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Measuring calorie and nutrition from food image

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Abstract: As individuals across the globe have become additional centered on their health it's necessary to stay the diet management. In this paper we tend to project a semi automatic system that is employed to live the calorie for the food intake for that purpose a nutrition table is employed. Our system uses a camera to record a photograph of the food before and when consumption it for the calculation of the calorie worth. when taking the food image the colour, shape, size and texture options area unit extracted and it's given to the Support Vector Machine (SVM)for recognizing the food portion then the calorie worth is measured. fatness is that the major explanation for overweight this results in the sort II polygenic disease, cardiopathy and cancer, measure the food is extremely necessary for a made healthy diet, measure calorie and nutrition in daily food is one among the challenge strategies. Smartphone plays a significant role in today's technological world victimisation this method can enhance the problem in intake of dietary consumption .In this project associate food image recognition system for measure the calorie and nutrition values was developed. When taking the food image the colour, shape, size and texture options area unit extracted and it's given to the K-nearest neighbor (KNN) for recognizing the food then the calorie worth is measured with the assistance of nutrition table. The most leading factors for various diseases, akin to cardiopathy, hyper-tension and polygenic disease. There's a robust correlation between fatness and positive energy balance, that is that the distinction eaten energy from exhausted energy. Energy Intake (EI) is being taken into consideration mutually of the first reasons for gaining weight. Energy intake are often outlined because the calorie equivalent of the consumed quantity. Measure nonsymbiotic peoples' EI presents method and technical challenges. Even supposing in depth analysis has been conducted in measure EI, correct and reasonable strategies haven't been projected nevertheless.

Keywords: KNN (K-nearest neighbor), EI (Energy Intake), Calorie, weight.

I. INTRODUCTION

The main reason for blubber is that the imbalance between the number of food intake and energy consumed by people. So, so as for the weighty to change state in an exceedingly healthy method, in addition as for traditional individuals to take care of a healthy weight, daily food intake should be measured[4].Obesity treatment desires the patient to notice the number of the daily food intake, however in most cases, it's not straightforward for the patients to live or management their daily intake because of the dearth of nutrition, education or self-control. Therefore, by using a semiautomatic food intake watching system, we will assist the patient and supply a good tool for the blubber treatment. Nowadays, new technologies similar to computers and sensible phones square measure concerned within the medical treatment of various varieties of diseases, and blubber is taken into account collectively of the common diseases. within the previous few years, a numbers of food intake measurement ways are developed. however most of those systems have drawbacks similar to giant calculation during this study, a novel framework is planned specifically to live food intake in independent conditions, and it builds upon the photography methodology. The

planned food intake analysis system consists of reference card detection and geometric transformations, image analysis, gram quantity estimation, and manual correction modules. we have a tendency to articulate a way to the find reference card and its corners and so utilize it in geometric and measure corrections. The reference card corners square measure accustomed geometrically correct the image to account for the view-angle and distance of the camera to the food. the colour of the reference card is employed to try to measure correction, that is crucial to extract reliable color options to be utilized in classification and segmentation.

Portion sizes were weighted before and when the meal by the researchers. When 5 minutes passed, researchers began to indicate food pictures depiction portion size incrementing from fifth to the ninety fifth marks.

Following these pictures, subjects were questioned to see the portion size related with consumed food and nutrient content of meals. Within the results of the form, apparently little portion sizes were overestimated whereas larger portion sizes were underestimated. Consequently, the food photography, that depicts numerous ranges of food portion sizes, was a useful methodology for the topic WHO was asked to estimate what was consumed. This analysis additionally unconcealed the errors seven wherever it occurred from the sense of conceptualization. in addition, body mass index, age, six and portion size square measure essential factors throughout the food intake estimation. Obtaining and measurement energy intake accurately in period of time could be a difficult task whereas individuals reside in their natural atmosphere. Currently, the doubly-labeled water (DLW) is thought because the gold normal for measurement energy intake in independent conditions. the basic plan behind this method is explained as follows. A water resolution that contains hydrogen atom and atomic number 8 is given to the topic. The water samples square measure gathered for analysis. within the body, the hydrogen atom is fluxed and became water, whereas atomic number 8 is fluxed and remodeled into water and greenhouse gas. The distinction of the rates of transformation results, from hydrogen atom to water and from atomic number 8 to water-carbon oxide, could be alive of greenhouse gas flux. With this greenhouse gas flux, energy expenditure may be calculated exploitation normal indirect measuring equations. The DLW consists of some experimental analysis, applications of indirect measuring, calculation ways and a few sophisticated assumptions and sources of errors. The DLW accounts for the full energy expenditure (TEE), and through energy balance, energy expenditure is appreciating energy intake. However, it's the actual fact that once an individual is experiencing an oversized energy deficiency, energy balance won't adequate to energy intake; this may cause some difficulties for getting AN correct estimate of energy intake. Even supposing the DLW offers U.S. AN objective live of energy intake, it needs some knotty experimental steps and drives a high-cost. Another downside of the DLW methodology is that it doesn't give any data concerning eaten composition of foods. As a result, the DLW has some limitations so as to get correct energy intake. Hence, it's not AN applicable methodology which may be merely used as a tool in independent conditions Most different ways to live food intake trust participant self-report, together with food records, 24-hour recall, and food frequency questionnaires. These ways trust the participants to recall or record their food consumption and estimate or live of the number (portion) of food eaten up. though these ways square measure oft used to estimate food intake in analysis and clinical settings, they underestimate food intake by thirty seventh or a lot of. Additionally to the current, folks that square measure overweight or weighty underreport food intake to a bigger degree than lean individuals once exploitation these ways. The biggest supply of error in estimating food intake from self-report is owing to participants' poor estimation of portion size. Hence, ways that don't trust the participant to estimate portion size square measure required. The goal of image standardization and acquisition step is to get 3D label system by having reference data similar to the dimension of the plate and completely different angular views. Within the segmentation step, the food regions square measure mechanically divided from the image scene by 1st changing image to grayscale then YCbCr color house. Color and physicist texture options square measure thought of to perform feature extraction step. when performing arts segmentation and extracting the options, applied math pattern recognition techniques square measure used to try to food recognition.

II. LITERATURE REVIEW

1. **World Health Organization, Geneva, Switzerland. (2011, Oct.).ObesityStudy[Online].**

Description:-As people across the globe are becoming more interested in watching their weight, eating more healthy, and avoiding obesity, a system that can measure calories and nutrition in every day meals can be very useful. In this paper, we propose a food calorie and nutrition measurement system that can help patients and dietitians to measure and manage daily food intake. Our system is built on food image processing and uses nutritional fact tables. Recently, there has been an increase in the usage of personal mobile technology such as smartphones or tablets, which users carry with them practically all the time. Via a special calibration technique, our system uses the built-in camera of such mobile devices and records a photo of the food before and after eating it to measure the consumption of calorie and nutrient components. Our results show that the accuracy of our system is acceptable and it will greatly improve and facilitate current manual calorie measurement techniques.

2. **Handbook of Obesity, 2nd ed.BatonRouge, LA, USA: Pennington Biomedical Research Center, 2004**.

Author:-HUANG Shiqi, LlUDaizhi, Hu Mingxing

Description: As people across the globe are becoming more interested in watching their weight, eating more healthy, and avoiding obesity, a system that can measure calories and nutrition in every day meals can be very useful. In this paper, we propose a food calorie and nutrition measurement system that can help patients and dietitians to measure and manage daily food intake. Our system is built on food image processing and uses nutritional fact tables. Recently, there has been an increase in the usage of personal mobile technology such as smartphones or tablets, which users carry with them practically all the time. Via a special calibration technique, our system uses the built-in camera of such mobile devices and records a photo of the food before and after eating it to measure the consumption of calorie and nutrient components. Our results show that the accuracy of our system is acceptable and it will greatly improve and facilitate current manual calorie measurement techniques.

3. **"A food portion size measurement system for image based dietary assessment," in Proc. IEEE 35th Bioeng.Conf.,Apr. 2009, pp. 3–5**.

Author:-J. Wenyan, Z. Ruizhen, Y. Ning, J. D. Fernstrom, M. H. Fernstrom,R. J.Sclabassi,

Description:A novel system consisting of a camera and a light emitting diode (LED) is presented for measuring food portion size. The LED is positioned at a fixed distance besides the camera with its optical axis parallel to the optical axis of the camera. The distance to and oblique angle of the object plane are calculated according to the deformation of the projected spotlight pattern. Experimental results show that satisfactory measurements of food portion size can be obtained with this simple system.

4. **A novel method for measuring nutrition intake based on food image," inIEEE Int. Instrum. Meas. Technol. Conf., Graz,Austria, May 2012,pp. 366–370.**

Author:-R. Almaghrabi, G. Villalobos, P. Pouladzadeh, and S. Shirmohammadi

Description:-In this paper, a food nutrition and energy intake recognition system for medical purposes is proposed. This system is built based on food image processing and shape recognition in addition to nutritional fact tables. Recently, countless studies suggested that the usage of technology such as smartphones may enhance the treatments for obesity and overweight patients. Via a special technique, the system records a photo of the food before and after eating in order to estimate the consumption calorie of the selected food and its nutrients components. Our system presents a new instrument in food intake measuring systems which can be useful and effective in obesity management.

5. "An identification approach for 2-Dautoregressive models in describing textures," CVGIP, Graph. ModelsImage Process., vol. 53, no. 2, pp. 121–131, 1993

**Author:-**B. Kartikeyan and A. Sarkar,

Description:-A technique for identification of the autoregressive components is developed to describe textural regions of digital images by a general class of two-dimensional autoregressive model. Since for such modeling the feature spaces for different classes are different, a classifier and a recognition scheme using the parameters of such models are presented. Examples with synthetic textures are presented to illustrate that the model identification is appropriate. The classification scheme is illustrated with real periodic and aperiodic textures. The overall misclassification rate is about 2.4%.

III. PROPOSED SYSTEM

The projected system depends on a replacement technique: the usage of the thumb as a standardisation relevancy estimate theamount of food from the captured picture. During this paper, we tend to propose a private software package instrument tomeasure the worth of calorie and nutrient intake employing a smartphone or anyother mobile device equipped with a camera. Our system uses image process and segmentation to spot food parts (i.e.segregating parts corresponding to egg, rice, vegetables, fruits then on, from the general food image) and measures the degree of every food portion, and calculates organic process realtys of every portion by calculative the mass of every portion from live dvolumeand matching it against existing organic process fact tables the general vogue is shown in Fig. 1. as a result of the figure shows, at the primary stage, footage unit taken by the user with a mobile device followed by a preprocessing step. Then, at the segmentation step, each image area unit analyzed to extract numerous segments of the food portion. it's legendary that whereas not having a good image segmentation mechanism, it is not potential to technique the image fitly,hence we tend to tend to used color and texture segmentation tools. We tend to area unit planning to show but these steps lead to associate correct food separation theme. for each detected food portion, a feature extraction technique should be performed. Throughout this step, varied food choices at the side of size, shape, color, and texture area unit extracted. The extracted choices area unit sent to the classification step where, practice the support vector machine (SVM) theme, the food portion area unit celebrated. Finally, by estimating the realm of the food portion and practice some process tables, the calorie worth of the food area unit   extracted. The thumb of the user and its placement on the plate is also a one-time standardisation technique for the thumb, that's utilized as a size respect to live the real-life size of food components inside the image. We tend to tend to report the conception of practice the thumb for standardisation, furthermore as its implementation. Associate example of food image capturing and thumb isolation and activity.

IV. PROPOSED METHODOLOGIES

In this chapter, we are going to discuss all the methodologies employed in the development of the FRS. Meanwhile, we are going to deeply justify every principle we tend to applied to make the system. we are going to outline a way to estimate the amount of calories from a picture by taking the benefits of some ideas that we tend to explained antecedently. First, we are going to bear the references that we tend to applied to our system to extract the measurements in a straightforward, unique way. we are going to justify the proper techniques to use this methodology to urge the simplest results. Then we are going to justify however we tend to used the result from the primary analysis stage to estimate volume thus we are able to continue our calculation properly.
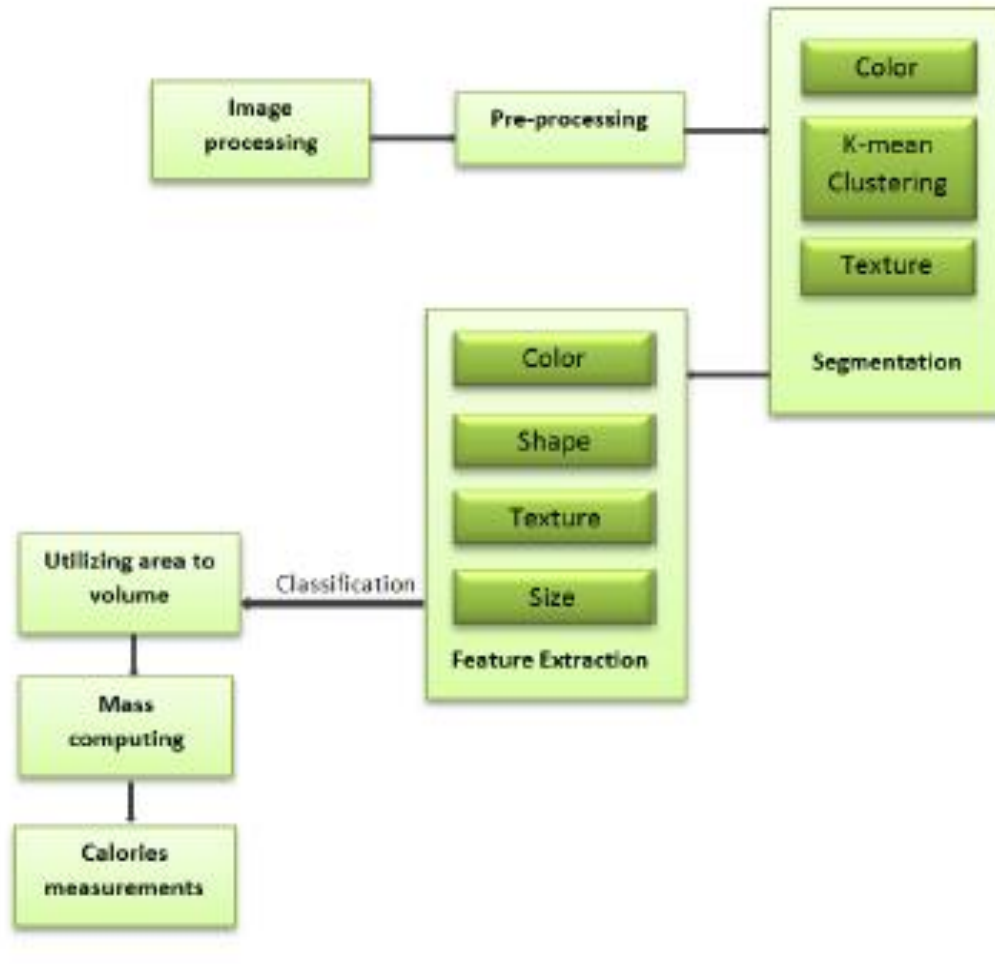
Once the image of the food is captured by the user, the image is reworked and ready for consequent step that we are going to justify within the following segment.

1. Pre-Processing

In the starting, an easy conversion should be performed on the image to vary the image size into a customary format for precise results for system segmentation. Thus, the dimensions of every image are going to be compared with commonplace size classes. We've outlined one size class as a customary, that ar 970×720 pixels for simplicity. Larger pictures are going to be reduced to the present size before accomplishment of any image-processing technique.

2. Image Segmentation and have Extraction

The segmentation part starts right away once analyzing the pre-processing step. This half can operate with four totally different features: color, texture, form and size, on that we tend to ar principally concentrating during this project. These components conjointly embody the calculation in pixels of the thumb and its size in pixels by employing a Gaussian edge detection filter and so the skin detection theme. The extracted sizes are going to be employed in remodeling the constituent size of food parts to actual, real-life size. additionally, the color feature are going to be extracted by victimization the color bar graph, whereas the dimensions feature are going to be extracted by together with the pixels within the Region of Interest (ROI) for every food portion. Moreover, this can provide America the form feature which can be employed in our calculative methodology.

3. Classification by KNN

Classification with the Support Vector Machine has been done. The extracted options antecedently mentioned are going to be fed into the KNN classifier so the classifier returns the food name as its output. For every feature, there'll be coaching and

testing part. In fact, the aim of victimization the KNN within the FRS is to supply a system that may predict or guess the board worth of information cases within the testing set, that ar simply given by their characteristics. to extend accuracy and scale back misclassification, the system will move with the user to verify the type of food parts, and therefore the user will then settle or alter the food sort as mentioned before. the utilization of KNN methodology during this model contains 5 texture options,colour options, 3 form options, and 6 size options. All the options of every food item ar extracted throughout the segmentation part. At constant time, it'll be used as coaching vectors for the KNN. This step is important for the FRS to calculate the quantity of calories. Classification with the KNN provides the system with the sort of food.

4. Getting Volume by Utilizing space Size

The estimation of food volume through a picture may be a major challenge in dietary intake assessment applications. during this section, we are going to examine the methodology of getting the volume of any food image by utilising the realm size that has been extracted from the pic once the image analysis and therefore the form recognition method. As before long because the photos of the selected food ar captured, the appliance starts to analyse the pixels of each thumb and meal from the primary pic (top view). the most ensuing worth from this calculation is that the space size (height and length) in pixels, which can be used with the opposite dimensions of the food item from the second pic (side photo) to come up with the degree (width). Finding the degree of the pic leads America to simply calculate the quantity of the calories within the elect food via a special algorithmic rule that depends on the organic process tables keep within our application. Within the next subsections, we are going to elucidate thoroughly however we calculate volume in irregular and regular shapes. Of course, the overwhelming majority of food is classified as having Associate in nursing irregular form. To calculate the extent and therefore the depth for a food portion, we tend to overlay a network of sq.s into the image phase (grid) so every square contains Associate in Nursing equal variety of pixels and, consequently, equal space size. There ar 2 reasons behind the usage of the grid within the image segmentation: 1st, compared to alternative volume estimation approaches, involving the grid can build the calculation additional simply match either regular or irregular food shapes, cherish toast, a chicken drumstick, cut or a chunk of cheese. Obviously, there'll be some estimation errors as mentioned earlier, however these errors is reduced by creating the grid finer. Second, having the grid within the image will have an effect on performance in binary ways:

▪   Late however additional correct recognition Associate in Nursingd response to the user within the condition of getting an admirable network form or

▪   A quicker however less correct response within the condition of getting a rougher network form.

5. Volume Calculation of Regular-Shaped Food from a picture

Some styles of food have regular shapes cherish sliced cheese or toast. just in case of standard shapes cherish a sq., circle, triangle etc., we are able to use linear formulas to calculate their space, rather than employing a grid. This, however, needs a further module that may recognise regular shapes. Some sample calculations for normal shapes in a very set of various food pictures.

6. Computing Mass

Measuring the mass of food within the image is that the interval step that may lead America to finding the quantity of calories since every variety of food incorporates a certain amount of calories counting on its weight. As an example, if Associate in nursing apple's weight is 138 grams, the quantity of calories is around seventy calories. If the apple weighs ninety grams, the quantity of calories is going to be concerning thirty five calories. To boot, all the nutrition tables that we tend to think about in our FRS as a customary ar supported the mass of food. The data of the food dimensions within the image, as mentioned before, can provide the system the flexibility to calculate the mass of the food within the image through applying the subsequent general mathematical equation.

$$M=\rho\ V \quad (3)$$

Where M is that the mass of the food portion, ρ is that the food density, and V is that the food volume extracted before from the image, and the user's thumb within the pic. (Note that thumb size is often mounted within the picture). in any case the antecedently expressed procedures (preprocessing, image process, form recognition and KNN classification), the FRS will simply estimate the mass of any food within the image. The unit of measurement are going to be in grams, just like the tables in reality.

V. RESULT

1.   Performance Analysis

The aim of this section is to analyse and assess the results from our experiments. Our experiments show that the accuracy level varied from one form of food to a different. supported this, the amount of accuracy results are often divided supported the outcomes we have a tendency to extracted from our mensuration technique to high, regular or medium, and low accuracy. Figure18 shows a graph of every accuracy level. Food with High Accuracy Results After calorie estimation, we have a tendency to found that some varieties of food gave high accuracy results with less than five-hitter error, as well as bread, cookies, fish and a few food take little components, comparable to carrot slices, cheese, a cucumber and a chunk of cake. we have a tendency to noticed that those varieties of food area unit additional doubtless in regular and easy shapes, or they will be divided into components as regular shapes comparable to a sq., circle or triangle. Moreover, foods that have nearly no depth provided a extremely correct result, higher than alternative varieties with massive depth.
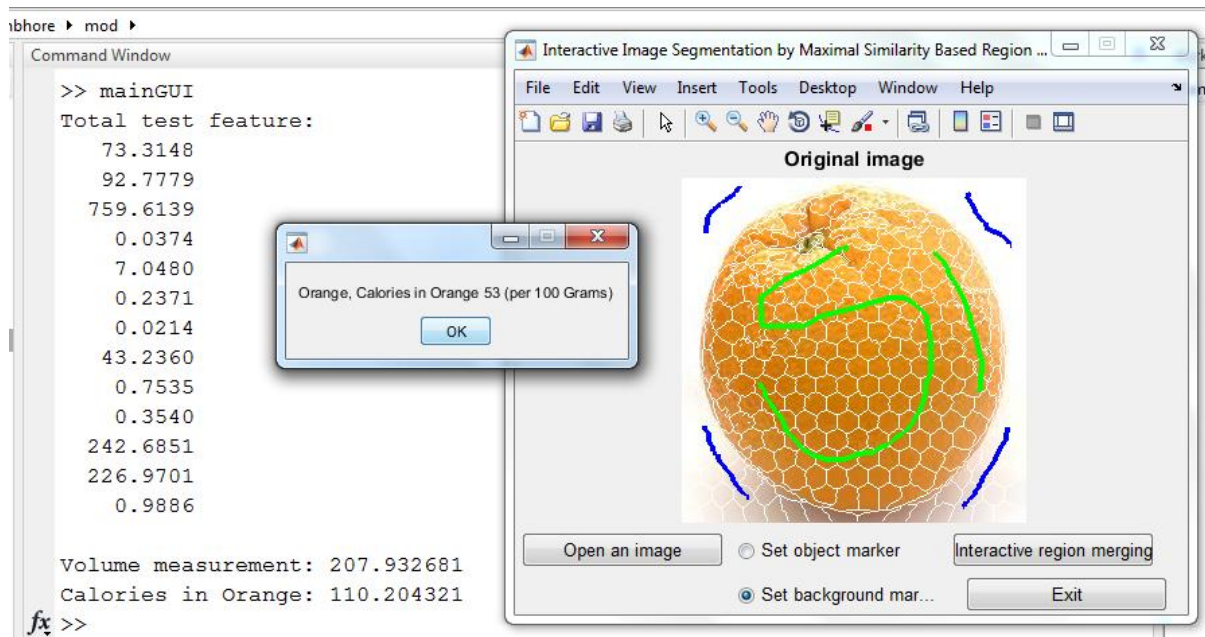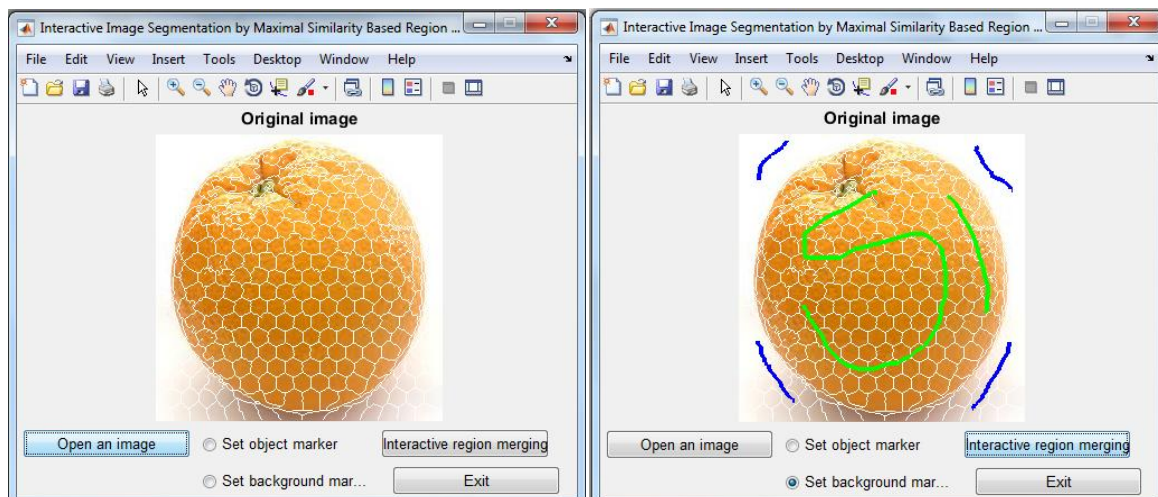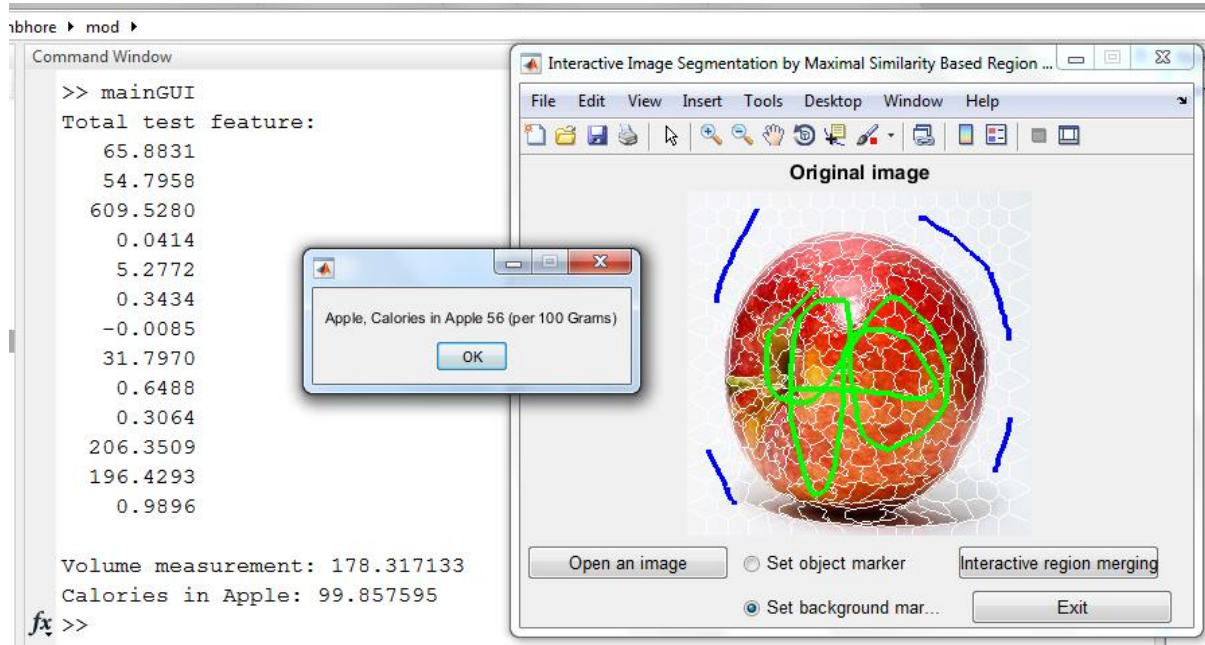
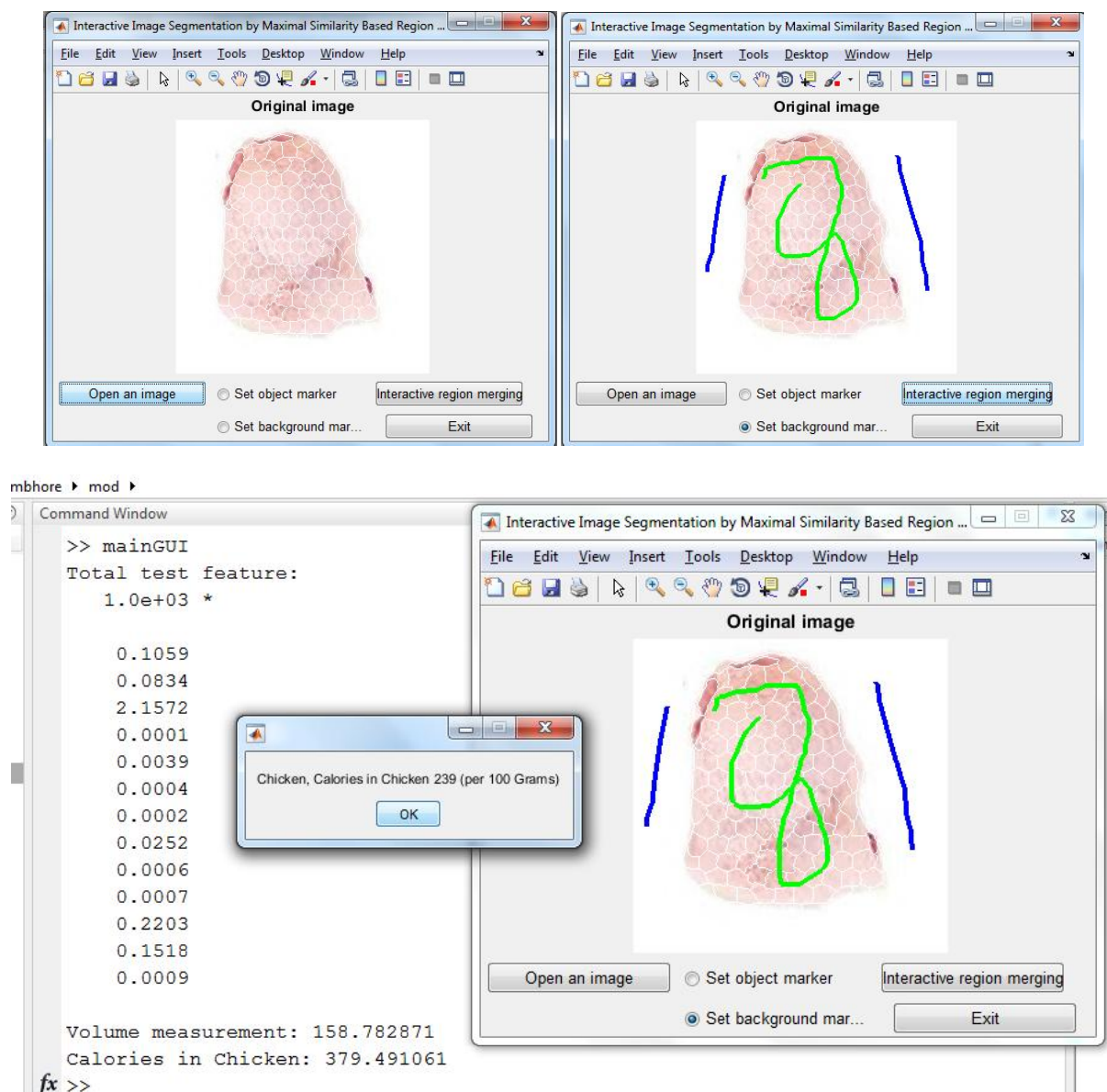2.   Food with Medium Accuracy Results

The experiment showed that some varieties of food, comparable to cut, multigrain bread and doughnuts with chocolate on the highest, provided results that may be classified as medium accuracy; the margin of error ranged between five-hitter to ten. We have a tendency to notice that those varieties of food presumably have a daily form or are often divided into components often and with affordable depth. In addition, those varieties of foods solid a shadow on the plate, that will increase the error once scheming the realm.

3.   Food with Low Accuracy Results

Other varieties of foods, comparable to apples, oranges, tomatoes and potatoes, showed a weak response and low accuracy results. The error rate ranged from ten to below 15 August 1945. we have a tendency to found that the high error rate is because of many reasons, as well as the food shapes, comparable to foods that take spherical or cone-shaped forms wherever the ratio is extremely massive. This can have an effect on the expanse of the realm. As well, some varieties of foods, comparable to rice and cabbage, yielded low accuracy results because of the color feature, that is kind of kind of like the color of the dish. Moreover, some varieties of food could have nice size, however occupy atiny low area.

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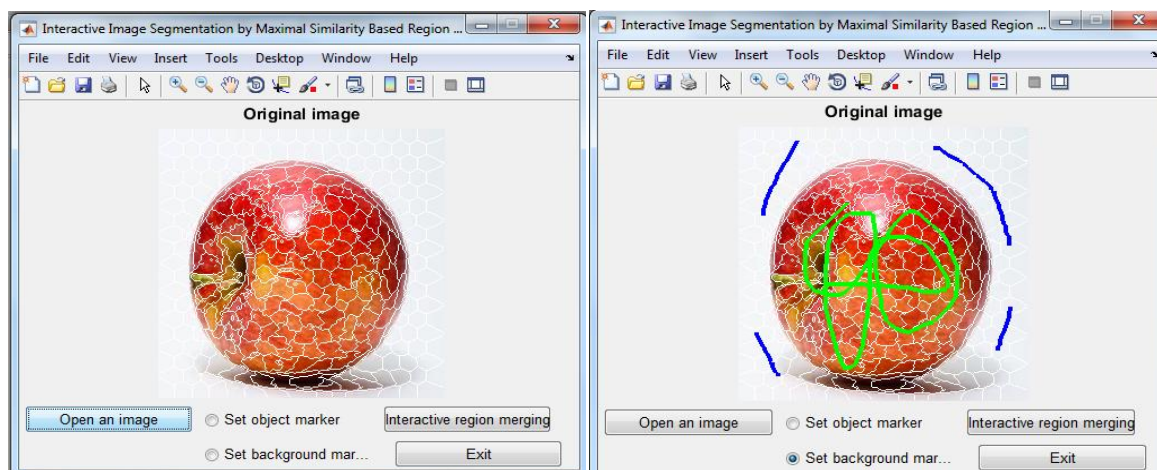
VI. CONCLUSION

The need to own a system that measures daily food intake is crucial thanks to the rise of fatness rates round the world and to unravel the matter of under-reporting in dietary intake assessments. additionally, estimating food volume and caloric assumptions area unit thought-about challenges once planning any dietary intake applications. Therefore, during this thesis, we tend to planned a activity methodology to estimate the number of calories from any food pictures through measurement the degree of the food parts within the image. to achieve our goal, we tend to designed the FRS application, which may be used on mobile devices and tablets. during this paper, we tend to planned a activity methodology that estimates the number of calories from a food's image.By measurement the degree of the food parts from the image and victimisation nutritionary facts tables to live the number of calorie and nutrition within the food. As we tend to argued, our system is intended to assist dieticians for the treatment of fat or overweight individuals, though traditional individuals may get pleasure from our system by dominant a lot of closely their daily consumption without fear concerning gluttony and weight gain and distinguishing food things in a picture victimisation image process and segmentation, food classification victimisation SVM, food portion volume activity, and calorie activity supported food portion mass and nutritionary tables. an apparent avenue for future work is to hide a lot of food varieties from a spread of cuisines round the world. additionally, a lot of work is required for supporting mixed or maybe liquid food, if potential. during this paper, we've an inclination to projected a live methodology That estimates the number of calories from a food's image By measurement the degree of the food elements from the image and exploitation biological process facts tables to

measure the number of calorie and nutrition among the food. As we've an inclination to argued, our system is meant to assist dieticians for the treatment of fat or overweight people, although ancient people could get pleasure from our system by dominant a great deal of closely their daily intake without fear concerning gluttony and weight gain and characteristic food things in a very image exploitation image method and segmentation, food classification exploitation SVM, food portion volume live, and calorie live supported food portion mass and biological process tables. an evident avenue for future work is to cover a great deal of food varieties from a diffusion of cuisines around the world. in addition, a great deal of labor is needed for supporting mixed or maybe liquid food, if potential.

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