IJCTA, 9(36), 2016, pp. 355-361

Vegetable-Fruit Identification Based on Intensity and Texture Segmentation

Sufola das Chagas Silva Araujo* K. Meenakshi Sundaram and G. Boopathi*****

Abstract : The process of Identification of Vegetable-Fruit was developed based on dimensions, hue and profile features. But many of the Vegetable-Fruit images have comparable or very often matching dimensions, hue and profile values. As a result it would not be adequate and effectual to identify and distinguish these images based only on these limited features. Thisproposed technique considers additional features like intensity and texture that will combine with the existing features. This in turn will increase the correctness and precision of identification. The K-nearest neighbor's principle is used to carry out this identification

Keywords : KNN, Vegetable-Fruit Identification, Classification, Texture, Hue.

1. INTRODUCTION

Computer vision is faced with a challenge of object recognition system. The Vegetable-Fruit identification system is one of the most crucial field of computer technology[3].The approach of computersutilized for Vegetable-Fruit identification is based on features that describe the Vegetable-Fruit: size, shape, color, texture and intensity. The K-nearest neighbor's algorithm is utilized to carry out this identification. Hue and texture are the foundational traits of natural images, and plays key role in pictorial understanding [3][1][16]. The setup could be adopted in super market which makes the consumers tag what they bought [1][3][16]. For a long time Color has been used as a primary feature to identify objects. However, now-a-days a combination of various features like intensity, size, color, texture and shape are combined depending upon the application, to identify objects. Normally, by considering more number of features, the outcome of the methods proposed can be enhanced [5][6][15]. These features can be distinguished as geometric information, *i.e.*, size and shape; and surface information, *i.e.*,color and texture. These features facilitated to extract the required Vegetable-Fruitfrom its background [3][1][16]. The analysis for the methods was based on color, shape and size, combinedtogether to improveprecision of recognition [3][16].

2. METHODOLOGY

The KNN Algorithm is the technique used to develop an object identification scheme[16].

KNN Algorithm: The KNN algorithm is based on distance measurement. Here the identification is done utilizing the Euclidean distance grid which measures the similarity between the various traits of the Vegetable-Fruit under identification and the cached attributes of the Vegetable-Fruit. The algorithm calculates the minimum distance between the unknown Vegetable-Fruit under identification and the stored Vegetable-Fruit.

The sample is shown in the figure 1. The proposed Vegetable-Fruit identification system shown in Figure 2 requires a conversion of the colour space of the images, *i.e*, one channel consisting of luminance

* Department of Computer Engineering, Padre Conceicao College of Engineering, Goa, India

** Faculty of Computing

*** Faculty of Engineering, Botho University – Gaborone, Botswana

information and the other two consisting of chrominance information. In this the HSV representation is utilized. The hue is independent of theposition of the object with respect to the illumination and camera direction. Therefore Hue is more widely used for object extraction [8]. Texture information is obtained from the Luminance channel 'V', and colour information is obtained from the Chrominance channels 'H' and 'S'.Subsequently the threshold value of this image is calculated. Standard deviation, Mean andvariance are calculated from H and S values. Here the Hue is more suited for object retrieval asHue gives the exact color values as compared to RGB components. The RGB channel is less sensitive to lighting as compared to otherchannels [11][10][2]. The brightness is calculated utilizing the V channel and the texture features are computed from H and S channels. Brightness V can be calculated by:

$$Cmax = (R', G', B')$$
$$Cmin = (R, G, B)$$
$$V = Cmax$$

In this approach the accuracy of identification is increased by setting a threshold of 1. The Training Dataset is selected based on the desired inputs and additional attributes used for prediction. A part of the data set is taken as Training Data and this Training is based on the relationship between the data and attributes. The Testing phase consists of prediction of this relationship between data and attributes on the remaining part of the dataset.

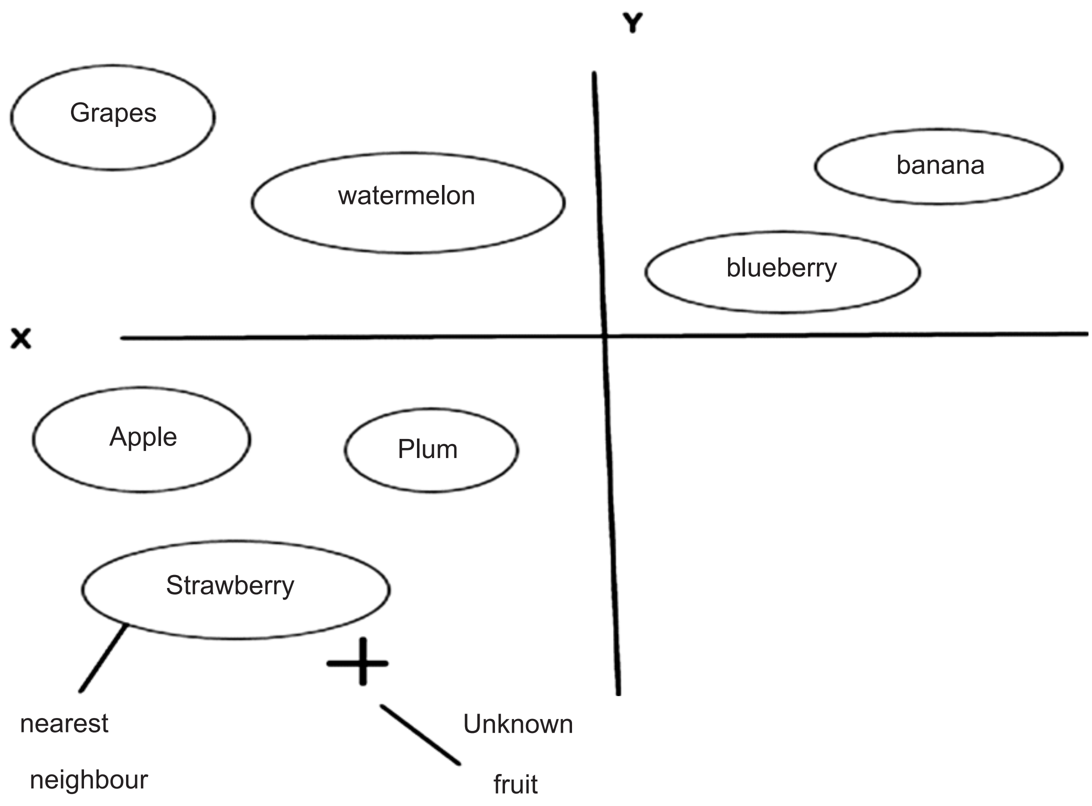

Figure 1: Classification diagram

Extraction of the Image using Segmentation : Here the image under identification and the images from the database are first region segmented from their background [5][6][15][7].These areas are represented by different sectors sets. The system segments images based on the colour. To achieve this, system divides the image into sections [9]. A feature array is formed utilizing each of these blocks. Sizes of blocks are chosen appropriately [10]. Image segmentation is a technique of segregating a digital image into multiple portions. Segmentation is carried out to facilitate the portrayal of an illustration into a more intelligible entity to be analysed. Image segmentation is predominantly used to pinpoint items and perimeters (contours, profiles etc.) in images [10]. In the segmentation process every pixel is labelled according to certain characteristics [9], i.e., identical labels share close characteristics. Image is divided into different regions that are analogous with opted properties such as brightness, colour, reflectivity, feel, etc. Segmentation is carried out to extract segments or contours from the entire image [12][14].Pixels with similar characteristics such as colour, texture or intensity are classified under one region[17].

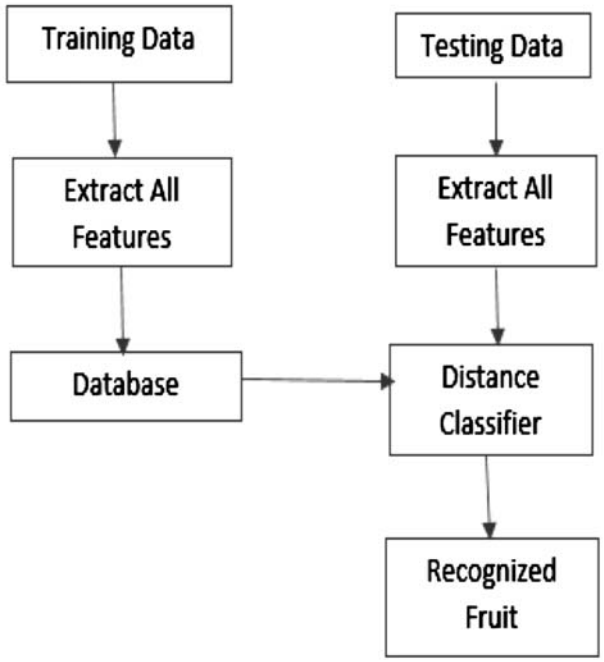

Figure 2: Vegetable-Fruit Identification System

In the testing phase, the image under test is classified based on features such as hue and feel and compared with the corresponding feature values of the images stored in the database. The Minimum Distance Criteria is utilized to classify the images based on the features. The image obtained after classification is identified from the training set as the one that has the minimum distance when compared with the test image.

The K-Nearest Neighbours is an algorithm that is being employed extensively for classification. During classification development, the unknown object in the query representation will be compared to every illustration of objects that were earlier being used to train or build up the classification algorithm[1][4][13]. The Euclidean distance measures the minimum distance if the images are similar. The Euclidean distance between two points is given as,

$$p = (p_1, p_2, p_3, \dots, p_n)$$

and $$Q = (q_1, q_2, q_3, \dots, q_n)$$

In Euclidean *n*-shape, is defined as :

$$(1)\sqrt{(p_1 - q_1)^2 + (p_2 - q_2)^2 + \dots + (p_n - q_n)^2}$$

This KNN function determines the distance between the features of the initialised Vegetable-Fruit specimen and compares it with the attributes of every databaseVegetable-Fruits and classifies the input Vegetable-Fruitaccordingly. In this way the algorithm finds the 'K' nearest samples, and then classifies the unknown input Vegetable-Fruit samples to the set or cluster at the site of location of formation of the nearest neighbours. This is followed by calculating the brightness values for red Vegetable-Fruits.

The different Vegetable-Fruit images used for training, in this method are shown below.

Table 1 shows the corresponding RGB and HSV values for all the input Vegetable-Fruit images

Training Images

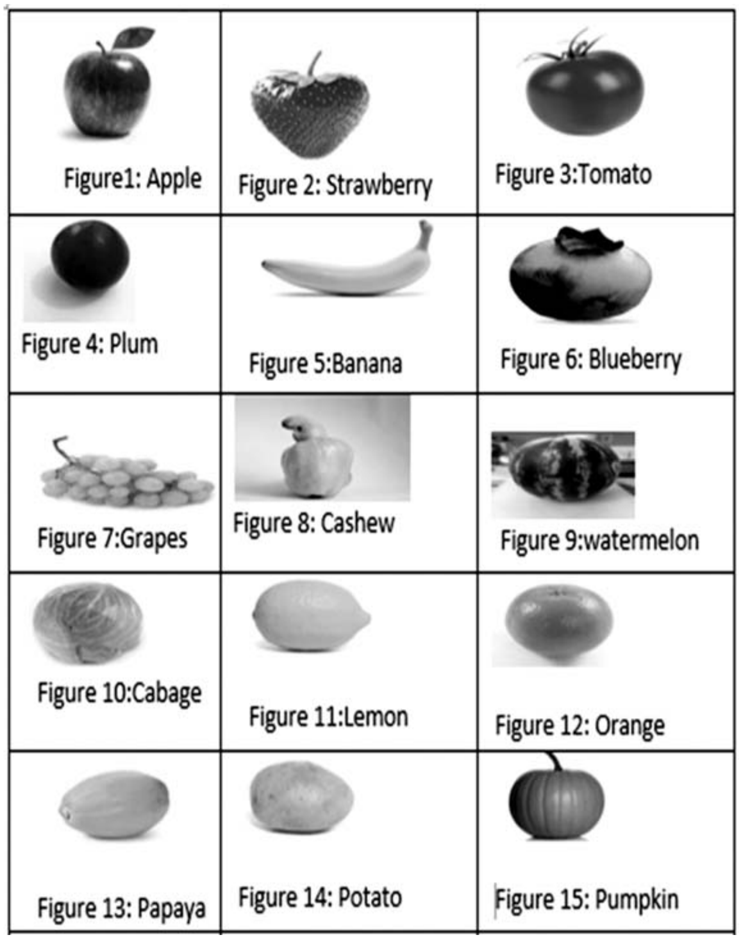

Figure 3

The classified output of the different red Vegetable-Fruits are shown in figure 3. And the brightness values of these red Vegetable-Fruits are shown in Table 2.

Table 1

RGB and HSV values of input Vegetable-Fruit images

Input Frut Image	*Red(R)*	*Green(G)*	*Blue(B)*	*Hue(H)*	*Saturation(S)*	*Brightness(V)*
Apple	170	46	54	0.9892	0.7294	0.6666
Strawberry	239	0	0	0.0	1.0	0.9372
Tomato	213	1	0	7.8246	1.0	0.8352
Plum	90	30	31	0.9610	0.8555	0.3529
Banana	219	192	53	0.1393	0.7579	0.8588
Blueberry	191	205	214	0.5652	0.1074	0.8392
Grapes	219	230	100	0.1807	0.5652	0.9019
Cashew	192	114	40	0.0811	0.7916	0.7529
Watermelon	239	221	217	0.0303	0.0920	0.9372
Cabbage	115	153	70	0.2429	0.5424	0.6
Lemon	255	211	2	0.1376	0.9921	1.0
Orange	243	232	226	0.0588	0.0699	0.9552
Papaya	252	178	3	0.1171	0.9880	0.9882
Potato	249	184	82	0.1017	0.6706	0.9764
Pumpkin	224	129	30	0.0807	0.8660	0.8784

Table 2
Brightness values for red colourVegetable-Fruits

Input Red Fruit Image	*Red(R)*	*Green(G)*	*Blue(B)*	*Brightness 'V'*
Apple	163	19	46	163
Strawberry	164	0	0	164
Tomato	213	1	0	213
Plum	90	13	31	90

Table 3
The identification results obtained on the test Vegetable-Fruitimages passed through Vegetable-Fruit Identification System

Input Fruit Image	*Mean*	*Variance*	*Standard Deviation*
Apple	25149.06	4.4072	6638701.0
Strawberry	25192.54	4.29237	6551662
Tomato	18048.58	2.4992	4999224.5
Plum	13246.61	5.8488	2418430.2
Banana	25230.55	5.22752	7226861.5
Blueberry	85678.66	4.52419	2.12701
Grapes	25205.55	4.47153	6686951.0
Cashew	25198.5	4.68690	6846100
Watermelon	21599.0	1.0184	3191249.2
Cabbage	19999.07	2.34911	4846769.0
Lemon	25252.53	4.54627	674260
Orange	16017.0	2.05045	45281940
Papaya	650665.4	3.50062	1.8709948
Potato	25229.0	5.10554	7145312.5
Pumpkin	107065.9	7.66588	2.76873
Apple	25198.54	3.752232	6125547
Strawberry	25311.02	3.712664	6093164.0
Tomato	53489.523	2.08689	1.444608
Plum	19999.07	1.564939	3955931.2
Banana	25251.03	4.620650	6797536
Blueberry	44699.016	1.310914	3620651.2
Grapes	25161.057	4.797215	6926193.5
Cashew	70498.18	3.843067	1.960374
Watermelon	562897.25	1.47999	1.216548
Cabbage	779684.25	4.422364	2.102941
Lemon	25121.525	5.279981	7266348.0
Orange	25170.54	4.539293	6737428.0
Papaya	622101.3	3.098090	1.7601392
Potato	25177.533	3.994160	6319937.0
Pumpkin	22298.564	3.44977	5873481.5

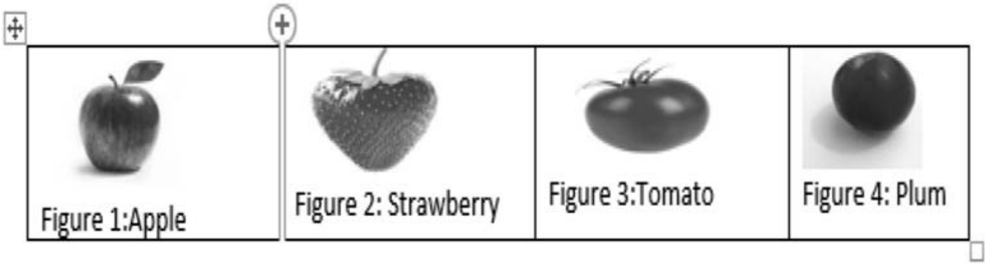

Figure 3: Red Vegetable-Fruit images

Data Set : Various Vegetable-Fruit images are collected for Vegetable-Fruit identification system.

The Dataset comprises of different category of Vegetable-Fruits images used for identification based on the proposed method. These images are of Apple, Strawberry, Tomato, Plum, Banana, Blueberry, Grapes, Cashew, Watermelon, Cabbage, Lemon, Orange, Papaya, Potato and Pumpkin. First these Vegetable-Fruit images are allocated into two groups, training and testing groups, where half of the Vegetable-Fruit samples from each collection are incorporated to prepare the system and the balance half samples serves as the testing set[13]. The images from the training set are processed by the proposed system to enhance the accuracy for proper identification. The method will estimate the mean values for each of the color (RGB) elements. Below shows the Table 3 which displays theidentification results on the test Vegetable-Fruit images passed through Vegetable-Fruit Identification System

3. RESULTS AND DISCUSSIONS

Classification accuracy can be improved by varying the value of'K'inthe K-nearest neighbour classifier. Minimum Euclidean distance measurements are considered to analyse the similarity between the tested Vegetable-Fruit image and the dataset image. If an apple was selected from all the Vegetable-Fruit images of the data set then based on the colour and intensity feature we get Apple, Strawberry, Tomato and plum as the output as shown in Figure 3.Mean, Variance and Standard deviation are computed for these four selected images for further texture based classification. The output of the Vegetable-Fruit Identification System was analysed which delivered positive results 93.05% of the time. The proposed system can be relevantly used in realityfor identification and classification of differentfruit and vegetables types.

4. CONCLUSION

Our proposed method can classify, identify, and recognize the fruit and the vegetable image specimen. The chosen characteristics given to the system are mentioned in the Table 1, Table 2. The procedure is being developed for the detection of different fruit and vegetables samples. The procedure used in this proposed method, can be further improvised to increase the accuracy of the identification. Further improvement can be achieved by using different color space, different features and other classification techniques.

5. REFERENCES

1. Pragati Ninawe1, Mrs.Shikha Pandey2, "A Completion on Fruit Recognition System Using K-Nearest Neighbors Algorithm," Volume 3 Issue 7, July 2014.
2. Martin Muller, Peter Karasev, IwanKolesov and Allen Tennenbaum "Optical Flow Estimation for Flame Detection in videos" IEEE Transaction on Image Processing, Vol 22, No 7, July 2013
3. Woo ChawSeng, "A new method for fruits Recognition system," IEEE., Volume:01,pp 130 - 134, 5-7 Aug. 2009
4. Woo ChawSeng. "A new method for fruits recognition system", 2009 International Conference on Electrical Engineering and Informatics, 08/2009.
5. Yan Na, Hongmin Lu and Ying Zhang, "Content Analysis Based Medical Images Fusion with Fuzzy Inference," Fifth International Conference on Fuzzy Systems and Knowledge Discovery, IEEE, 2008.
6. Ryszard S. Choraś. "Fuzzy Processing Technique for Content-Based Image Retrieval", Lecture Notes in Computer Science, 2004

7. Biologically Inspired Intelligent Robots Using Artificial Muscles" ,International Journal of pharma and bio sciences [8]B. S. Anami, D. G. Savakar, P. H. Unki and S.S. Sheelawant (2006). "An Artificial Neural Network Model for Separation, Classification and Gradation of Bulk Grain samples". IEEE First International Conference on Signal and Image Processing held at Hubli , India during 7-9 December 2006 .pp 511—520.

9. "A Robust Region-Based Similarity Measure", The Information Retrieval Series, 2004.

10. YixinChen,James Z. Wang, A Region-Based Fuzzy Feature Matching Approach to Content-Based Image Retrieval, IEEE Transactions of Pattern Analysis And Machine Intelligence, Vol 24,No 9,September 2002

11. Chad Carson, Serge Belongie, Hayit Greenspan and Jitendra Malik "Blobworld:Image Segmentation using Expectation-Maximization and its application toimage querying" IEEE Transaction on Pattern Analysis and Machine Intelligence, Vol 24, No 8, August 2002

12. B. Johnston, M. Atkins, B. Mackiewich, and M. Anderson, "Segmentationof multiple sclerosis lesions in intensity corrected multispectral MRI," Medical Imaging, IEEE Transactions on, vol. 15, no. 2, pp. 154–169, April 1996.

13. Xiaohua Wang, , Wei Huang, Chao Jin, Min Hu, and Fuji Ren. "Fruit recognition based on multifeature and multi-decision", 2014 IEEE 3rd International Conference on Cloud Computing and Intelligence Systems, 2014

14. Christophe Aube. "Fuzzy algorithms to extract vacuoles of steatosis on liver histological color images", 2007 29th Annual International Conference of the IEEE Engineering inMedicine and Biology Society, 08/2007

15. Cognitive Computational Semantic for high resolution image interpretation using artificial neural network", Biomedical Research.

16. Miss. VrushaliNagpure ,Prof.Kavita Joshi "Grading of Cashew Nuts on the Bases of Texture, Color and Size" International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169 Volume: 4 Issue:4, 171 – 173, April 2016

17. Estimation of Spectrum in Mobility based on Time Series Models ",International Conference on Recent Innovations in Engineering & Technology, ICRIET, BANGALORE