A Review of Image Processing Methods for Fruit Disease Detection

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Abstract

Fruit disease cause a calamitous problem and results in economic and agricultural industry loss. Earlier detection of infected fruit had done manually but now with the advancement in technology image processing techniques was developed. There are two phases; first is for training and the other is for testing. In training phases, all the data related to the infected and non-infected fruit is stored and in testing phase, it is analyzed that whether the fruit is infected or not and if yes then by which disease. In this paper, the different existing techniques used to detect the infected fruit are discussed. These techniques are proved to be beneficial for the farmers as they help in detection of fruit disease in early stages.

Keywords: Back Propagation Neural Network, CCV, K-means Clustering, LBP, SVM

I. INTRODUCTION

Earlier the detection and identification of disease is done by experts. Depending upon the observation of experts farmers take further steps to control the disease. In developing countries consulting experts is quite costly and time consuming, that’s why automated disease detection techniques were developed. Agricultural industry is using technological solutions for improving fruit production and quality. By using this system economical loss of farmers can be avoided. Automatic detection of fruit disease is important as it detects the symptoms on fruit at very growing stage which results in reducing the economic loss per year and this will also help the farmers in taking preventive measures for next year by observing present conditions of fruit. Some diseases also infect other parts of tree i.e. shoot and branches. Common diseases of mango: – pectobacterium, agrobacterium, rhinocladium, anthracnose, powdery mildew, red rust. Pectobacterium and agrobacterium are bacterial disease of mango. Rhinocladium is a fungal mango disease. Anthracnose is caused by humidity and change in climatic conditions i.e. temperature between 24-30 degree and extra rainy conditions. Powdery mildew is caused by rain or mist accompanied by cooler night during flowering. Red rust is caused by alga. As Mango is irregular in shape so, visual inspection of mango is not enough to judge its conditions.

II. LITERATURE SURVEY

Yan-Cheng Zhang et al. (2007) provided a system for detection of cotton leaf disease by using fuzzy feature selection technique. They had proposed an approach fuzzy curves and fuzzy surfaces which could able to find the feature for recognition pattern system. Fuzzy curves may rapidly separate necessary features subset and Fuzzy surfaces removes only those features that are based on other significant features. Zulkifli Bin Husin et al. (2012) proposed image processing approach for the study of plant chili disease detection. The image is firstly improved to prevent the data after extraction then color space is used to minimize the brightness. Color feature is used for recognition of the disease. Shiv Ram Dubey et al. (2012) used the local binary patterns for the detection of apple fruit disease. For segmentation they had proposed k mean clustering algorithm then for feature extraction they had used Global Color Histogram (GCH), Color Coherence Vector (CCV) and Local Binary Pattern (LBP) and for classification and training they had used Multi-class SVM classifier. Sagar Patil and Anjali Chandavale (2015) had proposed a system for detecting disease. They had used k-mean clustering along with color, texture and shape feature for detecting disease. This system is developed for detecting diseases like bacterial blight, leaf curl, Grey Mildew, leaf spot, target spot and leaf blotch in monocot and dicot plants.S. S. Samnakkki and V. S. Rajpurohit (2015) provided a system for detection of pomegranate disease. They had done resizing, filtering, conversion of filtered image into L*a*b color space and then they had used k-mean clustering algorithm for segmentation along with color and texture feature for extracting the infected region of the image. Manisha A. Bhanje and Prof. H. A. Hingoliwal(2015) proposed a system for improving the efficiency of automatic fruit disease detection by adding Intent search technique. They had done there work on pomegranate fruit having disease bacterial blight.

For detecting disease the image should go through the following steps:
1) Pre-processing
2) Segmentation
3) Feature extraction
4) Classification.

A. Image Pre-processing:

The aim of this step is to eliminate noise and to enhance the image quality. Super resolution technique can be used for converting low resolution image into high resolution image. Morphological operations can be used to remove noise. Pre-processing required for shadow removal, image correction. Shadow removal is very important because shadow may disturb segmentation and feature extraction.

B. Image Segmentation:

Partitioning of image into foreground and background or finding the region of interest by using certain algorithms or making clusters of regions by comparing the similarities between adjacent pixels.

1) Thresholding:

This technique is used when the contrast of background and foreground is easily distinguishable. In global threshold a benchmark is chosen below that all the pixels are marked ‘0’ and considered as background and above that all the pixels are marked as ‘1’ and considered as the part of foreground. ‘Otsu threshold’ is a thresholding technique in which threshold value selected will depend upon the infraclass variance pixels.

2) Region Growing:

In region growing technique a seed is chosen based on the properties of the neighborhood pixels expansion of the region of interest starts. In this technique seed selection is a key operation. Expansion of R.O.I is based upon similarities between the adjacent pixels.

3) k-mean Clustering:

In this technique k is the no. of clusters. It operates on Actual Observations. K-mean treats each observation as an object. In this k-mean clustering, partition is found in which different objects in the cluster are nearer to each other and objects in other clusters are far away to each other. Iterative algorithm is used in order to decrease the sum of distances from each object to its clustered centroid.

4) Fuzzy C-mean Clustering:

In c-mean clustering, iterative algorithm is used. Initially, calculation is done for fuzzy cluster centers and also fuzzy partition matrix is created. In the next step of iteration, the objective function is reduced in order to find the better position for the cluster. This iteration process is stop automatically when the maximum number of iterations is reached.

C. Feature extraction

It extracts relevant information from the input image in order to minimize the extent of sources required to define a dataset.

1) Color:

A color feature is one of the visual features as it is very stable. RGB and HIS colour system is mainly used. Infected part of a fruit can be easily identified by colour feature. Color image processing is categorized into three principle areas: Colour transformation, Spatial processing of individual colour planes, Colour vector processing.

2) Texture:

Image texture provides information about spatial arrangements of colour of an image. When fruit suffer from any disease its texture feature change. So, we can analyze disease type by using texture feature.

3) Shape:

Morphology is tool used for extracting image components. By using morphological operations, infected part shape can be extracted from healthy fruit and leaf. Erosion operation can be used for obtaining boundaries of the image. Four major characteristics:

1) Geometric characteristics – it includes perimeter, area, axis, orientation angle and so on.

2) Area description features – depending on the target area its feature is described using a set of characteristics.

3) Moment invariants: In these, geometric characteristics such as Hu invariant moments, orthogonal moments, etc. are described by using its feature.

4) Fourier shape descriptor.

D. Classification

Support Vector Machine (SVM) making an N-dimensional hyper plane which is optimally partitions the data into different parts. Support vector models are related closely to neural networks. SVM evaluates more relevant information in a convenient way.

III. RESULTS OF EXISTING TECHNIQUES

<table>
<thead>
<tr>
<th>Author</th>
<th>Plant Disease</th>
<th>Technique used</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yan-Cheng Zhang [1]</td>
<td>Cotton leaf disease</td>
<td>Fuzzy curves and fuzzy surfaces for feature extraction</td>
<td>Not given</td>
</tr>
<tr>
<td>Zulkifi Bin Husin[2]</td>
<td>Plant chili disease</td>
<td>Color space</td>
<td>Not given</td>
</tr>
<tr>
<td>Authors</td>
<td>Disease</td>
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<tr>
<td>Shiv Ram Dubey</td>
<td>Apple fruit disease</td>
<td>Complete local binary patterns</td>
<td>93.14%</td>
</tr>
<tr>
<td>Sagar Patil</td>
<td>Plant disease detection</td>
<td>Monocot and Dicot Family</td>
<td></td>
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<tr>
<td>S.S.Sannakki</td>
<td>Pomegranate disease</td>
<td>Back propagation neural network</td>
<td>87%</td>
</tr>
<tr>
<td>Manisha A. Bhange</td>
<td>Pomegranate disease</td>
<td>K-mean clustering with Intent Search technique</td>
<td>Not given</td>
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</tbody>
</table>

IV. CONCLUSION

In Fruit Detection System we had analyzed that the proposed technique based on fuzzification in which fuzzy curves and fuzzy surfaces rapidly find the feature for pattern recognition system. Fuzzy surfaces remove those features that are based on other significant features. It had proved for providing good results in feature extraction. K-mean clustering algorithm had proved to be the one of the best techniques for segmentation. SVM had proved to be best for classification as it maps input data with high dimensional feature space through linear or non-linear mapping techniques. When the quality of image is low or the resolution of image is low Intent Search Technique had proved to be best for improving the quality of image.

REFERENCES