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AN ANLYSIS OF PLANT DISEASE AND THEIR DETECTION

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ABSTRACT

One of the biggest revolutions of modern history is the invention of agriculture for a healthier lifestyle. It significantly changed the human culture and played an important role in the development of the population and biological improvements in food production and domestication. The frequency of pests on food crops increased because environmental circumstances were changing, and diseases on crops increased rapidly. These diseases inflict catastrophic social, economic, and ecological casualties, and this extraordinary challenge is a concern for the correct and prompt detection of diseases. In this contest, technology has left its mark on the potential of farmers and is still to be exploited. As input for making the right decision, farmers need timely and credible sources of knowledge. Study into Agriculture have to be planned by improving the disease diagnostics method with the use of newer technology to enhance efficiency and quantity for agricultural production and its allied operation. In various applications of the agricultural industry, computer methodologies have been used for automation. Timely farming decisions and disease management are taken using image analysis and machinery of learning techniques in planning and creating a method for the diagnosis of diseases.

Keywords: ANN, Principal component analysis.

I. INTRODUCTION

The plant disease cuts both the plant's growth and production significantly. The methods and means of fighting plant diseases to preserve a proper supply of food products to the living bodies around the world are therefore required. It was still difficult to recognize and diagnose plant disease. The only available method for diagnosis of the seriousness of the condition was previously naked eye observation (visual analysis). In order to correct assessments of disease by experts from the region, this approach includes constant observation of the crop field. Given the continuous human observations needed for visual analysis, the procedure (visual analysis) is very expensive, slow, and time-consuming for wide areas of plants. The increasingly exponential population is gradually shifting the market for the production of food goods. Such conditions force society to continue using modern technologies then the illness can be assessed early at the right time to adopt the corrective measures. The image processing techniques have shown themselves to be one of the exact and economic processes used to calculate the parameters of different plant diseases.

In the Indian economy, the agriculture industry has played a significant part. The distribution of food surpluses to an expanding population, contribution to the formation of resources, supplying raw material to factories, the consumer sector, and significant contributions to foreign trade play an important role in agriculture. Agriculture is also important. Although the contribution of agriculture continually declines, with the growing population, it remains the principal division of employment with a number of variations. The rate of competitive, profitable, diversified, and sustainable agriculture must, therefore, be accelerated up [1], [2]. The three key challenges for Indian agriculture are to strengthen agricultural productivity by the unit of land, to eliminate rural poverty by socially diversifiable schemes, and to confirm that agricultural development meets food security needs. The physio geographic and climate conditions of India were very diverse [3].

II. AGRICULTURE

In modern times, agriculture does not just feed the increasing population but enhances the lives of people. The Gross Domestic Product (GDP) accounted for 17.32 percent in agriculture and allied industries, i.e., about 50 percent of the overall workforce; however, farming adds steadily to India's GDP each year [4]. Different plant diseases have led to a progressive decline in agricultural development. Traditionally, a visual estimation is based on the features of plant infection symptoms and obvious indicators of pathogens for the detection and estimation

of the seriousness of diseases. The extent of the disease is determined by the professional person from the same area, and extensive study and research are performed by naked-eye observations. It can take much longer and challenge for skilled individuals with the specialized ability for the evaluation of a condition to using this technique [5].

III. IMAGE PROCESSING

With its applications in numerous fields of science, a day's image processing is growing exponentially. Any of the main applications for science and technology image processing include remote sensing, medical image processing, vision machine, face detection, claim a reality, biometry, industries, transmission of information, optical character recognition, forecasting, and the detection of fingerprints, etc. For their edibility and affordability, research areas that have historically used analog images are now transitioning to digital systems. Image processing is described as managing a double-dimensional image signal and using a device to apply standard signal processing techniques. The result of picture processing could be an image or an image-related result of features or features. Image processing is split into three parts: image capture, processing, and the completed production presentation. The first step in every vision system is capturing the picture. It can be bought with cell phones, cameras, satellites, or scanners. During image processing, the methods available to extract the requisite fine detail from image acquisition systems are used. The technique of image processing is, therefore, more precisely defined as a key to interconnecting the human visual system with digital imaging equipment that easily processes the image as a meaningful entity.

3.1 Implication of Image Processing in Agriculture

Agriculture is the production of essential food crops from time immemorial. Today, farming has not only been a way to satisfy the ever-growing food demand, but it is also a cornerstone of the nation's economy. As economic growth intensified, a vast number of occupations connected to agriculture arose. In a wider context, agriculture is the source and growth of the national economy, which offers private sector investment opportunities and the primary source of agriculture-related industries and economies. In the early stages, the identification of these diseases in plants in many plant sections is one of the hard tasks [6]. The several diseases in various plant sections, however, display visual signs, which are important for the diagnosis of these diseases. Plant disease diagnosis is an outstanding and intelligent ability.

3.2 Problem Statement

Environmental factors play a crucial role in causing infection by pathogens, which differ from pathogen to pathogen. The fungal disease involves high humidity and specific temperature levels. The plant growth is influenced by key environmental factors, including relative humidity, temperature, wind, and sunlight. If one of the environmental conditions suggested above is out of control with a particular plant's cultivation, the tendency for a disease rises quickly in a plant. Relative humidity seems to have a positive influence on plant disease growth. When relative humidity is between 80 and 90 percent, the common disease is favourable. These conditions in the rainy season can be reached. Thus, the continual irrigation of wet foil lets the disease grow in plants [7].

IV. ALGORITHM FOR LEAF DISEASE DETECTION

The image processing technique has many important and effective agricultural uses in the area of foliar disease detection. For starters, in the detection of the disease types, the form of the infected region is found, the edges of the diseased leaf are noticed, the ratio of diseases is measured, the target layers are divided, and the affected areas are coloured. The block diagram of the algorithm with image processing is seen in Figure 1 to define and distinguish different leaf diseases.

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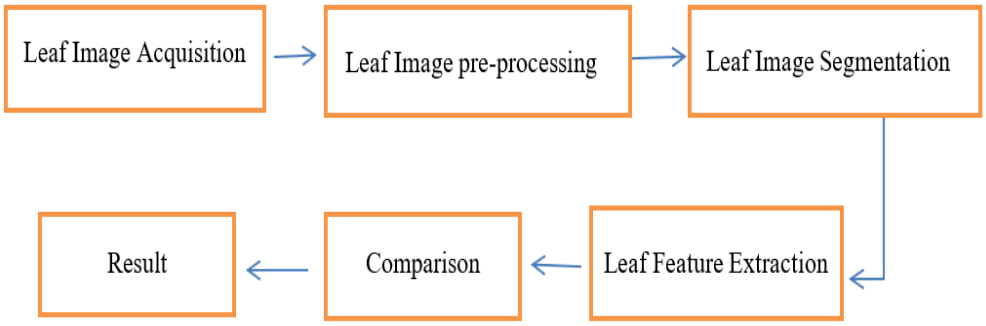

Fig-1: Generalized flow diagram for leaf disease detection

Digital leaf pictures are taken from a digital camera, cell telephone, and so on. Pre-processing of photographs is performed to highlight the attributes of a certain type of leaf. Then the segmentation of the leaf image is used to distinguish the object of interest. A feature extraction technique uses the morphological, chromatic, and structural properties of the leaf to remove relevant features. These extracted properties are often used to compare the original picture in order to obtain the end result.

Image processing is reliable, according to the procedure used to capture the object's image. Instead of visual inspection with the naked eye, the use of an image acquisition instrument in the modern period raises the costs of research. In addition, both the changes in image quality and image interpretation may increase costs. Image therapy cannot be able to examine crop diseases due to their inaccessibility to capture the photos below the soil surface (root red, stem red, wilt, damping off, and root-knot) in crops owing to its inaccessibility to capture the images below the soil surface.

V. CONCLUSION

There are many pathogens such as Macrophomina, Rhizoctonia bataticola, etc., that are well-formed under dry conditions, while pathogens such as Rhizoctonia solani or Ascohyta blight grow well under high moisture. Temperature – Temperature variations are both beneficial and unfavourable for the disease and its development. The participation of host pathogens involves a particular temperature range in order to inflict harvest damage. The nature of diseases is a significant factor in deciding the nature of the illness in warm or cold weather conditions. In addition to the desideration of the disease type, the rate of pathogens multiplication is affected by temperature [8]. For e.g., at a temperature range between 25-35 °C, the multiplication rate of the Rhizoctonia bataticola is higher. Wind and Sun- Pollution with the disease is mostly caused by wind in large fields and from one location to another. This is probably because of the passage of wind pathogens. The wind and sunlight mixture often alter the conditions of plant surfaces as well—favourable conditions such as quicker drying decrease pathogen contamination. Similarly, the sun itself plays a big part in the health of plants. If the plants do not have adequate sunshine to fulfil their cultural requirements, they become more vulnerable to infection [9].

Table-1: Foliar diseases along with its agents and symptom

Name of disease	Type of disease	Type of vegetation	Agriculture Information (Symptoms of disease)
Early blight	Fungal	Appears on tomato and potato plants	It first appears on the older and lower parts of the leaves as small brown spots with concentric rings that form a –bull ‘s eyell pattern. Later leaf surface turns to yellow, wither and die.
Downy mildew	Fungal	Found on grapes and vegetables	Due to this yellow to white patches on the upper surfaces of older leaves appeared.
Rust	Fungal	Found on grapes and vegetables	Due to this slightly raised spots on the undersides of leaves and on the stems can be seen. After a short period, these spots become covered with rust-coloured spore masses. Later, it turns to yellow-green and eventually black.
Powdery mildew	Fungal	Affects a wide range of plants like grapes, onion, apple, wheat, etc.	Upper surface of infected leaves is usually covered with a white to grey powdery growth. The increase in the quantity of infection may turn brown and drop the plant leaves.

Mosaic virus	Plant virus	Found on tobacco plants, pulses, etc.	Due to this yellow stripes or spots on foliage occur.
Leaf spot	Parasitic fungi or bacterial	Found on tomato, peppers, etc.	Due to this infected leaf became brown or black and water-soaked spots occur on the foliage.
Late blight	Fungal	Found on tomato and potato	It appears on the lower and older leaves as a water-soaked and grey- green spots. Later these spots became dark.
Leaf curl	Fungal,	Found on chilli, pulses, papaya, etc.	Due to this infected leaves grow reddish, thickened and puckered causing leaves to curl and distort.
Fire blight	Bacterial	Found on apples, pears, etc.	Due to this most of the infected leaves and branch tips will rapidly turn brown or black
Anthracnose	Fungal	Found on a variety of plants in warm and humid areas	Here infected plants develop dark, water-soaked lesions on stem, leaves or fruit and it causes the wilting, withering, and dying of tissues.

The main goal of this proposal is that the main diseases in leaf be identified and recognized using image recognition and machine learning techniques by designing and developing an automated method. The aim of this work consists of many phases- Build a practical data collection for standard leaf images. Create a new segmentation algorithm and create and deploy image extraction techniques. Build a smart disease recognition device. Establish a method of classification with computer training to classify diseased leaf sections into the disease class. To design a treatment guidance framework to discourage the use of pesticides and other knowledge required in order to support growers, pathologists, and farmers in improving the accuracy of major crop diagnoses for diseases.

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