Image Processing for Fruit Shape and Texture Feature Extraction - Review

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ABSTRACT
Image processing is effective tool for analysis in various fields and applications in agriculture. Today's very advanced and automated industries used more accurate method for different inspection processes of agriculture object. This task known as robotics task. 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 many kind of task fulfills like object Shape , size, color detection, texture extraction , firmness of object, aroma, maturity 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, texture, feature extraction, classification

1. INTRODUCTION
In India 70% population depend on agriculture but Indian industries do not have robotics type of automation in agriculture. This automation is more required[1]. There are more numbers of products available in agriculture.so task of assembling and sorting are very difficult[4] .This paper attempts to demonstrate the recognition of basic agriculture objects using an algorithm, that extracts information from the image using shape and texture feature algorithms.

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] This paper reviews fruit shape detection.

Brief summary about different fruit grading technologies using feature extraction described in section II. more useful introduction of many methods are described in section III.

Merit and demerit of all algorithms are described in section VI. At last conclusion of review paper is described in section V.

2. DEFINITION OF SHAPE AND TEXTURE
Object defines by colors, texture or shape. Shape means 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.

 An image texture is a set of attribute calculated in image processing designed to find texture of an image. Image texture gives us information about the image color or intensity. Image textures are one way that can be used to help in segmentation or classification of images. [17]To analyze an image texture in computer graphics, there are two ways to approach the issue: Structured Approach and Statistical Approach. In this section review is made on how different parameters can be used for automatic fruit grading system.

3. ITERATURE REVIEW
This section introduced small introduction about shape and texture based research or review paper.

In paper [2] 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 [3] 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 [4] Hui Zhang* done image segmentation using region based method. Images divide into number of block of pixel 4*4 . Now this block divide in 2*2 so it's again divide into 4 new block and each 4 block have first pixel value. Thus this 4 value represent by 2*2 means at last block of 16 pixel convert into 4 pixels. These perform on full image so each block has some same value. So it's called as texture of images and it's done very fast.

This Paper [5] shape normally evaluated by considering size, shape, color, freshness and finally the absence of visual defects. This review shows the main applications of shape analysis on agricultural products. And have such relationships with shape like (1) genetic (2) conformity and condition ratios (3) products characterization (4) product sorting and finally (5) clone selection.

Paper[5] contain shape detection method like Objects Ratios and Shape Indices , Outline-Based Methods ,Multivariate Analyses. In this three method outline based method provide 94% output.

In paper [6] Stan Sclaroff, Member, IEEE, and Lifeng Liu discuss a method for deformable shape detection and shape recognition is described. Deformable shape templates are used to partition the image into a globally consistent interpretation determined by the minimum description length principle. Segmentation using traditional low-level image-processing technique. The system is implemented and tested in color segmentation uses 2D shape models and global information. In this paper [6] include two stages over segmentation using traditional region segmentation algorithm that's followed by deformable model based evolution and the statistical shape model is used to prior probabilities on global for each object of class.

In paper [7] shape detection task done by geometric shape detection there for in paper fuzzy logic are used . Image converted into grey scale image and find boundary of object using chain code. And find area of object. Now find clockwise and anticlockwise inclination of object. Now find ratio of bounding box and take difference with object ratio. And based on remaining ratio choose shape. This fuzzy method provide more accurate output around 95% but one limitation is side of object .

In this paper [8] Slamet Riyadi, done shape detection on papaya fruit using otsu method. In this method noise remove using morphological technique. In this method boundary recognize using 4 connected pixel. In this algorithm shape classified into 4 different size .S(small), M(medium),L(large) ,XL(Extra-large) this classification done using MLP neural network. Thus this method provides 94% accuracy in shape detection.

In this paper [9] 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.

This paper [10] contains image processing and pattern recognition techniques, which will be useful to analyze bio-images. It Means this paper does not provide their technical details, it will be possible to grasp their main tasks and typical tools to handle the tasks. In Paper introduces gray level transformation, binarization, image filtering, image segmentation, visual object tracking, optical flow and image registration. Image pattern recognition is the technique to classify an input image into one of the Pre-defined classes and also has a large research area. Paper contains two main modules, that is, feature extraction module and classification module. Throughout the paper, it will be emphasized that bio image is a very difficult target for image processing and pattern recognition.

In paper [11] 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.

Paper [12] contain shape based technique using hybrid Fourier descriptors (FD) and spatial domain analysis (SDA) is described in this paper. Shape boundary representative: 1.complex-valued signature (CVS) or real-valued signature(RVS) are used for boundary detection where cvs divided in two types (i) centered based complex coordinates and (ii) non-centered based complex coordinates The fruit shape recognition uses the shape boundary in recognizing the fruit while color information obtained from the extracted red-green-blue color scheme during training process artificial neural network (ANN) system is used in the recall phase in accurately detecting the color of such a fruit. ANN has been used for color sorting and identification. The two results are then combined using logic gates system. Highest classification accuracy of 99.1% was obtained in this work.

In paper [13] 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 approach- 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.

1.system first performs background subtraction and then creates a feature database that contains the extracted features of all the fruits that are used as a training set

2.The code-transformer will produce a code that will be used as a key to search the database.

In paper [15] Li Liu and Paul W. Fieguth, Members are done texture classification based on random projection, suitable for large texture database applications. A small set of random features is extracted from local image patches. After that process the random features are embedded into a bag-of-words model to perform texture classification. This approach is totally different from traditional approach. In this paper experiments on each of the CUReT , the Brodatz, and the MSRC databases, comparing the proposed approach to four state-of-the-art texture classification methods: Patch, Patch-MRF, MR8, and LBP. In this paper show that We show that approach leads to significant improvements in classification accuracy and reductions in feature dimensionality.

In paper [16] many methods are available for identify objects have been proposed by several researchers. Commonly, the methods did not capture color information, because color was not recognized as an important aspect to the identification. In this paper, shape and vein, color, and texture features were incorporated to classify a Objects. In this paper, a neural network called Probabilistic Neural network (PNN) was used as a classifier. The experimental result shows that the method for classification gives average accuracy of 93.75% when it was tested on Flavia dataset, that contains 32 kinds of plant leaves. It means that the method gives better performance compared to the original work. This paper are many methods include that Shape Features , Color Features, Vein Features, Texture Features -Feature Normalization

In this paper [19], 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.

In paper [20] 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.

This section reviewed the study done by several researchers in the area of image categorization, fruits recognition, fruit classification, fruit disease identification using images. Fruit classification and fruit disease identification can be seen as an instance of image categorization. Most of the researches in the field of fruit recognition have considered colour and texture properties for the categorization.

4. MERITS AND DEMERITS OF ALGORITHMS.

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

Table 1. Merits and Demerits of algorithm

Methods	Merits	Demerits	Reference
Fractal Dimension Technique	1) This method provide 94.56% of accurate result.	1) It is more expensive in computational time and store in memory. 2) Difficult to implement.	[1]
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	[11]
Chain Code	1) The advantage is easily store in storage. 2) Easy to implement.	1) Chain not remove any kind of noise.	[7]
Ratios and Shape Indices	1) The major advantage of this method provide much accuracy in fruit shape detection.	1) This method must be as reduce as possible against noise, i.e., they must be the same whichever be the strength of the noise in a give range that affects the pattern.	[5]
Outline base methods	1)This method namely used for detect any kind of curve 2)This method detect shape with having a global efficiency of 93.2%.	1) This method used for only shape outline border.	[5]
Grey level co-occurrence matrices GLCM	1) This method provide high accuracy. 2) These method is useful in motion estimation from video.	1)Very difficult to implement.	[14]
Optimal edge-based shape	1) This enables to localization	1) Here is problem of vehicle	[3]

detection	and detection shape of object.	detection in aerial images, human facial feature detection	
Probabilistic Neural network (PNN)	1) This method provide 93.75% accuracy in texture extraction	1) Neural network also detect Gaussian noise as a texture.	[16]

5. CONCLUSION

This paper reviewed the advancement of digital Image processing technology in the field of agriculture. Some image processing approaches used in the field of agriculture and fruit classification is described in this paper. In paper we done shape and texture extraction methods review in above session. In future we will expand our task on fruit shape detection or texture extraction algorithms so we refer above session. Here some method are introduced like Fractal Dimension Technique, Hough Transform, Edge based detection etc. from this all method fractal dimension and axis ratio shape detection(fuzzy logic) provide better result . Chain code also provide best result but in chain code comparison is difficult. Other future work includes the implementation of such systems in real life which detect fruit type from single image and try to provide best classification accuracy.

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