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Review on Normal and Affected Fruit Classification

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***Abstract*—** Automatic identification and classification of fruit diseases based on their particular symptoms are very useful to farmers and also agriculture scientists. Farmers and scientist are more concerned about fruit safety and quality because India is the second largest producer of fruits. Color and texture feature classification is used for recognition of fruits and to classify whether they are normal and affected fruit images. Color , texture components are extracted from fruit images. The RGB color features and the texture features are reduced in affected fruits. The BPNN classifier can be used for classification to get the improved result. This technique is used in agriculture and horticulture fields.

Keywords: *feature extraction, feature reduction, classifier.*

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I. INTRODUCTION

In the past few years, automation and intelligent sensing technologies have revolutionized our fruit production and processing routines. There are rising concerns about fruit safety and quality. Also, rising labor costs, shortage of skilled workers, and the need to improve production processes have all put pressure on producers and processors. India is the second largest producer of fruits with a production of 44.04 million tonnes from an area of 3.72 million hectares. This accounts 10 percent of the world fruit production. A multiple and large variety of fruits are grown in India in which apple, citrus, banana, grape, mango, are the major ones. Also, India is a large low cost producer of fruit, and horticulture has huge export potential. Fruit industry is a major industry which contributes 20 percent of the nation's growth. But due to improper cultivation of fruits, lack of maintenance and manual inspection there has been a decrease in production of good quality of fruits. Farmers are finding difficulty; especially in finding the fruits affected which results in huge loss of revenue to the farmers and the nation.

Automatic identification and classification of fruits is very useful for the agriculture, export system, scientist in research center. Today in every city there are number of malls in which the fruits are kept for sell. So this method is useful in various places. Every fruit having the unique color texture and shape features. So these features are used for the classification of the fruit type.

Automatic identification and classification of diseases based on their particular symptoms are very useful to farmers and also agriculture scientists. Farmers and scientist are more concerned about fruit safety and quality because India is the second largest producer of fruits. Color and texture feature classification is used for recognition of normal and affected fruits images. The RGB color feature are reduced in affected fruits and the texture is also reduced. Using the color and texture features we can classify the quality of fruit images. But using the both color and texture features at a same time it will be more effective. This work having application in agriculture and horticulture fields and research centers.

Figure.1 Images of normal fruit produce: (a) apple, (b) banana1, (c) chikoo, (d) pomegranate[1]

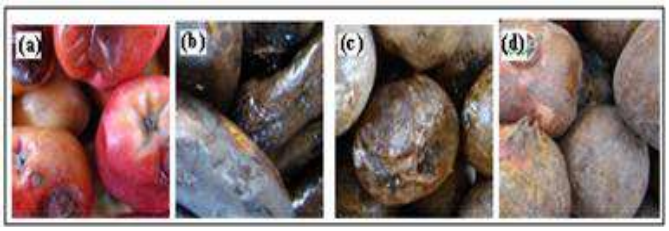

Figure.2 Images of affected fruit produce: (a) apple, (b) banana1, (c) chikoo, (d) pomegranate[1]

II. RESEARCH REVIEW

Fruit recognition using Color and Texture Features [8]. Minimum distance classifier based upon the statistical and co-occurrence features derived from the Wavelet transformed sub- bands. Each fruit having the different color and texture features.

Identification and Classification of Normal and Affected Agriculture/horticulture Produce Based on Combined Color and Texture Feature Extraction.[3].The color and texture features are used to recognize and classify different agriculture or horticulture products into normal and affected using neural network classifier. The combination of color and texture features gives the very effective result.

Automatic fruit and vegetable classification from images [4], Automatic classification introduced multi-class fruit-and-vegetable categorization task in a semi-controlled environment, like a distribution center or the supermarket or mall cashier.

Fast and Accurate Detection and Classification of Plant Diseases [5], in first phase they identifying the infected objects based upon K-means clustering procedure. In next phase masking of green pixels and the pixels on boundaries, in that firstly the green pixels are identified and then these are masked . and then in third phase feature exaction is done using the co-occurrence method in this the RGB images are converted into the Hue Saturation Intensity (HSI) representation. Then the color co-occurrence is generated for each pixel .In last phase artificial neural network is used for detecting and classifying the type of disease. This scheme classifies the plant leaves and stems at hand into normal and affected classes.

Classification of grapefruit peel diseases using color texture feature analysis [6], this research demonstrated that color imaging and texture feature analysis could be used for classifying citrus peel diseases under the controlled laboratory lighting conditions. This system is developed for the five common diseased peel conditions canker, copper burn, greasy spot, melanose , and wind scar.

Grading and Classification of Anthracnose Fungal Disease of Fruits based on Statistical Texture Features [7], the method consists of two phases. In the first phase, segmentation techniques is used in which thresholding, region growing, K-means clustering and watershed are applied for separating anthracnose affected areas from normal area. Then these affected areas are calculated which gives the percentage of affected area. In the second phase texture features are extracted using Run length Matrix. These features are then used for classification. Artificial neural network is used for the classification.

III. PROPOSED METHODOLOGY

The present methodology work as follows image acquisition, feature extraction, feature reduction and last classification are carried out. The block diagram of this methodology is shown in (Fig.3)

A. Algorithm for Color Feature Extraction and reduction System[1]

Input: Normal and Affected Fruit images
Output : Type of fruit and whether it is normal or affected .
Start
Step1: Extracts the color feature values from the input fruit images.
Step2: Set the threshold value for feature reduction.
Step3: Reduce the color feature values.
Step4: Classify the feature values using the classification.
Stop.

B. Algorithm for Texture Feature Extraction and reduction System[1]

Input: Fruit images
Output : Type of fruit and whether it is normal or affected .
Start
Step1: Extracts the texture feature values from the input fruit images.
Step2: Set the threshold value for feature reduction.
Step3: Reduce the texture feature values.
Step4: Classify the feature values using the classification.
Stop

C. Image Acquisition

First the normal fruits images are taken by color Digital Camera which having a resolution of 12 mega pixels. The images are taken keeping a distance of 0.5m from the samples. The same fruits' samples are when they get affected after 7-10 days. Images of affected samples are taken with same camera. Image database also created by collecting it from Google .

D. Feature Extraction and Reduction

Fruits having the different colors and texture so they are differentiated from one another by color and texture features. Hence this methodology considers color and texture features for the classification of fruits into normal and affected.

1) Color Features: The RGB color model is used to extract color features from the original image. First the RGB values are extracted from the input images. The Hue (H), Saturation(S) and luminance(Y) are extracted from RGB color components. Quantification is obtained by computing mean, variance and range for given color image. So mean, variance and range represents the global characteristics for image. Then these statistics are then given to the classifier.

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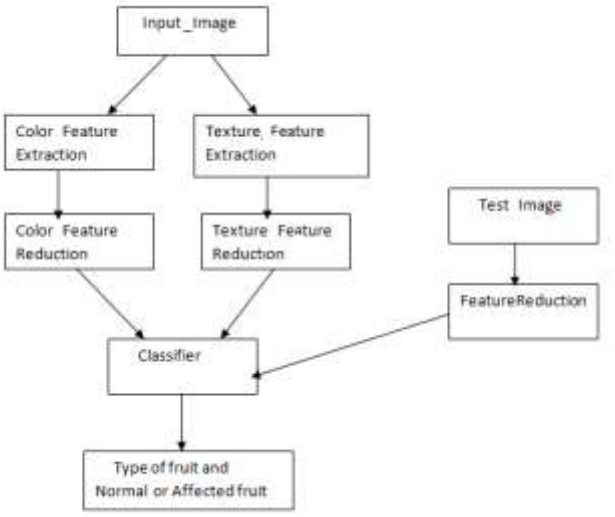

Figure 3. Block diagram of classification of normal and affected fruits[1]

2) Feature Reduction: which are common color features in both normal and affected fruit image are consider for classification.One threshold value is set for reduction. Those feature values are greater than threshold are considered and others are removed . So for first-level 10 features are considered as feature reduction step. Then the only 2 features are taken for second level which contribute for better classification than previous one.

3) Texture Features: Some fruit image samples have same color features, however texture change from one fruit type to another. The surface patterns vary from image to image. In such cases texture feature becomes the idle for recongition. They have given gray level Co-Occurrence matrix used for texture analysis. The Co-Occurrence matrix is a reduced mixture of gray values in the range 0 to 255. Like color features in 5 texture feature contribute more to the classification of fruits into affected and normal. Therefore they considered 5 features as first-level feature reduction and 2 feature as second level feature reduction shown. The reduction is done based threshold**.**

4) Combined Feature Extraction and Reduction: Combined color and texture features gives more advantages. The combiened classification gives more accuracies over the separated color and texture. This type is very useful for those fruits which having same color.

E. Classifier

There are different types of classifiers. A artificial neural network, support vector machine, decision tree. But for this work a multilayered back propagation neural network classifier is more suitable. A multilayered back propagation neural network (BPNN) is used as a classifier for classification. This classifier having three important layers, input layer, hidden layer layer, output layer. The classifier accuracy is tested u s in g images of different fruit images. The average accuracies are shown in table 1.

IV. CONCLUSION

Use of combined color and texture feature gives more advantage than individual one The accuracy is also increased. A BPNN classifier is found suitable in this work. The results from this study conclude that identification of normal and affected fruits decides quality of fruit . The study is related to classification of fruits with both image processing and pattern recognition techniques.

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TABLE I. AVERAGE ACCURACY FOR NORMAL AND AFFECTED FRUIT IMAGES[1].

	Average accuracy for normal type	Average accuracy for affected type
Using 2 color features	89.15%	88.58%
Using 2 texture features	93.15%	89.50%
Using combined color and texture.	96.85%	93.89%

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