

Detection and Classification of leaf diseases

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Abstract- Our country India has always been an agriculture dominant country from the beginning of its civilization. Agriculture not only provides food, fodder and fuel for people but also is a way to earn livelihood for most of the people living in rural areas. So, all the people living either in rural or in urban areas directly or indirectly depends on the agricultural yield. The population of our country has increased drastically after the independence which puts a lot of pressure on the agricultural sector to support it. In such a scenario if the crops get infected by disease, it can have adverse effects on the people as well as economy of the country. Unlike the old times new technologies are developed and used today to detect these diseases in plants because the manual process of detection took a lot of time, effort and cost. Using the modern techniques diseases can be detected well in time and can be prevented from spreading. Many methods have been developed till date to execute the process of detection and classification such as k-Nearest Neighbor Classifier, Support Vector Machine, Principal Component Analysis, Linear discriminant analysis, Artificial neural network, Fuzzy logic etc.

KEYWORDS: Image processing, k-Nearest Neighbor, SVM, GLCM, Neural network

1. INTRODUCTION

The basic requirement of all the living organism to sustain their life is air, water and food. For the humans and other animals, we directly or indirectly depend on the plants for food. Plants also provides oxygen to the animals which we breathe in during the process of respiration which circulates in our blood and provide energy. Therefore, all the humans and animals depend on plants for their survival. Agriculture is not just a way to support life on earth, it also provides fuel, fodder and employment to lots of people who earn their livelihood from farming only. Thus, agriculture contributes a great deal in the economy of the country. In such a scenario it is very important that the plants must be kept healthy. But it is not easy to do so. Because plants can also suffer from disease in a very similar way that animals do. Like animals, plants can be infected by microorganisms like

fungi, bacteria, viruses, viroid, protozoa etc. The other cause for diseases in plants can be excess or lack of mineral uptake by plants from the soil. Some of the diseases are Anthracnose, Bacterial blight, Apple scab. Creospora leaf disease, Bacterial Canker, Black knot, Blossom end rot, Cedar apple rust etc. They can cause havoc for the farmers and for the economy. So, these diseases in plants must be detected well in time and must be classified so that proper measures could be taken to either prevent or recover from the disease. In early times, when people were unaware about the advances in science and technology the work of detection was done manually which took a lot of effort, time and capital. But with the advanced technology being developed over time it is much easier to detect the diseases well in time and saves a lot of time and effort of the farmers. In this paper the advanced method of image processing has been used to detect and classify the diseases. The solution to the problem given in this paper comprises of four main phases; the first phase includes the process of creation of a color transformation structure on the RGB leaf image and then, the application of color space transformation for the transformation structure. Then image thus obtained is segmented using the clustering technique of K-means. The second phase comprises of steps that include removal of unnecessary part (green area) within leaf area that is to be dragonized. In third phase calculation of the texture features for the segmented infected images of the object. In the fourth and the last phase the extracted features from previous phase are passed through a pre-trained neural network.

2. PROPOSED METHODOLOGY

For the image processing techniques to be carried out first of all the process of image acquisition of various leaves should be done using high resolution camera so that we can achieve better results & efficiency. Then the image processing techniques are applied to these images to extract useful features that are necessary for further analysis. The sequential steps being followed in order to do so are:

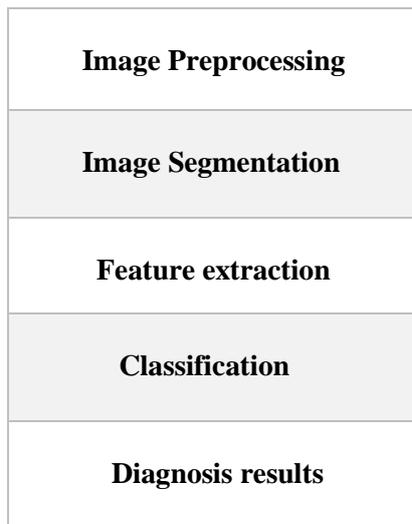


Figure 1. Block Diagram of proposed approach

2.1 IMAGE PREPROCESSING

When we acquire a digitized image, noise gets added to it which disturbs the image by adding some unwanted signals to it which can result in inadequate results and so it should be removed. For removing these noises different filtering techniques are used. Color space transformation structure is created for the acquired image. For achieving greater precision for the process of detection and classification, creation of a device independent color space is necessary. In a device independent color space, the properties of an image like brightness or contrast doesn't depend on the device on which image is to be taken. This conversion is useful because the actual properties of an image is kept in its original state.

2.2 IMAGE SEGMENTATION

The image obtained after the above phase is taken for segmentation. In segmentation process different number of segments are created based on the similarities in the properties of different pixels. For the accurate detection of disease, the green cells of the leaves must be masked. The green cells of a leaf indicate that they are healthy cells and thus don't contribute much in the identification of diseases. Here the method of K-mean clustering is used for dividing the cells into different cluster. There are K number of clusters each containing their own centers. First these centers are placed at any random position but are placed in a way that all these k centers remain as far as possible from each other. Then each datapoint is taken and assigned a cluster depending on their closeness with a given center After this the mean of all the data points in a cluster is calculated and the new center is found out. These two steps are repeated until no more changes can be done to these clusters.

2.3 FEATURE EXTRACTION

The segment of interest i.e., the segment containing the disease is taken and looked for different features such as energy, entropy, mean, standard deviation homogeneity, skewness etc. These features can be calculated by finding the HIS components of the image. The H(hue) component describes the color itself but in the form of an angle. The S(saturation) component describes that how much are the colors mixed with white color. The I(intensity) component of the color describes its mixing with black color. 0 means black and 1 means white.

After this GLCM (Gray level cooccurrence matrix) is generated for every H and S image of the infected cluster. A function is used to calculate this GLCM matrix.

2.4 CLASSIFICATION

After the extraction of all the features these features are given to a classifier to classify the type of disease with which the plant is infected. For the process of classification, a multiclass SVM (Support vector machine) classifier has been used. An SVM is a binary classifier which can classify the given dataset into two separate classes. These classes are defined based on a hyperplane. The main objective is to determine a function which can determine the hyperplane. The hyperplane must be such that it maximizes the distance between the support vectors. Support vectors are the data objects that lie on the border on either side of hyperplane.

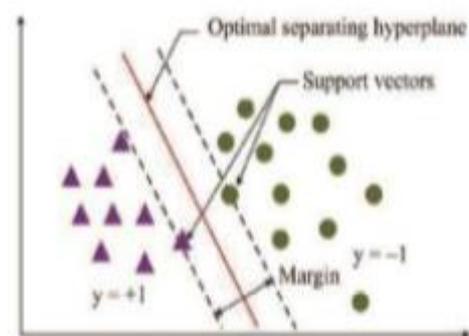


Figure 2. A Linear SVM

A multi-class SVM converts the data set to quite a few binary problems, It uses one against all approach to determine the class of disease. In this approach, there will be one binary SVM for each of the class to isolate the dataset of one class from that of the other classes.

2.5 DIAGNOSIS RESULTS

This stage shows the result of detection and classification process. It tells the name of the disease with which a plant is infected. It also shows how much of the area of the given cluster of cells is infected with the disease. The percentage of area being affected being affected can simply be calculated using a simple formula:

Total % affected area = (No. of affected leaf pixels / Total no. of leaf pixels) * 100

3. CONCLUSION

In our fast running livelihood where agriculture plays a major role in our livelihood by providing us with basic needs of food and fodder, it is our responsibility to keep them protected from different types of diseases which can be caused by different kind of pathogens, pests etc. An early detection and prevention method should be applied for which different image processing techniques are developed. All the techniques work towards the same goal of achieving high accuracy in detecting these diseases. So, this paper represents various approaches that have been adopted by researchers for detection and recognition of various plant leaf diseases. Among all the different techniques used for the experiment the best technique will be carried out which gives maximum profit. Where a technique has benefits it also comes with several limitation. There is still no general method or a common system that can be used to apply on different datasets. So a method is needed that can be commonly applied to all kinds of data.

REFERENCES

- [1] Prakash M.Manikar, Shreekant Ghorpade, Mayur Adawadkar "Plant leaf disease detection and classification using image processing technique" IJIERE Volume 2, Issue 4,2015.
- [2] Rakesh Chaware, Rohit Karpe, Prithvi Pakhale, Prof. smita desai "Detection and recognition of leaf disease using image processing" IJESC Volume 7, Issue 5, 2017
- [3] Vijay Borate, Sheetal Patange, Vaibhav vede, Onkar kale "Plant leaf disease detection using machine learning" IJARIE Volume 4, Issue 2,2018
- [4] M.Akila, P.Deepan "A review of different classification technique in machine learning using weka for plant disease detection" IJERT Volume 6, Issue 7,2018
- [5] R.Ramya, Dr.P.Kumar, D.Mugilan, M.Babykala "detection and classification of plant leaf disease by using deep learning algorithm" IRJET Volume 5, Issue 5, May 2018
- [6] Pooja kulinavar, Vidya I. Hadimani "Classification of leaf diseases based on multiclass SVM classifier" IJARIT Volume 3, issue 4, 2017
- [7] P.R.Patil, Prof. N.B.Bhawarkar "Crop disease detection with preventive measures using image processing" IJERA, ISSN:2248-9622
- [8] Aarju Dixit, Sumit Nema "Wheat leaf disease detection using machine learning method" IJCSMC Volume 7, Issue 5 May 2018
- [9] Rani Pagariya, Mahip Bartere "Review paper on identification of plant disease using image processing technique" IJARCET, Volume 3, Issue 11, November 2014.
- [10] H.al-Hiary, S.Bani ahmad, M Reyalat, M.Barik, Z.AL Rahamneh "Fast and accurate detection and classification of plant diseases" IJCA Volume 17, Issue 1, March 2011
- [11] Priti Badar, Suchitra C. "Disease detection of pomegranate plant using image processing" IJCSMC, Volume 5, Issue 5, May 2016.
- [12] www.mathsworks.in
- [13] Priti Badar, Suchitra C. "Disease detection of pomegranate plant using image processing" IJCSMC, Volume 5, Issue 5, May 2016.