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Measurement of Calorie from Image of an Apple

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***Abstract* ---** Nowadays, every individual has become health-conscious and wants to be protected against diseases. Everyone wants to eat a balanced diet and also keep a track of the daily calorie intake. This work in the image processing domain serves this purpose as it determines the calorie content from the image itself. For the purpose of calorie calculation, an image of the food sample is required. Initially, a person captures an image of apple; which is later processed in MATLAB. One of the key requirements of this work is that the images be taken at a constant distance of 25-35 cms from the apple. The different varieties of apples that are taken into consideration are: dark red, lighter red and one with red with yellowish parts. In the pre-processing stage, this image is read and converted into gray. Later, at the segmentation stage, the image is analyzed using K means clustering algorithm to extract the image of apples. After this, the feature extraction process takes place, which includes extraction of features like color, shape, size, weight and texture. The determination of weight is undertaken by calculating the number of pixels. Next, in the classification step, SVM classifier is used in which, the apple will be analyzed using some nutritional tables and the calorie value will be displayed to the person.

***Keywords*—** Image processing, k-means, MATLAB, segmentation, SVM classifier

I. INTRODUCTION

In the past few years, there has been a huge rise in people diagnosed with diseases like blood pressure, obesity, cancer and diabetes to name a few. As a result; today, people have started to become cautious and particular about their food intake. Intervention into the dietary domain with the help of modern technologies can encourage people to plan a healthy diet for themselves and keep a track of their nutritional intake. Therefore this project, which is concerned with the measurement of nutritional intake and provide accurate calorie value can be beneficial for not only the dieticians keeping a track of obese patients, but also for a common man conscious about his food intake. For simplicity, this system is designed to measure calorie value of apples.

The global concern for a check on healthy dietary system, the growth in population of people grappled with diseases, and lack of nutritious daily food intake of people were the motivations behind this project. Also, the effective implementation of image processing in this dietary domain to extract as accurate results as possible was an interesting objective to be attained.

II. LITERATURE REVIEW

There have been many works in this domain done in the past. Few of the works are based on manual approach of 24 hours dietary recall [1]. In this method, a dietician is responsible for preparing a list of the entire food intake on that particular day. Hence, the person is asked to remember all the food he/she ate in the past day as precisely as possible. This process becomes tedious and is obviously lacking accuracy because it is completely dependent upon memorizing capability of the person.

An improvisation in this manual approach was to capture the image of food before every meal. This image can later be processed to compute the overall calorie content in it. A calibration card can be taken as a reference, and placed near the plate before capturing the image, which will be helpful for understanding the dimension of food in the picture [2]. It has a drawback that the user will always have to carry the card around whenever he eats his/her meal so as to calculate the nutritional content.

Another method requires the capturing of food to be done with the food placed in a special tray (for calibration purpose), and then the image is processed using neural networks [3].

Many works have been proposed for attaining the objective of calorie level detection by taking the photo from a camera. One of such works uses a personal digital assistive (PDA) system, in which the person records in detail his/her daily food intake [4]. Another approach in [5] takes food images captured from smart phones and compares them with photos of pre-defined foods with known nutritional values already enlisted in a database. This approach has a disadvantage that the size of the food remains unaccounted.

III. SYSTEM METHODOLOGY

A. *Block Diagram*

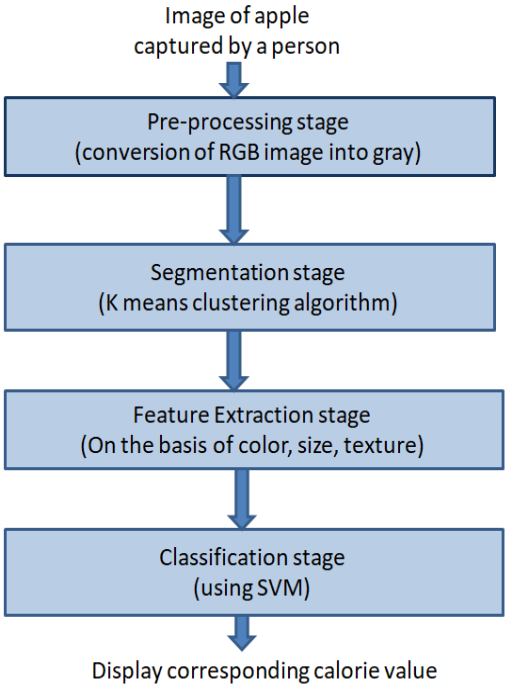

Fig. 1

B. *Overview of proposed System*

The overall style of the proposed system is shown in the block diagram. In the first step, the input image is captured with the user's mobile device followed by the pre-processing stage. The image is next segmented by k-means clustering mechanism for clustering the image. The feature extraction is done by the GLCM method, which is a process of image statistical analysis of mean, entropy, variance, and standard deviation. The extracted features are sent to classifier step, in which multi SVM classifier is used for classification of various features. After analyzing with the reference image the calorie value is measured.

K-MEANS CLUSTERING

Clustering is used to separate clusters of an object in an image. Here k is the factor which decides the range of clusters that should be portioned off. The shortest distance is measured continuously by finding Euclidean distance between the nodes so as to group a node into a suitable cluster.

FEATURE EXTRACTION

The feature analysis is the essential step to know the food portion of an image. Here the feature analysis is done by using image statistical method. The GLCM is used for feature extraction. The GLCM is a co-occurrence matrix which is obtained by calculating the mean, variance, entropy, and standard deviation, which is further used for analyzing the image with the reference image. From the extracted image, the weight is calculated by calculating number of pixels in an image by the array concept method by using ismember function in MATLAB.

MULTI-CLASS –SVM CLASSIFIER

The SVM classifier is an unsupervised kernel-based learning method. The multi-class SVM classifier is used here because different features are being compared with the reference image. The feature extracted values are compared with the training data set values and the calorie value of an image is displayed.

IV. RESULTS

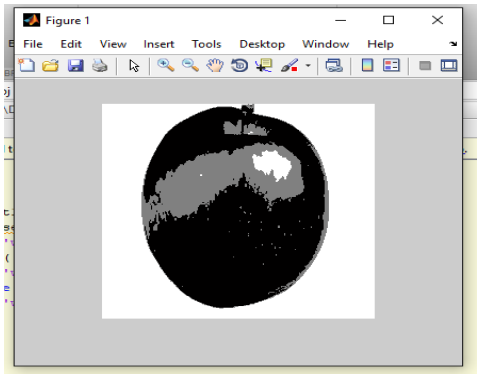

Figure 2 Result after applying pre-processing and segmentation steps

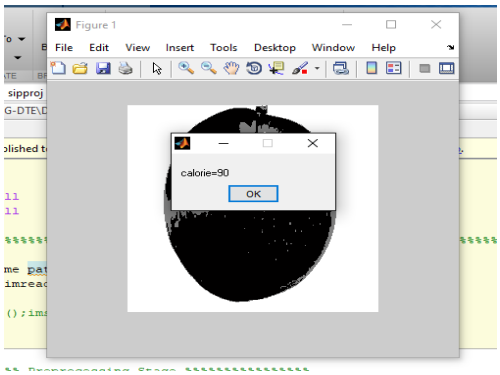

Figure 3 Display of calorie content of apple

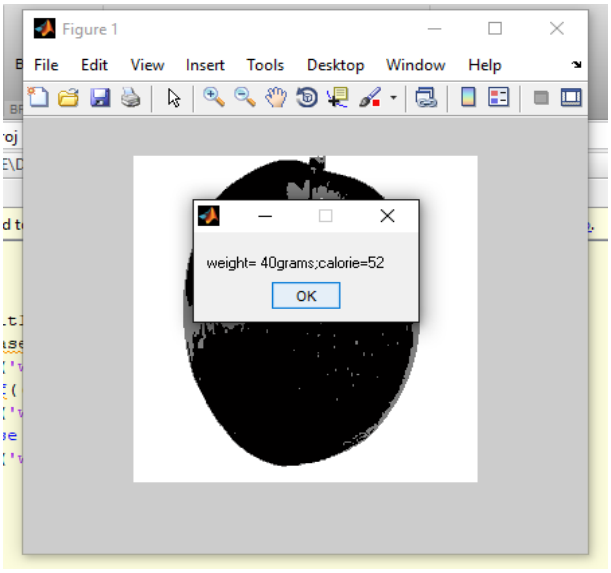

Figure 4 Calorie displayed as per the weight assumed from the number of pixels

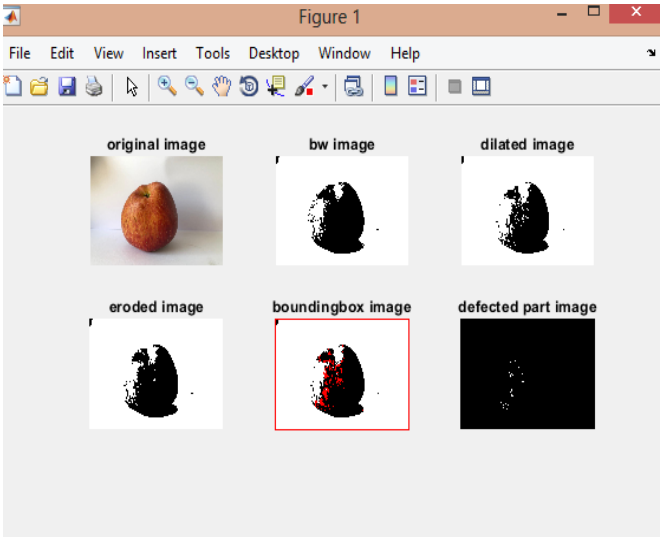

Figure 5 Finding Defective Part of an Apple using Bounding Box

As shown in the results, Figure 3 displays the preprocessing stage output which is obtained after using K-means algorithms. And the calorie content of an apple is measured with GLCM, and the outcome of calorie values obtained after classification is shown in Figure 4 and Figure 5. Finally, Figure 6 displays the defective part of an apple which is found out with region crops method.

V. CONCLUSION AND FUTURE WORK

An image processing algorithm to find the calorie content for an apple was proposed. The apples taken are from different varieties and vary in color such as dark red, lighter red and one with red with yellowish parts. The images of apples are processed and an approximation about its weight is made with respect to its area of coverage. Keeping these parameters in context, SVM algorithm is utilized and a final display is made in textbox about the calorie content of the apple. With this imaging technique, apples can be categorized into varying values of calorie contents.

This concept of calculation of nutritional content can be extended to any type of food. The system will have to be able to distinguish between different types of food based on its color, texture and size. Once that is done, it should classify the food item into its corresponding type which can be done with the help of SVM classifiers. For example, a carrot should be identified by the system accurately and classified into its own class rather than being confused with some other reddish colored food item.

The weight of apple can be calculated with more accuracy by bounding box method.

Also, in order to improve the accuracy of image processing technique in this project, filters can be used; e.g., Gabor filters.

REFERENCES

[1] M. B. E. Livingstone, P. J. Robson, and J. M. W. Wallace, "Issues in dietary intake assessment of children and adolescents," *British Journal of Nutrition*, vol. 92, no. S2, pp. S213–S222, 2004.

[2] S. Mingui, L. Qiang, K. Schmidt, Y. Lei, Y. Ning, J. D. Fernstrom, et al., "Determination of food portion size by image processing," in Proc. 30th Annu. Int. Conf. Eng. Med. Biol. Soc., Aug. 2008, pp. 871–874.

[3] B. Schölkopf, A. Smola, R. Williamson, and P. L. Bartlett, "New support vector algorithms," Neural Comput., vol. 12, no. 5, pp. 1207–1245, May 2000.

[4] L. E. Burke, M. Warziski, T. Starrett, J. Choo, E. Music, S. Sereika, et al., "Self-monitoring dietary intake: Current andfuture practices," J. Renal Nutrition Off. J. Council Renal Nutrition Nat. Kidney Found., vol. 15, no. 3, pp. 281–290, 2005.

[5] C. Gao, F. Kong, and J. Tan, "Healthaware: Tackling obesity with health aware smart phone systems," in Proc. IEEE Int. Conf. Robot. Biometics, Dec. 2009, pp. 1549–1554.

[6] B. Kartikeyan and A. Sarkar, "An identification approach for 2-D autoregressive models in describing textures," CVGIP, Graph. Models Image Process., vol. 53, no. 2, pp. 121–131, 1993.

[7] A. K. Jain and F. Farrokhnia, "Unsupervised texture segmentation using Gabor filters," Pattern Recognition., vol. 24, no. 12, pp. 1167–1186, 1991.

[8] C. J. C. Burges, "A tutorial on support vector machines for pattern recognition," Data Mining Knowl., vol. 2, no. 2, pp. 121–167, 1998.

[9] J. B. MacQueen (1967): "Some Methods for classification and Analysis of Multivariate Observations, Proceedings of 5-th Berkeley Symposium on Mathematical Statistics and Probability", Berkeley, University of California Press, 1:281-297

[10] Jain, Ramesh & Kasturi, Rangachar & G. Schunck, Brian. (1995). Machine Vision.

[11] Cristianini, Nello; and Shawe-Taylor, John; An Introduction to Support Vector Machines and other kernel-based learning methods, Cambridge University Press, 2000, ISBN 0-521-78019-5 (SVM Book).

