Crop Disease Detection System

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Abstract: The economy has a significant impact on agricultural productivity. This is one of the factors that makes plant disease detection crucial in agriculture. Because there is a lack of sufficient care in this region, plant diseases substantially harm plants and have an impact on the quality, quantity, or profitability of their merchandise. Automated methods for plant disease detection are helpful since they eliminate the need for intensive surveillance on sizeable arable farms and catch disease indications early on. If it occurs on the leaves of the plant. This project addresses plant leaf disease detection and prediction using neural networks. Dataset used is provided through the following address *https://github.com/pratikkayal/PlantDoc-Dataset .*

Keywords: Crop Disease Detection, Image Processing, Computer Vision

1. Introduction

The majority of people in India are dependent on agriculture. The goal of agricultural research is to raise output and food quality at a reasonable price. The interactions between soils, seeds, and pesticides that result in agricultural production systems are intricate.
Fruits and vegetables make up the bulk of agricultural output. Plant diseases can impact the quality of agricultural goods, and product quality management is generally a prerequisite to have a more value product. In a nutshell, illness is a disruption of a plant's natural processes such photosynthesis, transpiration, pollination, and fertilisation. It's crucial to diagnose plant illnesses early. Continuous professional oversight of farmers can be both prohibitively expensive and time-consuming. It is extremely real to find a quick, cheap, and reliable approach for automatically identifying chronic illness in plant leaves. Computer vision allows you to use images to inspect, control, and guide robots. Based on leaf microstructure, the goal of this study is to identify leaf diseases.
As mentioned above, our system aims at finding the health of the subject plant. First, it distinguishes whether the subject plant is healthy or not. If healthy then display the appropriate message but if not then show the following details: 1. Name of the disease that infected the plant 2. Cause of the disease 3. Devise solution(s) 4. Precautions to be taken Analyse images that serve a variety of purposes, such as: • Disease detection on plant

fruit, stems, and leaves. • Area by area, measure the impacted area. • Locate the limits of the impacted region and establish the fruit's size and form. • Establish what colour the impacted area is. These are some typical signs of bacterial, fungal, and viral plant leaf diseases[1][2][3].

2. Literature Review [2022]

The literature on the detection of plant leaf diseases is extensive. This section highlights some important contributions. The methodology was adapted from Anand H. Kulkarni et al. Gabor He used filters to identify features and an ANN-based classifier to classify symptoms, which was proposed to show a 91% detection rate.For the purpose of quickly classifying data, F. Agenti et al. provided reinforcement learning and non parametric algorithms in their study. P. Revathi et almethod .'s for locating edges. It uses homogenisation techniques such as Sobel and Canny filters. The lesions were classified based on these edge features. A uniform pixel counting algorithm (HPCCDD) was developed to classify cotton disease. It claims 98.1% accuracy compared to existing algorithms [4][5].

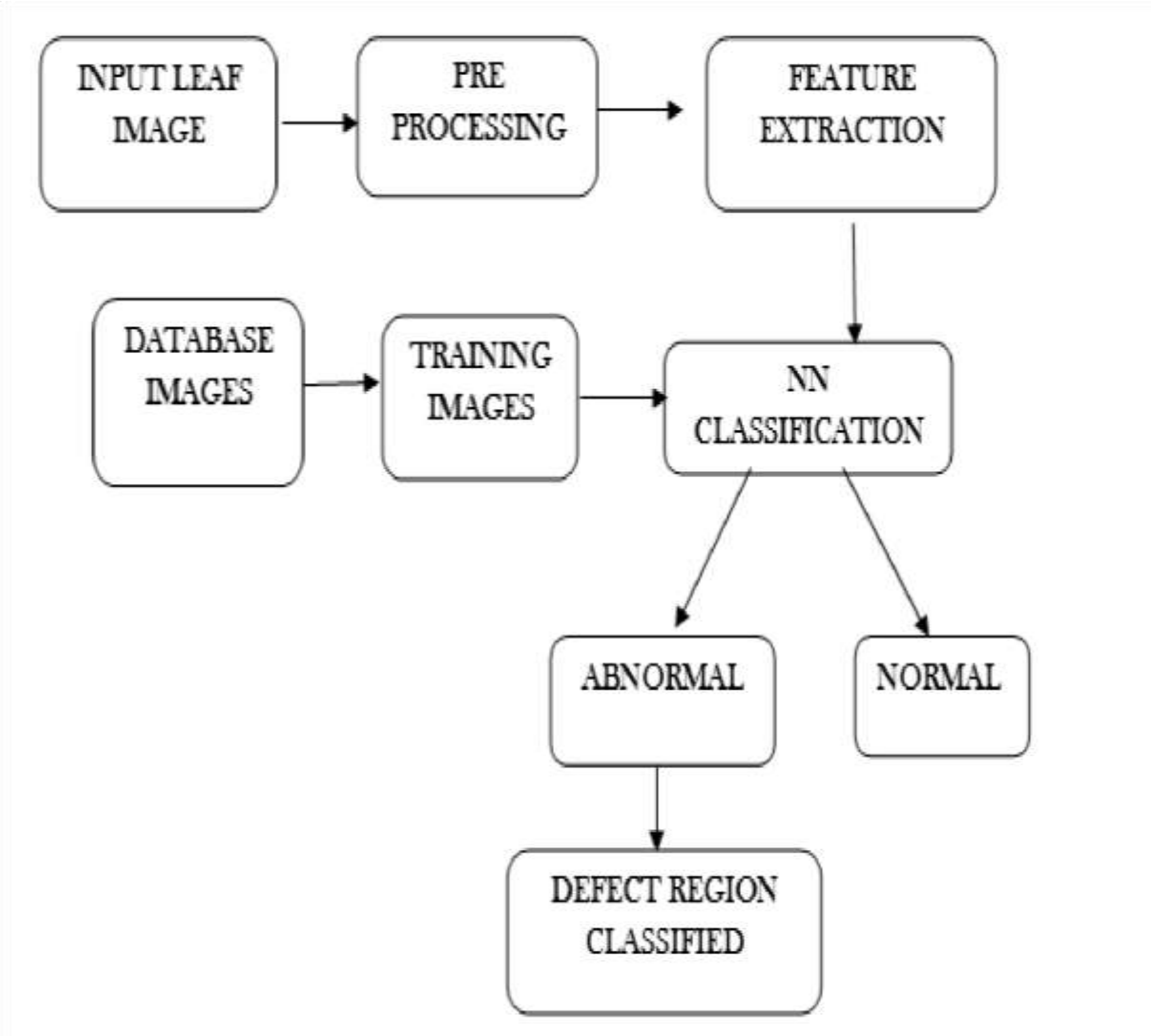
In their article, Tushar H. Jaware et al. For segmenting low-level pictures, we have created an advanced form of the k-means technique. Sanjay B. Dhaygude et al. used the Grayscale Spatial Dependency Matrices (SGDM) method to compute statistical texture features.

Extract.The RGB picture was transformed into an HSV colour space representation, which displays the H, S, and V colour components. Al-Tarawneh investigated olive leaf spot disease using c-means classification and autocropping segmentation. The RGB colour space is changed to Lab colour space and a regularisation is used to improve the image. We contrast fuzzy c-means clustering with fuzzy k-means clustering. Yan-Cheng Zhang et al. used fuzzy curve (FC) and fuzzy surface (FS) to select cotton leaf disease features.The dimensional vector space was thereby condensed. Haiguang Wang et al. modelled grape and wheat diseases using backpropagation (BP) networks. Classify. The dimensionality of the data points was additionally decreased through principal component analysis (PCA). Simona E. wrote the article [6][7].

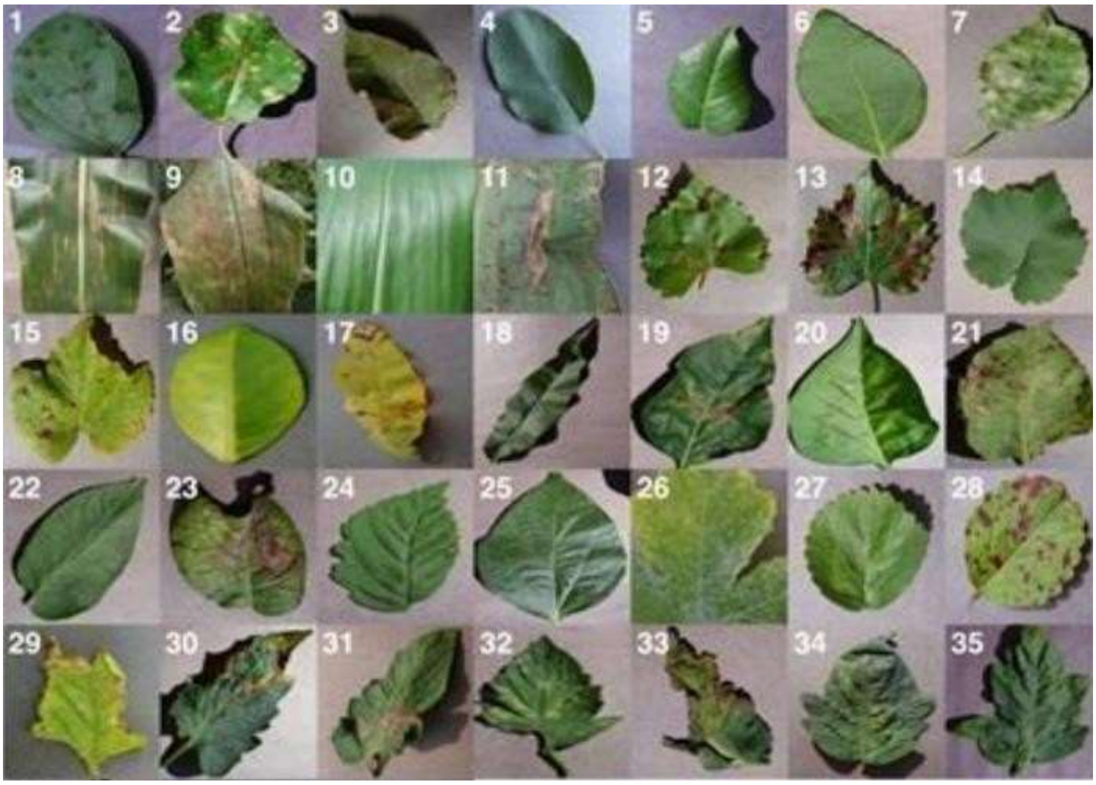
Grigorescu and others Based on the Gabor filter's local power spectrum, its texture characteristics may be calculated. They came to the conclusion that only textural characteristics are seen by the grid cell operator. S. Arivazhagan et al. suggested employing textural characteristics to identify aberrant patches and categorise them. Proposed. The algorithm was examined on ten different plant species, including bananas, six different types of beans, jackfruit, lemons, mangoes, potatoes, tomatoes, and sapotas. The accuracy of a support vector machine (SVM) classification was 94.74%. built a neural network classification algorithm based on statistical classification, which has an accuracy of about 93% in detecting and classifying disorders. See H. Al-Hairy et al. for clustering and categorization of plant diseases. We create BP neural networks and K-means clustering.Five illnesses were examined with the suggested approach [8][9] [18][19].

Fine whiteness, cottony and grey mould, early and late burn scars, and so on. Menukaewjinda and others We attempted a different ANN called a Back Propagation Neural Network for effective vine leaf colour segmentation with a complicated backdrop (BPNN). Additionally, they looked at genetic algorithms (GA) and modified self-organising trait maps (MSOFM), showing that these methods allow for the automated tweaking of criteria for colour extraction of grape leaf diseases. discovered. Support vector machines (SVMs) have also proven to be very effective in classifying leaf diseases. Twenty-one colour, four shape, and twenty-five texture features were identified by Hai Guang Wang et al. Extracted. BackPropagation (BP) nets, radial basis function (RBF) neural pathways, generalised regression networks (GRNN), and probabilistic neural networks (PNN) were utilised after principal component analysis (PCA) was performed to minimise the dimensionality of feature data processing. aclassification tool for illnesses [10][11].

FLOWCHART



3. Methodology



We started our project implementation in the ‘Google Colab’ Platform. We have created the file named as “ML Model for plant leaf disease” and before this, we have to find the dataset for our model to train and build. So, for that we have took the dataset from the Github and URL is given below: - DATASET (GITHUB URL):- https://github.com/spMohanty/ PlantVillage-Dataset Now, we have downloaded the dataset in our local machine. But, it contains hundreds of plant leaf species and we don’t have so much required hardware and software to implement all the classes 7 of the plant leaf in our model. So, we have choose the three main plant species as they are given below: - • Pepper Bell • Potato • Tomato These three plant species contain both of the dataset: - • Healthy • Diseased [12][13] [20].

DATA COLLECTION:- An interdisciplinary scientific subject called computer vision studies how sophisticated knowledge is extracted by computers from digital pictures and movies. From a technical standpoint, our goal is to comprehend and automate operations that the visual system of humans is capable of. The collection, processing, analysis, and comprehension of digital pictures, as well as the extraction of high-dimensional data from the actual world to create numerical or symbolic information, are all activities related to computer vision. as a decision [14][15] [21].

DATA ANALYSIS:- An Artificial Neural Network (ANN), or connectionist system, is a type of computing architecture that takes its cues from the bayesian neuron networks that constitute up creature brains. These systems often "learn" to execute tasks by seeing examples rather than having task-specific rules coded into them. For instance, in image recognition, photographs containing cats can be applied to detect sample images which have been manually labelled as "cat" or "not a cat" and utilising the outcomes to identify cats in additional images. You can discover how to recognise They do this action with no foreknowledge of cat faces, hair, tails, or whiskers. Instead, it uses the samples it analyses to automatically create IDs [16][17] [22].

RESULT TABLE:

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[ ] model.summary()

Model: "sequential_1"
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Layer (type)	Output Shape	Param #
conv2d_1 (Conv2D)	(None, 256, 256, 32)	896
activation_1 (Activation)	(None, 256, 256, 32)	0
batch_normalization_1 (Batch	(None, 256, 256, 32)	128
max_pooling2d_1 (MaxPooling2	(None, 85, 85, 32)	0
dropout_1 (Dropout)	(None, 85, 85, 32)	0
conv2d_2 (Conv2D)	(None, 85, 85, 64)	18496
activation_2 (Activation)	(None, 85, 85, 64)	0
batch_normalization_2 (Batch	(None, 85, 85, 64)	256
conv2d_3 (Conv2D)	(None, 85, 85, 64)	36928
activation_3 (Activation)	(None, 85, 85, 64)	0
batch_normalization_3 (Batch	(None, 85, 85, 64)	256
max_pooling2d_2 (MaxPooling2	(None, 42, 42, 64)	0
dropout_2 (Dropout)	(None, 42, 42, 64)	0
conv2d_4 (Conv2D)	(None, 42, 42, 128)	73856
activation_4 (Activation)	(None, 42, 42, 128)	0
batch_normalization_4 (Batch	(None, 42, 42, 128)	512
conv2d_5 (Conv2D)	(None, 42, 42, 128)	147584
activation_5 (Activation)	(None, 42, 42, 128)	0
batch_normalization_5 (Batch	(None, 42, 42, 128)	512
max_pooling2d_3 (MaxPooling2	(None, 21, 21, 128)	0
dropout_3 (Dropout)	(None, 21, 21, 128)	0
flatten_1 (Flatten)	(None, 56448)	0
dense_1 (Dense)	(None, 1024)	57803776
activation_6 (Activation)	(None, 1024)	0
batch_normalization_6 (Batch	(None, 1024)	4096
dropout_4 (Dropout)	(None, 1024)	0
dense_2 (Dense)	(None, 15)	15375

4. Conclusion:

The methods for identifying plant diseases in various plant species using image processing are reviewed and summarised in this work. The algorithms BPNN, SVM, K-Means clustering, and SGDM are the most often used for identifying plant diseases. These methods can be used to examine both healthy and sick plants' leaves. The difficulties with these methods include automating the continuous, and mechanised plant leaf disease monitoring process as well as refining background data to increase the accuracy of the generated pictures. It is comprised. According to this assessment, this disease detection technique is probably capable of spotting plant leaf illnesses, but it also has several drawbacks. Therefore, there is potential for advancement in the current investigations.

The above result is obtained after proccesing this dataset *https://github.com/pratikkayal/PlantDoc-Dataset .*

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