Leaf Syndrome Prediction and Remedies Recommendation System using Deep Learning

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Abstract:- Being an agricultural country 58% of Indian people depend on agriculture for their livelihood. In agriculture, due to various plant diseases there are large economical food losses which can also lead to famine. Loss of food crops due to plant infections caused by microorganisms like various bacteria, fungi and viruses are serious problems. To reduce the damage caused by diseases in culture during their growth, preventing them before happening is an effective way to reduce plant infections. Previously, farmers or specialists identified diseases and plant diseases according to their knowledge and work experience. But this is the traditional approach and very expensive also required continuous care and also not economical for large yards. It should also be noted that many agricultural areas are very difficult to monitor regularly and recognize the need to develop fast, cheap and reliable blood monitoring technologies to detect diseases for agricultural progress. Plant leaves are the important components of plants. The quite difficult task for the crop owner and the scientist is to identify diseased leaves. Finding traces of leaf infections requires farmers to use new methods. By this article we will discuss different leaves and their diseases and the ways used to trace these infections.

Keywords: *Image Processing, Leaf Infection Identification, Deep Learning*

1. INTRODUCTION

Agriculture Husbandry is the most important way of livelihood and income for most people in India. Large portion of the population of India is solely dependent on agricultural resources. It plays a key role in the India's financial growth. As there is rise in population, the demand for food also rises. Thus, farmers have to use hybrid seeds, pesticides, insecticides, different fertilizers, etc. to meet the demand for food. Sometimes farmers did not know how much pesticides they actually need. They mercilessly use chemical fertilizers, drugs, insects, etc. for the growth of many plants and to improve the quality of food.

In India people used organic farming method in the past which made food healthier then and now. Some of them have good amount of knowledge about plants and their infections and they can also spot it with their naked eye. The best way to prevent diseases is to prevent them.

Yet, to fulfill the demand for agricultural products in line with the demands of the globe, farmers increasingly use contemporary instruments and methods. Farmers use contemporary agricultural techniques, which makes crops more susceptible to plant diseases. If plant infections are identified early, they can cause significant losses to harvests and the economy of the country. The best way to avoid plant diseases is through preventive.

If plant infections are not treated promptly, there could be a food shortage, which would put a huge portion of the population at risk of starving.

to help farmers overcome the difficulties of contemporary farming and to offer them solutions. For plant disease, we have employed the image processing method. We are attempting to assist farmers in identifying crop illnesses and provide treatments using this technology.

2. Challenges

We encounter several obstacles throughout the endeavor, and here are just a few of them:

- Information gathering.
- Data of poor quality.
- Unwanted or irrelevant aspects of the data.
- Fewer data are available for training than for testing.
- Large amounts of data are required.
- Eliminate noise from the data.
- It is challenging to divide the illness location.
- Creating training and test data from the input photos.

- The color of crop leaf changes as a result of varying weather conditions.
- There is a need for precise monitoring of each individual plant.
- It takes a lot of precision to identify illnesses in various plants.

3. Plant Diseases

Food security is seriously threatened by plant diseases, yet due to a lack of the essential infrastructure in many places throughout the world, it is still difficult to identify them quickly. The process of diagnosing plant diseases by optically seeing their symptoms on plant leaves is extremely difficult.

Food losses are largely caused by plant diseases. Plant diseases are caused by a variety of factors, including environment, seed quality, plantation practices, and more. Plant diseases come in a variety of forms and can be divided into bacterial, viral, and fungal diseases. Color, form, and texture can be used to identify plant diseases.

3.1 Bacterial diseases:

Diseases brought on by bacteria are called bacterial diseases. Bacterial diseases are relatively challenging to manage. Using seeds free of pathogens helps reduce losses caused by bacterial illnesses. Crops should be bred with resistant types to minimize losses. The majority of plant illnesses caused by bacteria are found in crops like cherry, plum, tomato, sweet corn, tobacco, cucumber, etc.

All bacterial illnesses are also brought on by temperature and moisture. In nature, Spot's size may vary. That might happen on several parts. Bacterial pathogens can infect plants through wounds, poor weather, people, tools, and other things.

Fig.1 Leaf infected by Bacterial Disease

3.2 Viral Diseases:

Several viruses are the main culprits behind viral illnesses. Plant infections are difficult to spot. They attack plants, and the virus has a serious negative effect on output. It may have an impact on a variety of plant parts, including the leaves, roots, stem, etc. Plant viruses can potentially significantly reduce farmer yields. It is exceedingly challenging to safeguard the crops once the virus has infected the plant. Plants infected by viral infections also experience a reduction in their overall lifespan. So, the main reason for it is to preserve the crops. Among all the disorders, it is the most severe.

Fig.2 Leaf infected by Viral Disease

3.3 Fungal Disease:

The diseases that are brought on by fungi or other fungal organisms are known as fungal infections. An enormous group of microorganisms are found in fungi. All sexual and asexual fungus spread through the wind and water. Fungi can reproduce in a variety of ways. The primary cause of fungi infections is contaminated seeds, soil, animals, and crop leftovers. Blight, scab, rots, or other symptoms are linked to several plant diseases. The majority of the time, fungi are dispersed through pores by the air, water, mud, bugs, birds, etc. leftovers from infected plants.

Fig.3 Leaf infected by Fungal Disease

4. Module

With the aim of recognizing crop species as well as the presence and identification of illness on photos that the model has never seen before, we trained a model on photographs of plant leaves using convolutional neural network architecture. The highest accuracy of 92% shows that this objective has been accomplished. It is significant to note that, despite the model training requiring a significant amount of time (several hours on a good-performance GPU computer), the classification process itself is quick (less than a second on a CPU), making it possible to execute on a smartphone. The route to widespread global smartphone-assisted crop disease diagnosis is now crystal evident. Even though these are simple situations, a real-world program should be able to categorize photographs of an illness.

4.1 Image Acquisition

In this module of picture acquisition, the user may either choose an existing image from the gallery or can take a brand-new image from the gallery using the mobile device's camera using our Android application, that will be analyzed as the model's input.

4.2 Image Preprocessing

Noise from dust, spores, and water spots can also be included in photos that are taken from the real environment. The noise in the photos has to be eliminated in this module of the image processing. Using Python tools like Label Encoder, they were additionally labelled according to the class to which they belonged. To further examine the distribution of photographs across different directories, a bar chart was created. [1]

4.3 Image Segmentation

Our suggested system's third stage is image segmentation. Digital photos will be divided into many portions throughout this procedure. The primary goal of this stage is to divide the depiction of an input image into a few sets that are more significant and straightforward to study. [2]

4.4 Feature Extraction

Feature extraction, which is the fourth phase, is a challenging one. It is the procedure that determines or extracts the crucial aspect or characteristics of the data. Image and textural feature extraction is done in this module. Comparable to dimensionality reduction is feature extraction. By repurposing old features for new ones, it aims to cut down on the number of features. For instance, forms like squares, rectangles, triangles, and circles are among the elements recovered from the image, along with details like edges, corners, and points. [3]

4.5 Detection and identification of disease

In this module, our system will use deep learning techniques to determine whether the leaf is healthy or not, and it will then generate a file containing the appropriate data. The outcome will reveal whether or not the plant is impacted, how much, and from which infection.

5. Proposed Solution

Here, we provide a solution to assist farmers recognize plant illnesses and learn what precautions and treatments they can do to protect their crops from the disease. The suggested solution is shown with several photos.

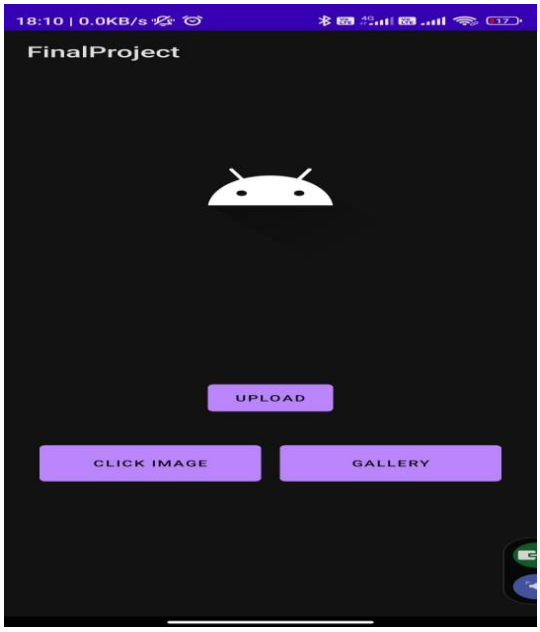

Fig.4 It shows the method to choose image

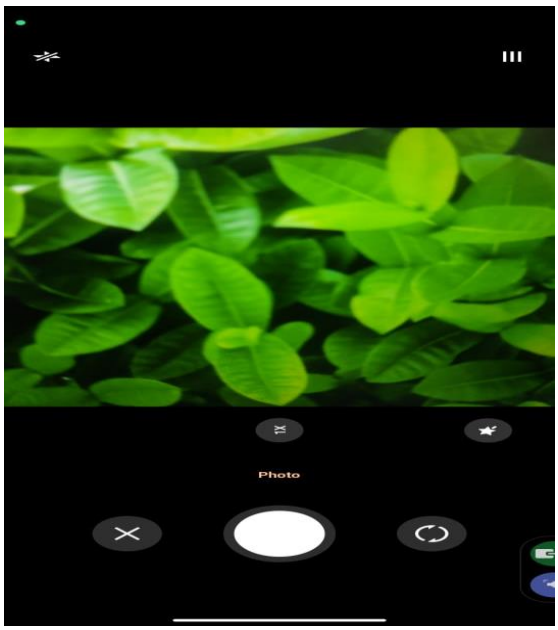

Fig. 5 Clicking image using camera

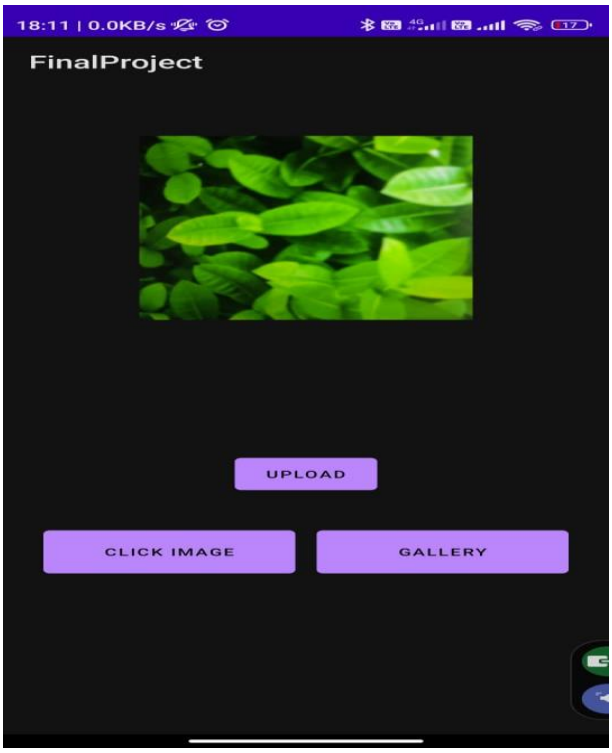

Fig.6 Upload Image after Click

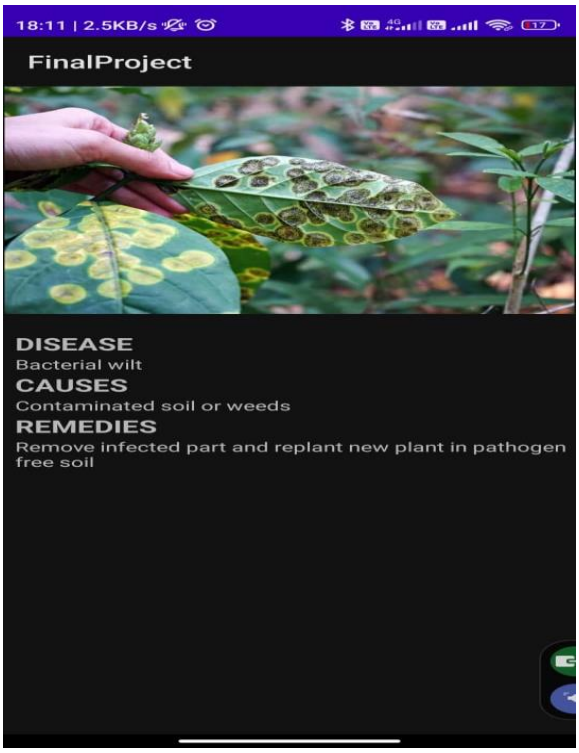

Fig.8 Showing Disease name, cause and remedies

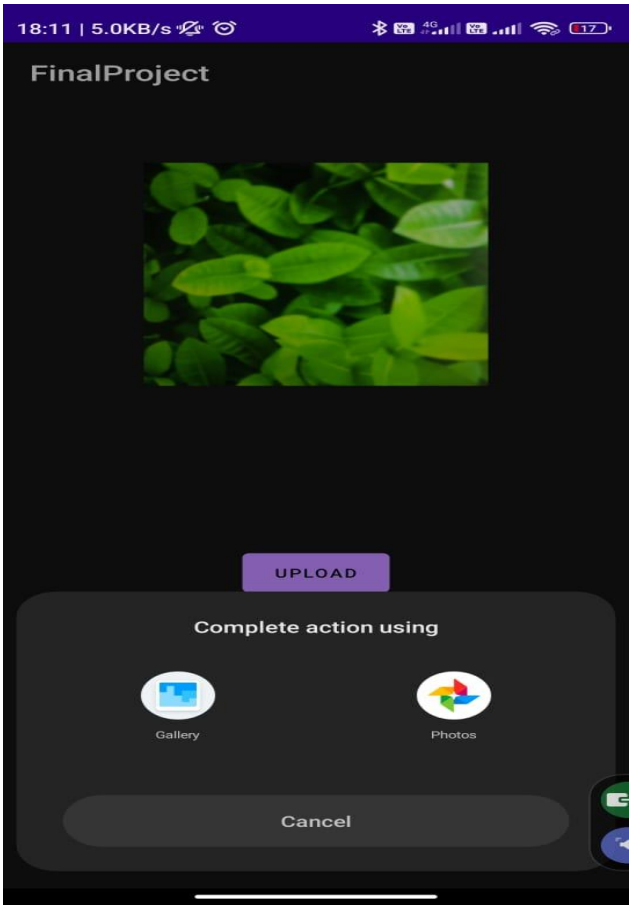

Fig.7 Image can be select from gallery as well

6. Implementation Results

The most crucial aspect of our project is this. Here, we train our model across 10 epochs. Additional epochs improve accuracy while reducing loss. Here, we can observe that accuracy improves with each step. Our model is trained ten times. Accuracy will rise as test photos train with thousands of training images, as predicted by our model. Greater accuracy indicates that our model operates correctly and produces the expected results. The most crucial aspect of this is to run just once; do not repeat this step as epochs take time after you have already completed it.

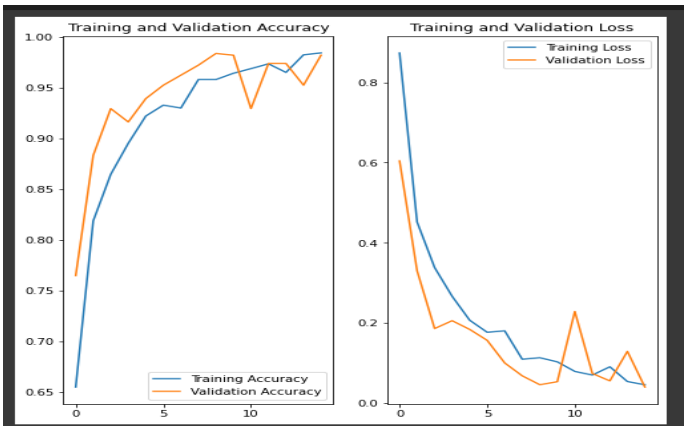

Fig. 9 Model accuracy during Training and Testing

Fig.10 Results with accuracy

7. Literature Review

We trained a version on images of plant leaves using the deep convolutional neural network architecture with the goal of distinguishing each crop type as well as the presence and diagnosis of disease on images that the version had previously been unable to see.

Plant leaf sickness with the aid of using bugs and environmental modifications are predominant issues withinside the agriculture region. A quick and accurate diagnosis of the leaf illness and prompt treatment can help to reduce financial loss. Researchers can now automate leaf illness diagnosis with a high degree of accuracy thanks to developments in modern technology like deep learning. In order to find leaf disease in plants, we thus employ a deep learning approach in our project. Our goal is to expand the version that is especially reliable and functional for our purpose, and we implement the convolutional network. This proposed variant can correctly find exceptional infections within plants.

Three layers make up a convolutional neural network: the input layer, the hidden layer, and the output layer. The fundamental units of CNN are convolutional layers, which confound the input and transmit their output to the following layer. In addition to conventional convolutional layers, pooled layer convolutional networks may also have nearby or global layers. Aggregate layers combine the output of neuron clusters in one layer into a single neuron and send it to another layer, reducing the quantity of the data and the number of parameters. The best way to vote is with the most volume possible. The nonlinear activation function is implemented via the Relu layer, a modified linear unit. By setting them to zero, it erases the incorrect values from the activation card. whole layer connectivity

Once the community is skilled, it may be evaluated. The community may be evaluated at the schooling facts, however this could now no longer offer a useful indication of the overall performance of the community as a predictive version, because it has visible all of these facts before. We can compare the overall performance of the community on a separate dataset, unseen during testing.

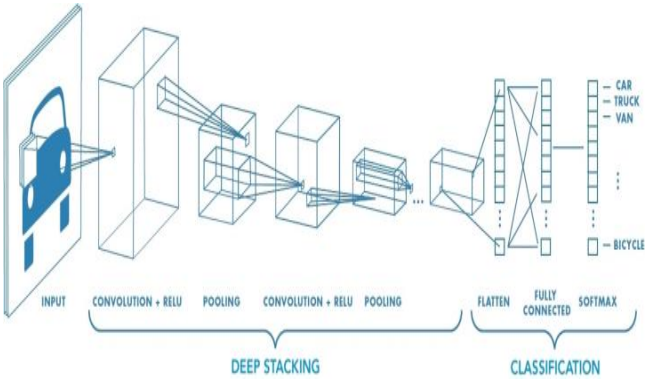

Fig.11 *A figure displays the all layers of CNN*

8. Conclusion

The designed method withinside the provided plant sickness identification machine specializes in producing a complicated and green machine which makes the system of making excessive yields of plants tons less complicated for farmers. The farmers may be capable of as it should be locating the form of sickness a selected plant is having the use of the photograph of the plant the designed model is primarily focused totally on those modules.

The current version is not the simplest to adapt to complex environments, but also increases the accuracy of recognition. Compared to the usual version, the version presented here is no longer the simplest, it ensures the stability of the convolutional neural community, but it also reduces the amount and complexity of the convolutional neural community in the evidence and achieves higher results.

9. References

[1]. Gittaly Dhingra describes the application of agriculture using computer vision technology to recognize and classify disease of plant leaves.

[2]. Keyvan Asefpour Vakilian demonstrates two types of fungus in plant leaves. ANN models with 3 layers were utilized to identify P. Cubensis and S. Fuliginea infection. Author has taken real time germinated seeds of cucumber on moist paper which is at c for days Further research is needed to Increase the ability of farmers to detect fungal and viral disease.

[3]. Mohammed Brahimi proposed a deep learning method to create a classifier for detection of diseases and the identification of disease is of great interest in the agriculture field around the world.