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# AgroBot For Detecting Diseases With The Help Of Image Processing And Automatic Spraying Pesticides

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**ABSTRACT**

***Plant diseases are a noteworthy risk to sustenance security, however their quick distinguishing proof stays troublesome in numerous parts of the world because of the non-attendance of the important foundation. Emergence of accurate techniques in the field of plant-based image classification has shown impressive results. This paper makes use of CNN in identifying between healthy and diseased plant from the data sets created. Our proposed paper includes various phases of implementation namely dataset creation, feature extraction, training the classifier and classification. The created datasets of diseased and healthy plants are collectively trained under CNN to classify the diseased and healthy images. For extracting features of an image we use Histogram of an Oriented Gradient (HOG). Overall, using machine learning to train the large data sets available publicly gives us a clear way to detect the disease present in plants in a colossal scale. Crop diseases are a noteworthy risk to sustenance security, however their quick distinguishing proof stays troublesome in numerous parts of the world because of the non-attendance of the important foundation. Emergence of accurate techniques in the field of leaf-based image classification has shown impressive results. This paper makes use of CNN in identifying between healthy and diseased leaf from the data sets created. Our proposed paper includes various phases of implementation namely dataset creation, feature extraction, training the classifier and classification. The created datasets of diseased and healthy leaves are collectively trained under CNN to classify the diseased and healthy images.***

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## I. INTRODUCTION

Machine Learning behaves like self-learning concept which will work without any interruption of a human. Now a day's self-driving cars, hand-writing recognition, Stock market are some of the examples of Machine Learning concepts. Machine learning will be able to predict the future based on the past or historical data. A computer program is said to be learned from experience E with respect to some clause of task T and performance measure P, if its performance on T as measured by P improves with experience E. Machine learning broadly uses three major learning algorithms supervised learning, unsupervised learning, Reinforcement learning. Machine learning can be used in each and every routine task performed by human being.

The research work deals with plant disease prediction with the help of machine learning. A plant disease is a physiological abnormality. Once a plant suffers from any diseases it shows up certain symptoms. Crop diseases are a major threat to food security, but their rapid identification remains difficult in many parts of the world due to the lack of the necessary infrastructure. The combination of increasing global smartphone penetration and recent advances in computer vision made possible by deep learning has paved the way for smartphone-assisted disease diagnosis. Symptoms are the outward changes in the physical appearance that are gradually developed and can be witnessed by naked eyes.

Illustrations of symptoms are wilt leaf spots, rots, cankers and many more. The visible effects of disease can broadly categorize in following types: -

**Wilting,** it is loss of turgor pressure in a plant leading to temporary or permanent drooping of leaves, shoots, or entire plants from lack of water or infection by different pathogens.

**Spot**, is a definite, localized, round to regular lesion, often with a border of a different color, characterized as to location (leaf spot, fruit spot) and color (brown spot, black spot);

**Powdery mildew**, is a fungal disease that affects a wide range of plants. Infected plants display white powdery spots on the leaves and stems. As the disease progresses, the spots get larger and denser.

**Galls**, these are abnormal growths that occur on leaves, twigs, or branches. They may be simple lumps or complicated structures, plain brown or brightly colored.

**Dryness,** after normal aging process generally leaf's get dry and fall down from the tree, but at other times drying of leaves may be a symptom of fungal attacks.

In plant disease diagnosis, data provided is small and some of the values are missing that will require imputation of values we will replace all the null values with -1.

The proposed research work applies the concept of ensemble learning that is implemented through machine learning algorithms. After implementation the result is compare to get the model has the highest accuracy.

## II. LITERATURE SURVEY

[1] Autobot for Precision farming

Today's scenario farmers are striving hard to cultivate the land and yield the production. In this paper Robot runs with many components as a multifunctioning robot. The several components used are camera, spraying mechanism, sensors. There are using login module and selection and display module. Relevance in project: To identify diseases we are using image processing technique. Then spraying mechanism are used for spray pesticides in the affected area. Information of all the crops are stored in database used by the farmer.

[2] Smart Leaf Infection Identification and Fertilizer Spray

In this paper an automated system has been developed to determine whether the plant is normal or diseased. This paper attempts to develop an automated system that detects the presence of disease in the plants. An automated disease detection system is developed using sensors like temperature, humidity and color based on variation in plant leaf health condition.

[3] AgRobots (A combination of image processing and data analytics for precision pesticide use)

India is mainly an agricultural country. This paper mainly deals with mechanism that uses image processing technique to analyze the ill part of the plant and provide pesticide to that part of the plant. In this proposed system openCV can be interfaced with the python for image processing .pesticide spraying mechanism is carried out by autonomous robot.

[4] Design and Development of Agrobot for Pesticide Spraying Using Grading System

India is a country where greater than 70% of people depends on agriculture. Agriculture is the column of Indian economic wealth. Our farmers work 24 hours to count over 1.20 billion. In India agriculture contributes about 16.1 % of full GDP and 10% of total transport. More than 60% land zone is cultivate building. Hence farmers need a well-founded system which can detect the infected crops. It's easy to use Agrobot to observe farms detect the diseases and automatically sprinkling.

## III.PROPOSED SYSTEM

The main aim of the proposed system is to detect plant diseases using IoT with Machine Learning. Hence, in the proposed work we have considered detection of plant disease present on leaves. The discrimination of normal and affected plant leaf can be measured based on variation in colour, Blight Spot, Rust, and Fungi. Image processing module (called as IP-module) with robotic setup will move over the land. First the camera is enabled then its start to capturing the plant leafs. Then these images are processed in order to Pre-processing, Feature Extraction, Segmentation and Classification with Machine Learning algorithm. The ip-modules details further forward through internet to end-users for analysis if any. After completing the identification process, a spray fertilizer module will spray & alert the end-user if disease identified otherwise it moves to another plants. In this project we are design the automatic robot module and leaf disease identification using image processing here.

Our working step process is following modules.

- Robot Modules
- Camera
- Sprinkler

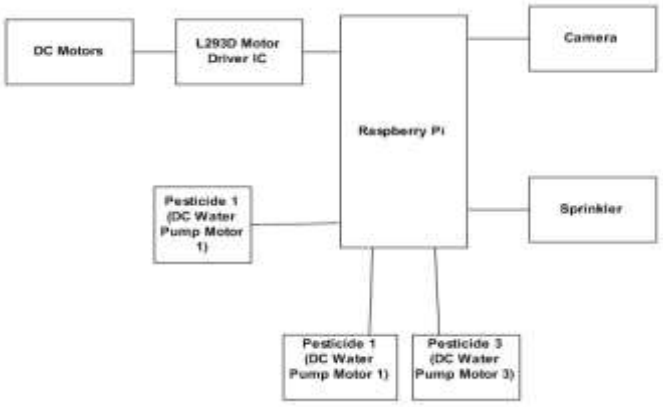



Fig.1:- System Architecture

**METHODOLOGY (CNN)**:

Convolutional neural network (CNN, or ConvNet) is a form deep learning and most commonly applied to analyzing visual imagery. CNNs use a variation of multilayer perceptrons designed to require minimal pre-processing. They are also known as shift invariant or space invariant artificial neural networks (SIANN), based on their shared-weights architecture and translation invariance characteristics. Convolutional networks were inspired by biological processes in that the connectivity pattern between neurons resembles the organization of the animal visual cortex. Individual cortical neurons respond to stimuli only in a restricted region of the visual field known as the receptive field.

The receptive fields of different neurons partially overlap such that they cover the entire visual field. CNNs use relatively little pre-processing compared to other image classification algorithms. This means that the network learns the filters that in traditional algorithms were hand-engineered. This independence from prior knowledge and human effort in feature design is a major advantage. They have applications in image and video recognition, recommender systems, image classification, medical image analysis, and natural language processing. A CNN consists of an input and an output layer, as well as multiple hidden layers. The hidden layers of a CNN typically consist of convolutional layers, pooling layers, fully connected layers and normalization layers**.**

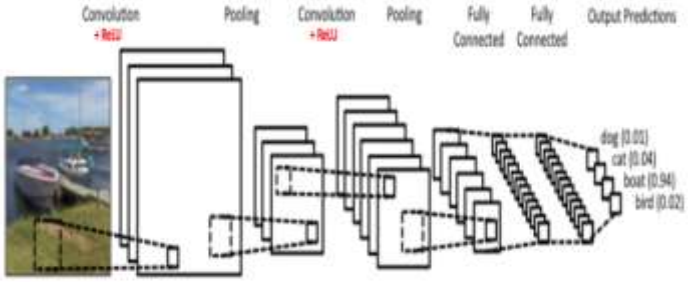



Fig2. Simple ConvNet

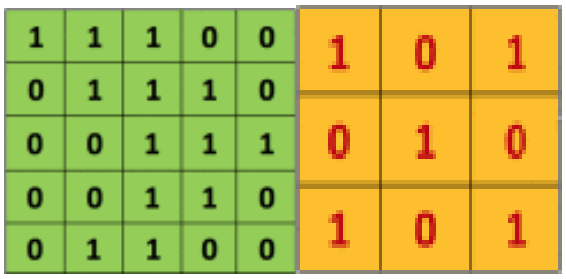
The Convolutional Neural Network in Fig. is similar in architecture to the original LeNet and classifies an input image into four categories: dog, cat, boat or bird. There are four main operations in the ConvNet shown in fig. above:

1. Convolution
2. Non Linearity (ReLU)
3. Pooling or Sub Sampling
4. Classification (Fully Connected Layer)

An Image is a matrix of pixel values. Essentially, every image can be represented as a matrix of pixel value Channel is a conventional term used to refer to a certain component of an image. An image from a standard digital camera will have three channels – red, green and blue – you can imagine those as three 2d-matrices stacked over each other (one for each color), each having pixel values in the range 0 to 255.

**The Convolution Step:**

ConvNets derive their name from the "convolution" operator. The primary purpose of Convolution in case of a ConvNet is to extract features from the input image. Convolution preserves the spatial relationship between pixels by learning image features using small squares of input data. We will not go into the mathematical details of Convolution here, but will try to understand how it works over images As we discussed above, every image can be considered as a matrix of pixel values. Consider a 5 x 5 image whose pixel values are only 0 and 1 (note that for a grayscale image, pixel values range from 0 to 255, the green matrix below is a special case where pixel values are only 0 and 1.




Also, consider another 3 x 3 matrix as shown. Then, the Convolution of the 5 x 5 image and the 3 x 3 matrix can be computed as shown in the animation in Fig below:

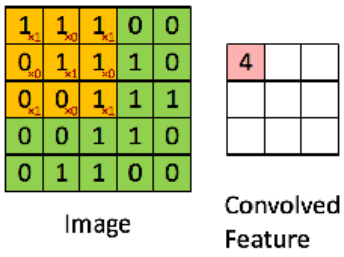



Fig3. The Convolution operation

The output matrix is called Convolved Feature or Feature Map. Take a moment to understand how the computation above is being done. We slide the orange matrix over our original image (green) by 1 pixel (also called 'stride') and for every position, we compute element wise multiplication (between the two matrices) and add the multiplication outputs to get the final integer which forms a single element of the output matrix (pink). Note that the 3×3 matrix "sees" only a part of the input image in each stride. In CNN terminology, the 3×3 matrix is called a 'filter' or 'kernel' or 'feature detector' and the matrix formed by sliding the filter over the image and computing the dot product is called the 'Convolved Feature' or 'Activation Map' or the 'Feature Map'. It is important to note that filters acts as feature detectors from the original input image.

It is evident from the animation above that different values of the filter matrix will produce different Feature Maps for the same input image. As an example, consider the following input image: It is evident from the animation above that different values of the filter matrix will produce different Feature Maps for the same input image. As an example, consider the following input image:

In the table below, we can see the effects of convolution of the above image with different filters. As shown, we can perform operations such as Edge Detection, Sharpen and Blur just by changing the numeric values of our filter matrix before the convolution operation– this means that different filters can detect different features from an image, for example edges, curves etc.


Introducing Non Linearity (ReLU):

An additional operation called ReLU has been used after every Convolution operation in Figure above. ReLU stands for Rectified Linear Unit and is a non-linear operation.

**The Pooling Step:**

Spatial Pooling (also called subsampling or downsampling) reduces the dimensionality of each feature map but retains the most important information. Spatial Pooling can be of different types: Max, Average, Sum etc.
In case of Max Pooling, we define a spatial neighborhood (for example, a 2×2 window) and take the largest element from the rectified feature map within that window. Instead of taking the largest element we could also take the average (Average Pooling) or sum of all elements in that window. In practice, Max Pooling has been shown to work better.
shows an example of Max Pooling operation on a Rectified Feature map (obtained after convolution + ReLU operation) by using a 2×2 window.

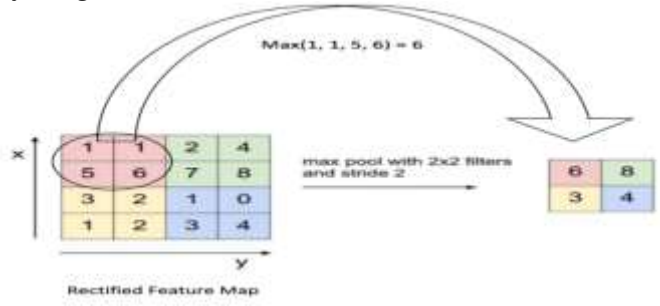



Fig5. Max Pooling

We slide our 2 x 2 window by 2 cells (also called 'stride') and take the maximum value in each region. As shown in Figure, this reduces the dimensionality of our feature map.

## IV. RESULT AND DISSCUSSION

In the proposed system, the plant disease is identified by image processing using the convolutional neural network (CNN) algorithm. Then the severity of the disease is identified by comparing value with the trained dataset and provides pesticides accordingly. In this proposed system the detection and curing of plant disease will be done automatically. Hence saving the loss and helps in agricultural field efficiently.

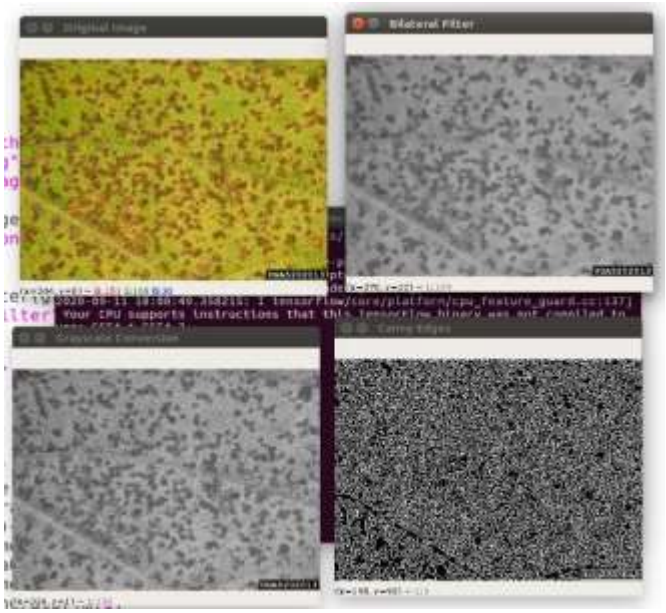


Fig 4: Image Processing

Fig 5: Robotic Module

Comparative results of existing and proposed system is as follow,

| **Parameters** | **Existing System** | **Proposed System** |
|---|---|---|
| Automatic detection of plant diseases | NO | YES |
| Automatic spraying of pesticides | NO | YES |
| AI based approach | NO | YES |
| CNN | NO | YES |
| Improved Speed | NO | YES |

| | | |
|---|---|---|
| Robotic Module | NO | YES |
| Image Processing | NO | YES |

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