DETECTION OF DISEASES FROM CROP LEAF IMAGE USING MACHINE LEARNING TECHNIQUES

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Abstract: *Agriculture plays a vital role in our day-to-day life. Identification of the disease of plant leaves is very important to prevent the losses in the yield. In this paper we are going to give some solutions and methodology to the challenges in the agriculture field. It includes deep learning and image processing algorithms which are tested on various plant leaves to detect diseases and recommend fertilizer which helps to increase the yield. Convolutional neural network (CNN) technology is used in our proposed system to classify plant leaf diseases and identify diseases in various plants. As a consequence, we were able to achieve very high accuracy in both training and testing, with accuracy values of (95.02%) for training and (95.02%) for testing for all used data sets.*

Keywords: **CNN , Image acquisition,Image segmentation,ResNet, Feature extraction, Classification**

1. INTRODUCTION

In many countries, agriculture is the foundation of the economy. The productivity of agriculture is influenced by a number of variables. Crop failure might result if effective detection techniques are not used in the early stages of crop production. Finding farm experts in rural locations who can provide reliable guidance on plant diseases is very challenging. Plants are an important source of food for everyone. As a result, it is critical to ensure that the plant is not infected with the disease. Making complex decisions based on the interconnections of a wide range of variables, such as crop specifications, soil conditions, climate change, and more, is the key to successful farming .Deep learning in agriculture allows for much higher precision, allowing farmers to treat plants almost individually, which increases the effectiveness of farmer's decision significantly. In most of the cases symptoms of disease are shown on the leaves, fruit and stem. The leaf is used for disease detection. In this paper we are going to see various methods used in the image segmentation and classification of plant diseases. We are even going to suggest fertilizers in our model so that farmers can make most use out of the model.

2. RESEARCH OBJECTIVE

The project "Detection of diseases from crop leaf images using machine learning techniques", aims at designing and developing an automated system for the detection of plant diseases. This project is to develop a reliable and efficient system that can accurately identify and classify various diseases affecting crops and plants. This system should be able to analyze plant images, detect and diagnose diseases, and provide recommendations for appropriate treatments to prevent further damage to crops. The system should also be scalable and adaptable to different plant species and environments, as well as able to work in real-time for timely interventions. The ultimate goal is to help farmers and growers improve crop yield and quality while minimizing the use of pesticides and other harmful chemicals.

3. LITERATURE REVIEW

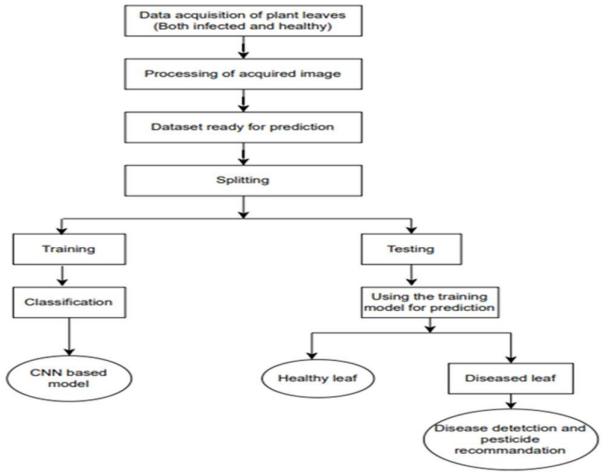
Pallapothala Tejaswini.et [1] have discussed various ways of using machine learning and deep learning approaches which will help in detecting diseases. In the paper, it is proposed that the deep learning-based models are more accurate but they are only suggested for large datasets thus working on the fungal disease of rice plants and having a dataset of 1600 images is taken to process the prediction of such diseases. The paper includes some experimental results performed using different deep learning models with
their accuracy rates. The VGG 16 with 58.4%, VGG 19 with 72.4%, Xception with 72.2%, ResNet50 with 72.2% and 5- layer convolution with 78.2% accuracy rates.

Anil A. Bharate, and M. S. Shirdhonkar[2] proposed methods for disease in plants such as apples, grapes, pepper, tomato, and pomegranate. They use image segmentation where they divide the image into many segments. They use color feature extraction such as color histogram, histogram intersection, etc. Texture features, Morphological features, Pattern Matching, a classification in which classification techniques have support vector machines, k-nearest neighbors, etc.

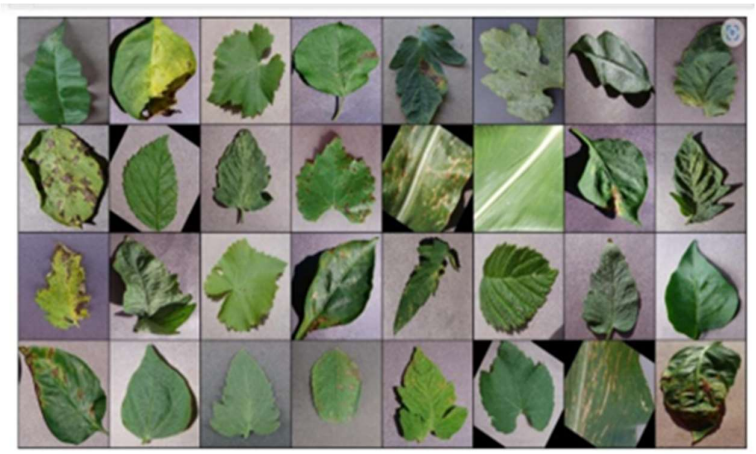
Sakshi Raina and Dr . Abhishek Gupta[3] has proposed all the techniques you can use to find the effective technique and use them appropriately. Since detecting plant disease in the early phase is very important and knowing the Plant disease takes a lot of time so we use many ML techniques to figure out the diseases to save time. This has all the techniques needed which are Convolution Neural Network ,GPD CNN ,Generative Adversarial Networks (GANs) ,Support Vector Machine, Particle Swarm Optimization (PSO) .

4. PROPOSED SYSTEM

The suggested plant disease detection system is a machine learning-based method that identifies and categorizes plant diseases.



It includes the following steps :
Image Acquisition :Images of various leaves are taken into consideration. Early blight, Bacterial Spot, and Late blight-affected leaves are used in a dataset. The effectiveness of the suggested methodology depends significantly on the image size and resolution.



Data Preprocessing: While using machine learning algorithms to detect plant diseases, this is a crucial step. To prepare the raw data for analysis, it entails converting and cleaning it. Image scaling, normalization, feature extraction, and data augmentation are the preprocessing operations which we will be performing on our data. Standardizing picture size is crucial for reducing the amount of the dataset and simplifying the learning process for the model. Contrast stretching and histogram equalization are two normalization methods that can enhance the image quality and make it simpler to spot illness signs. Extracting important aspects from the photos, such as color, texture, or form, is known as feature extraction. By applying techniques like flipping, rotating, or adding noise can stop the model from overfitting.

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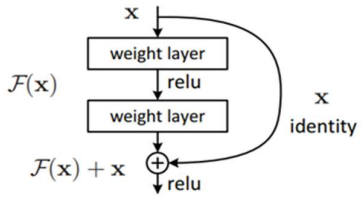
$F(x) := H(x) - x$ which gives $H(x) := F(x) + x$.



The advantage of using this type of skip connection is that regularizations will skip any layer that has a negative impact on the architecture's performance, allowing for the training of very deep neural networks without the issues associated with vanishing or exploding gradients.

5. RESULTS AND CONCLUSIONS

Initially, six machine learning algorithms were used to train models. The accuracy of each algorithm is mentioned in the table 5.1 below. ResNet has achieved an accuracy of 95.02% which is highest among all and thus this gives us the best performance.

Algorithm	Accuracy
ResNet	95%
Logistic Regression	84%
SVM	87%
Decision Trees	87%
Random Forest	89%

This model is designed to contribute towards determining plant diseases and recommending the fertilizer at the early phase in order to help the farmers to determine the plant diseases so that they can save their crops from diseases and give them the required treatment which helps in having a good crop yield. Machine learning, deep learning and image processing algorithms which are tested on various plant leaves to detect diseases which helps to increase the yield.

6. REFERENCES

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