AUTOMATIC DETECTION OF POMEGRANATE FRUITS USING K-MEANS CLUSTERING

S. Poorani[1], P. Gokila Brindha[2]

[1,2] *Department of Computer Technology-UG,Kongu Engineering College, (India)*

ABSTRACT

Nowadays in agriculture the labour work is very important. This paper is proposed to reduce the labour work in fruit picking by using the image clustering algorithm in a machine vision system. For plucking fruits such as citrus, apple, jujube, etc., so many different classification techniques were proposed. This paper focus on the automatic detection of the pomegranate fruits in an orchard. The image is segmented based on the color feature using k-means clustering algorithm. The K-Means algorithm produces accurate segmentation results only when applied to images defined by homogenous regions with respect to texture and color. Segmentation begins by clustering the pixels based on their color and spatial features. The clustered blocks are then merged to a specific number of regions. Thus it provides a solution for image retrieval. Thus our paper proposes the simulation results that has been attained using the algorithm.

Keywords: K-Means Clustering, Machine Vision System, Segmentation

I INTRODUCTION

Pomegranate is just a wonderful fruit to grow; the fruit is good for health and the trees are attractive in the landscape. The fruit should be a bright, deep red with no green color, though it may have a few streaks of yellow gold. A ripe pomegranate skin should be shiny and smooth without blemishes or cracks. Color is the first indication that pomegranate fruit is ripe and ready to be picked. The skin on a very ripe pomegranate will start losing its shine, looking a little leathery and slightly dull. Generally fruit plucking are done manually in most orchards/farms/places. But the problem here is that it is a time consuming and labour dependent process. In this paper the pomegranate is identified by using the color-based segmentation method of K-means clustering. The camera fixed in a plucking machine captures the image of the tree with fruits. The captured image is given to the k-means algorithm where the actual fuits are identified as a separate cluster.

II LITERATURE REVIEW

In [1] Yutan WangIn proposed a technique with an image segmentation approach based on color difference fusion in *RGB* color space to recognize ' Lingwu long jujubes' color features. Firstly, the three-dimensional histograms of each color component which is widely used in color space currently are compared; and then the jujubes' red area and non-red area was extracted respectively, thus, the whole target area is obtained by sum of those areas; then, watershed algorithm combined with mathematical morphology distance and gradient was utilized to overcome adhesion and occlusion phenomena; finally, the maturity level was recognized by the established recognition model of Lingwu long jujubes.

In [2] Subhajit Senguptaa, Won Suk Leeb used the the circular Hough transform, texture classification with a support vector machine, and keypoints by scale invariant feature transform algorithm to detect green citrus fruits. In[3] Ms.Chinki Chandhok, Mrs.Soni Chaturvedi, Dr.A.A Khurshid proposed a framework of unsupervised clustering of images based on the colour feature of the image.

In [4] P. Vimala Devi , K.Vijayarekha, reviewed the various techniques used in automatic inspection of fruits using machine vision techniques for defects identification in different fruits.

In[5] Rashmi Pandey, Sapan Naik, Roma Marfatia reviewed efficient algorithms for color feature extraction. different techniques like k-means classification, fuzzy, neural networks were proposed in fruit identificarion. The reviewed the techniques used for identifying fruits such as mango, dates, strawberry, apple, orange,tomato, grapes and pineapple.

In [6], Tajul Rosli B. Razak, Mahmod B. Othman, Mohd Nazari bin Abu Bakar, Khairul Adilah bt Ahmad, Ab Razak Mansor focused automated mango grading system using fuzzy image analysis. In proposed system, the process of mango grading had done based on size, color and skin feature.

In [7] Hong Zheng and Hongfei Lu used LS-SVM, which solves a set of linear equations instead of solving a quadratic programming problem, is used for the automatic detection of browning degree on mango fruits.

In [8] Jun Zhao, Joel Tow and Jayantha Katupitiya presented a vision based algorithm to locate apples in a single image. Texture based edge detection has been combined with redness measures, and area thresholding followed by circle fitting, todetermine the location of apples in the image plane.

III MATERIALS AND METHODS

3.1 Segmentation

Segmentation divides an image into its constituent regions or objects. Segmentation algorithms are based on one of two basic properties of color, gray values, or texture: discontinuity and similarity. Each image point is mapped to a point in a color space. The points in the color space are grouped to clusters. The clusters are then mapped back to regions in the image. The objects can be distinguished by assigning an arbitrary pixel value or average pixel value to the pixels belonging to the same clusters.

3.2 K-MEANS Clustering

Clustering is the process of partitioning a group of data points into a small number of clusters. In general, we have *n* data points $\mathbf{x}i,i=1...n$ that have to be partitioned in *k* clusters. The goal is to assign a cluster to each data point. K-means is a clustering method that aims to find the positions $\mu i,i=1...k$ of the clusters that minimize the *distance* from the data points to the cluster. K-means clustering solves

$$\operatorname{argmin}_{\mathbf{c}}\sum_{i=1}^{k}\sum_{\mathbf{x}\in ci} d(\mathbf{x},\mu i)=\operatorname{argmin}_{\mathbf{c}}\sum_{i=1}^{k}\sum_{\mathbf{x}\in ci}\|\mathbf{x}-\mu i\|_2^2$$

where $\mathbf{c}i$ is the set of points that belong to cluster *i*. The K-means clustering uses the square of the Euclidean distance $d(\mathbf{x},\mu i)=\|\mathbf{x}-\mu i\|_2^2$. This problem is not trivial (in fact it is NP-hard), so the K-means algorithm only hopes to find the global minimum, possibly getting stuck in a different solution.

3.3 Fruit Identification

Kmeans clustering is used to cluster the objects into three clusters using the Euclidean distance metric. Manually the pomegranates can be identified by its deep red color and shining surface. The pomegranate images was captured by digital camera Nikon under natural light conditions in an orchard. The first step is to read the image of the pomegranate tree using pom=imread('poma.png');. Now we have to create the color transformation structure by using makecform function, which converts RGB to L*a*b space.The transformation is now applied to the taken image. The kmeans is used to cluster the objects into three clusters using the Euclidean distance metric. For every object in the input image, kmeans returns an index corresponding to a cluster. Every pixel in the image is labeled with its cluster_index. There are red objects in one of the clusters. We can separate deep red from other colors using the 'L*' layer in the L*a*b* color space. The pomegranates are deep red. The 'L*' layer contains the brightness values of each color. The cluster that contains the red objects is found(pomegranate fruits). Extract the brightness values of the pixels in this cluster and threshold them using im2bw.The deep red cluster has the smallest cluster_center value. Now the pomegranate fruits are displayed separately because the remaining pixel values are set to zero.

IV RESULTS

The simulation environment MATLAB was used for our experiments.

Fig.1 Original Image

Fig.2 Image Labeled by Cluster Index

Fig.3 Objects in Cluster1

Fig.4 Objects in Cluster2

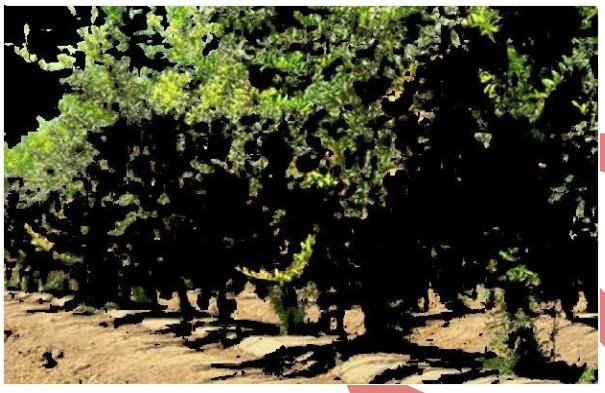

Fig.5 Objects in Cluster 3

Fig.1 is the original image. Fig.2 represents the image labeled by its cluster index and Fig.3 shows the image in cluster1 that displays the sky, matured leaves, stem, and shadow of the pomegranate tree, Fig.4 shows the image in cluster2 that displays the pomegranate fruits only. This is the thing we have to identified; Fig.5 shows the objects in cluster 3 that displays the young green leaves of the pomegranate trees and the soil in the land of the orchard.

V CONCLUSION

A method was proposed to identify pomegranate fruits from color images taken by digital camera under natural light conditions in the orchard. The color based segmentation based on k-means clustering were implemented. The color-based segmentation performed well in detecting pomegranate fruits. The results look promising, this recognition approach could be applied in automatic picking devices. In future this method can be improved to identify more types of fruits.

REFERENCES

[1] Yutan Wang, Jiangming Kan, Wenbin Li and Chuandong Zhan, Image Segmentation and Maturity Recognition Algorithm based on Color Features of Lingwu Long Jujube, *Advance Journal of Food Science and Technology 5(12): 1625-1631, 2013.*

[2]Subhajit Senguptaa, Won Suk Leeb, Identification and Determination of the Number of Green Citrus Fruit under Different Ambient Light Conditions,

[3] Ms.Chinki Chandhok, Mrs.Soni Chaturvedi, Dr.A.A Khurshid, An Approach to Image Segmentation using K-means Clustering Algorithm, *International Journal of Information Technology (IJIT), Volume – 1, Issue – 1, August 2012 ISSN 2279 – 008X .*

[4] P. Vimala Devi , K.Vijayarekha, Machine Vision Applications To Locate Fruits,Detect Defects And Remove Noise: A Review**,** *Rasayan.J.Chem,Vol. 7 | No.1 | 104-113 | January - March| 2014ISSN: 0974-1496 | e-ISSN: 0976-0083 | CODEN: RJCABP*

[5] Rashmi Pandey, Sapan Naik, Roma Marfatia, Image Processing and Machine Learning for Automated Fruit Grading System: A Technical Review, *International Journal of Computer Applications (0975 – 8887) Volume 81 – No 16, November 2013*

[6] V. Leemans and M.F. Destain, "A real-time grading method of apples based on features extracted from defects," *Journal of Food Engineering, vol. 61, no. 1, pp. 83-89, January 2004.*

[7]Hong Zheng and Hongfei Lu, "A least-squares support vector machine (LS-SVM) based on fractal analysis and CIELab parameters for the detection of browning degree on mango (Mangifera indica L.)," *Computers and Electronics in Agriculture, vol. 83, pp. 47-51, January 2012.*

[8] Jun Zhao, Joel Tow and Jayantha Katupitiya" On tree fruit recognition using texture properties and color data", *International Conference on Intelligent Robots and Systems 2005 IEEE/RSJ.*