A Novel Approach to Detect And Classify Leaf Diseases Based On Image Processing

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Abstract- *In this paper, image processing techniques are used to detect the plant leaf diseases. The objective of this work is to implement image analysis & classification techniques for detection of leaf diseases and classification. The proposed framework consists of four parts. They are (1) Image preprocessing (2) Segmentation of the leaf using K-means clustering to determine the diseased areas (3) feature extraction & (4) Classification of diseases. Texture features are extracted using statistical Gray-Level Co-Occurrence Matrix (GLCM) features and classification is done using Support Vector Machine (SVM).*

Keywords- leaf diseases, classification, SVM, K-Means Segmentation.

I. INTRODUCTION

In India, agriculture is the backbone of economy. 50% of the population is involved in farming activities directly or indirectly. Many varieties of fruits, cereals and vegetables are produced here and exported to other countries. Hence it is necessary to produce high quality products with an optimum yield. As diseases of the plants are unavoidable, detection of plant diseases is essential in the field of Agriculture. In plants, diseases can be found in various parts such as fruits, stems and leaves. The main diseases of plants are viral, fungus and bacterial disease like Alternaria, Anthracnose, bacterial spot, canker, etc.,. The viral disease is due to environmental changes, fungus disease is due to the presence of fungus in the leaf and bacterial disease is due to presence of germs in leaf or plants. The proposed framework can be used to identify leaf diseases. Automatic detection of plant diseases is an important research topic since it is able to automatically detect the diseases from the symptoms that appear on the plant leaves. Barbedo proposed an automatic method of disease symptoms segmentation in digital photographs of plant leaves, in which color channel manipulation & Boolean operation are applied on binary mask of leaf pixels [1]. He proposed the method of semi-automatic segmentation of plant leaf disease symptoms in which the histograms of the H and color channels are manipulated [2, 3]. Pang et al proposed the method of automatic segmentation of crop leaf spot disease images by integrating local threshold and seeded region growing [4]. Singh and Misra proposed detection of plant leaf diseases using soft computing techniques [5]. Prasad et al proposed unsupervised resolution independent based natural plant leaf

II. LITERATURE SURVEY

Zulkifli et al (2012) In this paper, Producing chili is a daunting task as the plant is exposed to the attacks from various micro-organisms and bacterial diseases and pests. The symptoms of the attacks are usually distinguished through the leaves, stems or fruit inspection. This paper discusses the effective way used in performing early detection of chili disease through leaf features inspection. Leaf image is captured and processed to determine the health status of each plant. Currently the chemicals are applied to the plants periodically without considering the requirement of each plant. This technique will ensure that the chemicals only applied when the plants are detected to be effected with the diseases. The image processing techniques are used to perform hundreds of chili disease images. The plant chili disease detection through leaf image and data processing techniques is very useful and inexpensive system especially for assisting farmers in monitoring the big plantation area. Chili is included in the main horticultural commodities. It becomes a very high demand in the market because supply is limited. Business chili indeed belongs in the high-risk plants. Therefore, strategies and technical knowledge and the field became an important matter to be mastered. The systematic and structured should be developing so that it will use by operators to increase the overall production. Many farmers refused to cultivate chili in the rainy season due to the increase of chili disease to become high risk for the quality control and productivity.

Diao et al (2012), found that Producing chili is a daunting task as the plant is exposed to the attacks from various micro-organisms and bacterial diseases and pests. The symptoms of the attacks are usually distinguished through the leaves, stems or fruit inspection. This paper discusses the effective way used in performing early detection of chili disease through leaf features inspection. Leaf image is captured and processed to determine the health status of each plant. Currently the chemicals are applied to the plants periodically without considering the requirement of each plant. This technique will

ensure that the chemicals only applied when the plants are detected to be effected with the diseases. The image processing techniques are used to perform hundreds of chili disease images. The plant chili disease detection through leaf image and data processing techniques is very useful and inexpensive system especially for assisting farmers in monitoring the big plantation area.India is an agricultural country; wherein about 70% of the population depends on agriculture. Farmers have wide range of diversity to select suitable Fruit and Vegetable crops. However, the cultivation of these crops for optimum yield and quality produce is highly technical. It can be improved by the aid of technological support. The management of perennial fruit crops requires close monitoring especially for the management of diseases that can affect production significantly and subsequently the post-harvest life.

J.G.A. Barbedo et al (2016), Showed that the gap between the current capabilities of image-based methods for automatic plant disease identification and the real-world needs is still wide. Although advances have been made on the subject, most methods are still not robust enough to deal with a wide variety of diseases and plant species. This paper proposes a method for disease identification, based on colour transformations, color histograms and a pair wise-based classification system. Its performance was tested using a large database containing images of symptoms belonging to 82 different biotic and abiotic stresses, affecting the leaves of 12 different plant species. The wide variety of images used in the tests made it possible to carry out an in-depth investigation about the main advantages and limitations of the proposed algorithm. A comparison with other algorithms is also presented, and some possible solutions for the main challenges that still prevent this kind of tool to be adopted in practice. The timely diagnosis of plant diseases is as important as it is challenging. Although human sight and cognition are remarkably powerful in identifying and interpreting patterns, the visual assessment of plant diseases, being a subjective task, is subject to psychological and cognitive phenomena that may lead to bias, optical illusions and, ultimately, to error. Ambiguities may be resolved by laboratorial analysis, however this is a process that is often time consuming and expensive. Considerable effort has been made in the search for methods to improve the reliability and speed of the process, which inevitably involves some kind of automation.

Jun Pang et al (2011), Explained the region growing algorithm has been used as a segmentation technique of digital images. Most region growing algorithms are using fixed or determinate criterions to distinguish disease spots from leaf image with gray level differences between leaf and disease spot. But in practice, the objects in the disease leaf image have fuzziness and uncertainty, and edges of the objects are unclear. Uncertainty and edges of the objects are unclear. What's more, the color of leaf and disease spots is uneven, and the gray level is overlapping, so it is difficult to use fixed threshold or determinate criteria to determine the uncertain objects in leaf disease spot images accurately. In order to improve the crop leaf spot disease image segmentation accuracy, an adaptive segmentation algorithm by integrating local threshold and seeded region growing (LTSRG) is proposed. Most algorithms are based on single-channel gray level information and the segmentation criterions are fixed. In most cases, the images of crop diseases are complex and ambiguous. In addition, the object boundaries are blurred. So it is difficult to determine a fixed threshold or criterion for diseases image segmentation effectively. In this paper, by integrating color information and spatial information, we propose an algorithm that combines the local threshold method and seed region growing method named LTSRG. This is an adaptive segmentation algorithm used for corn leaf disease spot segmentation, and it works efficiently. The algorithm was implemented on VC6.0. The segmentation algorithm uses the pixels of which the R-channel gray level is more than the G-channel gray level as initial seed points (pixels), and then local threshold i c is calculated for each connected seed region by Otsu. New seed pixels are included and the threshold C is re-calculated until no new seed pixel can be included.

S. Prasad et al (2013), Expalined A novel efficient and robust mobile vision system for unsupervised leaf image segmentation in mobile devices which uses a L*a*b* color texture features. In this digital world of ubiquitous computing human machine/mobile interaction (HMI) have packed up its role in human life. A texture based clustering algorithm is developed for plant leaf image segmentation and a pixel wise clustering approach to increase the efficiency. The algorithm is simple and optimized to execute on any Android based mobile devices. The performance of method is evaluated with various types of image resolutions and lighting conditions and results in better accuracy than existing approaches. Computer vision (CV) and image processing (IP) are the key role playing in the world of technology since past few decades. The presence of ubiquitous devices and ubiquitous computing is felt everywhere. In natural color image processing segmentation is an open challenge for the researchers. Natural image segmentation is based on some patterns which can be static or dynamic extracted from the input image(s). Image segmentation is performed to identify and recognize the objects in the image and the better the segmentation the better the recognition rate achieved. This recognition rate is very important in case of image analysis, medical imaging [1], biometrics, traffic monitoring and surveillance, satellite imaging [2], education and training, etc.

Minggang et al (2015), It proposes a disease leaf image segmentation is a key step in crop disease recognition. In the paper, a segmentation method of crop disease leaf image is proposed to segment leaf image with non-uniform illumination based on maximum entropy and genetic algorithm (GA). The information entropy is regarded as the fitness function of GA, the maximum entropy as convergence criterion of GA. After genetic operation, the optimal threshold is obtained to segment the image of disease leaf. The experimental results of the maize disease leaf image show that the proposed method can select the threshold automatically and efficiently, and has an advantage over the other three algorithms, and also can reserve the main spot features of the original disease leaf image.This method is very laborious, time consuming and impractical for large fields. Different experts can detect same part as different disease. To increase accuracy paper grid method is used. Drawback of this method is that this method is laborious. So a fast and accurate approach to identify the plant diseases is needed. Crop disease image segmentation, a fundamental computer vision technology and a critical step for the transformation from disease spot image processing to spot analysis and identification, is always an important research content in the field of crop leaf image processing. Disease leaf image segmentation is the process of dividing an image into multiple parts. Disease spot characteristics of crop leaf directly reflect the hazard rate of crop disease, and the disease spot is the evidence for recognition

Dhaygude et al (2013), This letter presents a detection of plant leaf is an very important factor to prevent serious outbreak. Automatic detection of plant disease is essential research topic. Most plant diseases are caused by fungi, bacteria, and viruses. Fungi are identified primarily from their morphology, with emphasis placed on their reproductive structures. Bacteria are considered more primitive than fungi and generally have simpler life cycles. With few exceptions, bacteria exist as single cells and increase in numbersby dividing into two cells during a process called binary fission Viruses are extremely tiny particles consisting of protein and genetic material with no associated protein. The term disease is usually used only for the destruction of live plants. The developed processing scheme consists of four main steps, first a color transformation structure for the input RGB image is created, and this RGB is converted to HSI because RGB is for color generation and his for color descriptor. Then green pixels are masked and removed using specific threshold value, then the image is segmented and the useful segments are extracted, finally the texture statistics is computed. From SGDM matrices. Finally the presence of diseases on the plant leaf is evaluated. The naked eye observation of experts is the main approach adopted in practice for detection and identification of plant diseases. But, this requires continuous monitoring of experts which might be prohibitively expensive in large farms. Automatic detection of plant diseases in an important research topic as it may prove benefits in monitoring large fields of crops, and thus automatically detect the diseases from the symptoms that appear on the plant leaves. This enables machine vision that is to provide image based automatic inspection, process control and robot guidance. Comparatively, visual identification is labor intensive, less accurate By SGDM the texture features are calculated and the classification is done using squared distance technique.

BAI Jie-yun et al (2011),Explained the traditional transformation from RGB model to HSI model is improved, meanwhile the leaf color information is extracted by similarity distance between pixels. The green component of leaf image in the RGB model is strengthened, and then the digital image is transformed to the HSI model by the improved method. Finally the image is divided by similarity distance of pixels' H weight which determines whether the pixel belongs to the blade. The results of simulation experiment shows that this algorithm can achieve a good image segmentation effect, and it has a high degree of accuracy as well as a clearly distinguish degree and many other advantages such as good consistency with human visual system. It completely meets the effectiveness and clarity requirements of image segmentation. Low-carbon living and low-carbon economy are advocated today, how to accurately measure the amount of oxygen emissions and carbon sequestration of the trees to serve for carbon sinks, carbon sequestration trading, carbon sequestration projects in species selection and energy saving measures has always been a problem. The plant world is considered to be the green kingdom of nature, this green color of plants is given by particular organism chlorophyll. Leaf color is an important characteristic index of tree groups, which directly reflects changes in chlorophyll content, and is used to indicate the photosynthesis process of growing trees, nutritional status and other attributes of trees.

N.Valliammal et al (2012), Showed Segmentation of the plant from background objects is a challenging task for different plant leaf recognition and classification. Before applying the proposed method pre-processing technique like image conversion, noise reduction by median filter, morphological operation and finally wavelet transformation has to be processed. The proposed method provides good results based on fuzzy threshold and clustering techniques for detection of most homogeneity region in plant leaf images. The relative performance of the conventional and proposed methods is evaluated using Variation of Information, Energy, Entropy and Evaluation Time. It proves that the proposed method gives suitable results for efficient classification and recognition. Huge Volumes of biological information are now providing on-

line access to hundreds and thousands of images of specimens, helping to digitize the complete Specimen Collection of the leaf images. Such a system will return within seconds the top matching species, along with supporting data that describes about textual descriptions and high resolution type specimen images just by feeding into the computer the photograph of a leaf specimen. Plants are living organisms belonging to the vegetable kingdom that can live on land or in water Image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. Segmentation is a basic pre-processing task in many image processing applications and essential to separate plant leafs from the background.

III. CONCLUSION

A method for detection and classification of leaf diseases is implemented. The segmentation of the diseased part is done using K-Means segmentation. Then, GLCM texture features are extracted and classification is done using SVM. The method is tested for detection of diseases in citrus leaves. Future work is to be carried out for classification of diseases in different plant species and to improve the classification accuracy.

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