Hybrid algorithm in identifying the plant disease and to suggest medical advice

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Abstract. Agriculture sector is the most important which is the reason for the life of every human being and every living objects in this world. The top tier problem of all formers in agriculture is to recognize the disease affected in a particular crop and their causes. Some disease spread easily and quick that may lead to disaster in the targeted production of that particular period. To overcome this problem, it would be best to recognize the diseases affected at initial stage. There are many systems exist for recognize the disease but these systems are concentrate only on the particular parts of the plant such as leaf, steam etc, and more over they did research using artificial neural networks (ANN) and some of the paper using support vector machines algorithm (SVMs). By using these algorithm, they can only detect whether it is affected or not and also they can concentrate only on the particular parts of the plant such as leaves. But this is not efficient. To overcome this demerit in our proposal we are aimed to concentrate on the entire plant for this purpose we are using the combination of following algorithms recurrent neural networks (RNNs), support vector machines (SVMs) and random forest algorithm. By using these algorithm, we can design a system which is more efficiently identify the plant’s diseases compare to the previous systems which is based on the image(plant) provided by the end user after identification process we provide complete information about the plant’s current condition and what type of pesticide should be used and how long it to used. In our system we are also plan to provide periodic intimation to the end user for the image of the affected plant for the purpose of tracking the diseases condition and provide complete agri assistant until the plant completely recovered from the disease. Our proposal mainly concentrates on the formers who are all not having sufficient knowledge about the plant disease, this system will save money and time of the formers.

1. Introduction

Agriculture is a backbone of India and many other countries all over the world. In Agriculture farmer’s main issue is crop disaster that occurs due to the lack of knowledge in various crop diseases, their diagnosis and their treatment. Crop diseases occur due to climatic changes; these climatic changes develop pathogen in the crops. This pathogen changes the crop’s host resistance
due to which it develops more pathogen interactions in crops. Pathogen’s growth disturbs crop’s characteristics. This situation gets complicated as the diseases spread more vigorously. When a particular pesticide is used on a crop for a longer duration, this may lead for a particular disease to fight against that pesticide which forms new disease that is more powerful than a previous one. So, this may lead us for the need of another pesticide to destroy the disease that formed (see ref [1-7]). Due to this occurrence, there is wastage of time and money. To overcome this loss of time and money we need to identify the disease and prevent them as soon as possible to save the crop from such disaster. There are many techniques to overcome this problem one of the technique is diagnosis of the crop by a trained professional and providing remedy for that particular disease but this not helpful for the farmers as this is expensive [8]. Another solution is technical but this existing systems concentrates only on a plant’s particular part such as leaves, stem, etc. Thus, none of them are efficient enough to solve this problem.

To overcome this problem, in this proposal we designed a efficient intelligent crop disease diagnosis and agri adviser system which concentrates on every part of the plant such as stem, leaves, fruits, flower, bud, node, branch. This is carried out by combining two technical more efficient algorithms that are recurrent neural networks (RNNs), support vector machines (SVMs) and random forest decision tree algorithm that are more accurate when compared to previous systems. In previous systems they commonly used artificial neural networks (ANN) and support vector machines to detect whether the crop is affected or not because artificial neural networks can recognize only images and support vector machines are capable of providing information such as affected or not (yes or no) cases. Thus, by combining these two technologies we are able to conclude only whether a crop is healthy or affected but this is not enough to obtain entire detail about the disease and their remedies [9,10]. To overcome this demerit, in our proposal we are going to use more intelligent efficient algorithm for image recognition and decision tree algorithm to predict which type of disease affected and more over we are also using support vector machine algorithm to increase the accuracy for identification purpose.

2. Review works

Numerous methodology yisas of now being used for identifying and analyzing plant disease using computer vision. One of the methods in infection identification is by removing shading highlight of the infected plant. In our proposed paper YCB Cr,HIS and CIELB shading models that utilized as a part of the investigation. After result, disease recognizes that effectively distinguished and stay unaffected by the commotion from various sources, for example, camera streak. What’s more, plant disease discovery could be accomplished by separating shape highlights technique. In this strategy we utilize threshold segmentation to decide every last region of a plant and triangle threshold for lessoning area, getting the normal exactness of 98.60% at the last test [11]. Encourage more, separating surface element could be utilized as a part of recognizing plant diseases. The surface element incorporates, for example, inertia, homogeneity and connection got by ascertaining the dim level co-occurrence network on image [12-14]. Blend of every one of these highlights gives a hearty highlight set to image change and better classification. Due to the quick advance of artificial intelligence, work in this paper is primarily centered around applying these philosophies and strategies. The method proposed by the writers consolidate the highlights separated by Particle Swarm Optimization (PSO) and forward neural system in bearing of deciding the harmed spots of a plant and enhancing the precision of the framework with the last general exactness of 95%. Likewise, recognition and differentiation of plant illnesses can be accomplished by utilizing Support Vector Machine calculation (SVM).

This system was executed for plant ailment and introduced in, where, contingent upon the sort and the phase of sickness, the grouping exactness was in the vicinity of 65% and 90%. In like manner, there are techniques that join the component extraction and Neural Network in Ensemble (NNE) for plant disease recognition. Such strategy was actualized just to recognize plant infections with definite testing exactness of 91%. In our examination, we misuse the profound learning strategy for plant sickness acknowledgment, driven by evolvement of profound learning system and application by and by. Broad pursuit of the cutting edge writing yielded no
confirmation that specialists investigated profound learning approach for plant diseases acknowledgment from plant images. Our technique for acknowledgment by applying profound RNN is exhibited in the areas underneath [15]. In this proposition we utilize irregular fairest calculation. This calculation is utilized to recognize the part or territory of a plant which is influenced by what sickness or its sort of illness, since this calculation is more proficient calculation that gives correct arrangement among n number of arrangements, and it is utilized for more productive and precise choice acquiring purpose. Here we uncommonly made utilization of arbitrary woodland calculation since it consolidates numerous choice trees with a specific end goal to make the framework more effective and exact in its outcomes [16].

Recurrent Neural Networks (RNN) is a category of artificial neural network which has become more familiar in the recent years. The RNN may be a special network, that has not like feed forward networks repeated connections. the key profit is that with these connections the network is able to seek advice from last states and may thus method whimsical sequences of input. the essential distinction between a feed forward nerve cell has solely connections from his input to his output. The repeated nerve cell instead has additionally an affiliation from his output once more to his input and thus it's during this example 3 weights. This third additional affiliation is termed feedback affiliation and there with the activation will flow spherical in an exceedingly loop. Once several feed forward and repeated neurons area unit connected, they kind a repeated neural network. The ability to store info is important for applications like speech process, non-Markovian management, and music composition [17].

In addition, RNN are used with success for serial information like handwriting recognition and speech recognition. The big advantage as compared to feed forward networks is, that RNN will handle sequent knowledge as represented within the paragraph before. During a single RNN is projected for sequence labeling. Most booming applications of RNN sit down with tasks like handwriting recognition and speech recognition. they're conjointly employed in for Clinical call support systems. They used a network supported the Jordan/Elman neural network. what is more during a continual fuzzy neural network for management of dynamic systems is projected. Newer application that uses combos of RNN with CNN area unit for scene labeling and object detection. The RNN offers 2 major advantages: Store data the continual network will use the feedback affiliation to store data over time in sort of activations. This ability is critical for several applications. Within the continual networks area unit represented that they need some sort of memory.

2.1 Learn Sequential Data

The RNN will handle ordered knowledge of discrentional length. The default feed forward network is which might simply figure one fastened size input to at least one fastened size output. With the continual approach conjointly one to several, several to at least one and plenty of of to several inputs to outputs ar attainable. One example for one to several networks is that you simply label a image with a sentence. the various to at least one approach may handle a sequence of pictures (for example a video) and turn out one sentence for it and eventually the various to several approach will be used for language translations. Different use cases for the various to several approaches might be to label every image of a video sequence. A decision tree may be a structure that features a root node, branches, and leaf node. Every internal node denotes a check on Associate in Nursing attribute, every branch denotes the result of a check, and every leaf node holds a category label. The upmost node within the tree is that the root node.

The advantages of decision tree

• It doesn't need any domain data.
• It is simple to grasp.
• The learning and classification steps of a choice tree are easy and quick.
Tree pruning is performed in order to remove anomalies in the training data due to noise or outliers. The pruned trees are smaller and less complex.

2.2 Diseases
Tomato disease is once in a while lethal if the correct administration is utilized. It is critical to come down with any tomato infection early, before it spreads to the greater part of your tomato plants and conceivably different plants in a similar family, for example, potatoes, egg plants, and peppers. Here are some normal tomato maladies, their side effects and what to do if tomato sicknesses debilitate your home vegetable garden.

1) Tomato Diseases - Foliage
2) Early Blight

Fig.1 Shows the tomato Disease and Early Blight that can influence the foliage, stems and product of tomatoes.
Indications: Dark spots with concentric rings create on more seasoned leaves first. The encompassing leaf zone may turn yellow. Influenced leaves may kick the bucket rashly, presenting the organic products to sun singe.
Administration: Early Blight parasite over winter sin plant deposit and is soil-borne. It can likewise come in on transplants. Expel influenced plants and completely clean fall plant trash.

Wet climate and focused on plants improve the probability of assault. Copper and additionally sulfur splashes can avoid encourage improvement of the organism. The biofungicide Serenade reduces issues.

2.3 Gray Leaf Spot
Gray Leaf Spot influences just the leaves of tomatoes, beginning with the most established clears out.
Side effects: Small, dim spots that can be seen on both the best and base surfaces of the clears out. The spots develop and turn a grayish dark colored. In the end, the focuses of the spots split and drop out. Encompassing leaf territories will turn yellow and the leaves will dry and drop.
Natural product generation is restrained.
Administration: Warm, clammy conditions intensif y gray leaf spot issues. Evacuate every influenced plant and fall plant flotsam and jetsam. Select safe assortments.

2.4 Late Blight
Fig.2 Late blight influences both the leave sand product of tomatoes. Late Blight is the illness in charge of the Irish Potato Famine. Late Blight spreads quickly. Cool, wet climate supports the improvement of the parasite. On the off chance that you speculate you have Late Blight, contact your Local Extension Service for distinct ID.
Fig. 2 Late Blight in Tomato plant

Manifestations: Greasy looking, unpredictably formed gray spots on clears out. A ring of white form can create around the spots, particularly in wet climate. The spots in the long run turn dry and papery. Darkened regions may show up on the stems. The natural product likewise grows huge, unpredictably molded, oily gray spots.

Administration: Copper showers offer some control. Serenade® works best as an impediment, instead of a cure.

Fig. 3 shows the Late Blight growth can spread over winter in ice free regions. Since it spreads to potatoes, it likewise overwinters in potato flotsam and jetsam and seed, even in colder zones.

Fig. 3 Late Blight spread in full leaf

2.5 Septoria Leaf Spot

Fig. 4 shows Septoria Leaf Spot is once in a while mixed up for Late Blight. Manifestations: The papery fixes on the leaves create little, dull bits inside them. More established leaves are influenced first.

Administration: Copper showers and Serenade® are fairly successful at ending the spread of indications.

Fig. 4 Septoria Leaf spot Disease

2.6 Southern Blight

Southern Blight shows as a white shape developing on the stem close to the dirt line.

Indications: Dark, round spots will show up on the lower stem and both the external and inward stem will move toward becoming stained. Southern Blight organism
supports the tomato stem and keeps the plant from taking up water and supplements. Youthful plants may crumple at the dirt line.

Administration: Crop turn appears to help. There has additionally been some confirmation that additional calcium and the utilization of composts containing ammonium offer some insurance.

Developing crisp tomatoes is one of the genuine delights of the vegetable cultivator. However, tomatoes can experience the ill effects of a wide range of ailments and bugs. Issues developing tomatoes are frequently the consequence of climate conditions. This is something that is out of the cultivator's control. In any case, on the off chance that you know your region is inclined to a specific illness, you should search for assortments that are recorded as safe. Your nearby Cooperative Extension Service ought to have the capacity to help you there.

2.7 Tomato Diseases -Fruit
Tomato sicknesses are once in a while deadly if the best possible administration is utilized. It is critical to get any tomato illness early, before it spreads to the greater part of your tomato plant sand conceivably different plants in a similar family, for example, potatoes, eggplants, and peppers. Fig.5 shows some basic tomato infections, their side effects and what to do if tomato ailment sunder mine your home vegetable garden.

![Fig.5 Basic tomato infections, their side effects](image)

2.8 Anthracnose
Anthracnose is an exceptionally regular growth that causes tomato natural product to decay. Indications: Small, round, indented spots show up on the natural product. The spots will increment in measure and obscure in the middle. A few spots may converge as they augment. The growth is frequently sprinkled onto the natural product from the dirt. It can likewise grab hold on Early Blight spots or kicking the bucket clears out. Wet climate supports the improvement of Anthracnose. Overripe tomatoes that interact with wet soil are particularly helpless. Fig.6 shows Bacterial Speck, there are a few bacterial issues that influence tomatoes including Bacterial Speck. Side effects: Tiny, raised, dim spots, for the most part with a white fringe.

![Fig.6 Bacterial side effect in Tomato Fruit](image)

Administration: Copper fungicide at first indications of side effects.
2.9 Blossom End Rot
Blossom End Rot is as great a portrayal as any.

Side effects: Dark brown/dark spots create at the blossom end of the leafy foods as the natural product decays. Administration: Generally credited to an absence of calcium amid organic product set. This could be caused by a lot of high nitrogen compost or uneven watering, bringing about changes of supplement accessibility.
Administration: Remove influenced foods grown from the ground general, profound watering. More data and photograph

2.10 Buck eye Rot
Fig.7 and shows Buckeye Rot in tomato and in other fruit which is more typical in Southern states, particularly amid wet periods. Side effects:

Buckeye Rot is like Blossom End Rot, with the exception of on green natural product. On matured natural product, the decaying region will show up water-doused, yet not dull in shading. The spoil creates on the zone of the organic product that touches the dirt. The spot will amplify and create concentric rings that take after a buckeye. The influenced region is smooth, recognizing it from Late Blight, which has an unpleasant surface.
Administration: Remove influenced leafy foods future organic products from contact with the dirt.

3. Methodology
The principle point of this proposition is distinguishing infections of a plant by utilizing an idea of image acknowledgment and anticipating the illness that happened by utilizing effective machine learning calculation. The procedure is completed by the accompanying advances.
3.1 Dataset
A specific arrangement of information is required at each phase of question acknowledgment from preparing stage to execution and till assessing. All the images that are gathered for dataset by downloading from internet, searched by ailment and plant name on different sources and after that they are assembled into various classes in light of their indications and ailments.
So as to perceive solid plant another class is added to the dataset. A additional class in the dataset with foundation images was gainful to acquire more precise result. Thus, profound neural system could be prepared to separate the plant from surrounding. All copy images is evaluated utilizing python content with metadata about its name, size, color.
Following stage is to advance the data set utilizing expanded images. The primary intention is to prepare the neural networks to recognize the solid plant and influenced plant and furthermore to separate the influenced plant among the ailments that is caused to distinguish which kind of disease is influenced to the plant. Finally specific arrangement of images for approval has been made and kept up.

3.2 Image processing and labeling
Images that have been downloaded from web were in different organizations alongside different resolutions and quality and with a specific end goal to get best highlighted image that is which would be a last images be utilized as dataset for profound neural system classifier were handled keeping in mind the end goal to pick up consistency while image processing. Besides cropping of image as a square in the district to be concentrated amid image preprocessing concepts. The image with determination less than 500 pxl were not considered as substantial image for dataset. The image is resized to 256 x 256 to decrease time of preparing that is naturally processed by composed content in python. The exactness of classes in dataset is assembled by watchwords search, agriculture specialists inspected each piece of a plant images and named every one of the images with fitting disease. Finally copy images are expelled from a dataset.

3.3 Augmented process
The fundamental purpose behind executing growth is to expand the dataset and distinguish slight changes occurred. The image increase contained one of a few change methods including relative transformation, perspective transformation, and basic image pivots. Relative changes were executed to express interpretations and revolutions where it is normal that a parallel line in unique image are as yet parallel in yield image. Point of view change 3 x 3 grid was required where straight line stays straight even after the transformation. Simple turns were connected and in addition pivot on various hub by different degrees were connected. The procedure of enlargement was fit the requirements, the leaves in indigenous habitat could differ in visual perspective. The expanded process for various images from a dataset is mechanized utilizing a specific application created in c++ utilizing open cv library so the parameters can be changed with expanding adaptability

4. Neural network training
Profound neural system was prepared with the end goal that it distinguishes the illness exactly. There are a few surely understood State-of-the- workmanship profound learning frameworks, such as python library and machine learning library that broadens Luo, torch7. CaffeNet show is principally used to manage vast dataset. Caffe system is appropriate for both research and industry purpose.

5. Experimental results
In our system, we are more efficiently identifying the plant disease and we provide medical advice to them. In previous system they where only find disease for particular part of the plant but we are develope a system which capable of finding disease in entire plant. the existing system they are not providing the periodic update or intimation to the farmers about the condition about the plant and disease but in our system, we ate providing periodic update about asking the image of the plant and providing medical assistant based on that and providing addition information
such as growth rate so on. The out of our system contain what is disease which affect the plant and what is remedies for that such as how much pesticide to be used and how long it is to be used additionally provide the information such as when next periodic update is given and growth rate of the plant. We are planned provide voice assistant to the farmer who is not capable of reading the text. Which may improve the user-friendly nature of the application.

6. Conclusions and future enhancement

Our motive in this paper is to provide complete guide to a farmer to provide high yield in agriculture. in the previous proposal the system deals only with leaves but in our system, it deals with all parts of a plant such as leaves, stem, fruit, flowers etc. Here we use a technique of recurrent neural networks (RNN) and support vector machines to provide best and efficient results so that it would guide a farmer to get a complete idea of a disease affected to a crop such as type of disease, prevention, and its treatment so that production automatically increases.

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