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Analysis of various Plant Disease detection Techniques

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Abstract- The plant disease detection is the approach which is applied to predict disease type from the input image. The plant disease detection has the two phases which are feature extraction and classification. In the previous years, various techniques has been designed for the plant disease detection. The various classifications methods has been designed for the plant disease detection like SVM, decision etc. In this paper, various plant disease detection techniques are reviewed and analyzed in terms of certain parameters.

Keywords- Plant Disease detection, SVM, Classification, Feature extraction

I. INTRODUCTION

The technology that uses various computer algorithms for performing image process on various digital images is known as digital image processing. Huge varieties of algorithms are applied on the computer file and several problems like addition of noise and signal distortion are avoided from entering the complete process. A special entity of data processing is represented by the information that is extracted from images. The properties of data that is extracted from images are very different from the properties of normal text data. For example, their storage and retrieval properties are different [1]. The visual characterization of images is different and it is possible to represent them in numerical manner. However, for searching the image databases, it is important to evaluate huge amount of numbers. In order to process an image is successful manner the basic requirements of processing include identification, extraction and classification of objects of these images [2]. A scanner or any video camera which is linked to computers is used to digitize the images. Within the computer memory, the image data is stored in the form of media storage once the digitization is performed. A video frame or a picture can be given as input in this process. An image or properties that are relevant to an image are given as output. Within the agricultural fields, it is very important to perform digital image process. The crop diseases are observed within high accuracy through this process. The symptoms of characteristic diseases can be achieved at early stages with the help of detecting and recognizing diseases within plants through digital image method [3]. The crop diseases are diagnosed by analyzing the digital pictures by the plant pathologists using digital image process. Some techniques are applied collectively by the computer systems area unit that is designed for agricultural applications. The valuable data that is important for analysis is extracted by applying image processing techniques on the digital pictures that are gathered from a camera. Mainly the leaves and stems of plants have diseases. Identification of the diseases at very early stages is very important for farmers [4]. Image analyzer, feature extraction and classifier are the three important components present within the general system that is designed to identify and recognize the types of diseases that are present in plants. There are two important phases in which the processing of components is divided. The offline or training phase is the initial processing phase in which an image analyzer was used to process a set of input images. The extraction of certain features was done through this step, which were given as input to the classifier in addition with the data that states whether disease is present or not [5]. Different sources like cameras of different pixel capturing qualities are used to gather images of plants. In order to perform processing, these collected and stored within the RGB format. The plants are either placed within a black box or on a white background that has light sources to avoid the variance in light intensities. Thus, the brightness is improved and reflection is removed here. A sub-field of image processing is image enhancement in which the appearance of an image is enhanced with the help of certain techniques provided by it. Thus, the suitability of an image to be used within a specific application is increased and its important features are highlighted [6]. Depending upon the types of requirements, the resizing of collected images is done. The transformation of images into a different color space is done before processing further. The unnecessary noise present within the collected images is removed with the help of these techniques. Some of the examples of these techniques are Dilation and Erosion, Median and Mean filter, Gaussian

Filter and Anisotropic diffusion technique. Within image analysis and pattern recognition, the initial step performed is image segmentation. The quality of the end results achieved after analysis is determined through this step [7]. An image is divided into constituent objects by applying segmentation. On the basis of the type of problem that is being resolved, the level of subdivision is set up. Thus, in an application when the objects of interest are isolated, only then the segmentation needs to be stopped. Certain features or characteristics of every segmented area are calculated for minimizing the image such that feature extraction can be performed on it. The classification of input images as per the degree of availability of diseases in them is done through a classifier. The features that are evaluated in the previously mentioned step are used to perform this classification. For modeling and providing solutions to real world problems, certain methodologies were integrated which were called soft computing techniques. In order to handle real-life ambiguous scenarios, the flexible information processing capability is provided by the soft computing techniques [8]. An appropriate solution is provided at minimal cost by providing the solution to a problem that is precise to real-life scenarios through these methods. Some of the cost computing techniques are mentioned below:

a. Genetic Algorithm (GA): The principles that are inspired by natural genetics are used by this soft computing approach to provide solutions of various issues. The Darwin's theory of evolution is the basis of generating these genetic algorithms. Within several scientific and engineering problems, these algorithms are applied successfully. The population of randomly generated chromosomes is used at the beginning step. For the concrete problem that is being solved, a candidate solution is represented by each chromosome. Further, depending upon the genetic process that occurs within the nature, the genetic operators are applied to achieve better chromosomes. The information related to the initially unknown search space which is gathered is then exploited by GA for searching and optimizing the problems in a very robust manner.

b. Particle Swarm Optimization (PSO): The social behaviors of birds flocking are simulated by the PSO algorithm. The methods through which the food sources, suiting habitat and roosting places are identified as used here [9]. A population potential is maintained here through which a potential solution to an optimization issue is represented by each particle. Several candidate solutions are maintained within the search space through the working of PSO. Through the optimization of objective function, each candidate solution is evaluated at each iteration and for that solution, the fitness is determined. The particle that is flying through the landscape in order to identify the highest or lowest objective function is used to represent each candidate solution provided in this method.

c. Ant Colony Optimization (ACO): As the name suggests, this algorithm is based on the activities performed by ants in nature. The difficult combinatorial problems are solved through this population-based algorithm [10]. The pheromone trail behavior of real ant colonies is used as inspiration to develop this algorithm. When an ant goes in search of food on a certain path, it leaves a trail known as pheromone behind it. Thus, the best path available on the weighted graph is identified to transform the optimization problem by applying ACO. The movements are made on graph to build solutions incrementally by the artificial ants. A set of parameters that are relevant to the graph components is known as pheromone in this algorithm. The ants can modify the values of these set of parameters at runtime.

II. LITERATURE REVIEW

Vijai Singh, et.al (2017) presented a study related to various diseases classification techniques which are applied to detect the plant leaf diseases. Further, to detect and classify the plant leaf diseases in automatic manner, an algorithm is proposed for image segmentation approach [11]. Through the evaluations it was seen that optimum results were achieved through least computational efforts. It was also possible to identify the diseases in plants at early stages through this algorithm.

Shunping Ji, et.al (2018) proposed a novel 3D CNN-based approach through which the crops can be classified automatically from the remote sensing images given as input [12]. For improving the accuracy to a required threshold value such that higher efficiency can be achieved, an active learning mechanism is introduced within the CNN model. In comparison to other existing approaches, comparative analysis is performed which show that the dynamics of crop growth can be categorized efficiently as compared to existing traditional techniques.

Tom Brosch, et.al (2016) proposed a new technique on the basis of deep 3D convolutional encoder networks for performing segmentation on magnetic resonance images [13]. The convolutional pathway and deconvolutional pathway are two interconnected pathways involved in neural network of proposed model. Larger abstract and higher-level of image features are learned through convolutional pathway. The final segmentation at voxel level is predicted using a deconvolutional pathway. The performance is improved and shortcut connections are added as per the results achieved at the end which show that the accuracy level is increased by applying proposed approach.

Guillermo L. Grinblat, et.al (2016) proposed a deep CNN through which the leaf vein patterns are examined for identifying the problem of a plant [14]. White bean, red bean and soybean are the three various legume species which are

aimed to be categorized in this work. The accuracy of the referred pipeline is enhanced to significant amount through this deep learning technique. Also, the relevant vein patterns are unveiled with the help of analyzing the resulting models through a simple visualization technique.

Jayme Garcia Arnal Barbedo, et.al (2016) proposed a technique to identify the diseases in plants on the basis of color transformation, color histogram and a pair-wise classification approach [15]. A huge database that includes images of symptoms that affect the leaves of 12 various plant species is taken to test the performance of proposed system. The major merits and demerits of proposed algorithm were investigated by performing several tests on different images. Even though the results achieved have shown some efficiency, there is still some scope of improvement here.

Mads Dyrmann, et.al (2016) proposed a novel technique using CNN through which the species of plant can be recognized from color images [16]. There are six various datasets used to gather images used in the dataset here. In terms of resolution, lighting and types of soil, the properties of these images are different. With respect to the stabilization and illumination of camera, the images gathered under controlled conditions are included here. Simulations are performed which show around 86% of classification accuracy for the proposed technique.

Jiang Lu, et.al (2017) proposed a novel wheat disease diagnosis design named as DMIL-WDDS that is based on deep multiple instance learning [17]. The localization of diseased areas is done through this approach with higher accuracy level in comparison to the existing approaches. The agricultural disease diagnosis was supported b y designing the proposed approach within the mobile applications.

Halimatu Sadiyah Abdullahi, et.al (2017) introduced a database by collecting several images with the help of remote sensing approaches. A model was proposed for determining the appropriate treatment approaches for various types of crops grown in different locations [18]. Within the model, various features were extracted, classified, segmented and then given as input in the designed approach. For optimizing the production on maize plantation, deep-DNN was applied to recognize and classify the plant images. Simulations were performed which showed that around 99% of accuracy was achieved when the proposed model was applied.

Tisen Huang, et.al (2017) proposed SVM technique through which the sugarcane borer diseases can be detected. For processing three images which are of similar sugarcane that has an interval of 120o, the machine vision technology was applied along with threshold segmentation, filling and corrosion operation [19]. It was seen through the experimental results that the complete sugarcane corer diseases detection can be done in effective manner with the help of applying proposed technique in these applications.

Sue Han Lee, et.al (2017) proposed a novel approach in which CNN is applied to learn important leaf features directly from the raw representations provided from input data [20]. Further, on the basis of Deconvolutional Network, the intuition of selected features was provided. The hierarchical botanical definitions of leaf characters are very appropriate as per these findings. The new hybrid feature extraction models were provided in this paper through which the discriminative power of plant classification systems was enhanced.

Table 1 Comparison

Authors Names	Year	Description	Outcomes
Vijai Singh, A.K. Misra	2017	To detect and classify the plant leaf diseases in automatic manner, an algorithm is proposed for image segmentation approach.	Through the evaluations it was seen that optimum results were achieved through least computational efforts.
Shunping Ji, Chi Zhang, Anjian Xu, Yun Shi and Yulin Duan	2018	A novel 3D CNN-based approach was proposed through which the crops can be classified automatically from the remote sensing images given as input.	In comparison to other existing approaches, comparative analysis is performed which show that the dynamics of crop growth can be categorized efficiently as compared to existing traditional techniques.
Tom Brosch, Lisa Y.W. Tang, Youngjin Yoo, David K.B. Li, Anthony Traboulsee, and Roger Tam	2016	A new technique was proposed on the basis of deep 3D convolutional encoder networks for performing segmentation on magnetic resonance images.	The performance is improved and shortcut connections are added as per the results achieved at the end which show that the accuracy level is increased by applying proposed approach.
Guillermo L. Grinblat, Lucas C. Uzal, Mónica G. Larese, Pablo M. Granitto	2016	A deep CNN was proposed through which the leaf vein patterns are examined for identifying the problem of a plant.	The accuracy of the referred pipeline is enhanced to significant amount through this deep learning technique.

Jayme Garcia Arnal Barbedo, Luciano Vieira Koenigkan, Thiago Teixeira Santos	2016	A technique was proposed to identify the diseases in plants on the basis of color transformation, color histogram and a pair-wise classification approach.	Even though the results achieved have shown some efficiency, there is still some scope of improvement here.
Mads Dyrmann, Henrik Karstoft, Henrik Skov Midtiby	2016	A novel technique was proposed using CNN through which the species of plant can be recognized from color images.	Simulations are performed which show around 86% of classification accuracy for the proposed technique.
Jiang Lu, Jie Hu, Guannan Zhao, Fenghua Mei, Changshui Zhang	2017	A novel wheat disease diagnosis design named as DMIL-WDDS was proposed that is based on deep multiple instance learning.	The agricultural disease diagnosis was supported by designing the proposed approach within the mobile applications.
Halimatu Sadiyah Abdullahi, Ray E. Sheriff, Fatima Mahieddine	2017	A model was proposed for determining the appropriate treatment approaches for various types of crops grown in different locations.	Simulations were performed which showed that around 99% of accuracy was achieved when the proposed model was applied.
Tisen Huang, Rui Yang, Wenshan Huang, Yiqi Huanga, Xi Qiao	2017	SVM technique was used through which the sugarcane borer diseases can be detected.	It was seen through the experimental results that the complete sugarcane corer diseases detection can be done in effective manner with the help of applying proposed technique in these applications.
Sue Han Lee, Chee Seng Chan, Simon Joseph Mayo, Paolo Remagnino	2017	A novel approach was proposed in which CNN is applied to learn important leaf features directly from the raw representations provided from input data.	The new hybrid feature extraction models were provided in this paper through which the discriminative power of plant classification systems was enhanced.

III. CONCLUSION

In this work, various plant disease techniques are review which is based on feature extraction and classification. The plant disease detection techniques are based on the classification and textural feature extraction. In this work, the various classification n methods are analyzed for the plant disease detection. In future, novel classification method will be designed for the plant disease detection.

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