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Plant Disease Detection and Comparison of Organic and Chemical Products Effects Using Machine Learning

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ABSTRACT: Disease detection is the biggest challenge for the farmers in the field of agriculture. This project describes a software prototype system for identifying the disease along with disease control methods. Farmers have to capture the image of the disease affected leaf. Then they have to upload this image to the software. Identifying disease over crops is one of the major challenging tasks for the crop technicians and farmers in the field of agriculture. This also causes damage to crops leading to low yield and to the farmers. Image database of the disease is also taken for consideration. Set of training images are compared with the testing images to enable. The convolutional neural network classification approach is adopted to identify the class of disease. Then organic and chemical pesticide is recommended for the disease which is identified. Finally, both the pesticides are compared and best among them is predicted.

KEYWORDS: Plant disease detection, CNN, Max pooling, Infected leaf.

I. INTRODUCTION

Agrarian efficiency is something on which economy profoundly depends. This is the one of the reasons that disease recognition in plants assumes a significant job in agribusiness field, as having disease in plants are very characteristic. In the event that appropriate consideration isn't taken here, at that point it causes genuine impacts on plants and because of which individual item quality, amount or efficiency is influenced. Recognition of plant sickness through some auto-programmed strategy is useful as it diminishes a huge work of observing in huge ranches of crops, and at beginning period itself it identifies the side effects of sicknesses for example at the point when they show up on plant leaves.

Innovation helps individuals in expanding the generation of food. Anyway the generation of food can be influenced by number of factor, for example, climatic change, infections, soil fruitfulness and so forth. Out of these, disease plays major job to influence the generation of food. Agriculture plays a significant job in Indian economy. Leaf spot infections debilitate trees and bushes by intruding on photosynthesis, the procedure by which plants make vitality that supports development and guard frameworks and impacts survival [1].

Over 58% smallholder rancher relies upon horticulture as their head methods for occupation. In the creating scene, more than 80 percent of the agrarian creation is produced by smallholder ranchers, and reports of yield loss of more than half because of vermin and illnesses are common [2]. The creation is diminishing step by step with different variables and one of them is sicknesses on plants which are not identified early arrange.

Different endeavours have been created to avoid crop misfortune due to maladies. Chronicled methodologies of broad application of pesticides have in the previous decade progressively been enhanced by coordinated irritation the board (IPM) approaches [7]. Autonomous of the methodology, distinguishing an illness effectively at the point when it initially shows up is a vital advance for proficient illness the board. Verifiably, ailment recognizable proof has been upheld by farming augmentation associations or other organizations, for example, neighbourhood plant facilities. In later occasions, such endeavours have also been upheld by giving data for sickness finding web based, utilizing the expanding web infiltration around the world. Considerably more as of late, devices in view of cell phones have multiplied, exploiting of the generally unrivalled fast take-up of cell phone innovation in all pieces of the world [8].

There is different work is done in earlier years. Bacterial sickness lessens plants development rapidly so to distinguish this kind of infections, Identifying the ailment at beginning time and proposing the arrangement so greatest mischief can be maintained a strategic distance from to expand the harvest yield have utilized ANN and K-intends to group the ailment and grade the ailment for. There is a need to structure the programmed framework to identify the leaf ailment and suggest the correct pesticide.

So as to create exact picture classifiers for the reasons of plant disease determination, we required an enormous, confirmed dataset of pictures of unhealthy and solid plants. To address this issue, we have used datasets that are accessible from Shri TaralabaluKrishi Kendra, Davangere.

Paper is organized as follows. Section II describes related works of plant disease detection and guide to our proposed work. Datasets collected along block diagram and Architecture of proposed system is given in Section III. Section IV presents results showing results of images tested. Finally, Section V presents conclusion.

II. RELATED WORK

In 2017, Vijai Singh A.K. Misra exhibits a calculation for picture division method which is utilized for programmed identification and order of plant leaf illnesses. It moreover spreads overview on various infections characterization strategies that can be utilized for plant leaf illness identification. Picture division, which is a significant angle for sickness discovery in plant leaf illness, is finished by utilizing hereditary calculation.

In 2016, SharadaPrasannaMohanty, David Hughes and Marcel Salathe Utilizing an open dataset of 54,306 pictures of ailing and sound plant leaves gathered under controlled conditions, they train a profound convolutional neural system to distinguish 14 harvest species and 26 ailments (or nonattendance thereof). The prepared model accomplishes an exactness of 99.35% on a held-out test set, exhibiting the practicality of this methodology.

In 2016, DavoudAshourloo, Hossein Aghighi, Ali Akbar Matkan, MohammadReza Mobasheri, and Amir Moeini Rad uses the spectra of the contaminated and non-tainted leaves in various infection manifestations were estimated utilizing a non-imagingspectroradiometer in the electromagnetic district of 350 to 2500 nm. So as to deliver a ground truth dataset, we utilized photographs of an advanced camera to figure the infection seriousness and ailment manifestations portions. At that point, extraordinary test sizes of gathered datasets were used to prepare each technique.

In 2016, Noa Schor, Avital Bechar, Timea Ignat present an automated location framework for joined recognition of two significant dangers of nursery ringer peppers: Powdery buildup (PM) and Tomato spotted wither infection (TSWV). The framework depends on a controller which encourages arriving at different location presents. A few identification calculations are created dependent on head part investigation (PCA) and the coefficient of variety (CV). Tests find out the framework can effectively identify the plant and arrive at the identification posture required for PM, yet it experiences issues in arriving at the TSWV discovery present.

In 2016, Lucas G. Nachtigall and Ricardo M. Araujo ponders the utilization of Convolutional Neural Systems to naturally distinguish and characterize sicknesses, wholesome insufficiencies and harm by herbicides on apple trees from pictures of their leaves. This errand is basic to ensure a high nature of the subsequent yields and is at present to a great extent performed by specialists in the field, which can seriously constrain scale and include to costs.

In 2016, DavoudAshourloo, Ali Akbar Matkan planned for building up an unearthly malady file that can distinguish the phases of wheat leaf rust malady at different DS levels. To meet the point of the investigation, the reflectance spectra (350–2500 nm) of tainted leaves with various side effect parts and DS levels were estimated with a spectroradiometer.

From above case studies, it is clear that plant disease is one of the main factor to affect the agriculture sector. Hence, detection of plant disease plays an important role. These study convey all possible factors for detection of plant diseases and its possible detection methods which are classical and also our proposed system. The studies show that even there exists classical methods using CNN, KNN and many more methods to detect plant disease. Our proposed system is more accurate in detecting it in all possible ways and also recommending organic products to prevent diseases in plants and also for better yield.

III. METHODOLOGY

MODULE DESCRIPTION

The fundamental point is to structure a framework which is proficient and which give disease name and pesticides name as quick as conceivable. For that reason, we utilize two stage: first is training stage and second is testing stage. In first stage: Image procurement, Image Pre-preparing and CNN based preparing. In second stage Image procurement, Image Pre-preparing, classification and disease distinguishing proof and pesticides identification. For experimentation reason we have utilized Sri TaralabaluKrishi Kendra datasets.

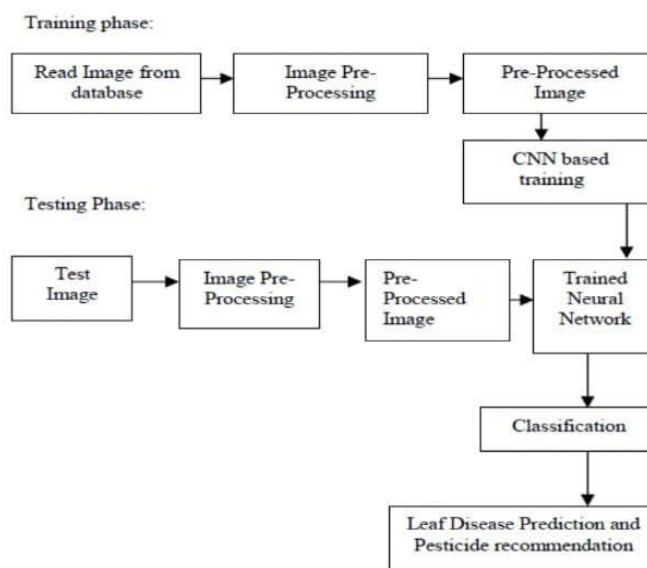


Fig.1: Block diagram of proposed system

❖ **Image Acquisition:** For training, Image is taken from database. And for testing, you can take image from camera at real time but in this project, we made a particular folder on mobile from that image will be fetched by android application and send through java web services i.e. tomcat server to server side system on which pre-processing is done and later on algorithm test that particular image.



Fig. 2: Sample images of leaves from dataset

❖ **Image Pre-Processing:** Image should be processed before sending to the algorithm for testing and training purpose. For that purpose, in this project image is scaled or resize into 150 x 150 dimensions. As we used colour image so that we don't need any colour conversion techniques and that pre-processed image is directly passed to algorithm for training and testing purpose.

❖ Convolutional Neural Network: Once pre-processing is done, then CNN is used for training purpose and after that we get trained model. That CNN method is written with help of tensor flow. By using this model, we classify the image that system is getting after pre-processing of testing image. Then we get particular disease name or healthy leaf name if there is no disease on that leaf and that disease name is send to android application and with the help of that disease name we get particular pesticide name which help farmer to take respective action in order to decrease percentage of disease.

SYSTEM ARCHITECTURE

This architecture diagram illustrates how the system is built and is the basic construction of the software method. Creations of such structures and documentation of these structures is the main responsible of software architecture.

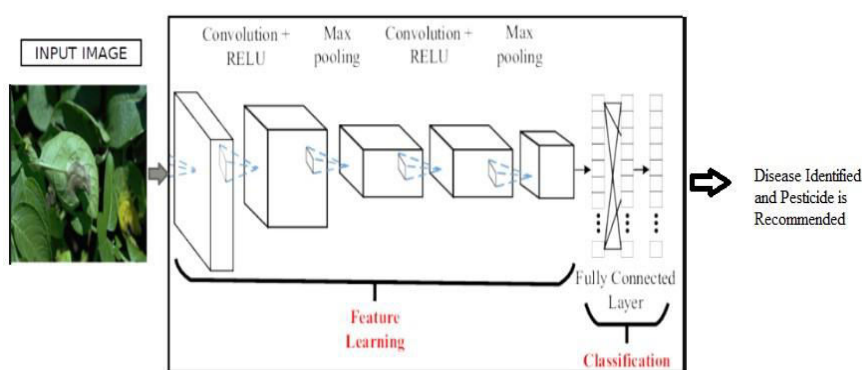


Fig.3: Architecture Diagram of proposed system

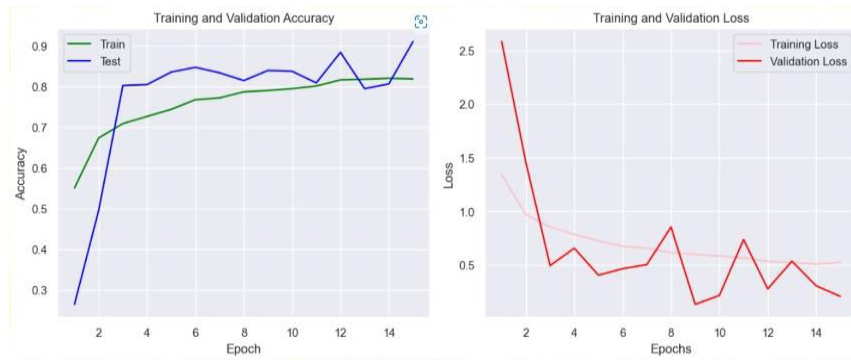
Main Steps to build an architecture if proposed system are:

- Convolution Operation
- ReLU Layer (Rectified Linear Unit)
- Pooling Layer (Max Pooling)
- Flattening
- Fully Connected Layer

1. Convolution is the first layer to extract features from the input image and it learns the relationship between features using kernel or filters with input images.
2. ReLU Layer: ReLU stands for the Rectified Linear Unit for a non-linear operation. The output is $f(x) = \max(0, x)$. We use this because to introduce the non-linearity to CNN.
3. Pooling Layer: it is used to reduce the number of parameters by downsampling and retain only the valuable information to process further. There are types of Pooling: Max Pooling (Choose this). Average and Sum pooling.
4. Flattening: we flatten our entire matrix into a vector like a vertical one. so, that it will be passed to the input layer.
5. Fully Connected Layer: we pass our flatten vector into input Layer. We combined these features to create a model. Finally, we have an activation function such as softmax or sigmoid to classify the outputs.

IV. RESULTS

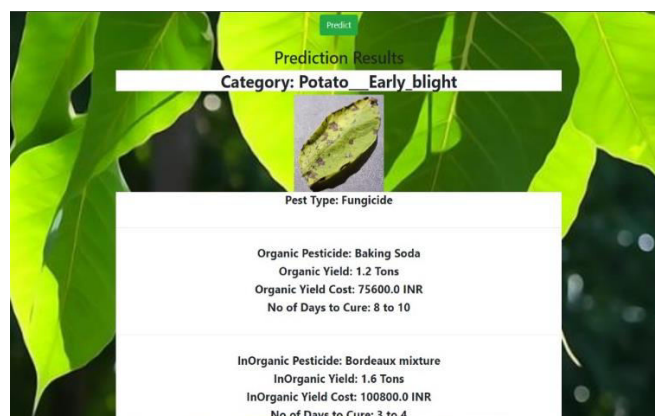
Figures shows the results of our project:



(a) Predicted result of Training Model



(b) Predicted result of test image of healthy potato leaf



(c) Predicted result of test image of unhealthy potato leaf



(d) Predicted result of test image of healthy pepper bell leaf



(e) Predicted result of test image of unhealthy pepper bell leaf

V. CONCLUSION

The proposed system was developed taking in mind the benefits of the farmers and agricultural sector. The developed system can detect disease in plant and also provide the remedy that can be taken against the disease. By proper knowledge of the disease and the remedy can be taken for improving the health of the plant. The proposed system is based on python and gives an accuracy of around 93%. The accuracy and the speed can be increased by use of Googles GPU for processing.

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