Cotton Leaf Disease Detection

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Abstract— *Agriculture plays a major role in the society, cotton is considered to be the more economic crop. In this concept we will detect a cotton disease which the plant get affected. In a large acre of garden there are number of plants located there, we will detect the plants which get affected by this cotton disease. In this concept of detecting cotton disease we use a modules known as Tensorflow and Numpy. In the area of research, diagnosis of disease symptoms in the plants duly applying image processing methods is a matter of big concern. According to validation data, the proposed methodology may have an accuracy of 90.2%. The disease is recognised, categorised, and identified in the image, and the presence of an object in the leaf can also be managed to pick up.*

Keywords— Machine learning, leaf disease detection, Tensorflow,Numpy, object detection, YOLO Algorithm.

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I. INTRODUCTION

Australia is free of the alien plant pest known as cotton leaf curl disease. The cotton sector in Australia is seriously threatened by this virus. The virus that Silverleaf whiteflies transmit the disease cotton leaf curl disease (CLCuD) to cotton and other susceptible host plants. A range of unique CLCuD is linked to viruses that cause cotton leaf curl. A cotton leaf curl virus and a related betasatellite component are commonly required for the disease to manifest in host plants. The cotton leaf curl virus but not the beta satellite infection cannot cause any signs in plants. Two to three weeks after infection, symptoms of CLCuD illness in cotton plants frequently manifest. Young leaves begin to expand and darken in the early stages, and they begin to bend sharply downward.

Later infection phases are indicated by the upward or downward curling of leaf edges as well as leaf yellowing or mosaic. Enations can form along leaf veins, typically on the underside of leaves, and resemble cup-shaped leaves. Gossypium, Gossypium hirstum barbadense, Gossypium herbaceum, four varieties of perennial shrubs in the Malvaceae family that are cultivated for the fluffy fibre that protects the plant's seeds, are referred to as "cotton." In recent years, G. hirsutum has provided 90% of the cotton grown worldwide. The cotton plant's main stem produces several buds at the top.

Each axillary branch of the plant bears a single, reddish- purple, yellow, or white blossom that develops into an oval, leathery seed capsule, or "boll," that is 2–6 centimeters (0.8–2.4 in) long. When ripe bolls break apart, the distinctive white cotton fibers and seed are frequently visible. The cotton plant typically only endures one growing season and can reach heights of one to five meters (3.3-4.9 ft). The roots of cotton, also known as tree cotton, are unknown, despite the fact that theplant originated in Mexico, North East Africa, and Australia.

Although agriculture is Ethiopia's main industry, there are a number of issues with output and quality and no cutting-edge technologies have been investigated in the development of automation in agricultural research.

It is caused by many pests and diseases. Recent advancements in technology have attracted a number of academics who research the identification and categorization of pests and diseases of cotton leaves. Many constraints exist in Ethiopia, which lower the product's yield and quality. Traditional methods are used, especially for identifying potential pests or diseases in Ethiopian cotton. Although a sizable portion of farmland is ideal for cotton plantations, little emphasis has been paid to research into cotton crop production.

II. DISEASES OF COTTON LEAF

A. Bacterial Blight

DISEASES OF COTTON LEAF Type A: Bacterial Blight The main cause of the bacterial illness known as "bacterial blight" is the bacteria "Xanthomonas Campestris pv. Malvacearum" [4]. An early sign of bacterial blight is a dark green colour.A 1- to 5- mm-long, angular spot with a reddish-brown border appeared on a leaf.. These sharp leaf spots initially appear as wet regions that eventually become from dark brown to black in color[6]. As the petioles and stems get diseased and the leaves prematurely fall off, the spots on the lesion area of the leaves may extend over the principal veins of the leaf [12]. A leaf afflicted by Bacterial Blight.

B. Alternaria

It is mostly a fungus called Alternaria Macrospora or . Alterneta that causes the sickness . Because the symptoms are so similar to those of bacterial leaf blight spots, the disease may be confused for it because it is more severe on the lower than the top half of the leaves. Little, dark, gray-brown or tan circular patches on the eaves that range in size from 1 to 10 mm at first turn dry, lifeless, and have cores that shatter and fall off(11) .Old spots can occasionally coalesce to form erratic dead regions. A leaf affected with Alternaria shown in Fig. 1(b). .leaves and vary from 1-10mm in size which later on become dry, dead with gray centers which crack and fall out [11]. Sometimes, Dead zones that aren't regular are created when old places mix.*Fig. 1(b),* shows Alternaria infected leaf.

C. Cerespora

The Cercospora Gossypina is the cause of cercospora [12]. The damaged leaf has red spot blemishes on the leaves that measure up to 2 cm across. The dots have circular or erratic shapes, with white centres and yellowish, purple, dark brown, or blackish edges [11]. The lesion site is constrained by the leaf's tiny veins, which causes the rakish leaf spot to manifest. This disease affects mature plants' more experienced leaves. A Cerespora-infected leaf is depicted in Fig. 1(c).

D. Grey Mildew

It is a fungus disease that is typically caused by Ramularia Areola Atk. and Mycosphaerella Areola in perfect stage.. in imperfect stage [12]. The infection first manifests as 3–4 mm- diameter triangular, square, or irregularly shaped white spots that occur on leaves [11]. On older leaves of mature plants, this disease primarily manifests as angular, irregular spots that are pale transparent and range in the size from 1 to 0 mm [8]. The diseased regions have a light to yellowish green tint on the top surface. The tissues in the leaves turn reddish brown, the little spots combine to form larger spots, and whitish frosty growth occasionally takes place on the top side as the disease infection progresses [8]. Fig. 1(d) depicts a leaf with grey Mildew infection.

E. Fusarium Wilt

Fusarium oxysporum is the biggest factor of this fungal disease [12]. The organism can assault cotton seedlings, but the sickness for the most part shows up when the plants are more matured[11]. The affected plants initially become noticeably slower-growing and darker green [4]. The leaves have lately faded and the foliage has disappeared. The symptoms first appear on lower leaves during the first blossoming season, and the leaf edges contract, initially turning yellow, then turning brown as they progress inward. A leaf with Fusarium Wilt infection is shown in Fig. 1(e).

Using clean seeds and removing contaminated plant tissues from the region can help to limit the spread of the infection, but planting resistant types is the most successful management tactic. Although some formal specialis (host-specific forms) have evolved resistance, the disease can occasionally be managed with soil fungicides depending on the forma specialis (host-specific form) responsible and causes reason for the infection. Rotation of the crop is typically inefficient due to its duration.

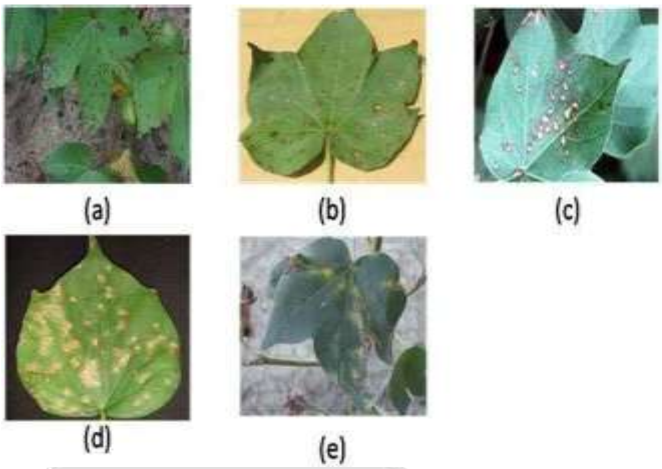

Fig. 1 Diseased leaf sample 1 (a) Bacterial Blight infected leaf[4] (b) Alternaria infected leaf (c) Cerespora infected leaf [12] (d) Grey Mildew infected leaf [12]
(e) Fusarium Wilt infected leaf [2]

II. LITERATURE SURVEY

Here, a very small number of national and internationalarticles are reviewed and presented.

Machine learning techniques for detecting Wheat Leaf Rust disease were proposed by Davoud Ashourloo et al. [1] in addition to an evaluation of the training sample size and the impact of disease symptoms on the methods of predictions. In this study, the performance of PLSR, v-SVR, and GPR is compared to that of PRI and NBNDVI. Combinations of disease symptoms at various disease severity levels produce complicated spectra that reduce the accuracy of PRI and NBNDVI while having no negative effects of the performances of PLSR, -SVR, and GPR. Because the GPR performs well with a smaller training data set than other approaches, its accuracy ishigher.

The three infections of cotton leaves Myrothecium, Alternaria, and Bacterial Blight been grouped by Rothe, P. R., et al. [4]. After segmenting the images using an active counter model, Hu's moments are extracted in the sense to train an adaptive neuro-fuzzy inference system. Back propagation neural networks (BPNN) is used for classification.Viraj A. Gulhane et al. [5] employed the Nearest Neighbourhood Classifier (KNN) and Principal Component Analysis (PCA) to identify illnesses on cotton leaves. Analysis of the data from theRGB's Green (G) channel using statistical software

After applying PCA/KNN multivariable techniques, the image is finished. In this case, green channel is taken into account for feature collection because it accurately shows disease or nutrient deficits. The idea of automatic feature extraction was put forth by Rothe, P. 5 R. et al. [6], in which the RGB image is initially recorded and transformed to grey scale.. The disturbance is removed using the Gaussian filter and LPF.For segmentation purposes, K-means clustering is used, followed by a graph cut energy minimization operation. The segmented RGB image was converted for color feature extraction.

Two steps were postulated by P. Revathi, et al. [9] to determine the disease's lesion location. For image analysis, the proposed HPCCDD Algorithm is utilised. and disease classification after segmentation using the Edge detection technique. In order to identify illness spots, this research developed RGB feature-based algorithms in which the collected images are initially processed before color image segmentation is performed. Using the Sobel and Canny filter, the edge characteristics are retrieved to locate the illness areas.

III. SYSTEM ARCHITECTURE

This chapter provides a comprehensive overview of what the current system will accomplish and how the suggested system will function. This explains the benefit and significance of utilizing this new system. This chapter displays the software and hardware requirements for the project's successful operation. Assuming that this prepared system must be built and implemented using five different technologies, This section lists the required hardware, software, and apps.

A. Block Diagram of the System

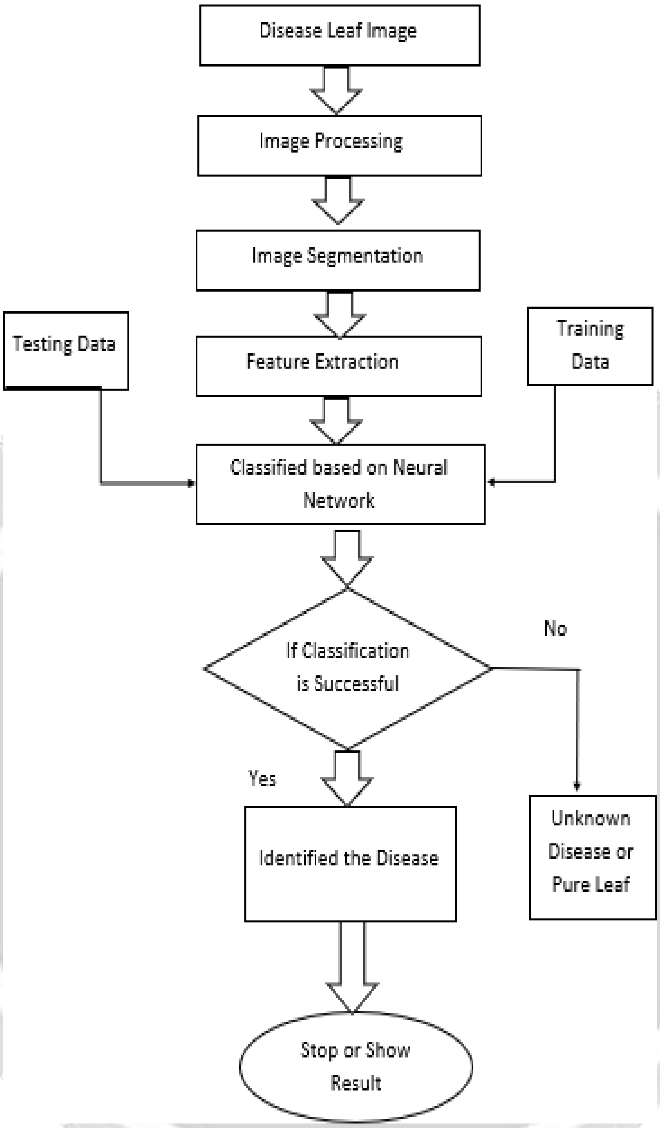

Fig. 2 Block diagram for identifying and preventing cotton leaf disease

Using a smartphone or digital camera, acquire field data for this model as its initial step. The obtained images were then prepared for further investigation using image preprocessing techniques. The CNN method was then utilised to extract features using a neural network from preprocessed images. Then, using an image analysis technique, the best picture extractions are extracted from the image. The training and test data that are utilised for identification are extracted based on thefeatures that are collected..

Design flow of the Leaf Disease Detection

The design flow for detecting cotton leaf disease is shown in Fig. 3. To achieve high accuracy, disease detection must be carried out step by step. Following are the primary steps in illness detection:

- *Image Acquisition*
- *Pre-processing*
- *Segmentation*

- *Feature Extraction*
- *Classification*

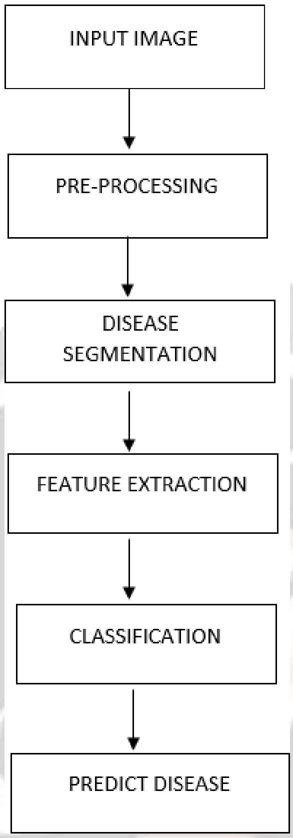

Fig. 3. Design flow for cotton leaf disease detection

1) *Datasets:* To examine model behaviour for test datasets and for developing datasets with specific properties. Dimensionality reduction entails lowering the amount of characteristics to be used in Principal Component Analysis in order to summarise, visualise, and choose the features. variables used to create the data For merging the predictions of various supervised models, use ensemble methods. For defining properties in picture and text data, use feature extraction. For choosing relevant attributes from which to build supervised models, use feature selection. Utilize parameter tuning to improve the efficacy of supervised models. Complex multi- dimensional data can be summarized and represented via manifold learning. Generalized linear models, discriminant analysis, naive bayes, lazy approaches, neural networks, support vector machines, and decision trees are just a few examples of the many supervised models.

2) *Tensorflow:* TensorFlow, a free and open-source software library, is used for dataflow and differentiable computing across a variety of tasks. It is a symbolic math library that is also utilized by neural network applications in machine learning. Google uses it for both research and production. Software for automatically captioning images, likeDeep Dream, is built on TensorFlow.

Features: Without any assurances on API backwards compatibility, TensorFlow provides trustworthy Python (for version 3.7 across all platforms) and APIs of C, 1, C++, Go, Java, JavaScript, and Swift..For C#, Haskell, Julia, MATLAB, R, Scala, Rust, OCaml, and Crystal, third-party packages are accessible. "The C API should serve as the foundation for new language support, .But not every feature is yet available in C." The Python API provides some additional features. Application: Automated image captioning programs like DeepDream are among the applications for which TensorFlowserves as the foundation.

3) *Image Processing:* Processing the picture is a technique for applying various operations to an image is the reason to improve it or to draw out some relevant information from it. According to simple form of definition, "Image processing is the study and alteration of a digital image, particularly to increase its quality."

4) *Digital-Image:A picture can be compared to a two- dimensional function, f(x, y), where x and y are spatial (plane) coordinates.*. The brightness or level of grey of the image at each particular position (x, y) is determined by the amplitude of the function at any given set of coordinates. With such a picture as the input and a signal processor, image processing is just signal processing. a group of qualities that are suitable for that image as the output. the process of importing, editing, and analysing the image.. Output that may be used to adjust the finished image or image-based report.

5) *Keras*: Open-source Keras is a neural network library built on Python. It is capable of working on top of TensorFlow. Its primary design objectives are user-friendliness, modularity, and extensibility since it wants to make it simple to quickly experiment with deep neural networks. François Chollet, a Google engineer, is its principal inventor and maintainer. It was created as a component of the ONEIROS (Open-ended Neuro-Electronic Intelligent Operating System for Robots) research initiative. Chollet also created the XCeption deep neural network model.

Features:Layers, objectives, activation functions, and optimizers have several implementations in Keras due to their widespread use as neural network building blocks, which makes it simpler to work with picture and text data and takes less coding to generate 4 neural networks.profundity neural networks. It also includes a variety of tools. The source, a Slack channel, and the GitHub problems page all offer community support. The Keras applications component provides pre-trained deep neural network models. Keras models are used for prediction, feature extraction, and fine tuning. This chapter presents in-depth information on Keras applications.

6) *Numpy*: In order to find underlying connections in a bit of data, a neural network is a collection of algorithms that simulates how the human mind works. In this sense, neural networks are collections of neurons that may have an organic or synthetic origin. Since neural networks can adjust to changing input, they can yield the best results even when the output criterion is left alone. Artificial intelligence-based neural network theory is quickly gaining favour in the design of trading systems. A neural network operates in a manner comparable to that of the human brain Both statistical methods share several characteristics, such as curve fitting, regression analysis, and network procedures. A neural network is composed of layers of connected nodes. A perceptron, which resembles a number of lineareach node is made up by regression.. Layers of linked nodes make up a neural network. A perceptron, which mimics a multiple linear regression, makes up each node. The multiple linear regression signal is fed into a possibly nonlinear activation function by the perceptron.

V. EXPERIMENTAL RESULTS

One of the numerous approaches to keras modelling is sequential modelling. In this sequential modelling, we assert that after each layer has been performed step-by-step, the entire network is created. We employ the LeNeT class to classify the image's width, height, and depth. one of the many methods for modelling keras The model is trustworthy if the likelihood of the sickness is 90% or greater.The Softmax classifier can tell us with a high degree of certainty whether these images represent a powdery disease, foliar disease, or some other disease.

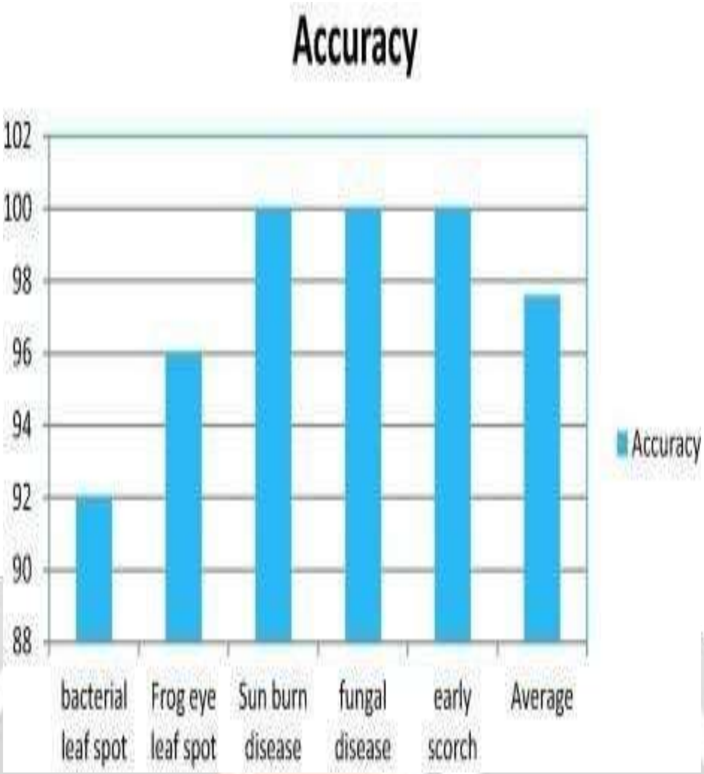

Fig. 4. Accuracy Representation in Graphics

VI. CONCLUSION

Based on the percentage of infection, the algorithm will help the end user identify the contaminated crop so that preventive action can be taken as soon as is feasible. In the interest of reducing the use of pesticides, the system which will be good for the environment and ecological balance. The suggested method can help Indian farmers identify diseases thatimpact cotton production early on in various ways.

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