# Agriculture Plant Disease Investigation and Image Classification with Artificial Neural Network Using ML

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*Abstract* — The position of agrarian product is pivotal to a nation's profitable growth. The biggest handicap to the product and quality of food, however, is factory complaint. Beforehand discovery of factory conditions is essential for maintaining global health and weal. The standard system of opinion entails a pathologist visiting the position and visually assessing each factory. still, due to lower delicacy and limited availability of mortal coffers, homemade examination for colorful factory conditions is limited. To address these problems, it's necessary to develop automated styles that can snappily identify and classify a wide range of factory conditions. The presence of low- intensity information in the image background and focus, the extreme colour similarity between healthy and diseased factory areas, the presence of noise in the samples, and changes in the position, chrominance, structure, and size of factory leaves make it delicate to directly identify and classify factory conditions. We've developed a dependable factory complaint bracket system using an InceptionV3 Architecture to address the forenamed issues. In this exploration, we suggested a deep literacy strategy grounded on InceptionV3 Architecture to identify splint conditions in a variety of shops. Chancing the factory complaint and its bracket is our end. The substantiated dataset is taken from the well- known public source kaggle. The dataset consists of 70,295 Factory images of Apple, Blueberry, Cherry, Corn (sludge), Grape, Orange, Peach, Pepper bell, Potato, jeer, Soybean, Strawberry and Tomato. The suggested system has the capacity to handle complex situations from a shops area and can successfully identify colorful forms of conditions.

***Keywords:*** Agriculture Plant Disease, Image Classification, Artificial Neural Network, ML

## I. INTRODUCTION

changeable climate change, without any proper irrigation fashion, lack of knowledge in using ultramodern technologies and use of fungicides have caused an imbalance in husbandry which has caused indecorous civilization and unhealthy crops thereby hanging food security. Factory pathogens will lead to crop loss. Due to creatures, weeds, pathogens it's estimated to reduce agrarian product between 20 to 40 encyclopedically. Agriculture is one the main sources of income in India it struggles to support fleetly growing population.

It's estimated that in India smallholder growers will induce around 80 percent of agrarian product and due to pests and factory complaint there's further than 50 percent of yield loss. Factory conditions reduce the quality and product of food crops. To overcome this we need large vindicated dataset of images which includes healthy and diseased splint images of all type of crop shops. Using this dataset develop an accurate image classifier which classifies the type of complaint at original stage. similar dataset wasn't available until recent and lower dataset won't give accurate bracket. So, Plant Village design was initiated to profit growers with early complaint discovery and started collecting thousands of images of all types of crops. This chapter focuses on automatic factory complaint discovery as a content of discussion.

The study demonstrates the specialized feasibility of deep literacy to enable automatic tomato factory complaint discovery through tomato splint images. The dataset correspond of both diseased and healthy splint images. In this chapter, deep complication neural network is used to classify the factory splint as healthy or diseased. colorful conditions of tomato splint is linked liketomato_mosaic, lateblight, unheroic twisted, septoria Leaf Spot, healthy, bacterial spot with total 21071 images. These conditions can be linked at original stage using CNN and growers can use any infection control tools to stop spreading complaint to other shops and also break pest problems while minimizing the pitfalls of mortal and terrain. Some of the challenges linked are as follows.

- Quality of the splint image
- Larger dataset
- Image denoising
- Segmenting exact spot of complaint in splint
- unyoking the training and testing samples from original images
- point birth like color, size, texture and shape from image
- Feting different type of complaint from factory leaves

Leaf conditions are trouble to the crop product and planter's frugality reduces immensely with increase in spread of crop complaint. Conventional styles of detecting crop conditions bear a great deal of knowledge and moxie. Further, these styles can be precious, time consuming, and indeed ineffective in some cases. These challenges can be answered using deep literacy ways which are having further implicit to identify colorful conditions. This motivates the work to concentrate substantially on splint complaint discovery and classify the complaint at early stage with great delicacy and help growers from huge loss. The study uses tomato splint for analysis as tomato is considered most profitable crop because it's grown four times in a time. Factory complaint is relatively natural because they cannot repel light intensity, high moisture, temperatureetc., it affects factory saturation, fruit color and fruit quality and temperature below 10 degree Celsius and above 38 degree Celsius affects factory towel and factory.

Due to all these environmental conditions shops are susceptible to conditions like fungus, bacteria, contagionsetc., Early discovery of factory complaint can help in adding yield by precluding from complaint. CNN improves the bracket delicacy in numerous fields, including husbandry.

 

So, deep complication neural network is used for demonstration.

The model proposed mongrel deep literacy model, which consists of transfer literacy, attention model, and powerhouse operation, is proposed along with a CNN-grounded VGG16 classifier to descry and classify conditions associated with shops. Pretrained imageNet weights were used for image preprocessing. Pre-trained images are trained on millions of images with 1000 different orders, which reduce the time for training new images. Further, all images were 3- dimensional, i.e., they were measured in terms of height, range, and channels( RGB).

## II. LITERATURE REVIEW

According to Ehsan Kianiet.al, 2017( 16) image segmentation done with the help of colors i.e. color image segmentation ways helps to more understand and break the problem. One can first find out the three- color image factors of an image which are Red, Green, and Blue factors. The red and Green factors help to identify the unheroic factors of the image which is generally marked as an infected part. Fuzzy sense is a good fashion to break a complaint bracket problem.

Vijai Singhet.al( 2017) An advancement of inheritable algorithm is proposed by the author named minimal distance algorithm to find the infected factory part of the factory that's to perform image segmentation. After the image segmentation step the author has checked the delicacy of the algorithm with other bracket algorithms like k mean clustering and SVM( 17).

Konstantinos 2018( 18) In this paper author has used a complication neural network fashion to identify colorful factory conditions. A detailed study has been done by the author. Images of colorful factory leaves are taken which includes both the infected leaves images and healthy leaves images and also the author has classified it in colorful classes and all CNN infrastructures gave further than 97 delicacy. The CNN infrastructures include AlexNet, AlexNetOWTBn, GoogLeNet, Overfeat, VGG.

Kamlesh Golhaniet.al, 2018 In this paper author has done a detailed review of colorful deep literacy algorithms along with their advantages and disadvantages also their optimization ways. A comparison has also been made for these ways about the affiliated work.( 19)

## III. METHODOLOGY

### A. *Problem Statement*

The proposed exploration work is carried on three crops Potato, tomato, and pepper. In a check, 61.33 of growers cultivating potatoes reported bright as one of the major reasons for their crop failure. According to The Hindu, in the time 2020, Maharashtra faced a huge extremity for tomato cropsapprox. 60 of crops failed due to a contagion. India has a 40 share of total pepper product encyclopedically. Pepper has also numerous herbal benefits in throat infections. India is the 2nd largest patron of tomatoes and potatoes followed by China which is the largest patron of these crops. perfecting fertilization and automating the system for complaint discovery can ameliorate the crop product of our country.

### B. *Objects*

There are three objects of the proposed methodology

1) To develop a prototype for a factory complaint discovery system.
2) To apply image processing ways to identify the complaint pattern.
3) Use machine literacy algorithms to prognosticate complaint.
4) Use transfer literacy ways to prognosticate complaint.

### C. *Compass*

The proposed methodology is used for the precise discovery of complaint in crops. Which can give controlled fertilization to growers. Accurate identification of complaint also helps growers to identify the infection and do fairly controlled fertilization to avoid any unborn crop failures.

### D. *Flow chart for the proposal model*

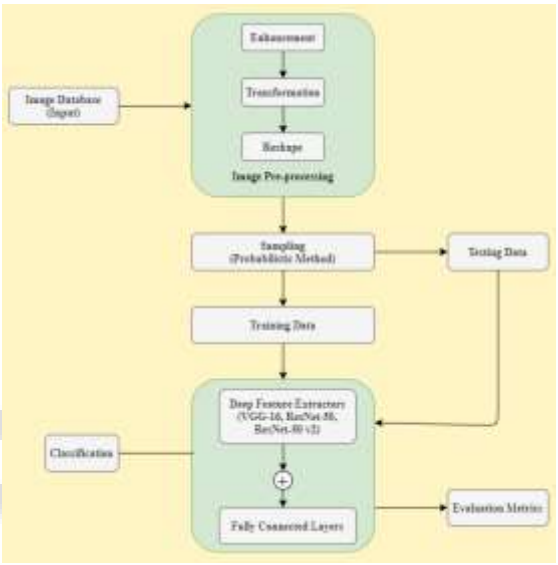


Fig. 3.4: Flow chart for the proposal model

### E. *Module Description*

Loading Dataset( RGB Images) The first stage of plant complaint identification and type system is loading dataset. This dataset contains high- quality RGB( red, green, blue) plant images which include healthy plant images and complaint plant images.

Pre-Processing The alternate stage of the plant complaint discovery and type system ispre- processing. In this stage remove noisy and inconsistent data from the dataset and extract only useful information. This system includes some ways like image resizing, image smoothing, image enhancement, etc.

Segmentation The third stage of the plant illness identification and type frame is segmentation. In this process partitioning image into various corridor like converting RGB( red, green, blue) to HSV( tincture, achromatism, value), converting RGB( red, green, blue) to LAB( radiance, green/ red, blue/ pusillanimous) and other ways. The segmentation should be possible by exercising different procedures like Otsu' strategies, K- means clustering. point birth The fourth stage of the plant complaint identification and type approach is point birth. point birth plays a significant part in image type. point birth can be employed in numerous operations. In-

 

plant complaint type uses multitudinous features like color, texture, morphology, and edges, etc. This approach has tracked down that morphological issues give preferable issues over different features. It tends to be relating the infected plant flake of the type plant image. We can likewise liberate unique shops and unique conditions from the dataset.

Bracket The fifth stage of the plant infection recognition and type system is the type fashion. This type stage performs any of the machine knowledge or deep knowledge ways for classifying the various conditions in shops.

Discovery and Bracket of Plant Disease This is the final outgrowth stage of our proposed system. In this stage, stoners can identify and characterize the plant infection.

### *F. Building the Model Architecture*

ResNets Architecture solves one of the notorious problems known as sinking slants. In ResNets, unlike in traditional neural networks, each caste feeds into the coming caste, we use a network with residual blocks, each caste feeds into the coming caste and directly into the layers about 2 – 3 hops down, to avoidover- fitting( a situation when evidence loss stop abating at a point and also keeps adding while training loss still decreases). This also helps in preventing sinking grade problem and allow us to train deep neural networks. ”

## IV. SAMPLE OUTPUTS


Fig. 4.1: Upload image


(1) Input Interface (2) Interface output
Fig. 4.2: Model loss and Accuracy

## V. RESULTS AND DISCUSSION

Disease discovery using ML At first machine literacy algorithm was enforced to descry factory complaint. This was done in two phases.I.) enforcing ML algorithm on potato dataset. II) enforcing ML algorithm on the entire dataset.

### *A. Enforcing ML Algorithm on Potato Dataset.*

The dataset which is considered in the proposed work is an openly penetrated dataset & it was aimlessly divided into the training dataset consists of 1820 images and the testing dataset consists of 780 images. The otsu algorithm was employed for the double image segmentation and infected region identification this was done with the help of preparing an image mask. The Gray LevelCo-occurrence Matrix is the main tool that implements the generalities learned from uprooted features. employed for point birth, &multi-class support vector machine( SVM) methodology was employed for the bracket of potato leaves. The model deduced is estimated using certain evaluation criteria perfection, recall, F1- score, and delicacy.

| Category Name | Precision (%) | Recall (%) | F1-score (%) | Accuracy (%) |
|---|---|---|---|---|
| Late Blight | 91.07 | 95.41 | 93.29 | 94.71 |
| Early Blight | 98.56 | 94.71 | 96.43 | 96.84 |
| Healthy | 98.93 | 98.62 | 98.76 | 96.43 |
| Overall | 96.12 | 96.25 | 96.16 | 95.99 |

Table 1: Evaluation Metrics of Potato Disease analysis using SVM

| Model | Accuracy (%) | Precision (%) | Recall (%) | F1-score (%) |
|---|---|---|---|---|
| VGG-16 | 98.74 | 98.76 | 98.74 | 98.74 |
| ResNet-50 | 98.84 | 98.85 | 98.84 | 98.83 |
| ResNet-50 v2 | 98.21 | 98.23 | 98.21 | 98.20 |

Table 2: Details of evaluation metrics obtained for the transfer learning models implemented

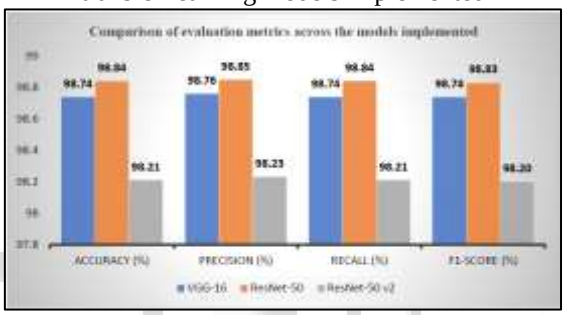


Fig. 5: Comparison of evaluation metrics across the models implemented

## VI. CONCLUSION

The machine learning algorithm used in proposed work is SVM. SVM gave good result in when the discovery orders were less. As the no of complaint orders increased it failed to achieve the delicacy. Transfer literacy is the current effective exploration for carrying the better performance of the models with a minimum and briskly training phase. It proved veritably true with the proposed frame. The proposed frame suitable to attain better delicacy with all the three models similar as VGG- 16, ResNet- 50, and ResNet- 50 v2, yet ResNet- 50 grounded transfer literacy model a bit more effective when compared to the other models. The proposed frame effective with themulti-class bracket of colorful conditions along with healthy leaves that include crops of pepper, potato, and tomato.

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