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Development and Advancement in Image Processing Technique for Detection of Various Diseases in Fruit & Vegetable Plants: A Review

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Abstract: This paper present a survey of method used for detection of vegetable plant and fruit diseases with the help of image processing technique. The Image processing steps are such as image acquisition, image filtering then segmentation and identify and classify vegetable plant and fruit diseases and measure different leaf parameters. In India our country economy is depend on agriculture sector. Most of the fruits export the overall world so need to increase the crop quality and production. But the various different seasons in India and various types of diseases observe on fruits and vegetables plants. The research need to analyses the disease and solution it to solve a given problem. As increasing growth and producibility of the agriculture field, farmers need automatic monitoring of disease of plants instead of physical methods [16].

Keywords- Leaf disease, Image processing, Feature extraction, segmentation, clustering, vector machine

INTRODUCTION

India is land of farmers normally observes visual manifestation of disease on fruit and vegetable leaf and other parts of plant. Experts may easily detect the disease on lab diagnostic test. But most of the farmer detects a disease by observation from that observation they conclude and wrong pesticides are used on plant. Because the expert cost is more and farmer cant paid for this extra burden. So observing this need to decide that survey a paper on fruit and vegetable disease detection technique uses till date. In this paper various techniques is used to detect disease of various fruit and vegetable fruit. The classification of disease can be summarizes using different technique. The detection of plant leaf disease is a very important factor to prevent serious outbreak. Most plant diseases are caused by fungi, bacteria, and viruses[2]. About 80-95% of diseases occurred on the cotton leaves are like Alternaria, Cercospora, Red spot, white spot and Yellow spot on the Leaf[2]likewise disease on other plants and fruits. Detection of diseases in plants, fruits and vegetables crops at early stages of development leads to reduced loss of yield and quality[3]. The diseases are also caused by bad environmental conditions. There are numerous characteristics and behaviors of such fruit diseases in which many of them are less distinguishable. The diagnosis of fruit disease is important [26].

Review of literature: There are many researchers had done work related to vegetable and fruit leaf disease analysis detection. Following is related literature survey of work related to the topic.

[1] Manisha Bhange, H.A.Hingoliwala (2015): In this paper researcher find the pomegranate disease using web based tools. In these tools they compare the images received from farmer with preloaded images that decides the fruit disease. They take images from digital camera as well as mobile camera because farmer uses a mobile camera. In this work researcher take two image databases for detection of disease, one for training purpose other for testing. In the training purpose, firstly input image is acquired by digital camera then image pre-processing is done for resizing the images by 300*300 PX. Then feature extraction is carried out by using color, morphology and CCV feature vectors for classification purpose. Next, clustering is performed by applying K-means clustering algorithm for partitioning the training dataset according to their features and finally classification is performed using support vector machine (SVM). In the testing phase input image will be acquired from user, then pre-processing, feature extraction is carried out and finally the image will be classified as disease infected or non-infected. In this work also compare the digital camera images and mobile camera images. The overall system accuracy is measured to be 82%.

[2] Vijay S.Bhong , Prof.B.V.Pawar(Feb 2016): In this paper researcher explain the various cotton leaf disease and its recommended treatment. In following image they explain the cotton disease recognition system. They acquire the image 512*512 pixel in frame size also said that their system is flexible for all image size. In image preprocessing using histogram equalization to increase contrast of images and feature extraction color feature variance is used for matching the train image features to database images. Then leaf Segmentation for detection of internal and external boundaries of the cotton leaf, use K-mean clustering algorithm technique and then finally perform a Leaf Recognition Before actual recognition process of cotton leaf image, the disease spot is located using color feature technique. Finally recognition is performed using neural-network to recognize the diseases. In their experimental results convert input image into RGB then Morphology technique is used for a broad set of image processing operations that process images based on shapes. Using morphological operation erosion and dilation on images to get the proper detection of disease. In paper they provide all steps experimental data and images provided for detection of disease.

[3] Prof. Mrs. Shubhangi A Kashid, Prof. Mrs. S G Shirsikar, Prof. J M Patil(Nov 2017):In this paper researcher explain the Pomegranate diseases and identifying symptoms then using image processing tool (MATLAB) for detection of disease. Using high resolution camera take images then k-means clustering to get the diseased part of the fruit. Then parts of images run through the various machine learning algorithms and classified based on their color and texture features. A image comparison based on accuracy between various machine learning algorithms is done namely K-Nearest Neighbors, Multi-Class Support Vector Machine, Naive Bayes and Multinomial Logistic Regression to achieve maximum accuracy for disease detection.They doing image processing and SVM methods to deal with the main issues of phytopathology i.e. disease detection and classification. Their system uses 80 images for training, some 30 testing purpose. The texture features are extracted using GLCM method, and given to the support vector machine. Support vector machines (SVMs) were initially intended for binary classification. It constructs a set of hyper planes in a high- or infinite dimensional space, which can be used for classification. The multiclass SVM to give labels to instances where the labels are drained from a finite set of several essentials. Multiclass SVM classifies the pomegranate diseases images into the respective diseases category.

[4] R. Swati., T.Mahalakshmi, Prof Alluri Srinivas(March 2016): In this research paper A robo (Firebird V Robo up to the range 30cm) used for plant leaf disease detection. Firstly describe a general disease in

Plant and its analysis and Symptoms like a fungal, bacterial & viral plant leaf diseases. In methodology section They acquire an image digital camera connecting to the Fire bird V Robo then using RGB image acquisition technique Convert the input image into color space then Segment the components from that Obtain the useful segments and then Computing the texture features and then Configuring the neural networks for recognition.

[5] Prema K, Carmel Mary Belinda(July 2019): In this research paper researcher uses a IOT (Internet of Things) system it includes sensors and cameras to capture the image of the plant leaf for which can be divided as 80-20 ratio for training and testing the images. Using this images its color, shape, texture and the leaf size are the attributes used for diagnosis. Image Pre-processing for noise removal and data normalization are used. Image Analysis using segmentation and then Training images are used to build deep convolutional neural net-work to extract the macro information about the image for identification of plant leaf disease.

[6] E. Ramesh, M.Yuvaraj, G. Srihari, K. Kamaraj(Feb 2019): In this paper brinjal leaf disease detection using segmentation and neural networks. Image capture using photographic camera then preprocessing of input image to enhance the standard of image and to remove the undesired distortion. In segmentation method the masking procedure adapted for differing the images in which set a threshold limit of a pixels. If pixel intensity of the inexperienced part is a smaller amount than the pre-computed threshold price, then zero value is set to the red, and other next colors' respectively from which obtain the helpful segments to classify the leaf diseases. Leaf image classification using pictures square measure affected and unaffected leaves the affected leaves the distribution of color isn't uniform. The image quality is improved by cagy edge detection rule. Form that images describe and identify the diseases of brinjal plant.

[7] Zulkifli Bin Husin, Abdul Hallis Bin Abdul Aziz, Ali Yeon Bin Md Shakaff, Rohani Binti S Mohamed Farook (2012): In this paper use a LABVIEW vision & MATLAB for detection of chili plant disease. The digital camera use for image capturing and the LABVIEW software tools to build Graphical User Interface (GUI). In GUI color identification and color image segmentation for healthy and non-healthy leaf. Leaf inspection in early stage is possible due to combined technique of two softwares. Edge detection, fourier filtering, morphological operations are done with help of image pre-processing and color clustering method is used for separating chili and non-chili leaves in feature extractions. Image recognition and the classification shows chili plant healthiness.

[8] Savita N. Ghaiwat, Parul Arora(2014): In this paper survey on different classification techniques that can be used for plant leaf disease classification. There are such a many classification techniques such as k-Nearest Neighbor Classifier, Probabilistic Neural Network, Genetic Algorithm, Support Vector Machine, and Principal Component Analysis, Artificial neural network, Fuzzy logic explain each technique in details. The conclusion of such survey is that k-nearest-neighbor method is simplest. But disadvantage of such method is the time complexity of making predictions. The neural networks are tolerant to noisy inputs but difficult to understand its structure of algorithm. SVM was found competitive with the best available machine learning algorithms in classifying high-dimensional data sets. In SVM computational complexity is reduced to quadratic optimization problem and it's easy to control complexity of decision rule and frequency of error. Its drawback is difficult to determine optimal parameters when training data is not linearly separable. It is more complex to understand and implement.

[9] P.R. Rothe, R. V. Kshirsagar (2015): In this paper describe the cotton Leaf Disease Identification using Pattern Recognition Techniques. Initially discuss the cotton leaf diseases in detail. For noise reduction low

pass filter and Gaussian filter is used. Feature extraction is a significant constituent of a pattern recognition system. It carries out two assignments: converting input parameter vector into a feature vector and/or reducing its dimensionality. The allocation and recognition of cotton leaf diseases are of the major importance as they have a cogent and momentous impact on quality and production of cotton. In this work they present a snake based approach for the segmentation of images of diseased cotton leaves. They extract using seven Hu's moments which can be used as shape descriptors for classification. Three diseases have been considered, namely Bacterial Blight, Myrothecium and Alternaria.

[10] Ch. Usha Kumari, N. Arun Vignesh, Asisa Kumar Panigrahy, L. Ramya, T.Padma(Aug 2019): In this paper researcher describe a detection of a fungal disease in cotton leaf and classification using neural network and support vector machine. Firstly acquiring leaf images from data base then input image segmentation using K-means clustering form that extracting features Contrast, Correlation, Energy, Mean, Standard Deviation, Entropy, Variance and Kurtosis from the cotton leaf then based on extracted features the type of disease is detected and classified using ANN and SVM classifiers. After that comparing the classification results for three different diseases using ANN and SVM. Three different diseases Alternaria Leaf Spot Fungal Disease (ALSFD), Grey Mildew Cotton Disease (GMCD), and Rust Foliar Fungal Disease (RFFD) are tested using this approach. The classification results show that the SVM classifier gives accurate disease detection compared to ANN.

[11] Kapil Prashar, Dr. Rajneesh Talwar, Dr. Chander Kant(Apr 2019): In this paper researcher detect Cotton Leaf Disease using CNN based on Overlapping Pooling Method and Multi-layered Learning with SVM & KNN. The feature descriptors of gray level co-occurrence matrix (GLCM), histogram of oriented gradients (HoG) and histogram (HIST) are utilized to detect the leaf diseases and classify the visual diseases. In which label data of each class to a particular label as it is obtained from the corresponding label database. Process each row in the feature set to extract GLCM features then compare predictions with original labels to compute statistical parameters in form of confusion matrix, obtain statistical type 1 and 2 features. The crop disease classification in this paper is accomplished by using the multi-faceted image features with the multiple classification algorithms.

[12] Sukhchain Singh, Er. Rachna Rajput(Nov 2017): In this paper detect and classification of fungal disease in grapes leaves using the genetic algorithm. Genetic algorithm is a tool of MATLAB. Use the color of pixels produce the results of that disease that how much disease in which for this firstly LAB technique is used. Here apply genetic algorithm to find the cluster of images then to find in images is affected with disease after that based on the clustering image segment fungal disease area and then calculate the percentage of disease in leaf. The accuracy is 97.7% of segmentation the image to detect the disease of the plant leaf.

[13] Sagar Vetal, R.S. Khule (Jun 2017): In this paper describe a Tomato Plant Disease Detection using Image Processing there are four key diseases are identified using image segmentation and Multi-class SVM algorithm. The segmentation is used for parting of damaged area on leaves image and Multi-class SVM algorithm is used for classification of accurate disease. Firstly take sample images then smoothen using Kurtosis and skewness filters. After that image segmentation using inverse difference method to part diseases affected area from the leaf. After that process finally two images are available, one with the only diseases part and other one is with disease extracted image. Special technique is used in place of RGB image into HIS color space. There are 80 images trained use for the Multi-class SVM model, totally algorithm is trained to detect four key diseases with 320 images. The result reported better classification accuracies for all the disease and percentage accuracy is 93.75%.

[14] Sagar Karmarkar, Gauri Jadhav, Mayuri Parkhe, Aditya Kadam, Himali Patel (Dec 2018): In this paper describe a tomato disease detection using image processing based on python to detect tomato fruit diseases like a bacterial and fungi. The images can take using digital camera interfaced with the raspberry pi board. After that image operation performed like an image cropping image segmentation, conversion to HSV (Hue saturation value), thresholding, image negation, Then original image gets masked with the binary mask which obtains the only the infected cluster of the image. Then features are extracted from this image using GLCM technique. Mask applied to the original image to obtain the infected part from the image.

[15] Appasaheb Gargade, Mr. S. A Khandekar (2019 IEEE): In this paper describe a custard apple leaf parameter disease and its analysis, detection using digital image processing. It is a review paper in this paper review a seventeen paper. The steps describe an image acquisition, image pre-processing, image segmentation, features extraction and machine learning algorithm. They describe a leaf and fruit weight estimation feature can be added by using image processing and machine learning technique. The Leaf and fruit weight estimation reduces the human handling of fruits and plant leaves. The machine learning algorithm provides better performance as machine learning technique can handle multi-dimensional and multi variety data in a dynamic environment. In this paper researcher give comparatively details about a different plant, method and material, parameter and accuracy. Also survey that different fruit plant leaf its disease, method and accuracy.

[16] Shubham kini, Sneha Bhagade, Vighnesh Gawad, Tushar Chaudhari(April2019): In this paper mentioned the Plant Disease Monitoring System in which they design an automatic detection of diseases; as the plant is exposed to the attacks from various micro-organisms and bacterial diseases and pests. In this design robot is used to capture an continuous images of chilli plants. The steps are carried out that is pre-processing uses the Fourier filtering, edge detection, and morphological operations. Then the computer vision extends the image processing paradigm for object classification and LabVIEW software used for developing a GUI.

[17] P.Vanaja, E.Pavithra, P.Jotheswaran, N.Kumaresan, N.Sathiyapriya(March 2018): In this paper working on a Cloud Based Plant Leaf Disease Detection System Using an Android Application this paper focus on smart irrigation system using android application microcontroller and sensors. The sensor uses such as humidity, soil moisture, temperature before the irrigation they detect a plant disease using image processing techniques using matlab.

[18] Mr. Sachin B. Jagtap, Mr. Shailesh M. Hambarde(Oct2014): In this paper researcher work on the topic Agricultural Plant Leaf Disease Detection and Diagnosis Using Image Processing Based on Morphological Feature Extraction in which Proposed System shows usefulness of integration of an image analyzer aided with pattern recognition within a diagnostic expert system model. In order to diagnose a disorder from leaf image four image processing phases have to be applied: Image enhancement, Image segmentation, Feature extraction, & classification. Firstly train it with a set of images of disorders. Applying this model to any other crop disorder requires only spatial care to be taken in order to acquire a sufficient set of images for training purpose as representative of these disorders. Then uses a fuzzy c-means (FCM) algorithm for a segmentation purpose. Then the Artificial Neural Network to perform classification.

[19] Malti K. Singh, Subrat Chetia(Dec 2017): In this paper researcher describe a topic Detection and Classification of Plant Leaf Diseases in Image Processing using MATLAB in this paper p study was carried out on plant leaf disease of Phaseolus vulgaris (Beans) and Camellia assamica (Tea) using the techniques image acquisition, image preprocessing, image segmentation, feature extraction and classification.

[20] Ashwini C, Anusha B, Divyashree B R, Impana V, Nisarga S P (2020): In this paper describe a topic Plant Disease Detection using Image Processing the researcher to point out disease in the leaf with a union

of shape, texture and color feature withdrawal. Firstly the farmers sends a digital image of the Diseased leaf of a plant and these images are read in MATLAB and processed automatically based on SVM. The output of this project is to get hold of relevant results that can spot out diseased leaf of certain commonly caused disease to plants. Firstly, healthy and diseased images are composed and pre-processed. Later, attributes like shape, color and texture are taken out from these images. Finally, these images are sorted by means support vector machine (SVM).

[21] Guiling Sun , Xinglong Jia , and Tianyu Geng(May 2018):In this paper describe a topic of Plant Diseases Recognition Based on Image Processing Technology in which say that improves image segmentation and disease recognition system. An improved histogram segmentation method; this method can detect an appropriate threshold automatically rather than manually, which is more scientific, reliable, and efficient. Meanwhile, the linear regression model can be modified easily by changing the independent and dependent variables; it has accuracy, applicability, and greater potential. Disease Recognition System Based on Multiple Linear Regressions. In this system, a total of eleven features are extracted from three aspects color, texture, and shape.

[22] Simranjeet kaur, Geetanjali Babbar, Gagandeep(July 2019):In this paper topic describe Image Processing and Classification, A Method for Plant Disease Detection, a plant disease detection is approach which is applied to detect diseases from the leaves. The plant disease detection include various stages which are pre-processing, segmentation, feature extraction and classification. In this paper approach of k-nearest neighbor is used. They used a MATLAB and results are analyzed in terms of accuracy and execution time. It is analyzed that accuracy of the proposed model is high and execution time is low as compared to existing technique.

[23] K.Gowthami,M.Pratyusha,B.Somasekhar, B.Hemanth Nag(April 2017):In this paper describe a topic Detection of Diseases in Different Plants Using Digital Image Processing in which discussed various techniques to segment the disease part of the plant. Also discussed some Feature extraction and classification techniques to extract the features of infected leaf and the classification of plant diseases. The use of ANN methods for classification of disease in plants such as self organizing feature map, back propagation algorithm, SVMs etc. can be efficiently used. From these methods, They tells accurately identify and classify various plant diseases using image processing techniques.

[24] Mrs.G. Saranya, Deepthi M, Bhuvaneshwari M, Gomathy R(2019): In this paper researcher discuss about a plant disease detection using image processing in which a The steps that are implemented here is image acquisition, segmentation, feature extraction and classification of plant diseases. Here a image acquisition purpose image sensor is used.

[25] Dharmasiri, S.B.D.H., Jayalal, S(June 2019): In this paper describe a Passion Fruit Disease Detection using Image Processing. This system can be used to identify passion fruit diseases quickly and automatically using the steps such as Image Acquisition, Image Preprocessing, Image Segmentation, Feature Extraction, Dataset Preparation, Training & Testing. In which a healthy and two types of passion fruit diseases namely passion fruit scab and woodiness images, were used for this system. According to this paper, passion fruit diseases can be identified in the average accuracy of 79% and its' stage can be identified in average accuracy 66%.The support vector machine algorithm was used for creating the models, which were built according to passion fruit diseases and its stages.

[26] Dakshayini Patil(2018): In this paper describe a topic Fruit Disease Detection using Image Processing Techniques. The fruits are used apple, banana, papaya, mango, watermelon. This paper presents architecture of the system, survey of various proposed methods to detect and classify fruit disease. Fruit disease detection strategy would likewise elevate Indian Farmers to do smart cultivating which sets aside opportunity to time choices which additionally spare time and lessen loss of fruit because of diseases.

[27] Ananthi N, Akshaya S, Aarthi B, Aishvarya J, Kumaran K(Nov 2019): In this paper describe a topic an Image Processing Based Fungus Detection System For Mangoes. In this paper develop an image

processing technique to analyze whether the fruit is free from chemicals and fungus. The affected portions of the fruit were identified. Through this process the type of defect present in the fruit were also identified. Based on the results they concluded that DNN classification is a key step to produce reliable outcome in detecting the presence of diseases in mango fruit.

[28] S.Pavithra, A.Priyadarshini, V.Praveena and T.Monika(Jun 2015): In this paper describe a topic Paddy leaf disease detection using SVM classifier. The identification of the symptoms affected by paddy disease, by means of a machine vision system may support farmers in proper evaluation of crops. They used image samples of images that showed visual symptoms of a disease. These diseased regions were identified and segmented using k-means segmentation. Color texture features were extracted from each segmented region and used as inputs to a SVM and ANN classifiers. The performance of SVM classifier found to be better than ANN classifier for the work done .It involves both image processing and pattern recognition techniques.

Conclusion

In this work, it is been concluded that plant and fruits disease detection is the technique to detect infected portion from the leaf and root. The plant disease detection mainly of two steps, in the first step the image segmentation is done and in the second step technique of feature extraction and classification is applied which will classify diseases and normal portion in the image. In this paper, like a different techniques of plant and fruit disease detection is discussed and reviewed in terms of various parameters.

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