Identification and Prevention of crops disease using AIML

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Abstract:

Agriculture is the back bone of India. According to 2021 report 58% of Indian population depends on agriculture for their livelihood. Agriculture shares 19.9 per cent of the Indian GDP. Surprisingly though agriculture share 19.9% of the Indian GDP there is no or very little intervention/use of computer-based technology. The agricultural output per acre in much less compared to the international output. The major reason for this is 1.) Poor disease management of the crop and 2.) Non proper use of fertilizer leading to nutritional deficiency in the crop and further exposing the crop to pest infestation/disease.

Indian farmer depends on personal inspection of the field for disease identification and nutritional deficiency this method has several shortcomings. 1.) Delay in identification 2.) Lack of proper knowledge 3.) Type of disease and their symptoms and the intervention needed 4.) Many a time overlapping symptom of disease and nutritional deficiency lead to wrong identification and intervention.

The above shortcoming leads to 1.) Delayed intervention by the farmers 2) Generalized approach leading to excessive, rampant, and non-proper use of pesticide and fertilizer. Thus, leading to quality detoriation, loss of yield and also increased cost of production.

The above issue of the delayed and non proper identification of causative pathogen genralized approach and hence rampant use of pesticide and nutritional deficiency can be addressed by involving Computer vision employed with AIML. One such Machine Learning algorithm is image processing using Convolutional Neural Networks (CNN). It will help the framer by classifying the crop disease and provide then the exact cure and prevention from the disease. Scanning camera using raspberry pi installed in the farms can scan the field the at regular interval and give the exact location of the affected area, which will help in early detection of the disease. The above approach shall help the farmer in timely and exact identification of the infestation and shall provide the farmers with tools to help proper disease management and nutritional manage. This will in conclusion help in decrease his cost of production, improve the quality and yield of his crop and will which will in return increase his revenue and thus profiting the framers.

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Keyword: early crop disease detection, Machine learning, CNN, Scanning camera.

I. Introduction:

Plant disease interferes with the normal functioning of the plant. All plant wild or cultivated are subjected to disease. Types of plant disease vary from season to season and depends on various factor such as:

1. Climate condition.
2. Environmental condition conducive to pathogens.
3. Pathogens.
4. Geographical location.
5. Presence of nematodes.
6. Also, some plants are more susceptible/resistant to pathogens.

Loss of crop from plant disease can have significant economic impact causing reduction in income to producers and higher price for consumer. An annual loss of 30 to 50 percent are not uncommon for major crops. Major disease outbreak have resulted in causing hunger, starvation and also migration.

Many valuable crops are very susceptible to disease and would have difficulty in surviving without human intervention.

Plant Disease Identification:

In general, a plant is said to be diseased when it is continuously disturbed by some disease-causing agent that results in abnormal physiological process that disrupts the plant normal structure, growth, function or often activities.

This interference with plant physiological system results in pathological condition or symptom. Plant disease can be majorly classified into categories infectious and non-infectious.

Infectious disease is caused by pathogenic organisam such as:

1. Fungus
2. Bacterial.
3. Viruses
4. Nematodes or parasites.

Non-infectious disease is caused by unfavourable growing atmospheric condition or excess or deficiency of essential mineral.

Diagnosis of plant disease:

Rapid and accurate diagnosis of plant ailment is critical in advance than proper control measures may be suggested diagnosis is largely based totally on feature signs expressed by means of the diseased plant identification of pathogen is also vital there are 3 steps include in analysis

1. Careful declaration
2. Kind of the records
3. Evaluation of the facts and logical decision to the reason

Examination of leaves is usually considered to be the best start line in disorder analysis the shade length form and margin of spots and blight lesion are regularly associated with precise fungus or micro organism.

Eg insect injured leaves typically show holes

For better crop yield and economic benefits to the framer there is an increasing awareness to for quick identification of plant disease causative pathogen and solution for disease control. The development of instrumentation for automated technology allow a large number of specimen to be scanned in a short period of time.

The result read automatically and analysed by a computational program to identify plant disease and causative pathogen.

II. Related work:

Monica Jhuria et al uses image processing for detection of disease and the fruit grading in [1]. they've used artificial neural community for detection of disease. they have got created separate databases, one for the schooling of already stored disease images and different for the implementation of the question pix. lower back propagation is used for the load adjustment of training databases. They don't forget 3 feature vectors, namely, color, textures and morphology [1]. they have got located that the morphological characteristic offers higher end result than the other two functions.

Mrunalini R. Badnakhe, Prashant R. Deshmukh compare the Otsu threshold and the k-approach clustering algorithm used for inflamed leaf analysis in [2]. they've concluded that the extracted values of the functions are much less for ok-means clustering. The clarity of ok-method clustering is extra accurate than other method. Adnan Mushtaq Ali Karol1 , Drushti Gulhane2 , Tejal Chandiwade3 used CNN for identity of plant disorder and affords remedies that may be used as a protection mechanism against the sickness. They used drone for higher insurance of the sector to screen the plants.[3]

III. Proposed Methodology:

Machine learning has a wide application in various fields. The most common machine learning technique is image recognition. Here we will be doing the same for proper crop disease management, where we will be processing the image of the plant obtained by cameras installed at strategic locations in the field using CNN to provide us the exact name of the disease and the cause of it and thus suggesting the way to cure it.

The method we used is:

1.) Taking image through scanner installed.
2.) Identifying the exact affected area.
3.) Dataset.
4.) Image recognition using CNN.
5.) Suggesting cure.

- **Scanning camera:**
  Scanning camera installed in the field at fixed location will scan the entire field at strategic location the image then can be uploaded in the system and processed by CNN algorithm.
- **Dataset:**
  Plant disease are majorly classified into two broad category infectious and non infectious infectious disease are caused by bacterial, fungal insect and viral., non infectious disease are caused by unfavourable atmospheric condition or nutritional deficiencies Each are caused by different factor and has different/overlapping symptoms and different cure. A centralized database with all possible type of disease will help the farmer to identify the exact disease why it is caused and what is the cure. For testing we have taken

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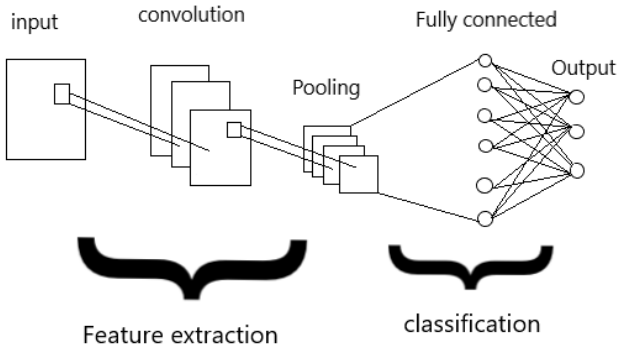
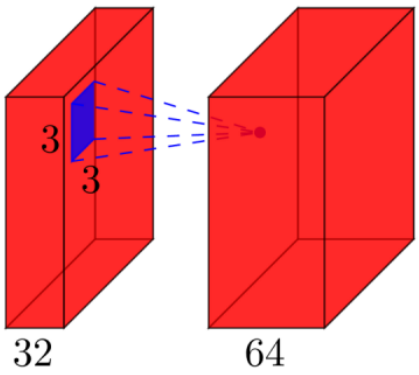
Soyabean crop and listed all possible disease and classifies then into the above category.

Fig 1(image source: plantvilla)

- Convolutional neural network:



Convolutional Neural Networks (CNN) is a machine learning algorithm which help to recognise the image accurately. By the use of this algorithm, we can take out the exact disease by processing the image.
There are various layer in CNN network.
Input Layer: All the input layer does is read the image.
Convolutional Layer: Consider a convolutional layer which takes "l" feature maps as the input and has "k" feature maps as output. The filter size is "n*m".



Pooling Layer: There are no parameters you could learn in pooling layer. This layer is just used to reduce the image dimension size.
Fully-connected Layer: In this layer, all inputs units have a separable weight to each output unit. For "n" inputs and "m" outputs, the number of weights is "n*m". Additionally, this layer has the bias for each output node, so "(n+1)*m" parameters.
Output Layer: This layer is the fully connected layer, so "(n+1)m" parameters, when "n" is the number of inputs and "m" is the number of outputs.
After getting image from the scanner camera installed in the field it will be processed (resized, reshaping) and converted into array using CNN . The model will be trained by using the dataset then the result will be classified into healthy or not healthy.

- **Suggesting cure**:

After successfully processing the image and classifying the image. The system will provide the disease, its type and, then it will give the solution to the farmer and the and it will suggest the preventing measures for the future.

CROP	DISEASE	TYPE	CURE
SOYABEAN	Alternaria Leaf Spot	Fungal	Strobilurin fungicides
SOYABEAN	Bacterial blight.	Bacterial	combination of copper and mancozeb-containing fungicides
SOYABEAN	Asian Soybean Rust	FUNGAL	Synthetic fungicides

Table 1: Soyabean crop Disease and the solution

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- **System overview**:

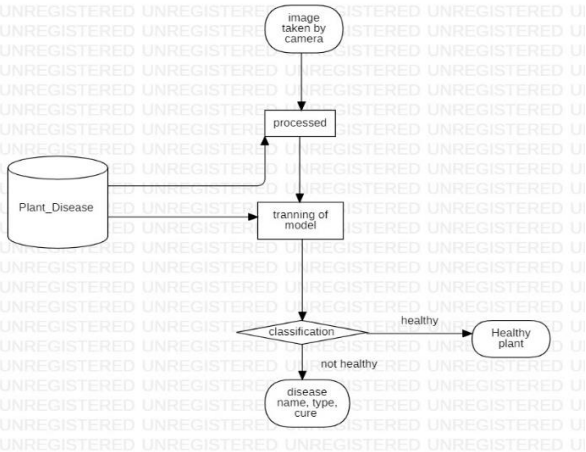

Fig 3 control flow of the model

IV. Conclusion:

Using Computation Vision program in agriculture will help the farmers increase their per acre output. With the help of Machine learning algorithm (CNN) in agriculture the major issue of crop disease identification is easily addressed and can be solved. This methodology will save the input cost, time and effort of the farmer and will increase their yield and output cost. With the help of this farmers will have a control on the pesticide and fertilizer usage.

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