International Journal of Engineering Applied Sciences and Technology, 2017
Vol. 2, Issue 3, ISSN No. 2455-2143, Pages 129-135
Published Online January-February 2017 in IJEAST (http://www.ijeast.com)

VARIOUS TECHNIQUES FOR FRUIT DISEASES AND DETECTION

Inderpreet Kaur
Department of CSE
CT GROUP, Punjab

Pooja
Department of CSE
CT GROUP, Punjab,INDIA

Sultana Kadri
Department of CSE
CT GROUP, Punjab,INDIA

Abstract—**Fruit and vegetable techniques is the major applications that can be used in the market to automatically detect the types of the fruit or vegetable purchased by the customer and to generate costs for it. We surveyed the approaches used for fruit disease detection, segmentation and classification of the images. We also compared state-of-the-art methods in this paper in two parts fruit and vegetable classification and fruit disease classification. In this paper number of techniques has been explained the from the year 2006 to 2016, almost every technique has been included.all the methods are explained briefly including their advantages and disadvantages.The methods in this paper are able to difference between different kind of fruits and its diseases which are very color,accuracyand texture.With the help of table which includes authors name,techniques,algorithms and challenges**.

Keywords—Fruitsclassification,Diseases,Techniques,Features and Accuracy etc

I. INTRODUCTION

The defective food products are occurrence on the shelves of the stores.One of the products are the fruits and vegetables.A human eye that they may appear on healthy and fresh but only after cutting or eating it, the customers know about its quality.Also affects the profitability for the producers.Therefore, they need to have applications which identify the quality of the fruits and vegetables so that the customers get only the best quality of product for the money they pay.The defects of fruits are checked using technologies are MRI ,x- ray imaging etc which are costly for the farmers to afford the space , users need to have scientific of knowledge to use and analyze the results ,and have harmful effects on the specimen used for research.They cannot be used by everyone and on each and every product. Some disease infects other areas of tree causing diseases like twigs, leaves, and branchesMany diseases occurring in the fruits that creates the particular texture or specific colored of spot.They can use these features for the detection of diseases in the fruit.Some common diseases of apple fruits are the apple scab, apple rot, and apple blotch.Apple scabs are the gray or brown corky spots. Apple rot is a fungal disease causing the brown or black, spreading rot in the fruit that they may be covered by the red halo. Apple blotch is the fungal of disease and which can vary in size from small, dark spots to large blotches that can cover of the fruit ppears on the surface .

In last year the lot of activity in the area of the fruit disease detection can be seen in which defect segmentation of fruits are performed on simple threshold method. An adaptive threshold method for the defect of segmentation on the apples is presented.Pixels are classified into the different classes using the different classification methods.The Bayesian classification where defected or healthy pixels are classified by comparingwith pre-calculated model.

India has a second rank in the production of fruit [15]. So fruits play very important role for farmers and also for agriculture. There are many applications related with image processing for agriculture. Like harvesting, grading, detecting damage and disease, plant growth monitoring are as under: Automatically grading of fruits for oil fresh fruit bunches and strawberry.

Calculating the size of fruit and also ripeness of fruit for its quality given in Crop disease and insects on crops are identifying for pest management system.Xavier et al [19] give the real time image processing system for weed/crop discrimination in which identified plant growing at different illumination and soil condition.Greenness was identified for plant and crop.Harvesting, Grading, Detection of damage and disease, Plant growth monitoring all applications given for different fruits like apple, tomatoes etc.

The different types of diseases of fruits determine the quality and quantity of yield. The diseases in fruits that are not only reduce the yield but also affect the variety from the cultivation. Fruit diseases appear on the spots on fruits and cause the severe loss. Excessive use of a pesticide for fruit disease treatment increases the danger of toxic residue level of agricultural products and has been identified as a major contributor to the ground water contamination. Pesticides are also among the highest components in the production cost and also it is not well as the health perspective so, their use must be minimized. Therefore, this paper reviewed such approaches which can detect the diseases in the fruits as soon as they produce their symptoms on the fruits such that proper management treatment can be applied. A work has been done to automate the visual inspection of the fruits with respect to

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size and color by machine vision.The detection of defects in the fruits using images is the still problematic due to the natural variability of the skin color in different types of the fruits, high variance of defect types. To know what control factors to consider next year to overcome similar losses, it is of great meaning to examine what is being celebrated.Few fruit diseases infect other areas of the tree,also causing diseases of leaves and the branches. The precise of segmentation is required for the defect of detection.The early stage detection of fruit diseases could be valuable source of theinformation for executing the proper management strategies and disease control the measures to prevent the development as well as the spread of fruit diseases.

II. PROGRESS SINCE 2006 TO 2016

R. Pydipati [1] et al. (2006) The industry of citrus is an important constituent of overall agricultural economy. Proper disease control measures the groves to minimize must be undertaken in citrus losses.The technological strategies using machine vision are investigated to achieve the intelligent farming, including early detection of diseases in the groves.This research used to the color co-occurrence method to determine the texture based hue, saturation, and intensity color features in the conjunction with statistical classification of algorithms could be used to identify the diseased. Normal and diseased citrus leaf samples with greasy spot, melanose, and scab were evaluated.The data models are relied on the intensity features of suffered a reduction in classification of accuracy when categorizing the leaf fronts, due to the darker pigmentation of the leaf in fronts that reduction was not experienced on the leaf backs where the lighter pigmentation are clearly revealed on the disease discoloration.The high accuracies were achieved onusing an unreduced dataset consisting of all HSI texture features and overall best performer was determined to be a reduced data model that relied on hue and saturation features.

Dae Gwan Kim [2] et al. (2009) The technologies that can be efficiently identify citrus diseases would be assure that fruit quality.The research was aimed to investigate the potential of color using texture features for detecting the citrus peel diseases. A color imaging system can be developed to acquire RGB images from grapefruits with normal and five common diseased peel conditions. A total of 39 image texture features were determined to transformed the hue (H), saturation (S), and intensity (I) region-of-interest images using the color co-occurrence method for each fruit of sample. Algorithms for the selecting useful of texture features that was developed on the stepwise discriminant analysis, and 14, 9, and 11 texture features were selected for the three colors.

Anderson Rocha [3] et al. (2010) Contemporary Vision and Pattern Recognition problems such as the face recognition, fingerprinting identification, image categorization, and DNA sequencing arbitrarily that the large number of classes and properties to consider.The such complex problems can be one feature descriptor is a difficult task and feature fusion may become mandatory. Although normal feature fusion is quite effective for some problems, it can yield unexpected classification results when the different features are not properly normalized and preprocessed. Besides it has the drawback of increasing the dimensionality which might require more training data. To cope with these problems, this paper introduces a unified approach that can combine many features and classifiers that requires less training and is more adequate to some problems than a naive method, where all features are simply concatenated and fed independently to each classification algorithm. Besides that, the presented technique is amenable to continuous learning, both when refining a learned model and also when adding new classes to be discriminated.

Arivazhagan Selvaraj [4] et al. (2010) The computer vision strategies used to recognize the fruits on the basis of four basic features that are characterizes the object: intensity, color, shape and texture.The paper proposes an efficient fusion of the color and texture features for recognition of fruit .The recognition is done by the minimum distance classifier based upon the statistical and co-occurrence features of derived from the Wavelet transformed sub- bands. Experimental results on a database of about 2635 fruits from 15 different classes confirm the effectiveness of the proposed approach.

Shiv Ram Dubey[5] et al. (2012) The manual sorting of apple fruit varieties to high cost, subjectivity, tediousness and inconsistency associated with the human beings. A means for the distinguishing apple varieties is needed and some reliable technique are needed to discriminate the varieties rapidly and non-destructively. The main objective of the research was to investigate applicability and performance of the Naive Bayes algorithm in the classification of apple fruit varieties. The methodology involved image acquisition, pre-processing and segmentation, analysis and classification of apple varieties. Apple classification system prototype was built using MATLAB R2015a development platform environment.The study indicated that Naive Bayes has good potential for identification of apple varieties nondestructively and accurately.

Jagadeesh Devdas Pujari [6] et al. (2013) In this paper,the areas of lesion affected by the anthracnose that are segmented using the segmentation techniques, graded based on the percentage of affected area and neural network classifier is used to classify normal and affected on the fruits.They have considered three types of fruit namely mango, grape and pomegranate for their work. The developed processing scheme consists of two phases. In the first phase, segmentation of techniques namely thresholding and region growing, K-means clustering and watershed are employed for separating the anthracnose affected lesion areas from the normal area. These affected areas are graded by the calculating the percentage of affected area. In the second phase texture features are extracted using matrix of runlength. These features are used for the classification purpose using the ANN classifierThey

have conducted the experimentation on fruits' image samples. The classification accuracies for the normal and affected anthracnose fruit types are 84.65%. The work finds the application in developing a machine vision system.

Jagadeesh. D. Pujari[7] et al. (2013) In this paper,they presented the reduced feature set of based approach for the recognition and classification on the images of fruits into the normal and affected. The RGB (color features are reduced from 18 to 2 and GLCM (Gray-level Cooccurrence Matrix) texture features are reduced from 30 to 2. The reduced feature set of comprises of 4 features namely, green mean, saturation mean, red GLCM summean and green GLCM summean. A feedback from classifier, performance is used in reducing the features. The average accuracy of the 89.15% for normal type and 88.58% for affected type is obtained using 2 color features.The average accuracies have increased to 96.85% for normal type and 93.89% for affected type when the reduced color and texture features are combined. The work finds application in developing a machine vision system in agriculture and horticulture fields.

Suvarna Kanakaraddi [8] et al. (2014) This paper provides a method which can be used to study plant diseases/traits using image processing. The method proposed is for increasing throughput & reducing human error. This project aims at analysis of chilli disease, specifically Fruit Rot. The system replaces the manual method of analysing the pathogenic affected area in chilli plants, and tells the quality of chilli based on numerical result obtained by the analysis of the diseased area of the plant. Image of disease affected chilli is captured and various image processing techniques are applied on the image to get the desired statistical results. This project makes use of pre-processing and filtering, techniques to remove unwanted noise from the image. Intensity of the image is increased to enhance the acquired image. After which the image is subjected to feature extraction. Colour feature is extracted from the pre -processed image, which makes use of RGB colour model. Based on colour features extracted and other numerical chilli is classified & graded.

Shiv Ram Dubey[9] et all (2014) In this paper, a framework for the recognition of fruit diseases is proposed. The proposed approach is composed of the following three main steps; defect segmentation, feature extraction, and classification. This paper also introduces an improved sum and difference histogram (ISADH) texture feature based on the intensity values of the neighbouring pixels. The gradient filters are also used with ISADH in this paper to boost the discriminative ability. We have considered apple diseases as a test case and evaluated our program. An image processing-based solution is proposed for the automatic detection and recognition of fruit diseases from images using colour and texture features. The proposed approach is composed of three steps: in the first step defect segmentation is carried out using K-means clustering-based image segmentation method, in the second step features are extracted from the segmented image, and finally in the third step images are classified Fruit disease recognition using improved sum and difference histogram 217 into one of the diseases using MSVM as a classifier which is trained with the same features of training images of each type of diseases. This paper also presented an efficient ISADH texture feature from the intensity values of the neighbouring pixels. We also incorporated our method with the gradient filters to enhance ISADH. We have taken apple diseases as a case study and evaluated our approach. Three types of apple diseases, namely: blotch, rot, and scab are used for the experiments.

Shiv Ram Dubey [10] et all (2015) For detection of disease required different features of fruit and classifier classified these features. For fruit grading segment the image after segmentation calculate infected and healthy portion of fruit and grading based on percentage of infection on fruit. This paper represents different features for fruit, different classifier for disease detection and different segmentation techniques for fruit grading process. In this paper conclude different colour and texture techniques for feature extraction. Each and every technique has some merit and demerits. Based on requirement we want to use method for colour and texture. Also give summaries of different classifier with its merits and demerits ANN and SVM give better accuracy then other classifier. Also see different segmentation techniques with its merits and demerits no such segmentation technique applicable in all images so use any of technique which is suitable for our application.

Shiv Ram Dubey [11] et all (2016) The presence of diseases in several kinds of fruits is the major factor of production and the economic degradation of the agricultural industry worldwide. An approach for the apple disease classification using color-, texture- and shape-based features is investigated and experiment tally verified in this paper. The primary steps of the introduced image processing-based method are as follows: (1) infected fruit part detection is done with the help of K-means clustering method, (2) color-, texture- and shape-based features are computed over the segmented image and combined to form the single descriptor, and (3) multi-class support vector machine is used to classify the apples into one of the infected or healthy categories. Apple fruit is taken as the test case in this study with three categories of diseases, namely blotch, rot and scab as well as healthy apples. The experimentation points out that the introduced

method is better as compared to the individual features. It also points out that shape feature is not better suited for this purpose.

The comparison of various algorithms are as follows on the basis of authors name's,algorithm and techniques.The different types of algorithms are used for this comparison.

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Table-1 Overall Comparison of Techniques on basis of their algorithms,pre-processing techniques and accuracy.

Reference	Data set	Pre Processing	Features	Color Space	Training	Evaluation Criteria	Average Accuracy
Pydipati et al. [1]	4 categories	Edge detection	Color cooccurrence methods	HSV Generalized Squared	Distance	Accuracy	>95%
Kim et al. [2]	6 categories	ROI Cropping	Intensity texture features	HSV	Discriminant Analysis	Accuracy	96%
Rocha et al. [3]	15 categories	K-means with 2 clusters	GCH+CCV+BIC+Unser (Fusion)	HSV	Multiclass SVM	Average Error	97%
Arivazhagan et al. [4]	15 categories	Cropping	Co-occurrence features such as contrast, energy, local homogeneity, cluster shade and cluster prominence	HSV	Minimum distance classifier	Recognition rate	86%
Dubey & Jalal [5]	4 categories	k-means clustering	Global Colour Histogram, Color Coherence Vector, Local Binary Pattern, Complete Local Binary Pattern	HSV	Multiclass SVM	Accuracy	
Dubey & Jalal [6]	15 categories	K-means with 2 clusters	ISADH	HSV	Multiclass SVM	Accuracy	99%
Chowdhury et al. [7]	10 categories		Color Histogram +Texure	HSV	Neural networks	Accuracy	96.55%
Pujari et al. [8]	2 categories	Normal and affected anthracnose fruit types	K-means Texture features	RGB	BPNN Classifier	Accuracy	84.65% for normal type and 76.6% for anthracnose affected type
Pujari et al. [9]	2 categories - Normal and affected fruit types		Color features+GLCM	YCbCr	BPNN Classifie	Accuracy	89.15% for normal type 88.58% for affected type
Kanakaraddi et al. [10]	4 categories	Median filtering	Color features	RGB	Decision tree	Disease severity	
Dubey & Jalal [11]	4 categories	K-means with 3 and 4 clusters	ISADH + Gradient filters	HSV	Multiclass SVM + KNN	Accuracy and AUC	>99%
Dubey & Jalal [12]	5 categories	K-means with 5 clusters	Color features	RGB	Multiclass SVM	Accuracy	
Dubey & Jalal [13]	5 categories	k-mean clustering	color, texture and shape	RGB	Multiclass SVM	Accuracy	95.94%

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Fruit	Accuracy of fruit	Features of fruit	Colour Techniques	Texture Techniques
Apple	Color and shape give more accuracy Shape give-90%	Color, texture, shape	HSV histogram	Grey Level Cooccurrence Matrices
	Local binary pattern give more accuracy-93%	Global color histogram ,color coherence vector, local binary pattern	Global color histogram	
Mango	More than 80%	Size, shape, color	L*a*b*	Gabor Filters
Plant leaf and steam disease	93%	Texture	Mean of three color array	Wavelets Transform
Strawberry	Color- 88.8% Shape- above 90%	Shape , size ,color	Dominant color method	Independent Component Analysis
Date	80%	Flabbiness, size ,shape	Color intensity	Local Binary Patterns
	98.6% (top-99%)	Color ,size and shape, texture		

Table-2 Types of fruits and their features and techniques

III. CONCLUSION

In this paper with help of table various methods for detection of fruit diseases has been explained.The best technique that comes out of all the techniques is apple fruit diseases detection for k-mean clustering. This is because the technique explained in this paper results in good color and texture which accuracy is 95%.In this paper we use the RGB model for detection of colors.In fututе work we worked on the different complex fruit imagesfor finding the good results using color and texture features.

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