particular food item.

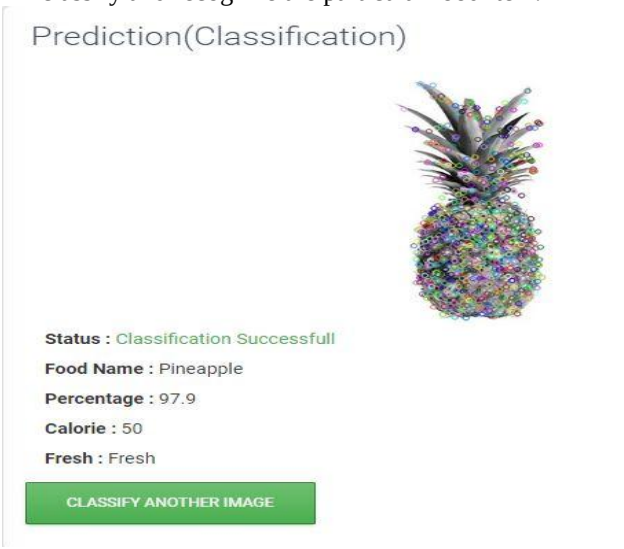


Figure 6. Classification

*B. User module*

To access the developed food identification and calorie recommendation system, the user is provided with the android application to be used on their mobile phones and other android based handheld devices. Identification of the food image provided by user and the daily calorie recommendation consists of the following phases.

*a) Registration:* A new user is registered on the android application before using the system. During registration process, details such as name, height, weight, age and gender are gathered from the user which will be useful in the next phases. The user is also asked to set the userid and the password to access the application, this will help to keep the user information secured.

 

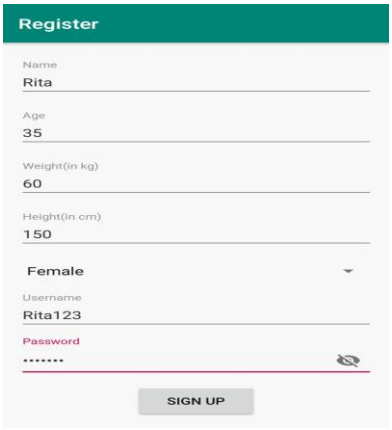


Figure 7. User Registration

*b) Set BMI :* BMI is the measure of body tissues which includes the fats, muscles and bones. It is calculated based upon the value of height and weight of the individual and depending upon the obtained value, the person is classified as under-weight, normal weight, over weight and obese. The values provided during registration are taken to calculate the BMI value, which is useful in the next phase for setting daily calorie limit.

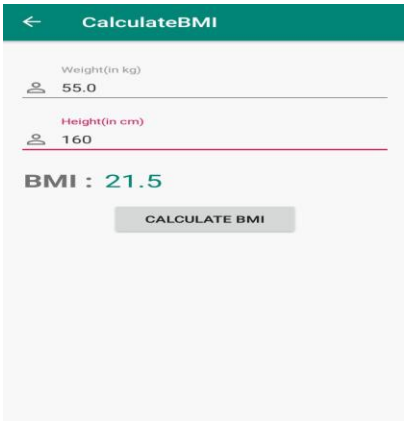


Figure 8. BMI Calculation

*c) Set Daily Calorie Limit:* Calorie is the energy requirement to perform regular body functions as well as other operations. Daily calorie limit is set for the individual depending upon its BMI value. Consuming less calories than the required amount can give rise to weakness and consuming more calories can give rise to obesity and excess fats on body. So, the intake of calories should be in appropriate amount in accordance with the BMI index.

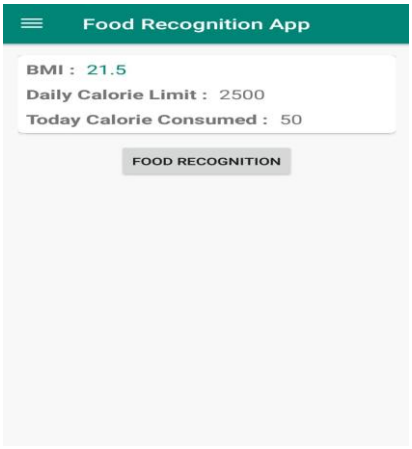


Figure 9. Daily Calorie Limit

*d) Food Recognition*: For the recognition of the food item and its calorie value before purchasing or consuming it, its image is clicked with the help of mobile phone or any handheld android based device and it will be uploaded with the help of the developed food recognition application. The result is shown to the user in the form of name of recognized food item along with its calorie value.


Figure 10. Food Recognition and Crowdsourcing

*e) Daily Calorie Count:* If the recognized food item is consumed by the user then, that much amount of calories are added to the daily calorie count of the user. The daily calorie count is compared with the daily calorie limit of the user and depending on that suggestions are provided to fulfill the daily calorie limit

 

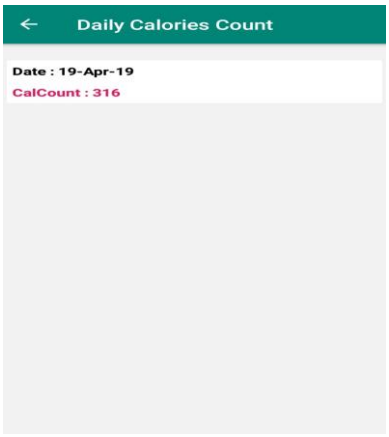


Figure 11. Daily Calorie Count

*f) Crowdsourcing:* Crowdsourcing is collecting the input data, information or facts from the users all around both experts and non-experts in the respective fields. It helps to make the data aggregate. Here, input is provided by the user in the form of whether the recognized food item is correct or not. It helps to keep the dataset always updated and dynamic.

## IV. Results and Discussion

The implementation results for the correct identification of the food image were measured by the four parameters, Recall, Precision, F-Measure and Accuracy

To calculate these measures, the terms needed are:

**True Positive (TP)**: Number of images correctly classified as fresh food images.

**True Negative (TN)**: Number of images correctly classified as non-fresh food images.

**False Positive (FP)**: Number of images incorrectly classified as fresh food images.

**False Negative (FN)**: Number of images incorrectly classified as non-fresh food images.

$$Recall = \frac{TP}{TP + FN} \quad (1)$$

$$Precision = \frac{TP}{TP + FP} \quad (2)$$

$$F1 = 2 \times \frac{Precision \times Recall}{Precision + Recall} \quad (3)$$

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \quad (4)$$

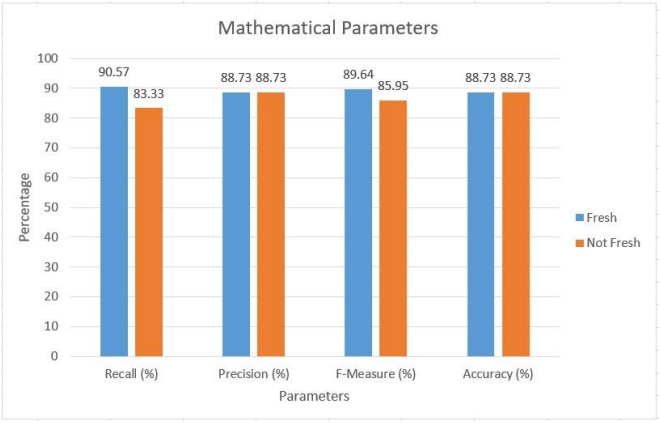


Figure 12. Performance Analysis

## V. Conclusion and Future Scope

In this article, a system developed for food identification and calorie recommendation is described. It helps to decide the calorie limit for the user depending upon the BMI index. Users can upload the image of food item before purchasing or consuming it, to know its calorie contents. The system also show whether the given fruit or vegetable is fresh or not. Knowing the calorie count in the food item help users to maintain their daily calorie limit appropriately for good health. The dataset of food images is kept updated by crowdsourcing. The accuracy for identification of the particular food item from the given image turned out to be 88.73% for both fresh and non-fresh food items. The fruits and vegetables with unique shape and texture provide greater accuracy. But, similar shape items like apple, pomegranate, tomato reduce the classification accuracy by some percent. Also, the classification of food item as fresh and not fresh is done accurately based on input given while training the dataset. In future, the system can be expanded to identify each component in the mix foods items along with its nutrition contents.

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