International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | Impact Factor: 7.194 |

|| Volume 8, Issue 4, April 2020 ||

Neural Network for Identification and Classification of Plant Leaf Diseases

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ABSTRACT: Protecting plantation forests from pests and diseases are essential for keeping trees healthy and productive. Diagnosis of diseases is critical for disease management in plantation forests. For forest plantation with large concession areas, manual identification is time consuming and subjective due to inconsistency of investigator's decision. This paper proposes a method for automatic leaf diseases identification through digital image processing using Fast Fuzzy C Means Segmentation technique (FFCM). In this paper, we propose a novel method for segmenting leaf disease after improving image quality by applying pre-processing methods. In pre-processing method, images are filtered by 2D adaptive anisotropic diffusion filter to eliminate the noise content and preserve edge information. The contrast improvement and intensity changes are smoothen by equalizing the histogram using adaptive mean adjustment technique to emphasize the segmentation process. Finally in future work the neural network is applied to classify the disease using Radial Basis Function Neural Network (BRBFNN) using Bacterial Foraging Optimization (BFO).

KEYWORDS: FFCM, Images ,Neural Networks, Preprocessing.

I.INTRODUCTION

1.1 Plant leaf diseases

The 70% of the Indian population and India economy depends on agriculture. The Farmers have wide range of diversity to select suitable Fruit and Vegetable crops. Crop cultivation plays an essential role in the agricultural field. Presently the loss of food is mainly due to infected crops, which is reflexively reduces the production rate. The main challenge is to reduce the usage of pesticides in the agricultural field and to increase the quality and quantity of the production rate.

In most of the cases symptoms of the disease in plants are seen on the stem, fruit and leaves. In the present work, symptoms of plant leaf have been considered for the detection of disease. In plants leafs, brown and yellow spots are common symptoms for general diseases. Early and late scorch, viral, bacterial and other fungal diseases are also generally found in plants. The early detection of plant diseases is one of the main reasons that can reduce the world crop losses. Identification of disease in plant by naked eye has less accuracy. It requires a tremendous amount of effort, money, and time. Therefore, the bacterial foraging optimization based radial basis function neural network used in image processing make it possible to detect plant leaf diseases automatically.

II.LITERATURE SURVEY

2.1 Plant Diseases Fundamentals

A. Bacterial Diseases

A bacterial disease is generally referred as the “Bacterial leaf spot”. It is initiated as the small, yellow green lesions on young leaves which usually seen as deformed and twisted, or dark, water-soaked, greasy - appearing lesions on older foliage.

B. Viral Diseases

All viral diseases are present in some degree of reduction in production and the life of virus infected plants is usually short. The most available symptoms of virus-infected plants are frequently appearing on the leaves, but some virus may cause on the leaves, fruits and roots. The Viral disease is very difficult to analyze. Leaves are seen as wrinkled, curled and growth may be undersized due to the virus. Some of viral disease affected leafs are Tobacco mosaic virus, Tomato spotted wilt virus, Tomato yellow leaf curl virus, Cucumber mosaic virus, Potato virus Y, Cauliflower mosaic virus, African cassava mosaic virus, Plum pox virus, Brome mosaic virus.

C. Fungal Diseases

Fungal disease can influence the Contaminated seed, soil, yield, weeds and spread by wind and water. In the introductory organize it shows up on lower or more seasoned clears out as water-soaked, gray-green spots. These spots are obscure and at that point white fungal development spread on the undersides. Yellow to white streak on the upper surfaces of more seasoned clears out happens. It spreads outward on the leaf surface causing it to turn yellow.

2.1 Challenges of image processing

2.1.1 Image Acquisition

The initial process is to collect the data set. It takes the image as input for further processing. We have taken most popular image domains so that we can take any formats like .bmp, .jpg, .gif as input.

2.1.2 Image Preprocessing

As the images are acquired from the real field it may contain dust, spores and water spots as noise. The purpose of data preprocessing is to eliminate the noise in the image, so as to adjust the pixel values. Anisotropic diffusion filter is used to remove the unwanted noise in the image.After removing the noise, the leaf image is segmented using image segmentation technology. The segmented images are clustered into different sectors using k-mean and fast fuzzy c mean clustering algorithm. Before clustering the images, the RGB color model is transformed into Lab color model. The advent of Lab color model is to easily cluster the segmented images.

2.1.3 Feature extraction Feature Feature extraction is the important part of the infected region in an image. Here shape and textural feature extraction is done. The shape based feature extraction like area, color axis length, eccentricity, solidity and perimeter are calculated. Similarly the texture based feature extraction like contrast, correlation, energy, homogeneity and mean can be calculated.

2.1.4 Neural Networks

An Artificial Neural Network is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements (neurons) working in unison to solve specific problems. Featureextraction of each image parameters are fed to the radial basis function neural network is used for train the data set. In neural networks test data set is applied mathematics classifiers that are accustomed confirm the plant condition.

III PROPOSED ALGORITHM

Fast Fuzzy C mean algorithm (FCM) is used for segmentation and clustering of diseased and normal plant leaf automatically

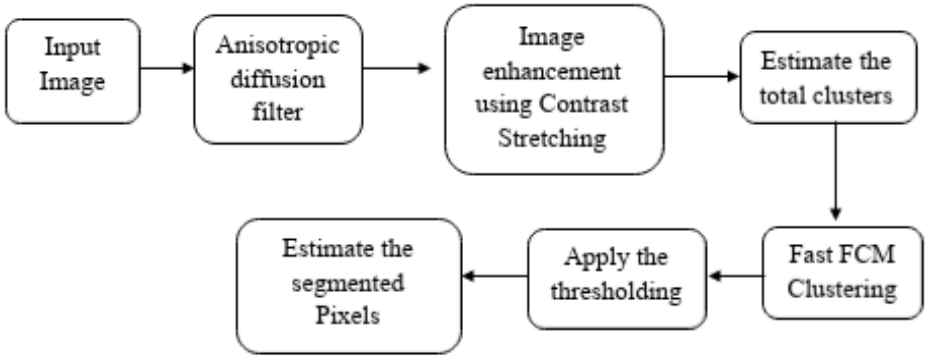

Figure 3 Block Diagram for image enhancement and FCM clustering.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | Impact Factor: 7.194 |

|| Volume 8, Issue 4, April 2020 ||

Initially, analysis of the behavior of anisotropic diffusion model is used to remove unwanted noise in an image. Image Enhancement is done using Contrast Limited Adaptive Histogram Equalization (CLAHE algorithm). Adaptive method computes several histograms, each corresponding to a distinct section of the image and uses them to redistribute the lightness values of the image. Image segmentation can be done with two type of clustering methods,

- k-means algorithm
- Modified Fuzzy C means algorithm.

This section elaborates the various methods and techniques involved in processing the datasets to identify disease in plant leaves.

3.1. Anisotropic Diffusion Filter

This algorithm is used to pre-processing of an image that avoids the unwanted noise of the image.

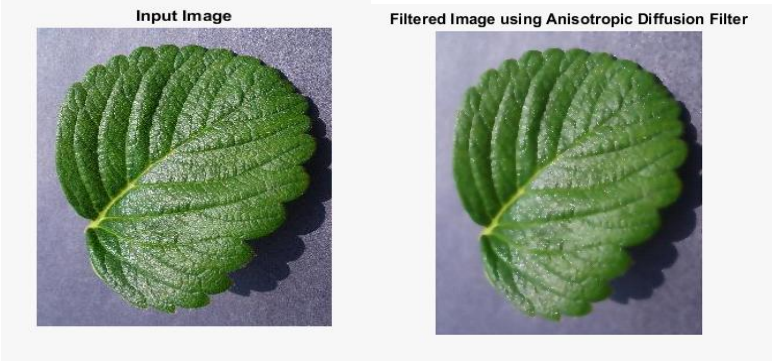

Figure 3.1 Anisotropic diffusion filter applied in normal leaf

Image pre-processing the anisotropic filter remove thenoise in an image. Here, the strawberry healthy leaf and strawberry leaf scorch taken as an input image and perform anisotropic filter for reduces the noise in an image.

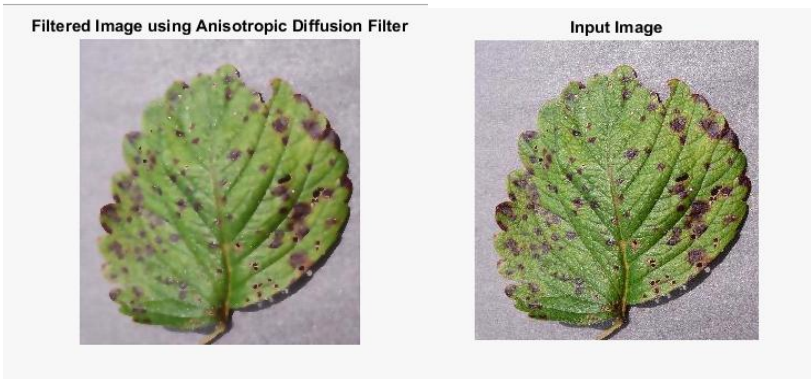

Figure 3.2 Anisotropic diffusion filter applied in abnormal leaf

IV .RESULT AND DISCUSSION

The Bacterial foraging optimization based radial basis function neural network is implemented in MATLAB R2010b working on system with i5 processor having 8GB RAM. To collect the leaf data set for the purpose of training images and testing them which are the leaf disease affect or not. The images are processed in several steps first pre-processing, image contrast and enhancement, edge detection, image segmentation and feature extraction after that the image can be trained in neural network.

4.1Training and Testing Data Set

Database contains 25 images of two different data set of disease affected and normal leaf.

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|| Volume 8, Issue 4, April 2020 ||

4.2Disease affected leaf

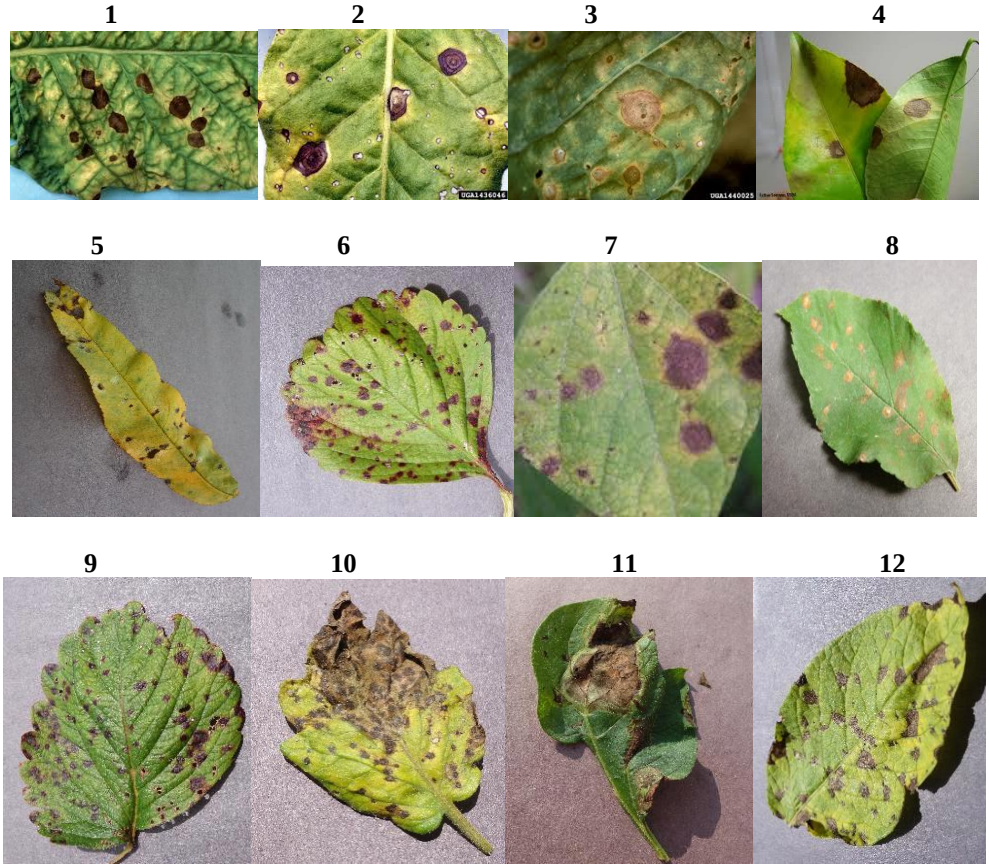
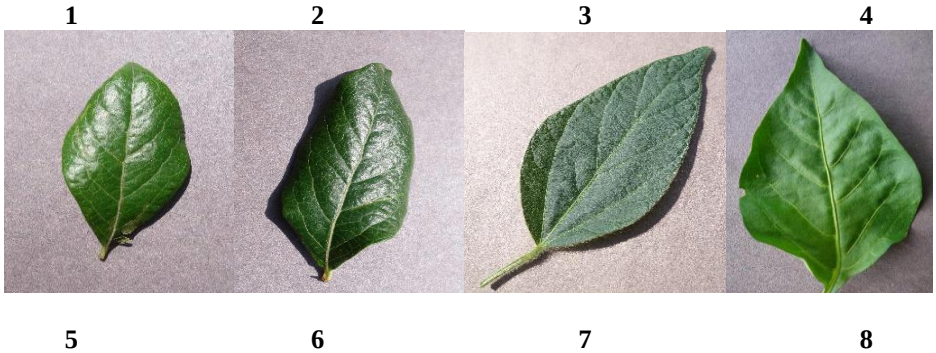


Figure 4.2 Disease affected leaf - 1-Cherry alternaria alternata,2-Cherry alternaria alternata,3-Cherry alternaria alternata,4-Orange alternaria alternata,5-Peach bacterial spot, 6-Strawberry leaf scorch,7-Potato alternaria alternata, 8-Apple cedar rust, 9- Strawberry leaf scorch,10-Bell pepper bacterial spot,11-Tomato septoria leaf spot,12- Potato alternaria alternata.

4.2.2. Normal leaf



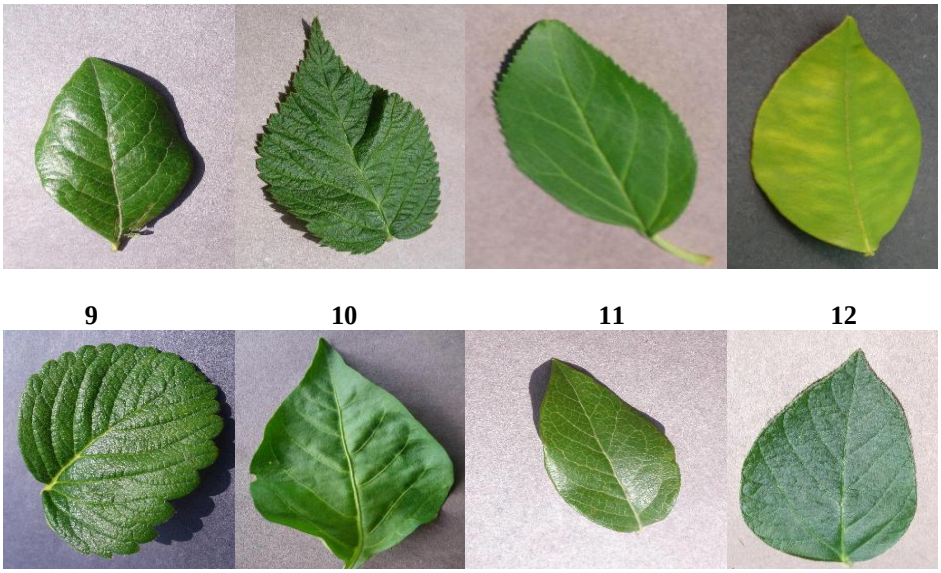


Figure 4.2.2 Normal leaf - 1-Blueberry leaf,2- Blueberry leaf,3-Apple, 4-Bell pepper leaf, 5-Blueberry leaf,6-Respberry leaf,7-cherry leaf,8-Orange,9-steraberry leaf,10- Bell pepper leaf,11- Blueberry leaf,12-Soyabean leaf.

V.CONCLUSION AND FUTURE WORK

The plant serves as the basic need for any living organisms. They are the most important and integral part of our surroundings. Just like a human or other living organism does plant do suffer from different kind of diseases. Such diseases are harmful to plant in a number of ways like can affect the growth of the plant, flowers, fruits, and leaves etc. Due to which a plant may even die. So in this work, we have enhanced segmented and clustered using fast fuzzy c mean algorithm. In future work i am going to propose a novel method named as Bacterial foraging optimization based Radial Basis Function Neural Network (BRBFNN) for identification and classification of plant leaf diseases. The results, when compared with other methods, show that the proposed method achieves higher performance both in terms of identification and classification of plant leaf diseases. In future work, plant leaf will be identified as normal or abnormal .

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