

# A Review on Leaf Parameter Analysis and Disease Identification using Machine Learning

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## ABSTRACT

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The leaf diseases need to be identified at the earliest as it indicates the disease well in advance which affects the yield of the fruit and crop. The black rot, black measles, leaf blight and mites are the well known disease causing agents for the leaf. Diseases on leaf and fruits will cause the economic losses and in agricultural based industries. In this paper the survey is carried on apple leaf and fruit diseases detection using the machine learning approaches. The algorithm designing should not be restricted to one plant hence specific algorithms are essential. The predict the disease for the fruit and plants the machine learning approaches are helpful. The extensive feature extraction such as leaf area, width, length of the leaf and so by considering these the machine learning approaches provides the greater accuracy. We have formulated the gaps and a proposed system, which will be helpful for new researchers in the field of leaf detection.

Keywords : Disease identification, plant, leaf, fruit, machine learning, deep learning.

## I. INTRODUCTION

Agriculture is the backbone of our country India which can be able to grow the fruits planting areas at the larger extent of lands. The apple fruits usually possess the high nutritional and medicinal values hence these fruits became the major producing fruit of the specific regions of the country. However, the diseases for these fruits and leaves are going to cause the loss to the farmers in terms of the quantity and quality which will directly relay on the fruit based industries. Hence, value for fruit, leaf detection system has been considerably increased.

Conventionally, the expert or trained group of people were going to test that the fruit or plant got affected by disease or not [1]. But visiting fields individually is not a economical ideas time and labour charges were high to meet these. To address this issue the researchers found a effective methodology of combining the digital image processing and machine learning approaches can be effectively applied on agricultural and yield loss recovery system [2].

The growth of the plant is going to be affected if the plant get infected from disease causing agents [3]. The disease causing agents can be fungus, bacteria or virus.

For different plants, the causing agents can affect the different parts.

Hence the classification and identification based on the plants is essential task. The yield of the crop is definitely get affected from the disease. To address this issue the only solution is to detect the disease at the earliest form and find the solution to it. If the farmer has a years of experience in specific crop farming then they can identify the disease part of the plant by simply viewing it and by not using any of the tools or machineries to identify it. But the disadvantage of these kinds of practice is farmer may experience a less light affects, weather changes, they may be fatigue to observe the disease spots on lead or so on. By having any kind of these error the farmer may come to wrong decision. Hence to maintain the healthy farms the automatic algorithm based systems are essential [4][5].

The steps involved in image processing application is preparation of database, remove the noises, segment the foreground from the background, extract the features and last step is classification [6][7][8].

By using the technology the usage of pesticides on the crop need to be reduced because it is going to be step towards eco- friendly. The identification of the disease depends on the individual plants and it is not a general study specific research is essential for every plants.

The keywords employed to refer the hundred paper are as follows, out of hundred thirty papers are referred to perform the revive paper, "Farming", "Agriculture", "Diseases", "apple Leaf", "apple fruit", "Machine learning" and "Deep learning".

The diseases caused to the apple leaf and fruit are as follows,

**Bitter rot:** This disease is going to be caused from the fungus, it causes the round brown circular shapes on the fruit. The radius of circle varies based on the infection and types, the below figure shows the bitten rot affected apple fruit from mild (left) to more effected region(right image).



Figure 1: Bitten rot for the apple fruit.

### Block Rot

This disease is going to affect the bottom of the fruit at the earlier stage. The color of the decay at the initial stage is brown color and later it turns to the black color. This disease is the dangerous disease as it proceeds further it becomes fully decay. The stages of the block rot is as shown in the belowfigure,



Figure 2: Black Rot initial stage.



Figure 3: Moderate and final stage of the black rot disease.

**White rot:** The characteristics of this plant is initially circular black or brown spots appears and a red spots are going to surround it. If the diseases propagates further it reaches the core area of the apple and destroys the full fruit. The mild and final stage of white rot is as shown in the below figure,



Figure 4: Initial stage of the white rot on apple.



Figure 5: Final stage of white rot if not treated whole fruit is loosen.

The other fruit diseases are apple scab, powdery mildew, rust, the effected area is as shown in the below figure,



Figure 6: Apple scab disease on apple.



Figure 7: Powdery mildew disease on apple fruit



Figure 8: Rot disease on the apple fruit.

The different diseases caused for the apple leaf are as shown in the below figure. The diseases are altermaria leaf spot, mosaic, rust and brown spot.

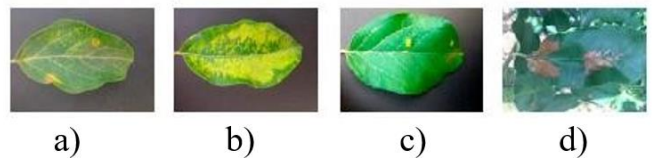


Figure 9: a) Altermaria b) Mosaic c) Rust d) Brown spot

As shown in the below figure 9, lesions generated by disease have a significant degree of similarity when they occur in comparable environments. As a second image, Mosaic's yellow lesions spread throughout the leaf, which is unlike any of the other disease lesions that appear. Diseases may be diagnosed and recognised with the use of the previously described observations. Rust and Alternaria leaf spot have many geometric aspects, making it more difficult to tell the two diseases apart. Finally, the Brown See lesion is

distinct in that it is brown with an uneven margin of green, making it easier to spot than the others.

**Outline of the paper**

The section 2 provides the details of the surveyed papers and has the stages for implementation. The stages are data base collection, pre-processing, split the image for training and testing, design the model, train the model and evaluate the results.

**II. LITERATURE SURVEY**

**Database for apple disease identification:**

For the first step the usual step to be employed is, the disease causing agents’s characteristics are taken from the experienced farmers, agricultural department, Doctrate scholars and research development wing to collect the dominant visual features and prepare the database[27- 36]. The digital camera are used to capture the input images for preparation of the database.

The plant pathodology 2020 has captured the three thousand six hundred fourty five images and it has three disease namely apple rust, apple scab and rust. The csv file provides the target and labels [37]. The instance of the database is as shown in the below figure.



Figure 10: Rust (Top), Scab (middle) and multiple disease in single leaf.

An another database is prepared by observing the plantation for a span three month July to October 2020. They had collected a total of 5,170 images of leaf which includes leaf mites, mosaic, litura moth and a healthy leaf. The instance of the database is as shown in the below figure,

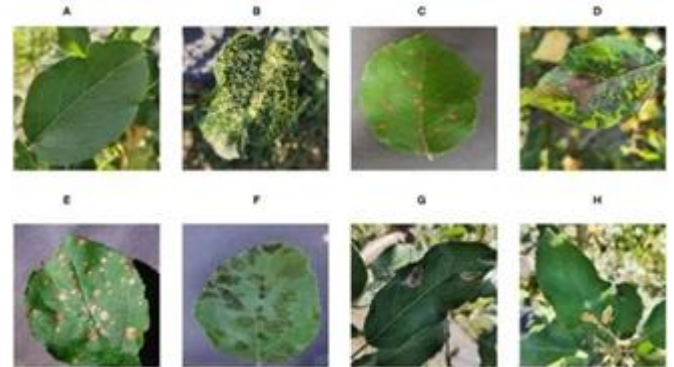


Figure 11: a) Healthy b) Mosaic c) Rust d) Glomerella leaf spot e) black rot f) scab g) litura moth h) leaf mites

The two database of apple fruits has been provided from the nps government [39] which has malus pumila (apple fruit and leaf) and CABI has fruits, developing fruits and blossom in their website [38].

Table 1: Leaf parameters.

Cit e	Plant leaf	Method & material	Paramete rs	Accurac y
[8]	Green gram, black gram and pigeo pea	IIPR Kanpur database (45 leaf) Draw leaf on image and count the no. of grids covered.	Area	97%
[9]	Ten cucumbers Images.	Grid count Paper weight module Leaf area	Leaf lengthand width.	68.94%, 92%, 97%, 98%

		meter Area calculatio n using below equation S2 = P1*S3/P S4 = P2*S5/P3  S2-> leaf area, p1 number of leaf pixel,  P-> number of A3 paper pixel S3-> area of A3 paper S4-> leaf area with reference circle P2-> number of leaf pixels P3-> number of circle pixels.		
[10]	Man y plan ts were considered	Scanner to obtain the database, Image processin g and computer vision methods,	Area	99%

Table 2: Pre-processing methods on disease.

Cite	Applie d on which part of the leaf	Pre- processi ng method	Segmentati on	Classificatio n
[11]	Leaf of the cotton plant	Gabor filter	-	Neural Network
[12]	Leaf of the corn plant	-	K mea ns clus teri ng	Back propagation Neural network
[13]	Leaf of the maize crop	Gaussian Filter	CbCr color space	Back propagation neural network.

Table 3: Papers on classification and segmentation.

Cit e	Part of plant researched	Disea ses	Metho d	Research gaps
[14]	Apple leaf	Grey spot, Brown spot,	INAR-SSD 78.80%	The training time is more. The same framework can be worked on the other crops by slight modificatio ns.
[15]	Mango leaf	Alga l	Decisi on tree- 89%	Only 120 images are considered, where accuracy varies when more number of images are

				considered
[16]	Apple fruit	Apple	Nine classifier methods Decision tree 86% ANN (highest) 88%	Combining robots with cyber-physical systems (CPS) and Internet of Things technology can achieve the goal of intelligent
[17]	Apple leaf	Powdery	SVM-94%	Manual segmentation is performed in the future scope automated system Can be implemented
[18]	Plant village database	Apple scab, brown spot and apple cedar	Deep learning-97%	Instead of real time images augmented images are employed which affects accuracy.
[19]	Grape's leaf	downy mildew & black rot	SVM (Multi-SVM)	Accuracy improves only when the testing and training ratio increase
[20]	Steam and leaves of plant	Early scorch, cotton	Neural network	Eliminates the intensity based

		n mold mold		texture features
[21]	Leaf of the cucumber	Downy Powdery Mildew	Neural Network (80%)	Feature extraction is complex.
[22]	Leaf of the plant	Early scorch	Neural network (82%)	Severity of leaf is not estimated.
[23]	Leaf of the plant	Bacterial Alternaria alternata,	Support	Memory consumption is more and didn't concentrate the diseases caused by viruses.
[24]	Apple leaf	Mosaic,	CNN (97%)	The high resolution leaves of the apple usage could have increase the more accurate results.
[25]	Rice	Rice rice sheath rot	KNN Minimum	The other forms of disease causing on rice need to be included.
[26]	Herbal plant identification (600 images)	Alkapulko, lagundi, oregano, niyogon	ANN (90%)	Number of leaf images were less

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