

Review on shape feature extraction and classification of fruit

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Abstract- Agriculture is important in human life. Image processing is effective tool for analysis in various fields and applications in agriculture. The agricultural industry is probably too oldest and most widespread industry in the world. In Indian agriculture industry many kind of activities are done like quality inspection, sorting, assembly, painting, packaging. Above mentioned activities are done manually. By using Digital Image processing tasks done conveniently and easily. Using Digital image processing, one can fulfil much kind of tasks like object shape, size and colour detection and other feature extraction etc. In this paper various algorithms of shape detection are explained and conclusions are provided for best algorithm even merits and demerits of each algorithm or method are described preciously.

Keywords- Fruit grading, Shape, Feature extraction, classification, Image Processing, Fruits, Texture.

I. INTRODUCTION

In India, 70% of people are depended on agriculture because India is an agricultural country [1]. There are more numbers of products available in agriculture so task of assembling and sorting are very difficult[26]. Now-a-days the people of India wants to use some technology that make them work easier, faster and with more perfection and with less cost. In the past few years, automation and intelligent sensing technologies have revolutionized our fruits production and processing routine. Today number of application in agriculture, where shape detection has been used like plant growth detection, weeds detection, fruit and food grading etc. These all application are doing their task using various type of sensors. Some applications do their task using image processing. Image processing is a large research area to improve the visibility of an input image and acquire some valuable information from it[10]. In Image processing also describe cropping, detect boundary of agriculture object i.e. Vegetables fruits or leaf [7].

Computer vision is a rapid, economic, consistent and objective inspection technique, which has expanded into many diverse industries. Its speed and accuracy satisfy ever-increasing production and quality requirements, hence aiding in the development of totally automated processes [3]. Detecting and locating object in digital image has become one of the most important applications for industrial use to ease user and save time. This technique has been developed year ago but improvement of it still requires in order to achieve the targeted objective more efficiently and accurately. The goal of this paper is to review methods for shape and texture detection [4].

The aim of this review paper is to research the use of image processing and computer vision techniques in the food industry. Brief summary about different fruits grading feature extraction are described in section II, method comparison are described in section III, at last conclusion of review paper is described in section IV.

II. LITERATURE REVIEW

Shape is one the important visual feature of an image which helps in automated fruit grading. Shape is also graphical data that contains location, size and rotational effects are filtered out. Grading applied on many fruits and vegetables. In this section review is made on how different parameters can be used for automatic fruit grading system..

In paper [5] G.P. Moreda Task Done by Shape Signature , Chain Code , Fourier descriptors ,Smooth curve approximation ,Wavelet descriptors or Fractal dimension algorithm These all are Contour Based Shape detection method . In Contour Based Fractal Dimension is best for detect shape or boundary of any object like leaf or fruit border. also done Region based method like Medial axis or skeleton technique and Geometric moments. in these both method best is geometric moments because its provide much redundant information about an object's shape or its depend on object rotation or size.

In paper [6] feature extraction is a method which define same kind change in full image that's why in this paper first RGB image convert into grey scale image now check all the value of each pixel some group of pixel have same type of change after some number of around all 8 pixel this change got in some type small image which can be 1 or less percentage from full image this small images join with each other and create one big image is called texture of this image.

In paper [22] experimental fruit data are chosen and collected as a fruit database. Experiment results show that average accuracy can be achieved more than 90%. There are two approaches- In first method tries to distinguish between two different images by extracting features related to the intensity among pixels and their neighbors. Second approach is to retrieve the variances of intensity between pixels. To enhance further, different features of color, shape, texture and size are combined together to improve the performance of the detection. Using color, shape and size-based features combined together to increase the accuracy of recognition. So accuracy up to 90% has been achieved. There are two processes that are used in the proposed method, which are training and classification.

In paper [23] describe apple grading system on European standards. Here used 1000 images of apple as a huge database and estimated ground colour area of golden delicious and done classification of much method and provide 78% and 72% accuracy.

In this paper [24], Shape is an attribute that affects the performance of many fruit quality sensors. Shape comparison and classification can be defined as the systematic arrangement of shapes within a database, based on some similarity criteria. These criteria are gathered in a similarity metric.

Paper [9] describes image processing & analysis techniques for finding weight of mango. The size of mango is estimate by weight. Relationship between weight and pixel of mango was analyzed with the help of statistical method.

In this paper [11] Pre defined Pattern is an arrangement of features that are defined by various characteristics of image such as shape, color and texture. Texture is an important part of image analysis. Paper contains study and review of many different techniques used for feature extraction and texture classification. The objective of study is to find technique or combination of techniques to reduce difficulty while increasing the accuracy of shape at the same time. Paper contains reviewing the three feature extraction methods: Gray Level Co-occurrence Matrix-GLCM, Local Binary Pattern-LBP and Gabor filter method-GFM. Also two classification methods KNN and SVM are used on the texture datasets Brodatz, CURET, VisTex and OuTex for the experimental purpose.

Image processing algorithm is used for sorting and detecting mango with help of captured image in [8]. To identify type of mango, the features of mango were collected. Mangoes are classified with the help of its physical features. Structure of mangoes is help in classification process. Object's pixels and defective area is classified with the help of threshold technique. This algorithm describes brown and green pixels. Brown pixels are considered as defective area and Green pixels are considered as good area.

Sorting system for lemon grading based on color and size parameters is presented in [13].

In paper [20] kutiba nanna describe algorithm for mango detection.. This algorithm is depend on pre-processing operators of object images which contains moving to gray scale image, detecting edges, calculation of range between to edges. Starting morphology and converting to binary image. To take advantage of mango, they used Randomized Hough Transform algorithm to find potential places for mango in images. By using Back propagation Neural Network, they find mango from these potential places. The dataset used to implementing this paper is 70 RGB images captured of mango fruits on trees. As shown in results, in the case of clear fruit in input images, the detection rates up to 96.26% while it decreases in the case of partially covering or overlapping.

Reduced color and texture features based identification and classification of affected fruits is done in [2]. Two color techniques are used in this work: i) RGB ii) Gray scale. The advantages of features, namely color and texture, are combined RGB component is separated from the original image. From RGB component Hue (H), Saturation(S), luminance(Y) is separated.

Digital image processing technique can be used to detect the mango from mango tree. CHT [Circular Hough transform] is used to detect the mango in [4]. If we want to detect the shape it will detect through edge detection method. And we detect through color method it will give 100% result and if we detect through CHT then it will 60% result. Firstly it will convert the original image into grey scale after that it will convert into binary image. Grayscale will filter the smoothness of the object and clear the edge.

Shape analysis methods works on object recognition, matching, registration, and analysis. In paper [14], shape boundary is used for interior part classified. Shape analysis method is classified on different criteria: i) It is based on shape boundary and its result is also known as boundary and global. ii) To determine the quality of object through shape description is difficult.

Paper [15] detects segment and physical properties of mango. Such as size, shape and color. Fruits analysed of the digital camera. The segmentation is applied on mango. There is various sizes graded by experienced farmer's eyes and hands. And this method used in good alternative and grading mango.

Computer vision based technique for grading and sorting of fruit is proposed in [12]. Grading is done based on maturity level. And this technique can be used in automatic fruit grading and sorting system. This technique can be low cost effective and more intelligent. The speed of sorting system is limited.

Shape is one of the important attribute for food quality evaluation during grading and classification in order to provide the consumer with homogeneous lots of product. Hence, it is one of the prerequisites effectively applied in packinghouses, where graders judge the fruit shape depending on whether or not it extracts from typical shape of variety [27].

Algorithms can be used in rapid shape retrieval by representative shape context. Two methods can be used: i) Feature based ii) Brightness based [17]. Feature based method is used in shape similarity and uses boundaries of image. Brightness based method same as feature based method. Method is used for object recognition. The results are achieved on handwritten digits and visual CAPTCHAs.

Computer vision is used for the agriculture and food industry in [21]. Computer vision system they provide rapid, economic and objective assignment. This technology analysis can be based on standard requirement and automated grading in fresh product. The non-destructive method can be used in food industry, agriculture including and grading of fruit and vegetable.

Shape and texture based method for vein recognition is proposed in [18]. In paper, two kinds of shape matching methods are used: 1) Hausdorff distance and 2) Line Edge Mapping (LEM). A sets of 100 persons of different ages above 16 and also different gender. In this, 5 images per person are used. In biometric method, most important is fingerprint which widely used in person identification. The five individual processing stages are available: image acquisition, image enhancement, vein pattern segmentation, feature extraction and matching. Hausdorff, LEM methods are used to detect the shape and Gabor magnitude method, is use for nearest neighbour classifier to texture and achieved results are 58%, 66%, and 80%. The most secure method is biometric.

Feature extraction is a method, which defines same kind change in full image that's why in paper [19], first RGB image convert into grey scale image now check all the value of each pixel. Some group of pixels have same type of change after some number of around all 8 pixels this change got in some type small image which have only 1 or less percentage from full image these small images join and create one big image is called texture of this image.

Nidhyanandhan, L. Ganesan [28] based on color and texture. Various parameters are taken into consideration for grading of fruit like intensity, color, shape and texture. To finish it with minimum distance classifier is used for classification of fruit based on Wavelet transformed sub bands. Accuracy achieved was 91.06%

III. METHOD COMPARISON

Below table introduce merits and demerits for shape featured based algorithm which are discussed in articles are refers for write a literature review paper.

Method	Merits	Demerits	Reference
Circular Hough Transform (CHT)	1) Easy implementation. 2) Easy to recover missing data from image. 3) More effective in remove noise from image.	1) Very difficult for object detection which have more attributes. 2) This method not useful to find length of object	[20]
Discrete Wavelet Transform	1) Wavelets are well localized in both time and frequency domain whereas the standard Fourier transform is only localized in frequency domain.	1) The disadvantage is loss of generality. 2) Wavelets have not been used widely in image processing due to the difficulty in designing complex filters which satisfy a perfect reconstruction property.	[16]
Fourier Transform of Boundary	1) The major advantage of this method is that it is easy to implement and based on a well-developed theory of Fourier analysis.	1) Fourier transform does not provide local shape information. After the Fourier transform, local shape information is distributed to all coefficients and not localized in the frequency domain.	[16]
Chain Code	1) The advantage is easily store in storage. 2) Easy to implement.	1) Chain not remove any kind of noise.	[7]
Scale Space	1) The great advantages are the high robustness to noise and the great coherence with human perception.	1) Computational complexity is average in scales-space method.	[16][14]

IV. CONCLUSION

This paper reviewed the advancement of digital Image processing technology in the field of agriculture. Computer vision techniques are very useful to analyze digital image of agricultural crop. Some image processing approaches used in the field of agriculture and fruit classification is described in this paper. In this paper we reviewed the work on the shape and texture extraction methods. In future we will extend our task on fruits shape detection or texture extraction algorithms. Here some methods are introduced like fractal dimension technique, Edge Detection and Boundary Tracing, Fourier Transform of Boundary, Scale Space fruit, Fourier Transform of Boundary etc. From these all methods Circular Hough Transform (CHT) and Edge Detection and Boundary Tracing also provide better results.

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