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A STUDY ON THE DEFECT OF PLANTS AND DISEASES USING DEEP LEARNING

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Abstract

Due to recent technological advancements, we are now able to simplify our artwork. Image analysis and deep learning are two fields that improve the detection process. These developments have made it easier to detect plant diseases. Due to the growing global population, food crops and therapeutic plants are becoming increasingly important. Each year, many different kinds of plants, including those that are consumed as food, get fatal diseases that reduce production. If we do not want manufacturing prices to decrease, we must utilize some automated techniques to locate the problem inside the plant. Robotics and image processing can be utilized to diagnose plant diseases. In this article, we will examine a possible model. A detailed analysis will lead to a model that gives us the specific details we need and helps us gain a deeper understanding. In order to assist in diagnosing diseases in flora, we trained a model based on deep learning. The neurons and synapses in synthetic neural networks closely resemble the fundamental properties of intelligence. Synthetic neural networks are mainly used to guide supervised research. A network of neurons can be trained to copy a device properties using precise data sets to the device's output and input. Images, for example, can be used to control the leaf model. In addition to identifying the condition, we will also provide solutions for the problem. Treatment would be provided for both conditions. By following the recommended approach, these problems may be addressed and the program's usefulness enhanced. Treatments will help people better understand the illness.

Keywords: Plant Village, Deep Learning, Agriculture, Convolutionary Neural Networks (CNN), Plant Disease.

INTRODUCTION

In both the economic and climate change fight, plants are essential. Planting more trees and plants has become a priority in several countries, including India, to protect the environment. Climate change is now a topic being explored at the United Nations General Assembly in 2019 since it has become a worldwide issue. Several studies suggest that industrial usage has caused the extinction of plants, resulting in global warming. The rate of climate change will increase 10-100 times faster in the future than the rate of glacial warming [1]. Compared to DE glacial warming. Viruses, bacteria, fungi, and insect pests are often responsible for crop infections. In a variety of species, one of the approaches presented in figure 1 can be used to diagnose these diseases. In addition to stems and vegetables, fruits can also be tested.

For the farming industry, these plants are crucial. Farming is a complex enterprise around the world [2]. The health care system, on the other hand, is dependent on plants [3]. The maintenance of vegetation is the primary concern worldwide, despite the fact that plants are necessary for human existence.

Sclerotinia (white mold) is a family which has many plant leaf diseases and stem rust comes under it. Leaf rust also belong to the same family. A normal leaf image is shown in the 1st figure. Mildew that grows on surfaces is powdery mildew. Septoria spot are the kind of spots which apper on berries known as anthracnose and phytophthora are some kind of leaf spots damping off a plant in the provided photo. The leaves of a plant getting yellow is know as a diseases called chlorosis.

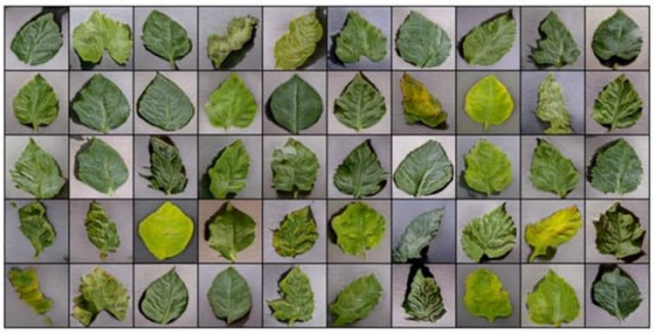

Fig 1 Some images of Regular types of leaves

There are several ways in which a plant's leaves may aid in the identification of a disease. The determination of a plant's health by observing its leaves, branches, or fruit can be easily done by an expert. In order to be effective, a significant sample size is required. A plant disease detection system that is automated would be much more useful in today's era of automation. There have been several research works conducted to fill in the gaps during the past decade. Most of these techniques rely on machine learning techniques [6].

In Figure 2, sick plants are depicted, which reflects how diseases can affect people's health. There is a risk that plant pests and diseases will cause hundreds of billions of dollars in losses to the food, textiles, and decorative industries [4]. A graphic representation of the learning rate, which shows how accurate the model is, can be found in Figure 7. A fungus or a chemical that

mimics a fungus can cause these diseases. There are some diseases which can easily spread amoung plants and this diseases can cause serious damang. Bacteria, parasites and viruses are some diseases which can spread fastly amoung plants. This diseases are need to be detected and treated promptly. Plant diseases present early symptoms that are difficult to identify.

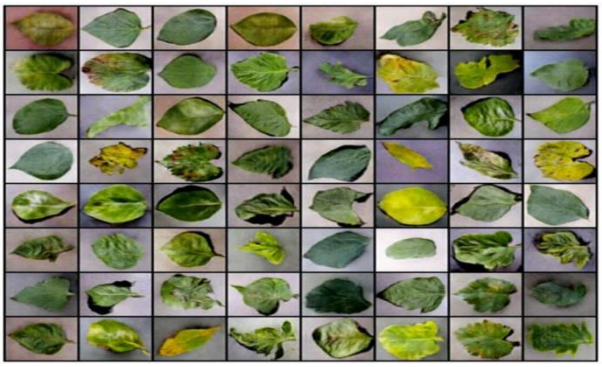

Fig 2 Diseased Plants Images.

• Finding out which areas have been affected - First and foremost, we need to figure out which areas have been affected. We will use CNN, contribute data, and use machine vision to do this. With machine vision, it is possible to gather photos of the collected plant images to determine if they contain infection or irritation.

• Achieving a reclaim of the feature set of the pretentious area - Getting a reclaim of the area affected by the pretentious area. By performing this procedure, you will be able to identify the disease accurately by identifying the features of the affected area. There are many plant classifications which are need to be understood to identify plant diseases and a CNN classifier can be trained for them. The classifier is needed to be activated with the help of the information provided from the 2nd level so that it can be trained to differ between many number of plant diseases. Plants not covered by leaves are categorized as "healthy". From each folder, 400 images were randomly selected.

• Some farmers and gardeners read some books to understand the different plant diseases. They even visit internet to classify and identify those diseases which they come across. There are many garden center which can help the farmers in the identification and classification of these diseases. The photo or a sample of the leaf could be a complete source of information. The present technology of CNN will first understand the defect in the plant with the data set for it After this the result can be produced from the CNN network trained to identify the diseases.

There are many differ models present which were used to identify the diseases in the leaf in the 3th figure. The main resaon to develop such models and projects is to make the process of identification of diseases faster from the previous method. Deep lereaning is used mostly for these plant diseases detection because its better than the normally used machine learning processes. CNN is more related to feature extraction so the required knowledge technically is less. [7]

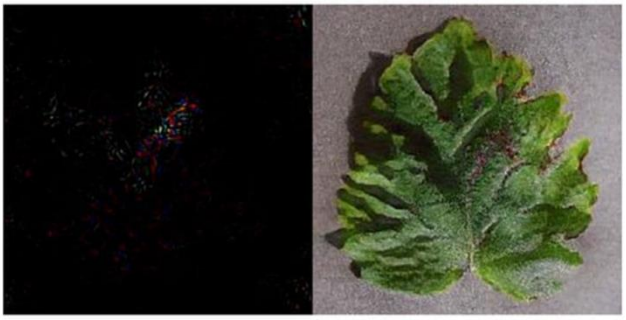

Fig 3 Leaf with Diseases

Our method of identifying plant illnesses is based on photos of plant leaves, similar to other studies. An automated instrument for identifying plant diseases, it is able to differentiate between ill and healthy plants and determine what kind of disease each one carries.

The CNN can be easiy trained to identify the healthy and unhealthy leaves amoung the large photo collection of a data set and CNN is used in this neural network known as convolutional neural networks. Once the trained model is given images of plant leaves, it can be trained to identify future plant diseases. Neural networks use convolution when learning deep knowledge. Consider CNN, the potential network for pictures.

In this case, it is a media company that extracts information from photos based on its algorithms, such as vertical and horizontal restrictions, RGB values, and other parameters. Among neural networks for deep learning, CNN [8] demonstrates the best capability for obtaining picture characteristics. Convolution neural networks (CNNs) are a type of deep learning network that can be applied here. In order to accomplish this, convolution neural networks (CNN), deep learning networks for pictures, could be programmed.

CNN uses data such as RGB measures, horizontal and vertical constraints, and other features to extract information from photos. Deep learning neural networks such as CNN [8] are the best at extracting visual information. Listed in Table 1 are the many types of diseases that may afflict plants in many different ways.

Table 1 Different Types of illness in plants

Bacterial	***Fungal***	***Viral***
Fire blight	*Anthracnose*	*Curly top*
Rice bacterial blight	*Black knot*	*Mosaic*
Canker	*Blight*	*Psorosis*
Crown gall	*Chestnut blight*	*Spotted wilt*
Rot	*Late blight*	
Basal rot	*Canker*	
Scab	*Clubroot*	
	Damping-off	
	Dutch elm disease	
	Ergot	
	Fusarium wilt	
	Panama disease	

We studied some papers related to plant diseases and understood some common plant diseases. We were able to learn details about over 3 categories of plant diseases by reading the papers. Bacterial, fungal and viral are the 3 categories under which we could classify the different type of diseases.

Bacterial diseases can be easily seen on the surface of the plants which have been affected by them. We can see the leaves changing colors, mostly yellow. As a result of this disease, there may be some tiny holes present. There is a major problem with fungi because they affect plants even internally. Plants are affected by viral diseases at the DNA level. The plant seed production and growth rate can be easily affected by these diseases.

REVIEW OF LITERATURE

In a MRI machine frequency which affect oxygen are produced. This frequency is send in different parts of the body which is needed to be examine in the form of pluse. This pluse produce the effect on the part of the body which is examined and spin in opposite way then its intial ways. All this process inside the MRI is called the Resonance. The Nuclear Magnetic resonance scanning is also know as NMR. This scanning process polarise the water molecule present in the body tissue. The signal produced afterwards can be recoreded to get the image of the body exposed to it.[1]

As part of a hybrid approach to biomedical imaging known as light acoustic imaging, the photoacoustic effect is used. A few of the many advantages of this technique include the ability to image the diffusive and other regimes with optical absorption contrasts and ultrasonic spatial resolution. Researchers report that optical acoustic imaging is effective for a number of things, including detecting disease, imaging neuron activity inside the brain, recording oxgyen inside blood, and assessing tumours. [2]

When a tomograph is produced by imaging an object then this process is know as Tomography. In terms of tomography, some methods include linear tomography, poly tomography, zonography, axial tomography processed by calculation [3]. A wide array of techniques are commonly used, including contact thermography, telethermography, and dynamic angio-thermography. Thermography based on digital imaging applies a concept derived from metabolic motion. The higher value can be calculated by taking vascular transmission into account around a breast cancer. [4]

Phytopathogens are organisms that cause harm to plants. There are studies and comparisons being conducted on different sensors. It is known that hyperspectral devices record a great deal of data, so a variety of approaches are required to get the most accurate results. Temperature is the most important thermographic parameter. These technologies have yet to reach their full potential, which presents a problem [5].

The aim of this essay is to examine the various methods of classifying plant diseases (Fang and Ramasamy, 2015). There are several direct approaches to biomarkers. The use of indirect techniques such as hyperspectral imaging and fluorescence imaging is an example [6].

Technologies based on spectroscopy and imaging - The study compares imaging technologies based on spectroscopy with profiling methods for assessing leaf health. Pant diseases can be accurately identified with the help of these diagnostic tools. A challenge for these systems is identifying and automating the optimal cure for individual plant diseases. [8] (Sankaran and coworkers, 2010).

PROPOSED METHODOLOGY

A plant leaf disease can be diagnosed quickly and accurately using digital signal processing. Acknowledging appropriate diseases will assist in reducing a variety of agricultural issues, enhancing productivity at the same time. Images of diseased leaves should be subjected to a variety of disease detection processes.

Weight Grade and Inaccuracy Signal

We can see the symbols metioned in the equations given below which can be defined as :-

- i, j, k - Different neurons present in the network
- n - Number of the training performed
- e - Value error of the jth neuron in the neuron network
- δ - Error signal
- w – Synaptic weight ∂ΔƎ δ

Error signal δ at a node j is:

$$\delta j = -\partial Ǝ / \partial netj \qquad \text{(i)}$$

The weight wijv gradient is given by:

$$\Delta wij = -\partial E / \partial wij \qquad \text{(ii)}$$

The set of nodes anterior to node i and node j:

$$Ai = \{ j : Ǝwij \} \qquad \text{(iii)}$$

$$Pi = \{ i : Ǝwij \} \qquad \text{(iv)}$$

Only when all the posterior node faults are known can errors of any unit be determined. This is a two-way note.

Based on data set the copy effect must used performed before the description of the situation and presented in Figure 4. A data set should then be used to classify infections using multiple classifier algorithms.

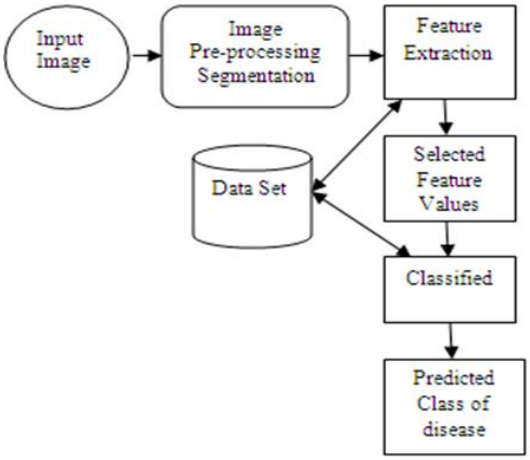

Fig 4 Image Identification Process

When appearances are achieved, images are acquired and converted into a format which can be used for final output. Digital images are created by converting analogue images into digital images. During the preprocessing step, pictures are enhanced, image segments are mapped, and color spaces are converted. First, the digital image is improved with a filter. Image processing is used to create the leaf picture. By restoring the RGB colours to chromaticity constraints, the filtered image is transformed into a chromatic image. People can be assisted in seeing colour more accurately by the Hue Sensitivity Value (HSV) method, which has a number of advantages. It is also possible to simplify analysis by dividing the image into logically sound components. To understand images feature-based is used and to classify them in different classes other approaches can also be used. Model based approaches and edge-based are used for the same edge-based.

Feature extraction previous step is Segmentation. As a result of segmenting the data and computing the predetermined dataset, several properties of the picture should be determined. In order to accomplish this kind of extraction, one can make use of statistical, structural, fractal, or signal processing techniques. Wavelets Transform is used to extract features. Color Co-occurrence Matrixes and Grey Level Co-occurrence Matrixes (GLCM) are other example of features extraction. Spatial Gray-level Dependency Matrixes (SGDM) and Gabor Filters are also used.

CONVOLUTIONAL NEURAL NETWORK (CNN)

It has been demonstrated that convolutional neural networks, also known as CNNs, are very effective at categorizing and recognizing images. Automated cars and robots are now equipped with ConvNets to power their vision systems. ConvNets provide the vision system with information about appearance, substance, and transport symbols.

In imagery identification and detection (ConvNets or CNNs), convolutional neural networks (CNNs) remain a widely used network architecture. There are many industries where CNNs are used, including in identifying faces and objects. Features don't have to be extracted, which is a significant advantage. CNN is based on creating invariant characteristics through

convolutional images and filters. The system learns to extract features as it transfers these characteristics to the next layer.

- Convolutional neural networks (CNNs) are deep learning systems that analyse organised arrays of data, such as demonstrations.

- Input photographs are better evaluated with CNNs that can identify outlines, grades, rounds, and level appreciations and appearances.

- It is their ability to deal with imperfect images directly and without any pre-processing that makes convolutional neural networks so effective in computer vision.

- Deep neural networks comprise more than 20 layers in a feed-forward neural network.

- The ability of convolutional neural networks to recognize increasingly complex structures is attributed to the convolutional layer. This is one layer layered on top of another and can recognize several layers at once.

- A convolutional neural network requires 25 layers to identify the face of humans, But to recognize the handwritten script only few layers are required.

- It is based on the idea that robots should be taught to perceive and feel the world in a similar way to humans. The process which modify and enable them to identify objects, classify objects, understanding voice and video recognition.

Design For (CNN) Convolutional Neural Network

- When many layers which invisible and are stacked on top of each other in a required arrangement forming a feed forward neural connecton which is also a CNN

- CNN can learn hierarchical characteristics because of its sequential construction.

- The human brain neurons are like a neural connection which is required for the pre-processing and is affected by the visual cortex organiztion

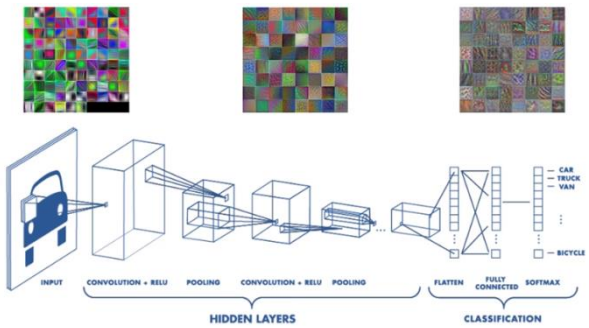

Fig 5 CNN's Industrial Application.

As shown in the figure 5 we can see a multilayer neural network which is formed by a group of convolutional layers.. CNNs rely on a 2D structure of input images (or other 2D inputs like speech signals) to operate. The translation-invariant features are built using local relationships and linked weights, which are then pooled. The fully-connected networks have more parameters as compare to CNN even when the number of hidden layers are same for both models. We're going to walk through the key components that contribute to making a typical CNN.

There are different sizes of CNN available with many configurations:

a) Input Layer b) Convolutional Layer c) Activation Function's Layer d) Pool Layer e) Interconnected Layer

1. Input Layer

The conversion can be applied to a 32 by 32 by 3 picture. 32 by 32 by 3 pixels are stored in this layer as raw data for the input layer.

2. Convolutional Layer

It is determined the output volume of all filters and patches by calculating their dot products. This layer will produce an output volume of 32 x 32 x 12 and assuming we use 12 filters in total.

3. Activation Function's Layer

By using the element-wise activation function, this layer will receive its output from the convolution layer. Multiple types of activation functions are available for activating a network, such as RELU: max(x, 0), Leaky RELU, Sigmoid: 1/(1+e-x), Tanh and many others. The volume does not change due to all this. As a result, 32 x 32 x 12 will be the output volume.

4. Pool Layer

It is necessary to add this layer to the comments in order to reduce the volume size. As a result, the calculation will be faster, memory will be saved, and overfitting will be avoided. A maximum pooling cover and a regular pooling cover are two of the most commonly used pooling covers. filters of size 2 x 2 and having a stride 2 will result in a maximum pool with a volume of 16x16x12.

5. Interconnected Layer

The data from the layer above is processed inside the layer of a neural network, the score of the class is calculated, and then on the basis of the number of classes an array is produced (1-D Array). A similar illustration can be found in the 6th figure.

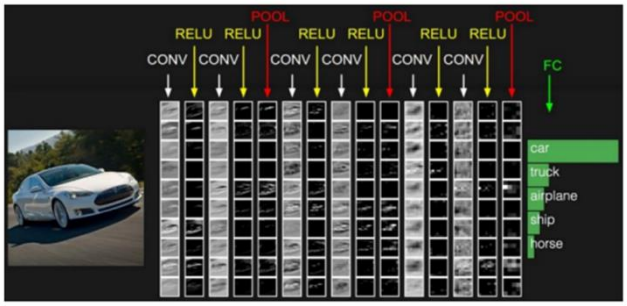

Fig 6: Diagram of the Fully Connected Layers

RESULTS & DISCUSSION

Deep learning has fixed the feature engineering problem, a long-standing problem in feature engineering.Deep learning takes over domain knowledge, and domain knowledge is no longer necessary. The basic building blocks of deep learning are ANNs.

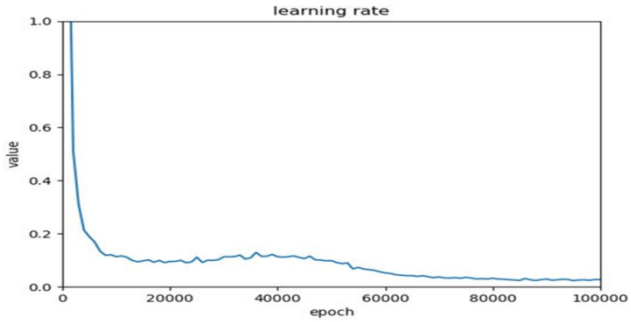

Fig 7: The graph of the ANN learning rate

In Figure 7 we can see how the ANN learns when it is trained for detecting some thing. The rate of learning for a model can be easily seen in the graph. Mathematically, they simulate general intelligence activity using neurons and synapses. For building neural networks, this TensorFlow package is one of the most popular. In this bundle, you will find all of the artificial neural network libraries. The classification of image words can be don using the package known as tensorFlow. In terms of methodology, artificial neural networks (ANNs) have advantages and disadvantages. The models producing results and which are completed made should be analysised completed so that no problem occures. When the testing is done the time could increase because there may be some unwanted input which causes the model to get delay.

CONCLUSION

We have conducted a study using image processing methods and techniques so that we can have a better understanding of plant desaese. A variety of techniques are used for clustering, including SVMs, BPNNs, SGDMs, and K-means. Plant leaf disease can be detected early using any of these methods. In SVMs, training parameters can be tricky to choose because they are non-linearly separable. It is possible for a neural system to handle unpredictable inputs. It takes a very long time for K-means NN to forecast anything. Each individual has a unique set of

limitations that dictate how they will approach a particular objective. The most reliable and direct method which can be used to understand and recognise the viruses in the plants is BPNN.

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