FRUIT DISEASE DETECTION USING IMAGE PROCESSING

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***Abstract* – In any agricultural industry, effective growth and improved field of any yield is very important and necessary. Nowadays, fruit field have good reference. Farmers follows manual monitoring system in this field. For this farmer have to wait till the fruit is improved. Manual monitoring system will not give exact result as it is a time taking process. So we need a smart monitoring system for the detection of disease in fruits. For this we have now proposed a new technology using some of the image processing technologies and algorithm. We implement this to detect the fruit disease. There are so many specified algorithms like K-means clustering techniques to cluster the images. Then using k-nearest neighbor algorithm, images will be classified into one of the classes. Here we can train the dataset image for detection. Our experimental results will give maximum possible results and are satisfied with accuracy.**

***Keywords* – Fruit Image, MATLAB Software, k-means clustering, k nearest neighbor algorithm.**

I. INTRODUCTION

Indian economy is dependent of agriculture and its production. Therefore, in the agricultural field detection of disease in fruits play an vital role. Almost all fruits are affected mainly by fungal, bacterial or viral diseases. The climatic condition also plays an important role in affection of fruits. To detect the fruit disease at its initial stage, the technology used here is image processing and the main tool is MATLAB. The main aim is to increase the quality. In fruits few general diseases are monitored by black speck. Image processing is used to classify the disease region concerned and to detect the difference in the area affected.

The existing method for detecting the disease in fruits is simply a naked eye observation by experts. Since large team of experts and continuous monitoring of the fruits is essential which costs much Farmers often lack the proper facilities or even an awareness, hence it is necessary to contact the experts. The fruits disease not only affects the food scale but also the live hood of many small holding farmers whose income mainly depends only on agriculture field.

In this condition the proposed technique is addressed to be beneficial in monitoring the large field. Automatic detection technique will take less efforts, less time, and it is more accurate. This also supports machine vision to provide automated proces s control, inspection, and guidance based on the image. This mainly controls the fruit disease. If the fruits disease is identified wrongly then it leads to huge loss of quality, time, money and production. The proposed method is done by observing the fruits for detection of plants affected by the disease. The two main characteristics that are achieved in these methods are speed and accuracy. The organisation of the report is explained briefly in the following chapters,

In chapter image processing are introduced. In next chapter threshold segmentation methods are explained. In chapter converting RGB to HSI is derived. K-Means clustering algorithm is simplified and KNN method is clearly explained.

II. RELATED WORK

There are several algorithms were developed for bone fracture detection. In this section a broad overview of the literature is presented, starting with papers that Vijaykumar V presented a filtering algorithm for Gaussian noise removal. First estimating the amount of noise from the noisy image, then replace the centre pixel by the mean of the sum of the surrounding pixels based on a threshold value. Compared to other filtering algorithms such as mean, alpha-trimmed mean, Wiener, K-means, bilateral and trilateral, this algorithm gives lower Mean Absolute Error (MAE) and higher Peak Signal to-Noise Ratio (PSNR). Generally the DICOM images are corrupted by the salt and pepper noise. Al-Khaffaf H proposed an extension of the K-fill algorithm to remove salt and pepper noise based on the number of black or white pixels in a 3 × 3 window. Assuming that the images are corrupted by the noise modelled as a sum of two random processes: a Poisson and a Gaussian, this approach allows them to jointly estimate the scale parameter of the Poisson component and the mean and variance of the Gaussian one. Finally, Zain, M. L. addressed the problem of image enhancement and speckle reduction using filtering technique. J Fan, et proposed a new automatic image segmentation method. Color edges in an image are first obtained automatically by combining an improved isotropic PL.Chithra et International Journal of Advanced Research in Computer Science, 8 , Sept–Oct 2017,381-388 © 2015-19, IJARCS All Rights Reserved 383 edge detector and a fast entropic thresholding technique. Also semantic human objects are generated by a seeded region aggregation procedure which takes the defected faces as object seeds. N Dhanachandra in their proposed method applied partial stretching enhancement

to the input image to improve the quality of the image. Subtractive clustering method was used to generate the initial centres and then these centres were used in k-means algorithm for segmentation of image. Seema used k-means clustering method is used for segmentation to extract region of interest from background. Color features are extracted from RGB image and HIS image. Then morphological features are calculated from RGB image. Later nearest neighbor classifier was used to classify. They got 100% accuracy. Devrim proposed an artificial neural network-based segmentation and apple grading by machine vision and they obtained 90% recognition. Malay K D proposed an image processing based method to assess fish quality and freshness. Wavelet domain coefficient was used for analysis of the acquired image. Also they used Haar filter for defining the freshness ranges

III. FRUIT DISEASE DESCRIPTION

1. Rot

1.1. Black Rot

The most destructive type of this is the infection of the fruit, and it begins with infected flowers before the fruit spreads. Black rot disease commonly causes the fruits on the tree to blossom end rot or mummify. Leaf signs are symptoms of early onset. Leaf symptoms such as purple spots on the upper surfaces of the leaf are caused by the obtuse botryosphaeria fungus that infects apple fruits, leaves and bark.

Figure.1.Black Rot.

1.2. Core rot

Common injuries that may result in Alternaria rot include mechanical or chemical injury, sun scalding injury, or freezing. Browning happened most often with the main rot occurrence rates. Infection can occur before or after harvest, although the post-harvest problem is more common. The fungus is soil borne, and spores survive primary infection in the soil.

Figure.2. Core rot

1.3. Brown rot

Big reds are fluffy but not mushy. Circular and medium brown in the early and middle developmental stages. Decayed area enlarges; small black spots about 1/8 inch wide slowly develop in the lenticles Whole fruit is decayed and turns black under warm conditions and develops a velvety shine.

Figure.3. Brown Rot

2. Scab

Apple scab winters primarily in fallen leaves and in the field. Production of disease is favoured by the warm, cool weather usually prevailing in spring and early summer. Fungal spores are carried to trees, leaves or fruits by wind, rain or splashing water from the ground. Newly opened apple leaves are highly susceptible to infection during times of humidity or raininess. The longer the leaves stay wet, the more severe the infection is. Apple scab is fast to spread between 55-75 degrees F.

Figure.4. Scab

3. Blotch

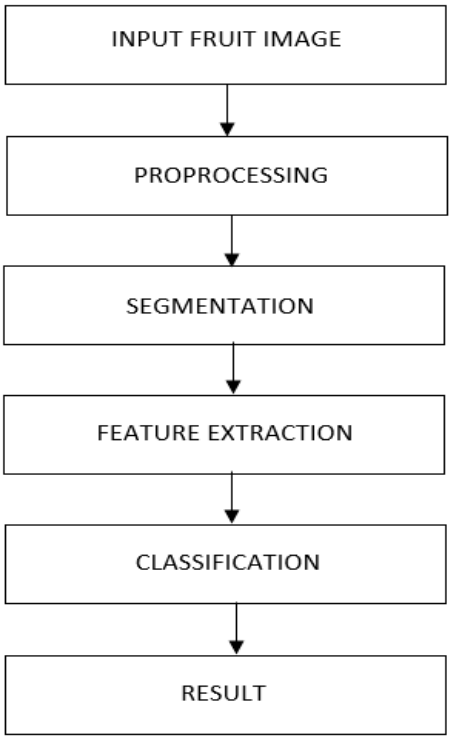
Brown to dull black, soothy blotches on the fruit surface with an indefinite outline shape. The blotches may have a diameter of 1⁄4 inch or greater. The blotches will coalesce to cover virtually all of the fruit. The sooty blotch fungus is confined to the fruit's outer surface, and the blotches can be quickly rubbed away in many instances. If infection occurs early in the season, however, you may need to vigorously rub off or bleach the fruit to eliminate it.

Figure.5.Blotch

IV. PROPOSED WORK

The Fig.1 shows the system flow diagram that has been implemented to get results of diseased fruit using classifier algorithms such as KNN (k nearest neighbour) algorithm. It is done using MATLAB software to obtain name of the diseased fruit. Input image is initially detected through web camera or digital camera. It is then processed for filtering, where the noises are removed. The filtered image is enhanced where the

image is brightened and increasing the contrast of image. The brightened image is segmented for better and accurate results. The process of segmentation of the input images increases the efficiency of the result. The diseases are clearly identified through segmentation process. The required features are extracted from the input image and compared to the trained data. Required or interested data are analysed and diseases are detected by comparing with RGB pixels of the images. Thus the diseases is detected and the results are displayed according to the input image.



Input Fruit Image

The first step of the proposed work is image acquisition. Leaf is captured through high resolution camera Image will be in RGB form(Red, Green, Blue). Colour Conversion of RGB-image structure is generated Color Space Conversion is applied to the image as the HIS observation model. To improve the precision of the disease detection and classification process, device dependent colour space is required. The procedure includes obtaining pictures from any equipment sources or from any database. This is the initial phase in the image processing process. The picture obtained is in RGB format.

Image Pre-processing

It is the second step in the detection of fruit disease using image processing technique. The success of identifying the disease is done by achieving eliminating noise, segmenting the images and feature extraction for the input image. The input images are processed from the image acquisition. This step consists of converting RGB (Red Green Blue) image to the grayscale image to speed the processing time. Then this grayscale image is processed to remove noise from the image. As it contains noise while image transmission. Median noise is used for image smoothening. Larger sigma provides larger filter to smoothening. Removing unwanted pixels in an image is called denoise.

Segmentation

The segmentation of images is the process of dividing an image into multiple parts. The main aim of segmentation is to simplify the image into a much easier-to-analyze form. K-means clustering algorithm is used to partition the image into different parts that have similar or unique characteristics. Division of image into diverse part of the same skin tone. It means paralleling of picture into various part of same elements or having same likeness. Simply the representation of the image, which is more meaningful as well as it is easier to analyse. K means clustering is more suitable than other clustering techniques for calculating the large amount of data. K means cluster operates on actual observations. Dividing the digital image into multiple segments using Image segmentation process. It is commonly used for image compression or object recognition. It is the partitioning of the digital image into the various multiple segments.

Feature Extraction

The important step is feature extraction to extract the images to get useful information. Collecting the set of pixels from the dividing the images. It will help to identify the Region of Interest (ROI). Input image is enhanced to protect information of the portentous pixels before colored from the background. It is used to reduce effects of illumination and distinguish between diseased and non-diseased leaf color, resulting color pixels are clustered to acquire group of colors in the image. Extraction of the function is based on the specified threshold value, which is determined for the corresponding pixel value. The intensity will be less than the pre computed threshold value, when pixel value of RGB is set to zero. Feature extraction gives more accurate disease classification and significant to reduce the processing.

Contrast:

The measure of intensity is returned between the pixel and neighbor over the whole image.

$$Contrast = \sum_{i,j=0}^{N-1} C(i,j)(i,j)\text{^}2$$

Energy:

It gives the sum of squared elements. The energy of the contrast image is 1.

$$Energy = \sum_{i,j=0}^{N-1} C(i,j)\text{^}2$$

Homogeneity:

It gives the value of closeness that is measured. Homogeneity for diagonal segment is 1.

$$Homogeneity = \sum_{i,j=0}^{N-1} \frac{C(i,j)}{1+(i-j)\text{^}2}$$

Correlation:

It gives the measure of pixel how it is correlated to the neighbour of the whole image. The value is 1 or -1 for perfect positive or negative image.

$$Correlation = \sum_{k=i,j=0}^{N-1} (i * j) * C(i,j) - (\mu x - \mu y)/\sigma x * \sigma y$$

K-Means Clustering Algorithm

Working Of K-Means Clustering Algorithm: The K-means is the simplest and most commonly used algorithm employing Euclidean distance. It classifies a given data set into certain number of clusters (K in K-means represents number of clusters required). The procedure starts with initialization of K clusters with K centroids, one for each cluster. The clusters and their centroids are recomputed until all the data points in each cluster are at the minimum distance from their centroids.

The Basic Algorithm Works As Follows:

Algorithm 1: Basic K-means Input: Dataset (D), Number of clusters (K) Output: Elements of Dataset classified into K clusters

1) Select K initial Centroids (cluster centres) randomly form the given data set.

2) Repeat – Assign all points in the dataset to the closest cluster centre (centroids) to form K clusters. – Recalculate centroids for each cluster to improve accuracy. Until no further improvement in accuracy. We observe, K-means provides iterative convergence process to c1assity the entire numerical data into distinct clusters on some similarity parameters.

Classification

Classification is the process of imposing a class on a new sample on the basis of learning attained by the classifier model during training. In this paper, the classification plant disease into five classes are done by using the KNN classifier.

1) K-nearest neighbor Classifier:

KNN is the simple and useful classifier for different classification problems. It does not require any prior knowledge of training like SVM or other machine learning algorithm. If the new training pattern is affixed to the subsisting training set then it doesn't require retraining. Before classifying a new element vector, a comparison should be finished with the training sample using distance metrics. Its k-nearest neighbors are then considered where the class that occurs most among the neighbors is given to the element that to be classified. A new element is classified on the basis of the neighbors are weighted by the distance measure. The appropriate working of the scheme depends on the proper selection of the appropriate parameter such as the 'k' which represents the number of neighbors used to give a class to any new element.

2) KNN Classifier Phases and Rules:

KNN classifier comprises of two phases. One is training phase where the leaf images are labelled with their classes and another one is testing phase where the leaf images are unlabelled and algorithm yields the list of k nearest data point (training data point) to label the unlabelled point and classifies their classes

KNN rules are:

- The set of stored training and testing data.
- Use euclidian distance which can given by (1) as distance parameter to measure the distance between stored records & unknown record to classify.

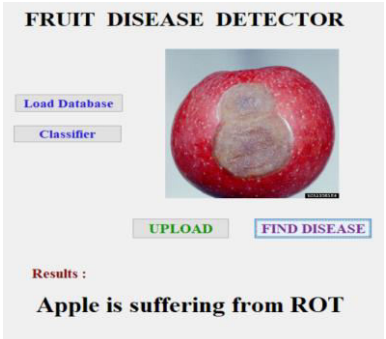
$$d(p_i, q_j) = \sqrt{\sum_{r=1}^{n} (p_{ir} - q_{jr})^2} \qquad (1)$$

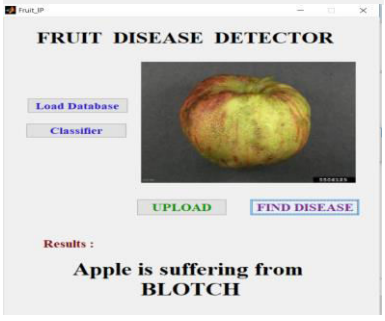
- Find k nearest neighbors & use class labels of nearest neighbors to find the class label of an unknown data by counting maximum vote

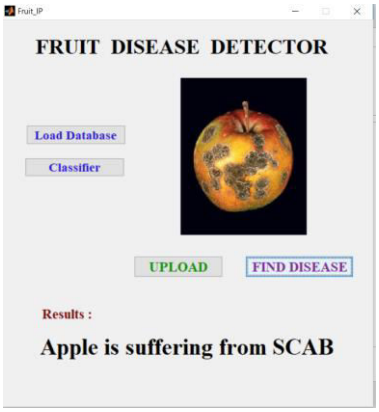
V. RESULT AND ANALYSIS

Input image is initially detected through web camera or digital camera. It is then processed for filtering, where the noises are removed. The filtered image is enhanced where the image is brightened and increasing the contrast of image. The brightened image is segmented for better and accurate results. The process of segmentation of the input images increases the efficiency of the result. The diseases are clearly identified through segmentation process. The required features are extracted from the input image and compared to the trained data. Required or interested data are analysed and diseases are detected by comparing with RGB pixels of the images. Thus the diseases is detected and the results are displayed according to the input image.









CONCLUSION

This work proposed a method which uses KNN approach to detect and classify various diseases that are present in plant fruit. Diseases such as blotch, rot and scab in apple are considered for the experiment. The segmentation of the disease portion is done by using the k-nearest neighbor classifier The inspection of fruits in is an important process. Manual inspection is time consuming process. Automated inspection reduces human interaction with goods, classify and detect defect of fruits faster than humans. The proposed approach used k-means clustering and segmentation technique. The proposed system is more feasible with less time complexity and less dependency.

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