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Plant Scanning and Disease Detection Using Image Classification

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Abstract: Disease detection in plants plays a very paramount role in agriculture. Disease in plants causes major endangerment and economic losses in agriculture industry ecumenical. Prognostication of crop health and disease early can facilitate the control of diseases. Magnification of plant is major requisite of farmers as they are a paramount aspects of ones survival, as the pabulum demand is incrementing at an expeditious rate due to an incrementalism in population. Moreover, the utilization of technology today has incremented the efficiency and precision of detecting diseases in plants. These techniques are applied to detect diseases from infected plants. Getting affected by a disease is very prevalent in plants due to sundry factors such as fertilizers, cultural practices followed, environmental conditions, etc. These diseases hurt agricultural yield and ineluctably the economy predicated on it. Plant disease detection utilizing image processing is the best way to detect and get exact results. This application will avail farmers to ken the correct information of the disease and avail in increase their yield. The moto is to detect sundry plants diseases and provide precautions and remedies to preserve the plants from eradicating.

Keywords: Plant Diseases, Machine Learning, Image Processing, CNN, Plant Village.

INTRODUCTION

Farming system in India is tactically utilized, according to region sagacious where they are most productive. Subsistence farming, organic farming, and industrial farming are sectors where they make a major contribution to India's agriculture. new modern mono cropping rigorous agriculture leads to loss in biodiversity, eradicated soil nutrients, As a result, toxic substances are utilized, which pollutes groundwater sources. Affects and transmutes the natural world in a negative way. Ravages overall soil degradation and erosion, necessitates a substantial quantity of water to irrigate, and utilizes a substantial quantity of fossil fuel energy. which leads to stagnating agriculture endangerment and productivity. Plant diseases additionally have posed a concern in the endangerment of crops. India engenders the second-most sizable voluminous magnitudes of wheat, rice, and fruit in the world.

There are certain diseases for rice that are blast disease, stem rot, flag smut, and bacterial leaf blight. It transpires during some unpropitious conditions. As same with the wheat like yellow rust brown rust and ebony rust. Plant disease can affect rudimentary plant functions such as nutrient and water absorption, and as a result, rudiment obligatory functions such as photosynthesis, fruit and flower endangerment, plant magnification, cell division, and enhancement can all be affected. Magnification of plants sometimes depends on the weather or it can be dependent on variants of bacteria, fungi, cytoplasm, viruses, droids and nematodes. The series of diseases caused by these infectious agents fluctuate from mild to vigorous depending on the intensity of the infectious agent, environmental conditions, host resistance, period of infection and sundry other factors. Disease symptoms vary with the infectious agent and the infected part. It includes leaf blights, root rots, fruit rots, leaf spots, fruit spots, etc. 70% of population depends on agriculture and nature. This will avail farmers to cull plants as there are immensely colossal range of diversity for culling different opportune crops and finding the opportune pesticides for plants. Hence damage to the plants will lead to immensely colossal loss in productivity and ineluctably affect the economy.

Leaves are the most consequential part of a plant that shows the disease symptoms at the earliest. In general, a plant becomes diseased when it is perpetually perturbed by some causal agent that results in an eccentric physiological process that disrupts the orchestration today's world the agricultural land mass is more than just being an alimenting sourcing. Plant disease have turned into a dilemma as it can cause consequential abbreviation in both quality and quantity of agricultural products. The unclad ocular perceive optical discernment off expert is the main approach adopted in practice for detection and identification of plant diseases. Plants disease can be relegated into two ways infectious and non-infectious depending on its cause, nature and the location site. Infectious plant diseases are caused by a pathogenic organism such as a fungus, bacterium, cytoplasm, virus, Virol, nematode, or parasitic flowering plant. infectious agent is capable of reproducing within or on its host and spreading from one susceptible host to another. Non infectious plant

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diseases are caused by inauspicious growing conditions, including extremes of temperature, disadvantageous relationships between moisture and oxygen, toxic substances in the soil or atmosphere, and an excess or deficiency of an essential mineral.

METHODOLOGY

Our proposed system is an application predicated software. We have an android predicated software which simply takes the image of the plant and uploads it to the mobile contrivance. Then this image is shipped through a Convolutional Neural network which converts the picture into a numerical form and relegates it with the opposite numerical arrays within the model. We are using a tensorflow model which is made into a tensorflowlite model because of the sizably voluminous size of the mundane tensorflow model. This model avails relegate the uploaded image numerical value to the dataset values. When a numerical array matches it calculates the confidence and exhibits the value which has the highest confidence. In this way, we can ascertain that we always have the highest confidence value exhibiting in the results. Refer the following Block Diagram:

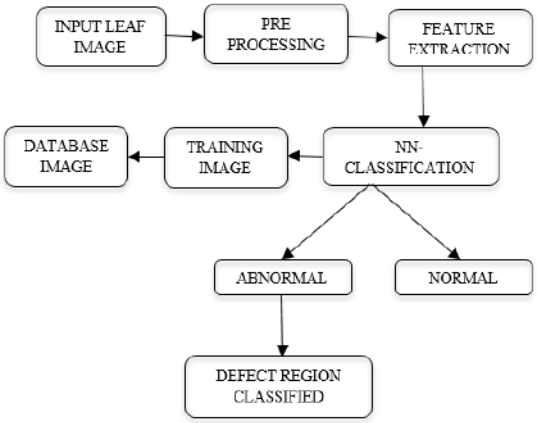

Fig. 1 Block Diagram

Dataset:
Plant Village dataset consists of 54,305 images of various plant leaves, divided into 17 classes. It consists of 12 kinds of plant species and 25 kinds of plant diseases. It has both salubrious and diseased crop images. We have amassed - and perpetuate to accumulate - tens of thousands of images of diseased and salubrious crops. The goal of this challenge is to develop algorithms than can accurately diagnose a disease predicated on an image.

Fig. 2 Classes of crop disease pairs

Image Acquisition:
Rudimentary this step consists of taking in the leaf image from the mobile contrivance. The application utilizes a camera module which enables the utilizer to take images. Since the images are taken from different mobile contrivances hence, the images obtained may be of different qualities. This may affect the precision of the system. Hence, to eschew this we send the image for pre-processing where the image quality is amended for further process.

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Pre-processing of the Images:

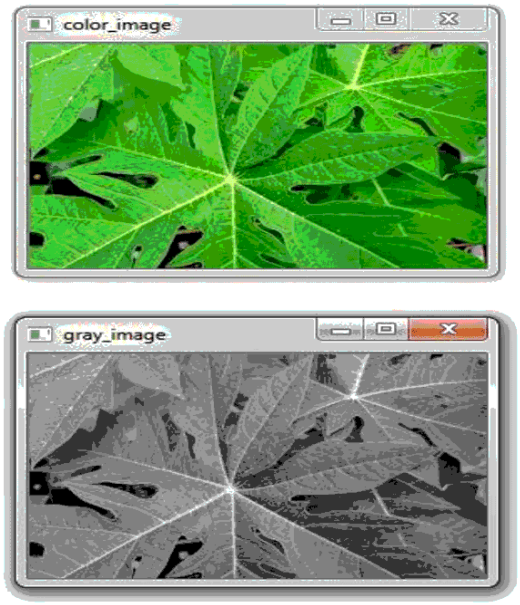

Fig. 3 Pre-Processing of Image

Since the images in the dataset may have some erraticism, pre-processing is a very critical phase in CNN because it may influence the system's precision. The images in the dataset have noise and non-uniform lighting which needs to be rectified in this step. We do so by applying segmentation on the images to dispense uneven backgrounds. Through segmentation we extract the pertinent part of the images. Hence, after segmentation we have the images of leaves with ebony background. Now to rectify the non-uniform lighting we convert the pictures to GS images and send it for further processing.

Feature Extraction:

Feature Extraction is done on the substructure of segmented clusters which has 4steps, and they are as follow:
Stage 1: Enter the cluster number of the disease caused leaf part only.
Stage 2: Convert the image into grey scale image if it is RGB
Stage 3: Engender the Grey Level Co-occurrence Matrices (GLCMs)
Stage 4: Derive Statistics (features) from GLCM (Gray Level Co-Occurrence Matrix)

The derived features are Contrast, Correlation, Energy, Homogeneity, Mean, Standard Deviation and Variance. These features are given as input to the classifier for further pro-cessing. The features are extracted from the disease affected leaf cluster. These features are very prompt to detect and relegate the plant disease.

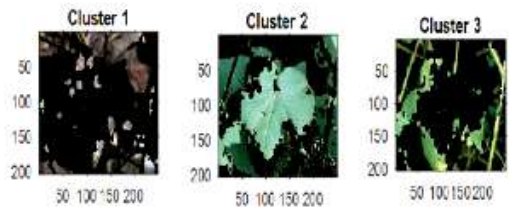

Fig. 4 Cotton leaf clusters

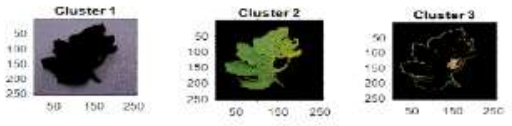

Fig. 5 Tomato leaf clusters

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Features	Fig 4: Cluster-1	Fig 7: Cluster-3
Contrast	0.507885746067059	0.213265931372549
Correlation	0.865689782098393	0.782224239224636
Energy	0.582100315095136	0.863527567334379
Homogeneity	0.946855538655952	0.972392714898460
Mean	23.1548459849249	5.63678487141927
Standard Deviation	48.8486649473881	24.3246848498623
Variance	2229.83298033050	550.457989402222

Fig. 6 Feature extracted for cluster-1 and cluster-3

1. Contrast: Contrast describes the intensity values of a pixel. Contrast of a pixel and its corresponding surrounded pixels in the entire image. This can be understood by assuming if the contrast value is 0 it implies that the whole image is constant or it will have high value if the neighbour pixel value varies with the high value.

$$\text{Contrast} = \sum_{i,j=0}^{N-1} P_{ij}(i-j)^2$$

2. Energy: Energy describes the uniformness in the image with square elements summation in the GLCM. This value generally varies between 0 and 1. If the value is 1 it means that the image is constant.

$$\text{Energy} = \sum_{i,j=0}^{N-1} (P_{ij})^2$$

3. Dissimilarity: While measuring the weights in the contrast measure as pixel goes away from the diagonal the weights increases drastically. The dissimilarity helps in measuring the weights linearly (0, 1, 2, 3…).

$$\text{Dissimilarity} = \sum_{i,j=0}^{N-1} P_{ij}|i-j|$$

4. Entropy: Entropy is responsible for the information needed to compress the image. Entropy describes the amount of loss of data in a signal which are being transmitted and also measures the signal data.

$$\text{Entropy} = \sum_{i,j=0}^{N-1} P_{ij} \log P_{ij}$$

5. Correlation: Correlation describes how to correlate a pixel to its neighbour pixels in the entire image. And the values of the range in between (-1, 1).

$$\text{Correlation} = \sum_{i,i=0}^{N-1} P_{ij}(i-\mu)(j-\mu)/\sigma$$

Where $P_{i,j}$ the pixel value of the image at position i, j and the N is the Number of grey levels.
Mean (μ) = Mean value or Average of all pixel values in the relationship contributed by GLCM Matrix.

$$\mu = \sum_{i,j=0}^{N-1} i P_{ij}$$

Variance (σ^2) = variance of the intensity values in the image.

$$\sigma^2 = \sum_{i,j=0}^{N-1} P_{ij}(i-\mu)^2$$

These parameters are subsidiary for analysing the alignment of the image and the corresponding properties and the feature vectors are calculated with the Grey level co-occurrence matrix.

CNN:

Convolutional Neural Networks are an involute neural network chain that works to get the features of the picture from a dataset which is trained and relegate them to get the required output. It trains the neural networks by utilizing the dataset images and transmuting them to numerical values.

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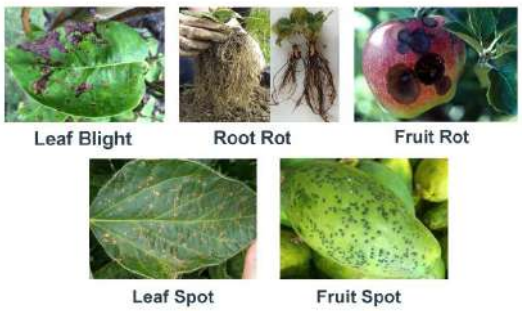

Fig. 7 Disease Classification

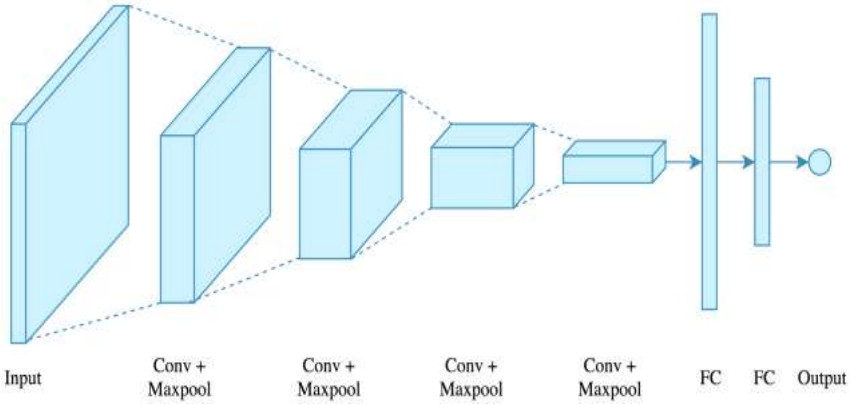

Fig. 8 CNN Classification

KNN:

The KNN is the relegation technique which is applied to relegate homogeneous and dissimilar data into more than one classes. The training samples are depicted by n dimensional numeric attributes. Every sample represents a point in an n-dimensional space. Along these lines, the more preponderant part of the training samples is stored in an n-dimensional pattern space. At the point when given an unknown sample, a k-most proximate neighbour classifier looks the pattern space for the k training samples that are most proximate to the unknown sample. "Propinquity" is defined in terms of Euclidean distance.

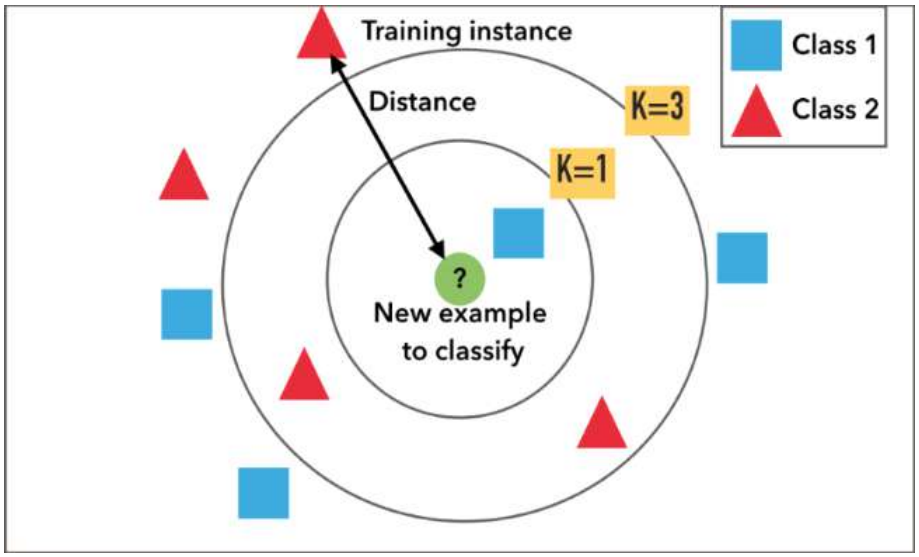

Fig. 9 KNN Classification

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RESULTS

Fig .10 Splash Screen

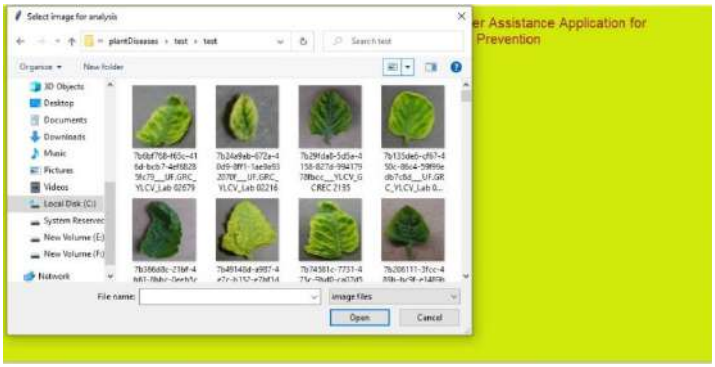

Fig .11 Select Leaf image

Fig .12 Leaf image inserted

Fig .13 Leaf image analysis

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Fig .14 Enhancement process

Fig .15 Segmentation process

CONCLUSION

In this research task,I should like to conclude that this is an efficient and best technique of automaticaaly detection of plant leaf is diseased. In this research, plant diseased is detected by using segementation. The segmentation is based on the feature and the edge detection technique. The color features extraction are applied on samples that are contained the healthy leaf of plant and the diseased leaf of the plant.

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