ANALYSIS OF FRUITS DISEASE DETECTION SYSTEM FOR AGRICULTURAL APPLICATIONS USING K MEANS CLUSTERING ALGORITHM

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Abstract— **This processing paper based on digital image techniques to detect, quantify and classify fruit diseases from digital images in the visible spectrum. Although disease symptoms can manifest in any part of the fruit, only methods that explore visible symptoms in fruits were considered. Fruits disease diagnosis helps to enhance both the quality and quantity of crop productivity. This was done for two main reasons: to overcome the real time problems and because methods dealing with a fruits have some peculiarities that would warrant a specific survey. The selected proposals are categorized into three classes according to their objective: detection, severity quantification, and classification. Each of those classes, are subdivided according to the main technical solution. Our experimental results express that the proposed solution can significantly support accurate detection and automatic classification of fruit diseases.**

Index Terms—**Fruit Disease, SVM, Threshold Strategy, K -Means clustering, Grading, Feature extraction.**

I. INTRODUCTION

The aim of research in the field of agriculture is to detect techniques so that production and quality can be enhanced with least expenditure and most profit. Common crop in this cause is fruits. Fruit is one of the healthier ways of living in earlier era. Fruits such as Apple, orange, peach, water melon etc. are all part of good and healthier diet.

Today's era however changing this myth. Most of the diseases now day are caused by eating these fruits. Prime reasons involving problems associated with fruits are pesticides and manure utilized. Image processing techniques are available used to detect degradation of fruits. Image extraction feature is critical in this aspect. Rest organized as follows Next section provide related work , next section provide tabular structure of fruit diseases, techniques for detections are shown in the next section and last section provide comprehensive conclusion and future scope.

Agriculture is critical area for people living. Work has been done toward accomplishing optimality in terms of production and quality. Image processing is the technique used in order to detect diseases present within the image. Image processing in collaboration with machine learning techniques enhances performance of detection. In addition work has been extended to include crop like rice. The detection of problem within rice crop is accomplished using technique of image processing like pre-processing, segmentation, extraction etc .Manual monitoring of crops by farmers is extensive task. So techniques have been devised using the applications of Artificial neural network to provide automated approach to detect external diseases within the fruit crop .Early detection of fruit disease is essential in order to rectify the problems present. Data mining techniques are utilized for this purpose.

Numerous trends have emerged in the horticultural sector in the past few years and become a source of income generation. Variety of fruits are being exported all over the world with the development in cold storage

facilities and transportation. It become the necessity of maintaining the highest level export quality which is mainly carried out by visual inspection by experts. This is expensive and time consuming due to distant location of farm. Precision Agriculture helps the farmers to equip with sufficient and economical information and control technology due to the development and exposure in many fields.

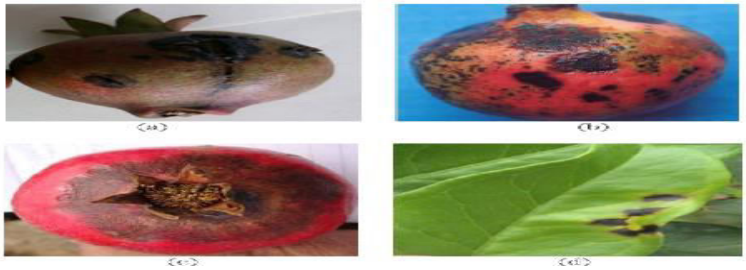

Figure.1.0 Different Sample Images of the Pomegranate Plant Diseases

The objectives is profit hike, agricultural input systemization and environmental damage reduction. In diseases have resulted in huge losses in pomegranate produced. These diseases are usually caused by micro-organisms like fungi, bacteria and viruses. The major diseases are Bacterial Blight, Fruit Spot, Fruit Rot and Leaf Spot. These diseases are very severe and destroy the orchards. Business of fruits indeed belongs in the high-risk category. An intelligent decision support system uses some high-tech and practical technology to appropriately detect and diagnose the plant diseases for prevention and control of plant diseases used Complete Local Binary Pattern (CLBP) for Apple fruit disease detection.

The proposed approach comprises of k-means clustering algorithm for feature extraction and images were classified using Multiclass support vector machine. Classified the grape fruit peel diseases using color-texture feature analysis. The Spatial Gray level Dependence Matrix (SGDM) is used for extracting texture feature while the HIS model is used for color. The HSI texture feature model gives better accuracy, so it becomes the robust model for classifying the fruits according to the peel conditions.

Grading System built by Machine Vision useful for identification of grading of pomegranate plant diseases.The system uses k-means clustering image based segmentation for leaves and fruit grading is calculated. Since, the timely diseases detection is essential and to prevent those diseases, we propose a system which detects and classifies various diseases of pomegranate using k-means clustering segmentation from the image database. Further, the back propagation algorithm is used for training the neural network. The query images are tested using this algorithm, and the accuracy of the work is calculated. The paper is organized as follows. Section II gives the description of pomegranate plant diseases. Section III gives block diagram and brief Description.

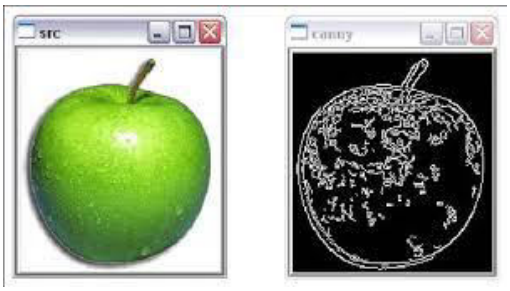

Figure1.1 Images may be subject to copyright

For analysis in various agricultural applications, digital image processing techniques have been established as an effective way such as plant recognition, soil quality estimation, and crop yield estimation etc. in the field of

agriculture. One of the applications of digital image processing techniques in agriculture is to detect plant disease. The disease types are classified into bacterial, viral, funga letc. on plant. In India the fungal diseases for grape leaf found are Downy Mildew, Powdery Mildew and Anthracnose. The proposed work focused on recognition and classification of fungal disease like Downy Mildew and Powdery Mildew using image processing. This work describes that how we can do the automatic detection of grape leaf diseases. The given system provides automatic, fast, accurate and less expensive method to detect and classify the grape leaf diseases.

II. LITERATURE REVIEW

In paper [1] authors present image processing technique for Apple fruit disease detection. Apple Blotch, Apple Rot and Apple Scab are diseases that studied and evaluated in author's research. First read input image and transform it from RGB to L*a*b* color space in image pre processing. The features used for fruit disease identification are Global Color Histogram, Local Binary Pattern, Color Coherence Vector and Completed Local Binary Pattern. K-Means clustering in 'a*b*' space is used for defect segmentation. Then from the results of K-Means, features are extracted to label each pixel in the image. It generates images of fruits that segment the image by color and shows the disease containing segment. CLBP feature gives more accurate result for identification of diseases. Multiclass SVM performs training and classification of fruit disease.

In paper [2] authors present the defect segmentation of fruits using images. The proposed approach uses K-means clustering technique for segmenting defects with three or four clusters. We have used defected apples for the experimental observations and evaluated the introduced method considering apples as a case study. Experimental results suggest that the proposed approach is able to accurately segment the defected area of fruits present in the image. K-means based defect segmentation approach is also segment defected area with the stem and calyx of the fruits.

In paper [3] authors present image processing technique for Pomegranate fruit diseases detection. This fruit is affected by Bacterial Blight, Fruit Spot, Fruit Rot and Leaf Spot. Images of fresh pomegranate are captured for creation of database and further processing. In pre-processing to remove noise filtering is done using (3*3), (5*5), (7*7) masks. In segmentation k-means methods is used to divide image into objects and regions. Statistical texture features are extracted using Gray level co-occurrence matrix (GLCM) formula. For training the neural networks, authors use Multilayer Perceptrons (MLP) to solve difficult problems by training the images using back-propagation algorithm.

In paper [4] authors present image processing technique for fruits disease detection with improved K-means clustering algorithm. User captures the disease image using digital media and loads fruit samples with its name to software after registration process. The image is then converted from RGB to HSV and grayscale. In threshold process, histogram and multi-level threshold techniques are used to isolate the relevant image from digital image after that boundary detection is carried out to get the required area for next processing. Software crops the required portion of image and generates the blocks after the segmentation for the proper evaluation of the portion. Improved K-Means algorithm calculates centroid value for each block and compares processed data with database to obtain results. The final result shows defect detection and disease of infected fruit

In paper [5] authors present. In this research a new technique to replace t In this research a new technique to replace the existing algorithm in the original space is used. The result of this research in proposed method could be used for the segmentation of fruit images. This method has the advantages of calculating various parameters and reducing the time consumption. The GUI has also designed to reduce the complexity of the software code. Existing algorithm in the original space is used. The result of this research confirms that the proposed method could be used for the segmentation of fruit images. This method has the advantages of calculating various parameters and reducing the time consumption. The graphical user interface has also designed to reduce the complexity of the software code.

In paper [6] authors present image analysis techniques to classify orange fruits into two commercially grading stages, which successfully extract useful and meaningful features to uniquely represent external surface for classification purposes. Genetic algorithm has been used as a random search technique wrapped with different classifiers to enhance the classification accuracy. Compared to SVM and BPNN, the AANN classifier obtains highest accuracy of 94.5%. The experimental results showed that employing the feature subset selection could be valuable in categorizing the fruits.

In paper [7] authors present Experimental results on the apple's data set indicate that the proposed method is better than the existing one. Also segmented images quality is based on the input images clarity. In future primary images can be acquired and analyzed. Also by properly selecting and implementing other segmentation methods along with other filtering methods the quality of the output can be further improved, so that it will help in accurate classification process.

In paper [8] authors present survey on different agriculture product diseases detection and classification using various image processing and machine learning techniques. We have highlighted summary of different color and texture based feature extraction with their advantages and disadvantages. Moreover, a different segmentation technique with its benefits and negative marks has been discussed. Also,the summary of different segmentation techniques along with its merits and disadvantages discussed briefly in the paper.

III. EXISTING SYSTEM

Fruit disease detection attracts significant attention in the field of agriculture where image based disease detection plays an important role. To improve the yield of fruits,it is necessary to detect the on set of diseases in plants and advice the farmers to act based on the suggestions.A novel web enabled disease detection system (WEDDS) based on compressed sensing (CS) is proposed to detect and classify the diseases in leaves. For segmentation of disease Statistical based thresholding strategy is proposed. At the monitoring site, the measurements are retrieved and the features are extracted from the reconstructed segmented image . Support vector machine classifier is used for the analysis and classification . The performance of the WEDDS has been evaluated in terms of accuracy and is compared with the existing techniques.

IV. PROPOSED SYSTEM

To realize the collection, management, visualization and uploading of real-time information in the fruit diseases, an information monitoring node based on image processing technique.In this project we propose an k means clustering algorithm based on segmentation for different plant analysis. Segmentation of the fruit from background objects is a challenging task for different fruit leaf recognition and classification. Before applying the proposed method pre-processing technique like image conversion, by median filter, morphological operation and finally wavelet transformation has to be processed. The proposed method provides good results based on clustering for detection of most homogeneity region in plant leaf images. The performance of the conventional and proposed methods is evaluated using Variation of Information, Energy, Entropy and Evaluation Time. The proposed method provides suitable results for efficient classification and recognition.

V. BLOCK DIAGRAM

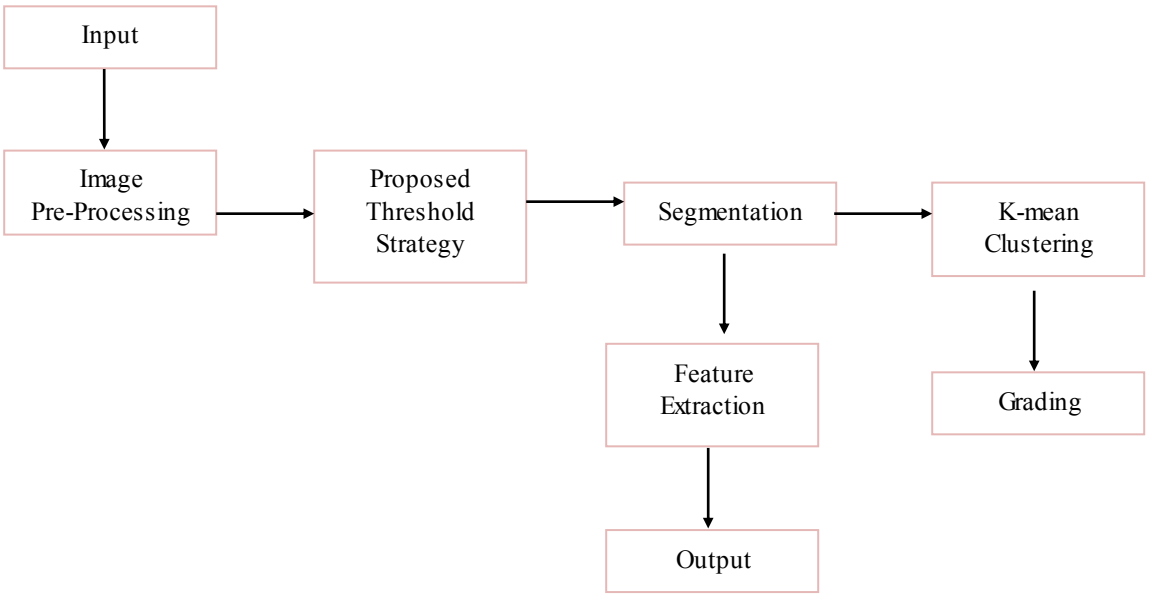

Figure.5.0 System Architecture

VI. MODULE DESCRIPTION

A. Image Preprocessing

Image pre-processing is the method of enhancing data images prior to computational processing . It is a form of signal processing for which the input is an image; the output of image processing may be either an image or a set of characteristics or parameters related to the image. Image Pre-processing uses the techniques such as image resize, erosion, dilation, cropping, etc.

B. Image Segmentation

Image segmentation using k-means algorithm is useful for the image analysis. An essential goal of image segmentation is to separate the object and background clear regardless the image has blur boundary. Defected segmentation of fruits can be seen as an instance of image segmentation in which number of segmentation is not clearly known. The basic goal of the proposed approach is to segment colors automatically using the K-means clustering technique and L*a*b* color space. The framework of defect segmentation operates in six steps as follows

Step 1: Read input image of defected fruits.

Step 2: Transformation of the Image from RGB to L*a*b* Color Space. We used L*a*b* color space because it consists of a luminosity layer in 'L*' channel and two chromaticity layer in 'a*' and 'b*' channels. Using the L*a*b* color space is computationally efficient because all of the color information is present in the 'a*' and 'b*' layers only.

Step 3: Classifing the Colors using K-Means Clustering in 'a*b*' Space. To calculate the difference between two colors, Euclidean distance metric is used.

Step 4: Label the Pixel in the Image from the Results of K-Means. For every pixel in our input, K-means computes an index corresponding to a
cluster. Each and Every pixel of the image will be labeled with its cluster index.

step 5: Generate Images are Segment the Input Image by Color. We have to separate the pixels in by color using pixel labels, which will result different images based on the number of clusters. Programmatically it determine the index of each cluster containing the defected part of the fruit. Because the K-means does not return the same cluster index value every time. But we can do this by using the center value of clusters, which contains the mean value of 'a*' and 'b*' for each cluster.

Figure.6.0 Image Before segmentation

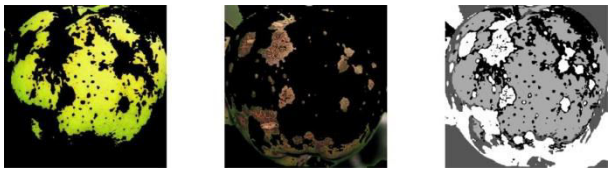

Figure.6.1 Image After Segmentation

Algorithm flow

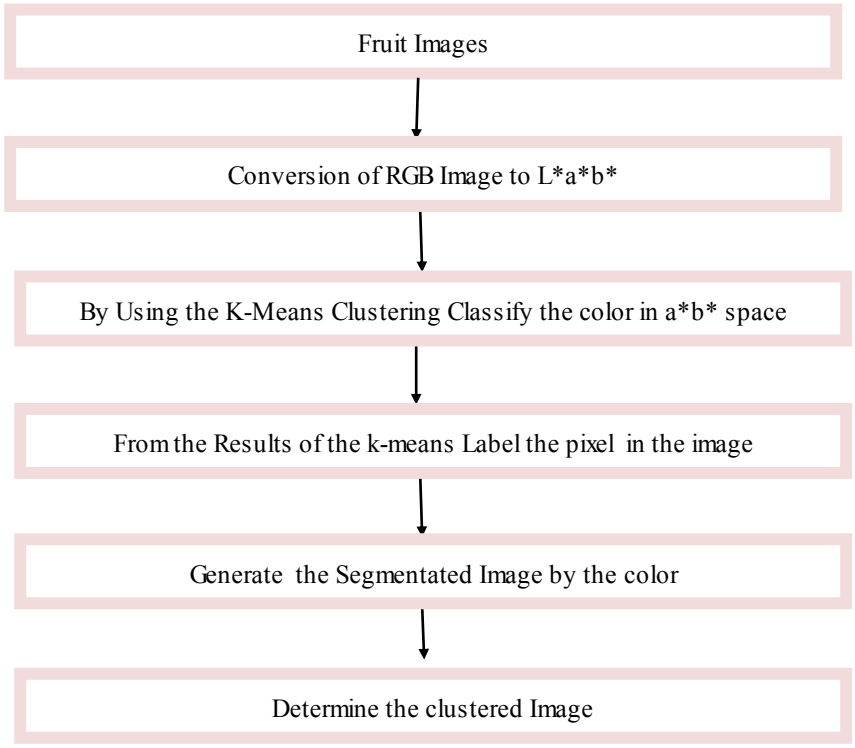

Figure.6.2 K-means clustering Flow chart

C. Feature Extraction

In proposed approach, we have used some state of the color and texture features to validate the accuracy and efficiency. The features used in the fruit disease classification problem are Global Color Histogram (GCH), Color Coherence Vector (CCV), Local Binary Pattern (LBP), and Complete Local Binary Pattern (CLBP).

1) Global Color Histogram (GCH)

The Global Color Histogram (GCH) is the simplest method to encode the information present in an image. A Global Color Histogram is a set of ordered values, for each distinct color, representing the probability of a pixel being of that color. Uniform normalization and quantization are used to avoid scaling bias and the number of distinct colors.

2) Color Coherence Vector (CCV)

The methods to compare images based on color coherence vectors are presented. They define the color coherence as the degree to which image pixels of that color are members of a large region with homogeneous color. These regions are referred as coherent regions. Coherent pixels are belongs to some sizable contiguous region, whereas incoherent pixels are not. In order to compute the CCVs, the method blurs and discreteness the image's color-space to eliminate small variations between neighboring pixels. Then, it finds the connected components in the image in order to classify the pixels in a given color \is either coherent or incoherent. After classifying the image pixels, CCV computes two color histograms: one for coherent pixels and another for incoherent pixels. The two histograms are stored as a single histogram.

D. Classification

Support Vector Machine (SVM) is used for classification. SVM find out the linear separating hyper plane which maximize margin and can be used for classification. SVM Will uses a nonlinear data into higher dimensions. Dimension boundary splits the tuples from one class to another. The training time of Support vector machine is slow but they are accurate. After applying SVM, clusters will classify into two classes with labels disease infected fruit images and non-infected fruit images. Infected image class consist fruit images affected by diseased fruit image and non-infected image class includes healthy fruit images.

Sample Data Base Images

Figure.6.3 Apple Scab

Figure.6.4 Apple Rot

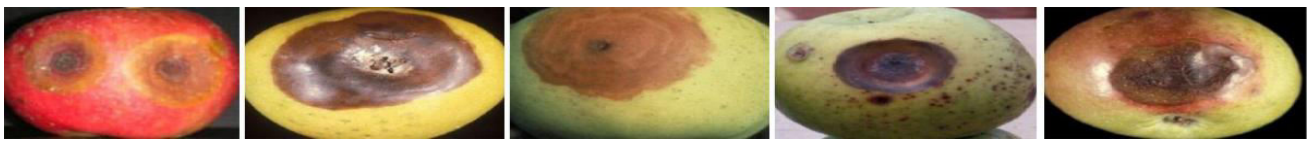

Figure.6.5 Apple Blotch

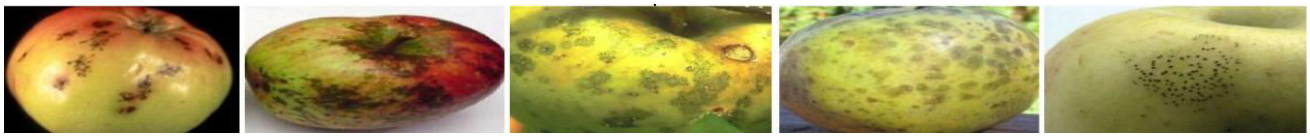

Figure.6.6 Normal Apple

VII. CONCLUSION

An image processing based solution is proposed and evaluated for the detection and classification of fruit diseases. This proposed approach is composed of mainly three steps. In the first step image segmentation is performed using genetic technique. In the second step features are extracted. In the third step training and classification are performed on genetic. Our experimental results indicate that the proposed solution can significantly support automatic detection and classification of fruit diseases. Based on the experiments, we have found that normal fruits are easily distinguishable with the diseased fruits and CLBP feature shows more accurate result for the classification of fruit diseases and achieved more than classification accuracy. Further work includes consideration of fusion of more than one feature to improve and enhance the output of the proposed method.

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