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Hybrid Detection Model for Crop Disease using CNN and SVM algorithm

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Abstract: *Plant and crop disease management practices have evolved significantly to limit harm. Utilizing big data analytic techniques, it is now possible to forecast the beginning of a change in the severity of diseases using new information and communication technology. The study's findings show that this approach is still in its early stages, with significant obstacles to overcome. The planned study's purpose is to look at a variety of machine algorithms for predicting plant diseases. A plant's response to the pathogen exhibits some obvious illness symptoms. Shape, size, etc are all visual characteristics that help identify the plant's status. The study paper covers all of these elements and using a variety of machine learning approaches to get a result. The proposed system model is tested on the Plant Disease dataset. Experiments reveal that the proposed model surpasses previous existing models with a classification accuracy of roughly 99 percent.*

Keywords: CNN, SVM, Machine learning, deep learning, crop disease, crop disease prediction

I. INTRODUCTION

Machine Learning is a self-learning notion that works without the need for human intervention. Self-driving cars, handwriting recognition, and the stock market are all instances of machine learning ideas today. Machine learning will be able to predict the future based on historical data. Machine learning can be used for any task that a human performs regularly This study's purpose is to apply machine learning to predict plant disease. A plant disease is a physiological anomaly, and the goal of this study is to use machine learning to forecast plant illness. Symptoms are visible changes in physical appearance that occur over time and can be seen with the naked eye. Wilt leaf spots, rots, cankers, and other symptoms are examples of symptoms: The visual manifestations of disease can be divided into classes:

Wilting is characterized by a reduction in turgor pressure in a plant that induces permanently or temporarily drooping of leaves, branches, or entire plants due to a lack of water or pathogenic infection.

The spot is a well-defined, isolated, round to regular lesion with a specific color border that can be defined by its position (leaf spot, fruit spot), as well as its colour (brown spot, black spot).

Powdery mildew is a fungus that can infect a wide range of plant species White powdery spots appear mostly on leaves and stems and infected plants. The spots grow exponentially and denser as the illness progresses.

Galls are anomalous growths on plant stems or branches that emerge in the leaves. They might be small lumps or complex formations, and they can be plain brown or vibrantly colored

Dryness is a symptom of fungal attacks. Usually, leaves dry out and fall from the trees as they grow, but it can as well as said to be a symptom of fungal attacks. We shall replace all null values with 1 in plant disease diagnosis because the data provided is minimal and some of the values are missing, necessitating imputation of values. Machine learning methods are used in the proposed research project to implement the concept of ensemble learning. Following deployment, the results and outcomes are compared to prove which model has the best accuracy.

II. MOTIVATION

Agriculture is the primary source of income for the vast majority of Indians. Crop diseases are one of the strongest factors of agricultural yield. To help the farmers, we will be developing a web application that will help the farmer determine whether /her crop is affected or not. If the crop is affected, then it will tell the farmer what disease his/her crop has and provide a solution.

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III. LITERATURE SURVEY

[1] Paper Name -Real-Time Detection of Apple Leaf Diseases Using Deep Learning Approach Based on Improved Convolutional Neural Networks.
Author -Peng Jiang, Yuehan Chen, Bin Liu, Dongjian He, and Chunquan Liang
Year -2019
Description - This model is being used to predict plant disease in apple trees. This model is slower than the existing models. Though it is slower, the accuracy rate of this model is higher(78.80% mAP).

[2] Paper Name - A Model of Plant Identification System Using GLCM, Lacunarity, and Shen Features
Author : Abdul Kadir
Year 2014
Description - This study examined two types of datasets that are widely used to assess plant identification system performance.

[3] Paper Name - Forecasting Plant and Crop Disease: An Explorative Study on Current Algorithms.
Author: Gianni Fenu and Francesca Maridina Malloci
Year -2021
Description - The results of the study reveal that this practice is still in its infancy and that many barriers need to be overcome.

[4] Paper Name - Crop Disease Detection Using Deep Learning.
Author - Rupanjali D. Baruah, R.M. Bhagat, Sudipta Roy, L.N. Sethi
Year - 2018
Description - The model proposed in this paper is based on deep learning.is trained using public datasets having images of healthy and diseased plant leaves. The model accomplishes its objectives by image classification of leaves as diseased or healthy depending on the defect pattern.

[5] Paper Name - Plant Disease Prediction using Machine Learning Algorithms
Author: G. Prem Rishi Kranth, M. Hema Lalitha, Laharika Basava, Anjali Mathur
Year -2018
Description - The goal of the proposed inquiry is to come up with different machine algorithms for plant disease prediction. The malady has tangible repercussions on a plant, such as a response to the infection.

IV. EXISTING SYSTEM

[1] Apple leaf disease detection

- It uses RCNN.
- This model can only diagnose infection in apple trees.
- Slower model
- It has an accuracy of 78.89 %.

[2] Plant Infection Detection Using Image Processing.

- It uses KNN and GLCM techniques.
- KNN is not quite as good as CNN whenever it comes to image processing.
- Accuracy is around 98 %.

V. PROPOSED SYSTEM

Hardware

1. Processor - Intel i3 core
2. Key Board - Standard Windows Keyboard.
3. Mouse - 2 or 3 Button Mouse

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Software

1. OS -Windows 7 (min).
2. Coding Languages used - Python, MySQL.
3. IDE – Anaconda.
4. Sypder

We are using the CNN which is also known as Convolutional Neural Network, instead of the ANN which is also known Articulated Neural Network. CNN trumps ANN in terms of accuracy, according to evaluations.. As some models with CNN already exist, we will be using the CNN algorithm along with the SVM algorithm.

VI. ALGORITHM

The hereunder is the algorithm used throughout the proposed framework:

6.1 CNN Algorithm

- A CNN (convolutional neural network) is a deep learning neural network that analyses structured arrays of data, like representations.

These proposed techniques are currently the best we have for image processing that is automated.

- Images contains data in the RGB format.
- Instead of an image, the computer sees a series of numbers. To store color images, 3D arrays are used.
- In the first two dimensions, the pixel's height and width is stored.
- The last measure reflects the red, green, and blue hues present in each pixel.
- Convolutional Neural Networks have 3 sorts of layers:

1) Convolutional Layer.
2) Pooling Layer.
3) Fully-Connected layer.

6.2 SVM Algorithm

- The Support Vector Machine, often known as SVM, is an extensively used Supervised Learning method for solving classification and regression situations. Therefore, it is best fit to classification.
- The SVM algorithm aims to find the decision boundary for categorizing n-dimensional space added to classes so that future data points may be conveniently sorted. The hyperplane is indeed the best decision plane feasible.
- SVM can be used to choose the extreme points that help build the hyperplane. The technique is called a Support Vector Machine since it uses support vectors to represent extreme cases or examples. Consider the picture below, which illustrates the usage of a decision boundary or hyperplane to identify two distinct categories:

A. Types of SVM

1. For linearly separable data, which is defined as data that can be divided into two main classes using a single straight line, linear SVM classifiers are used.

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VII. SYSTEM ARCHITECTURE

Flow Chart

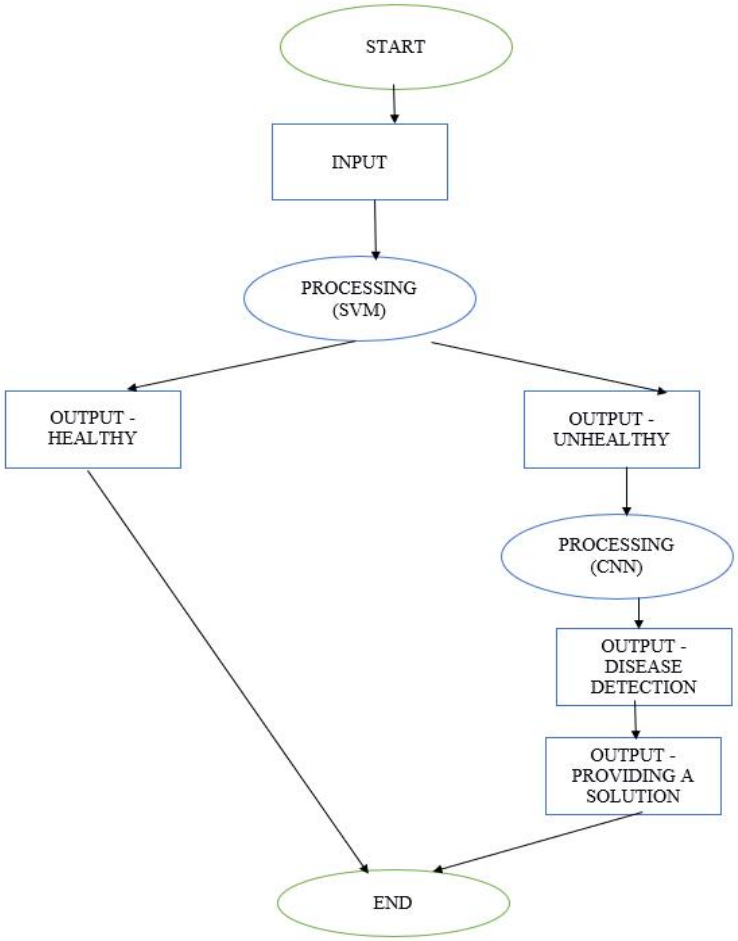

Figure 1 Flow Chart

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Block Diagram

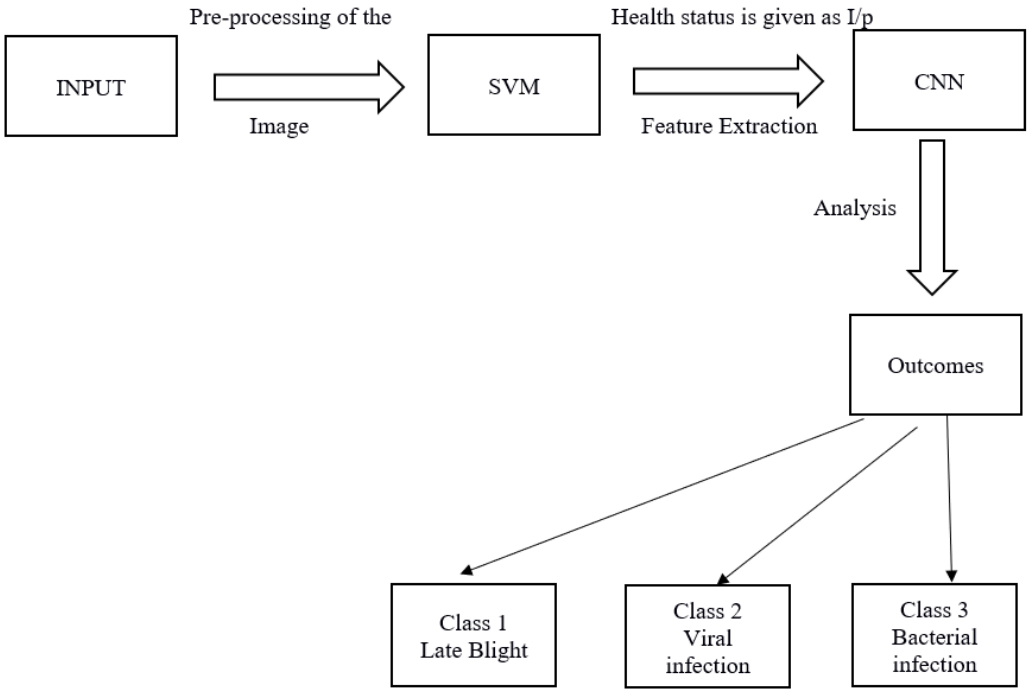

Figure 2 Block Diagram 1

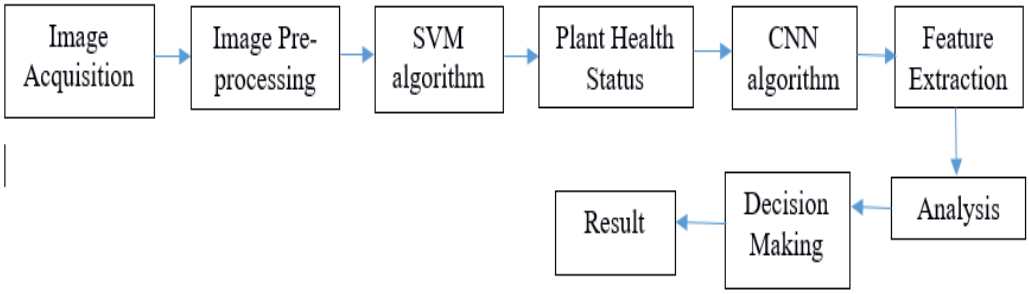

Figure 3 Block Diagram 2

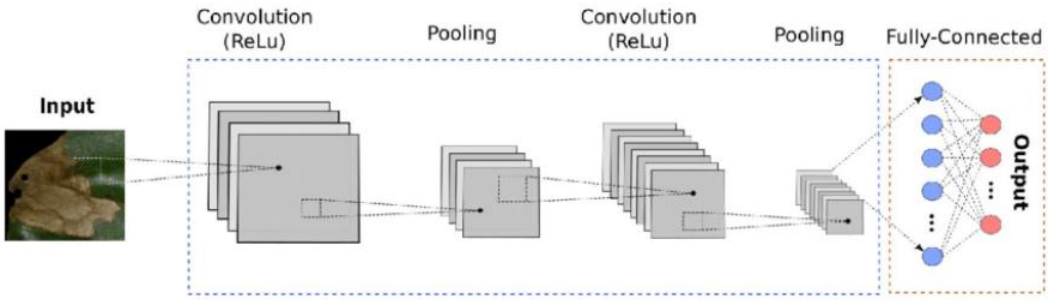

Figure 4 CNN Architecture

VIII. RESULT

- Our model is a hybrid model that uses the CNN and the SVM algorithms. This model surpasses the previous models. The accuracy of this model is approximately 99 %.

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- The comparison with of accuracies with different frame rates is as shown below:
- As there is a trade-off between accuracy and speed, 25 FPS with an accuracy of 98.99% was decided to be best suitable for the training and demonstration of the system.

Accuracy	FPS
99.99%	9
98.99%	25
89%	50
75%	100

As there is a trade-off between accuracy and speed, 25 FPS with an accuracy of 98.99% was decided to be best suitable for the training and demonstration of the system.

Performance Metrics:

- Precision: 0.99021
- Recall: 0.74
- True Positive: 3805
- True Negative: 3843
- False Positive: 195
- False Negative: 157
- Average Precision: 0.99085

Confusion Matrix:

	Class1(positive)	Class2(negative)
Class1(positive)	3843	195
Class2(negative)	157	3805

IX. FUTURE SCOPE

- We plan to add more data to improving the dataset's accuracy.
- We aim to expand our model that include diseases.

X. CONCLUSION

We created a hybrid model for image processing using the CNN and the SVM algorithm to detect plant diseases at an early stage so that they can be cured fast and will not affect the crop yield. Our model surpasses the previous models and it has a high accuracy of around 99 %.

XI. ACKNOWLEDGEMENT

It gives us great pleasure in presenting the preliminary project report on 'HYBRID MODEL FOR AUTOMATIC CROP DISEASE DETECTION USING CNN AND SVM ALGORITHM'.
I would like to take this opportunity to thank my internal guide, Prof. Gitanjali Mate for giving us all the help and guidance we needed. I am really grateful to them for their kind support. Their valuable suggestions were very helpful.
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BIOGRAPHY

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