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GLCM Algorithm and SVM Classification Method for Orange Fruit Quality Assessment

Kavita Komal
Student,
Punjabi University Patiala
kavitakomal1994@gmail.com

Dr.Sonia
Assistant Professor
Punjabi University Patiala.
ergoyalsonia@gmail.com

***Abstract*:- The image processing is the approach which is applied to process information which is stored in the form of pixels. This research work is related to orange fruit quality assessment. The orange fruit quality assessment has the various phases like pre-processing, feature extraction and classification. In the previous method Naïve Bayes classifier is applied for the quality assessment. The Naïve Bayes classification method gives low accuracy for the quality assessment. In this research work, the Naïve Bayes classification method is replaced with SVM classification for the quality assessment. The GLCM algorithm is applied for the feature extraction along with the threshold based segmentation. The proposed method is compared with the existing method in terms of accuracy, execution time, sensitivity, specificity. It is analyzed that accuracy, sensitivity, specificity of proposed method is high and execution time is low as compared to existing method for orange fruit quality assessment .**

Keywords: Threshold Segmentation, Region based segmentation, GLCM, Naïve Bayes, SVM

I. INTRODUCTION

The technique is used for analysis the pictures and to improve its quality of unprocessed is known as image processing. The raw images or pictures can be obtained from the cameras deployed on aircrafts, space shuttle, satellites or the images captured in daily routine for numerous objectives. A number of image processing methods have been developed in the last few years [1]. Various approaches explored for image processing are acquired from armed forces scouting flights, interplanetary explorers and rockets. Some factors like effortless accessibility of prevailing personnel processors, big dimensional reminiscence equipments, and graphic software etc play a fundamental role in the popularity of image processing techniques. It is used to find its usefulness in various areas like publishing business; article dispensation, armed forces, forensic Studies, explicit sculptures, film business, non-destructive assessment, fabric discipline and medical Imaging. Image scanning, image storing, image improvement and image elucidation are the general phases involved in image or picture processing. The image processing is mainly of two types [2]. These types are analog image processing and digital image processing. In analog picture processing, electrical methods are used to alter the picture. Different kinds of picture processing methods have been implemented in the last few years for analyzing the farming pictures like vegetables and fruits for acknowledgment and categorization causes. The scheme of fruit detection can be implemented in the form of picture text describer. This scheme comprises ability for the description of low level image characteristics or fruit picture's contents [3].

A number of techniques have been proposed for the detection and categorization of fruit pictures on the basis of color and shapes. The color and texture of various fruits depends on their growth. Color and texture are considered the primary quality of natural descriptions [4]. These factor also a play a significant character in image perception. Though, dissimilar fruit images can have alike or equal color and shape standards. Therefore, color or shape characteristics scrutiny techniques are not vigorous and adequately efficient for the identification and differentiation of fruits descriptions. The fruit detection scheme may be implemented for educational reasons in order to enhance knowledge, particularly for little children and down disease patients, of fruits prototype detection on the basis of fruit detection outcomes [5]. The scheme of fruit recognition can also be implemented in grocery stores so that consumers can tag their purchase with the help of computerized fruit detection system.

Numerous issues have to be conquered for enabling the scheme to execute computerized detection of the type of fruit or vegetable with the help of pictures taken from the camera. In a fruit recognition system, certain factors like unsure and erratic brightness circumstances in the field surroundings, uneven and multifaceted awning configurations and unreliable shade, figure and dimension of the fruit affects the accurateness of fruit identification and localization [6]. Also, some barriers like leaves, twigs, and other fruits also restrict the precision of fruit recognition in awning pictures. Various researches have been conducted in the last few years for the recognition of fruits in alike external atmosphere. The tradition techniques of fruit recognition used different kind of picture sensors, a variety of picture scrutinizes and soft calculation techniques. Support Vector Machine classifier is a supervised statistical learning algorithm. This approach is utilized for linear and non-linear deterioration scrutiny and prototype categorization. SVM approach segregates the two classes with an utmost fringe amid

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them with the help of a hyper-linear plane for linear separable categorization.
The characteristic vectors are planned to a novel characteristic space in a non-linear separable manner for non-linear separable categorization. After this, image classification is performed on the basis of linear SVM segregation. A recurrent network employs Backbone Propagation Neural Network (BPNN) algorithm. The weights of neural network get fixed after training. These weights can be utilized for the computation of output values for novel question images. These images do not exist in the learning database. Decision tree algorithm computes the class relationship by dividing a dataset into unvarying subsets in repetitive manner [7]. The acceptations and refusal of class labels at every intermediate phase are permitted by the Hierarchical classification model.
This technique has three sections. These are partitioning of nodes, detection of terminal nodes and distribution of class label to the terminal nodes. These classifiers are based on the hierarchical rule based technique. These classifiers use nonparametric approach. Several stochastic relations are driven to define the features of an image fuzzy measure classification process [8]. This classification process combines the different kinds of stochastic are combined wherein the constituent of this set of properties are fuzzy in nature. It gives the chance to explain different groups of stochastic features in the analogous form. The stochastic approach is used by this classification technique. The threshold choice and fuzzy integral are two factors that decide the performance and accuracy of this classification.

II. RELATED WORK

JyotiJhawar, et.al (2016): proposed approach was identified that Linear Regression based method could forecast the maturity of the unknown orange fruit in an explicit manner and also enabled the categorization into numerous modules with preferred lifetime. The tested outcomes indicated an achievement range of 90 and 98 percent. **XinXie, et.al (2018):** proposed an enhanced picture corresponding approach on navel orange exterior imperfection discovery [40].

The proposed approach combined wavelet transform (WT) and speeded up robust features (SURF) on the basis of compressed sensing and proposed approach ensured enhanced detection accurateness and competence, and attained quick recognition of navel orange imperfections. **Tanya Makkar, et.al (2018)** proposed an approach to identify fruit defects in the agricultural industry for reducing the production cost and time [9]. On comparing predicted and training dataset together, the feasibility of an approach reveals the efficient defect detection and classification in the agricultural industry. **Yang Gao, et.al (2018)** presented that CI-CH could form a layer of coating film is uniform and transparent in the fruit surface, it reduced the occurrence of fruit postharvest decay, slowed down the degradation rate of water loss and the content of TSS, TA and Vc, in order to delay the weight loss rate of fruit storage, while maintaining high commodity value [10]. From the above results, CI-CH, as a green environmental protection material, can prolong the storage time and maintain fruit quality of navel orange fruit. Therefore, CI-CH has great potential for application in the post-harvest preservation of citrus fruits. **Abhay Agarwal, et.al (2019)** an automatic apple fruit disease detection method is proposed and validated through image processing techniques. There are mainly three steps—Image Segmentation, Feature Extraction, and Classification [11].

The accuracy of the classifier is up to 98.387%. The SVM classifier correctly detected the diseases namely Apple scab, black rot canker, and core rot as well as healthy apples. **Santi Kumari Behera, et.al (2019)** presented a study which included around 283 types of mangoes present in India only, from that 30 types of mangoes are well known. Human vision sometimes leads to mismatch between the varieties of mango fruit [12]. This paper successfully classified the different kinds of mangoes with 90% accuracy. **Israel Pineda, et.al (2019)** presented that the production of high-quality food products needs an efficient method to detect defects in food, this is particularly true in the production of apples. Hyperspectral image processing is a popular technique to carry out this detection [13]. Our study considers the spectral range between 403 nm and 998 nm. Our results include the detection of scab, bruise, crack, and cut with and without stem and calyx. **Albert Cruza, et.al (2019)** presented a novel system, utilizing convolutional neural networks, for end-to-end detection of GY in red grape vine (cv. Sangiovese), using color images of leaf clippings [14].

III. MATERIAL AND METHODS

This research work is based on the orange fruit quality assessment. The orange fruit assessment can be done by implement procedure of local segmentation. The local segmentation technique consists of various phases are like back ground removal, background pixel removal, image Binarization, image subtraction, image morphological modification, removal of stem end pixels for detecting surface defect in an orange gray-level image. In this research work, the technique of SVM classifier will be applied to classify the defective and non defective regions. The SVM classifier will able to detect the percentage of portion of defective and non defective regions.

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3.1 Pre-processing: In the pre-processing phase, the input image will be cleaned using the method of denoising. The cleaned image will be further processed for the local segmentation.

3.2 The image segmentation description and procedure

The RGB image is transformed into the HIS model to do segmentation. In general, two techniques are used to detect diseased element of the fruit. These techniques are called Boundary detection and spot detection. The 8 connectivity of the pixels are considered for boundary detection. Afterwards, the boundary detection algorithm is implemented.

3.2.1 Gray level image binarization

The technique used for the improvement of unprocessed or raw pictures is known as image processing. Some examples of image processing are conversion of HIS/HSV color space, histogram equalization and color difference. For the processing of color hallucination RGB or HSV color space is used. HSV color space explains color or shades by the ratio of red, green, and blue colors. This color space explains the color by means of value, hue and saturation. Histogram equalization is considered a non linear structure. Histogram equalization performs the redistribution of pixel value to maintain the similar amount of pixels for every value in an array.

3.2.2 Texture feature using GLCM algorithm

The feature extraction is the third phase, in which GLCM algorithm will be applied for the feature extraction of the CT scan image In this step, the GLCM algorithm is applied for the feature extraction. The GLCM algorithm will extract the textural features of the input image. The GLCM algorithm extracts 13 features of the image for the tumor detection

$$\text{Energy} = \sqrt{\sum_{i,j=0}^{N-1} p_{i,j}^2}$$

Where, Pi, j - is the probability of the colour intensity at point (i, j)

N-1 - The total no.of pixels in the image is N and we have executed loop N-1 because starting value is 0.

$$\text{Entropy} = -\sum_{i=0}^{n-1} pi \log_b pi$$

pi- is the pixel no. whose log is taken to calculate the entropy value.

$$\text{Contrast} = \frac{I_{max} - I_{min}}{I_{max} + I_{min}}$$

Imax - Maximum pixel intensity of the image

Imin - Minimum pixel intensity of the image.

3.2.3 Region based segmentation

In the second phase, the technique of local segmentation will be applied which can segment the defective and non defective regions. The approach of region based segmentation will be applied which will segment the similar and dissimilar regions from the RGB scan image. The outh's segmentation technique is applied for the segmentation. The sectioned picture attained from thresholding comprises several benefits like lesser storage space, speedy dispensation velocity and easiness in exploitation in comparison with gray level picture that generally includes 256 steps. In the presented work, a gray scale picture is utilized for thresholding process. In this process, rgb picture is converted into binary picture. The obtained picture is in the form of black and white.

3.2.4 Use of SVM Classification: The approach of SVM classifier will be applied which will classify the defective and non defective regions. The SVM classifier will detect the percentage of area defective, It is an effective classifier which is used to perform regression, classification as well as general pattern recognition and hence it is called SVM classifier. It highly generalized the performance without including any prior knowledge even in the case when the input space is very high; this classifier is one of the best classifier amongst all. It is used for binary classification and for solving multiclass issue.

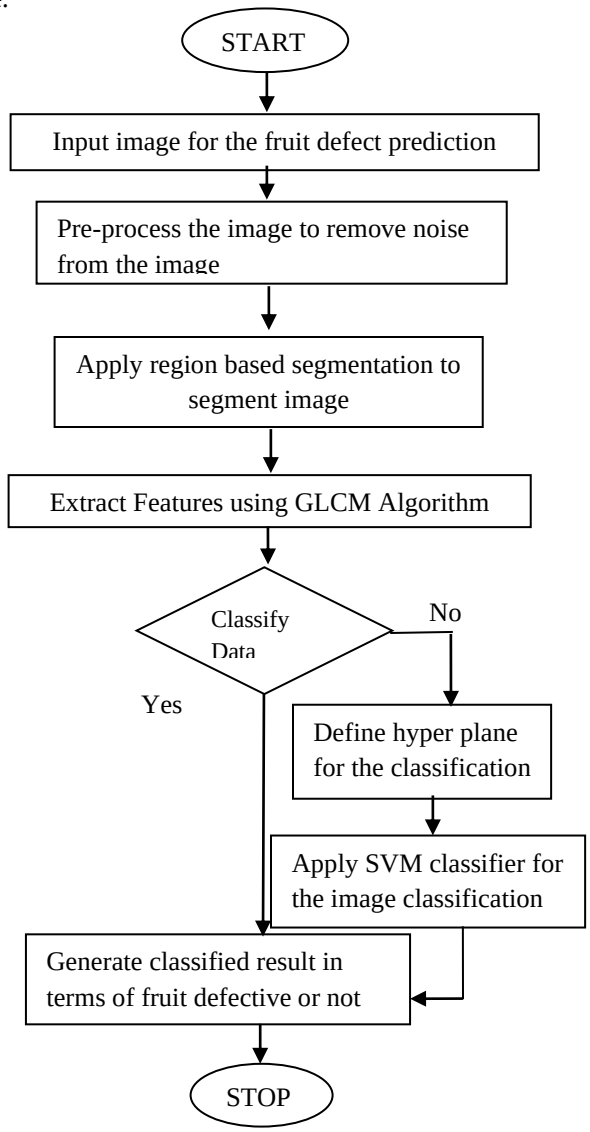

Figure 1: Proposed Flowchart

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Proposed Methodology following steps:

1. Start: The first step is to start the process.
2.Input Image: Then input image of orange has to be taken.
3. Pre-processing: Then image of the fruit is pre-processed to check whether any noise is present or not& if found then it is removed**.**
4. Apply region based segmentation to segment image: In this step, the Region based Segmentation is applied for the selection of ROI(Region of interest).
5. Extract features using GLCM algorithm: Now after the selection of Region of interest feature selection is done by using GLCM algorithm.
6. Classified: The classification means when process which can classify can data into certain classes according to there similarity. In this research work, we have to classify image into defective and non defective portion thats why we have used it.
7.Define hyper-plane for the classification: If the features are not classified then we have to define hyper- plane.
8.Apply SVM classifier for the image classification: Now we have to take SVM classifier for classification of the image.
9. Generate classified result in terms of fruit defective or not: The result appears whether the image of selected fruit is defective or not.
10.Stop: The process is now ended by getting the results.

3.2.5 Bilateral filter: It is used bilateral filter because of it performs best on the random noise which we have there in the images which we have taken as input. It is non-linear filter.

IV. SIMULATION RESULTS

The proposed research is implemented in MATLAB and the results are evaluated by comparing proposed and existing methods with respect to certain performance parameters. How to implement the program following 5 steps:

Figure 2 :Input Image

As shown in figure 2, this research work is related to quality prediction of the orange fruit. The input image is the diseased image of the orange from where we want to detect the quality of the orange using the RGB colour space.RGB colour space is input parameter that is use to show the coloured image.

Figure 3: Remove Background

As shown in figure 3. Remove background is used so that background is not detectable. In these step the region based segmentation is used called k-mean segmentation is applied to segment image. In the k-mean segmentation take input the number of segments you want to form.

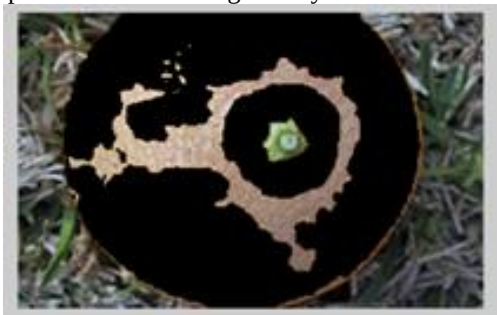

Figure 4 : Gray level image

In this process gray -level image binarization used. In gray level, threshold segmentation will used. The gray-level images are transformed into binary images using threshold algorithm. For this purpose, all the pixels under some threshold are set to zero while the pixels beyond that threshold level are set to one.

Figure 5: Original Image

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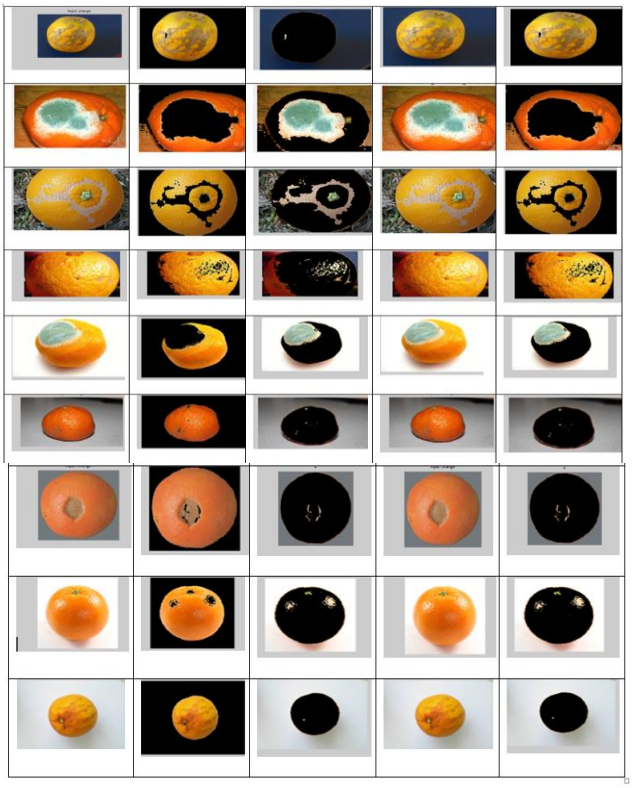
As shown in the figure 5 ., the input image is shown again from where the disease portion needs to be detected for the quality assessment.

Figure 6 : Disease Image

As shown in figure 6 , the region of interest is selected which is the diseased portion. The black portion in the image is the disease portion and other portion is the normal portion. The disease portion is used for the quality assessment of the original image.In these process,region based segmentation is used and to find out the defective area in the form of percentage and find out how much area is defective.



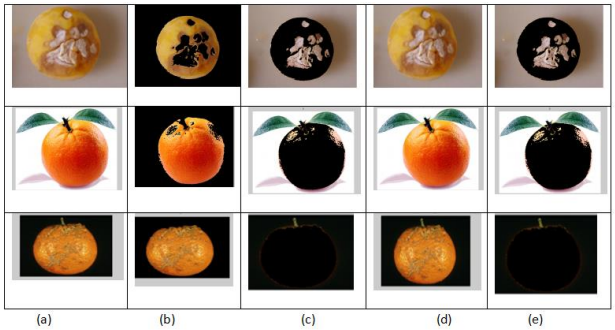


Figure 7: Different stages of the proposed segmentation process.(a)Input image(RGB) (b) Remove background.(c) Gray level image.(d) Original image.(e) Resulting diseases image.

In these figures SVM classification used. This research work is related to quality prediction of the orange fruit. The input image is the diseased image of the orange from where we want to detect the quality of the orange using the RGB colour space.RGB colour space is input parameter that is use to show the coloured image. The region based segmentation called k-mean segmentation is applied to segment image. In the k-mean segmentation take input the number of segments you want to form. In this process gray -level image binarization used.

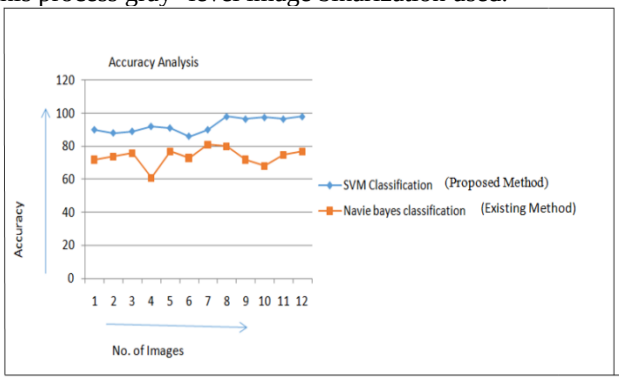


Figure 8: Accuracy Analysis

Accuracy is defined as the number of points correctly classified divided by total number of points multiplied by 100, as shown

$$\text{Accuracy} = \frac{\text{Number of points correctly classified}}{\text{Total Number of points}} * 100$$

As shown in the figure 8, the accuracy of the proposed technique is high as compared to existing technique because in the proposed technique SVM classification method is used for the defective region detection.

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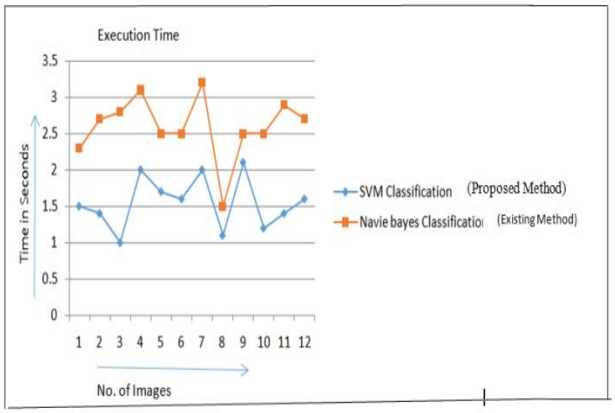

Figure 9 :Execution Analysis

Execution time is defined as difference of end time when algorithm stops performing and start time when algorithm starts performing as shown

Execution time = End time of algorithm- start of the algorithm

As shown in the figure 9, the execution time of the proposed method is low as compared to existing method because the complexity of the existing system is quite high. In the proposed system the execution time is low which directly reduce execution time .

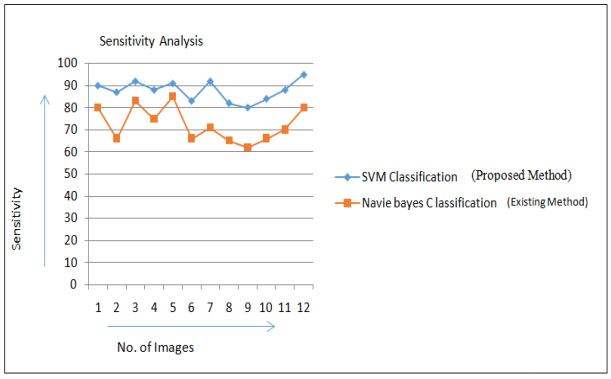

Figure 10: Sensitivity Analysis

Sensitivity: In pattern recognition, information retrieval and binary classification, precision (also called positive predictive value) is the fraction of relevant instances among the retrieved instances.

$$Sensitivity = \frac{True\ Positive}{True\ Positive + False\ Positive}$$

As shown in the figure 10 , the sensitivity of the proposed technique is high as compared to existing technique because in the proposed technique SVM classification method is used for the defective region detection.

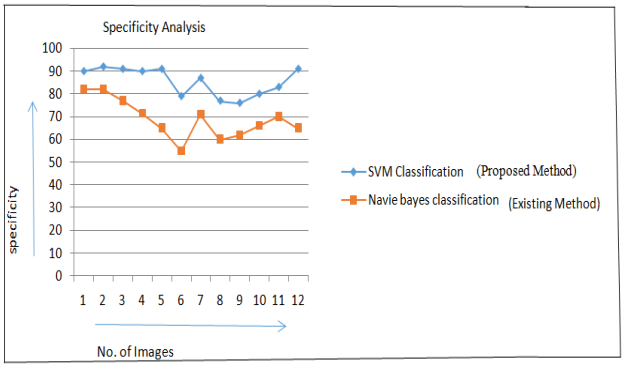

Figure 11 : Specificity Analysis

Specificity: Specificity is the fraction of relevant instances that have been retrieved over the total amount of relevant instances.

$$Specificity = \frac{True\ Positive}{True\ Positive + False\ Negative}$$

As shown in the figure 6, the specificity of the proposed technique is high as compared to existing technique because in the proposed technique SVM classification method is used for the defective region detection.

V. CONCLUSION

The main objective of image acquisition is the transformation of a visual picture into a group of arithmetical information. This data or information can be operated on a processor. The picture captured by a camera should be transformed into a convenient unit before the commencement of any video or picture processing. Mainly three stages are included in image acquisition procedure. The second step is the image segmentation which is applied with the region based segmentation called k-mean segmentation. The algorithm of GLCM is applied for the textual feature analysis in the step number four. In the last step, the SVM classification algorithm is applied for the fruit quality assessment. The proposed algorithm is implemented in MATLAB and results are analyzed in terms of accuracy, execution time, sensitivity, specificity. It is analyzed that proposed technique improve results about 8 to 10% in terms of accuracy and execution time, sensitivity, specificity as compared to existing technique.

REFERENCES

[1] Seng, W.C., Mirisaee, S.H., "A new method for fruits recognition system", In: International Conference on Electrical Engineering and Informatics, pp. 130--134, Bangi, Malaysi. (2009).

[2] Patel, H.N., Jain, R.K., Joshi, M.V., "Fruit detection using improved multiple features algorithm", 2011, Int J Comp Appln. 13, pp-1—5

[3] Rocha, A., Hauagge, D.C., Wainer, J., Goldenstein, S., "Automatic fruit and vegetable classification from images", 2010, Computers and Electronics in Agriculture, 70, 96—104

[4] Kavdır, I., Guyer, D.E., "Comparison of Artificial Neural Networks and Statistical Classifiers in Apple Sorting using Textural Feature", 2004, Biosystems Engg. 89, pp- 331-344

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 09, September-2019

[5] Yousef A.O., "Computer vision based date fruit grading system: Design and implementation", 2011, J of King Saud University – Computer and Information Sciences. 23, 29–36
[6] Jyoti Jhawar, "Orange Sorting by Applying Pattern Recognition on Colour Image",Procedia computer science 78(2016)691-697.
[7] Ab Razak Mansor,Mahmod Othman,Mohd Nazari Abu Bakar,Khairul Adilah Ahmad and Tajul Rosli Razak, "Mango size classification using RGB Colour Sensor and Fuzzy Logic Technique", Springer Nature Singapore Pte Ltd, vol.324,(2016).
[8] Thendral Ravi and Suhasini Ambalavanan, "Image Analysis for Efficient Surface Defect Detection of Orange Fruits", Proceedings of 3rd International Conference, Springer India,vol .256,(2016).
[9] Tanya Makkar, Seema Verma, Yogesh, and Ashwani Kumar Dubey, "Analysis and Detection of Fruit Defect Using Neural Network", Springer Nature Singapore Pte Ltd,vol.554-567,(2018).
[10] Yang Gao, Chaonan Kan, Chunpeng Wan, Chuying Chen, Ming Chen, Jinyin Chen, "Quality and biochemical changes of navel orange fruits during storage as affected by cinnamaldehyde -chitosan coating", Scientia Horticulturae 239 (2018) 80–86
[11] Abhay Agarwal, Adrija Sarkar and Ashwani Kumar Dubey, "Computer Vision-Based Fruit Disease Detection and Classification", Springer Nature Singapore Pte Ltd,vol. 851,(2019).
[12] Santi Kumari Behera, Shrabani Sangita, Amiya Kumar Rath and Prabira Kumar Sethy, "Automatic Classification of Mango Using Statistical Feature and SVM", Springer Nature Singapore Pte Ltd,vol.137-189,(2019).
[13] Israel Pineda, Nur Alam MD, and Oubong Gwun, "Calyx and Stem Discrimination for Apple Quality Control Using Hyperspectral Imaging", Springer Nature Switzerland AG,vol.274-287,(2019).
[14] Albert Cruza, Yiannis Ampatzidisb, Roberto Pierro, Alberto Materazzi, Alessandra Panattoni, Luigi De Bellis, Andrea Luvisi, "Detection of grapevine yellows symptoms in Vitis vinifera L. with artificial intelligence", Computers and Electronics in Agriculture 157 (2019) 63–76