

# Crop Disease Detection System In Agriculture

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**Abstract**—Farming is key to keep up a nation's money flow because it makes food crops. So, plant sicknesses are big risks to farm plants, leading to large money loss and less food all over the world. Old ways of finding these diseases, which mainly rely on touch, take a lot of time and often have errors. This work shows a full way to make new crop sickness finding tools. These use new tech like image checks, learning from data, and scanning from afar together. CNNs, a type of tech, can look at pictures of sick plants and spot and sort out usual plant diseases very well. Knowing crop sicknesses is key to keeping a farm community alive. Spotting these illnesses right and fast is vital for the field's health and output, and stops loss of cash and more. Every day, crop sicknesses cost farmers big money all over the world. Learning well helps farmers find diseases early in the crop leaves, so stopping crop loss. The model gets smart on a mix of good and bad plant pics, telling sickness types apart, like harm, rust, and mold. The system then warns farmers, via an app or web page, when it spots a disease and gives tips on how to treat it. Spotting issues early helps farmers make better choices. It cuts down the use of bad chemicals and improves the well-being and growth of crops. This work taps into AI's ability to scale up and save costs.

**Keywords**— CNN, deep learning, machine learning

## I. INTRODUCTION

India's heart is in farming, and it boosts the money flow in big ways. Farm-based tasks make up 16% of the GDP and a lot of what India sells to other places, almost 75% of the people in India lean on farming, be it straight or not (Himani, 2014)[1]. So, making sure plants are free from sickness and top-notch is key to help the country's money scene[1]. Plants, just like us, can get hit by a mix of sicknesses at different growth stages. This drops what farmers can make and sell. Spotting plant sickness early is a must to fix this: Sari. Often, farmers or farm science folks check the plants themselves, but it's a slow task — still, it's a must-do for quick care of plants[1].

A. Precision-agriculture- Targeted interventions improve aid control primarily based on unique disorder diagnoses. Farm-tech: aimed help works best when you know the exact crop sickness.[2]

Plant	Accuracy	F1 Score
Apple	0.91	0.91
Corn	0.94	0.94
Grapes	0.95	0.95
Potato	0.98	0.98
Tomato	0.87	0.87

Table 1 Rate of Accuracy

problems can be seen and named easy.[2] To tackle this, many experts across the world use new computer tech. They spot sickness with tools that learn from data (Ahmad 2019). Other years like 2016 and 2020 by Naik and Shiva, Panda and others, plus RAO and team, also looked into it. They tried deep study ways (Ashraf and Khan 2020, Chen and pals 2020, Karlekar and Seal 2020, Kim and team 2020). But, these new ways to teach machines cost a lot of money and need a lot of time and very high tech stuff when the system size is huge[2].

A. Deep Learning Methods:-Bits of the human brain work like this (Hayklin1998).[3] These plans make use of fake brain networks (ANNs) and types like it. For example, network types that fold over (CNNs) and network types that go back (RNNs) see hidden stuff in data. There are two big wins of Deep Learning ways over Machine Learning ways. First, things are cut out. Just take raw data, no need to pull out more parts of the data. Second, deep learning cuts down the time to learn. This is a must when you have to deal with big data in high detail. So it goes like that[3].

These systems play an important role in modern agriculture:-

B. Better farm crops - Spotting trouble early lets us step in fast, so we don't lose a lot of crops.[5]

C. Less spray:- When we know just where the problem is, we use fewer chemicals. This helps keep farming good for the earth[5].

D. Photo checks:- We take pictures of the plants with cameras or drones. Then, computers look at the photos to find signs of sickness, like wrong colors, spots, or marks.

E. Far watch:- Tools on satellites or drones gather info on how the crops are doing from up high. They look at special light signs that can tell us how bad the disease is.

F. Machine learning:- Programs are set to learn from big sets of data about well and sick plants to spot signs linked to certain sicknesses[3].

G. Internet of Things (IoT)- Sensors put in places gather facts about air facets (like heat, dampness) that may change how a sickness grows[2].

H. More speed:- Machines that spot sickness cut out the need for slow, hard hand checks, which saves time and work.[3]

I. Act fast:- Systems can give heads-up before the bad signs show, which lets us act sooner[4].Thus, old ways of farming matter here. People need plants. They give us power. Crops can get sick from many plant diseases. These sicknesses bring harm to people who farm, both socially and money-wise, and to the land around us. They also help us see sick parts inside plants[3].

## II. LITERATURE REVIEW

Kumar S. & Kaur, R. (2015). [Finding Sick Plants Using Pictures-]. *Big Journal of Computer Stuff* 124(16) 6-9. Using pictures to find sick plants is changing how we spot plant woes, giving fast help to farm hard times. Main steps are splitting pictures and pulling out key parts using ways like middle line filtering, smart cut-offs, and GLCM. Study folk have used steps like Closest Bunch, Help Line Gear, and Pushback Nets to name sick plants even though

Kulkarni P. (2021 November 22). Spying plant sickness with pictures and smart learning

Work on plant sickness find by using pics and deep learn has come far. Studies have used many rules, getting good ends with high right and F1 scores for many plants. For sure, apple, corn, and grape sickness finds had right from 91% to 95%, while potato hit 98%. These show how well the new ways work. They are right, don't cost much, and often don't need special gear.

Bedi P. & Gole P. (2021). Using tech in farming: How and why it's hard. *Tech in Farming* 5, 90-101. Spotting plant sickness with a new mixed tech model that uses deep tech. Spotting plant issues has gotten better with smart tech and deep tech, with studies hitting top marks using CNN setups like ResNet-152, Google Net, VGG and mixed models. Big wins include tools like Sanga and others' hand-held tool for banana sickness (99.2% right) and Bedi and Gole's new tech with fewer bits and 98.38% right. While deep tech works well, it often needs a lot of power, making it tough for places with less. New ideas aim to cut down on tech complexity but keep it right. Spotting plant leaf sicknesses with the help of image tech is key. It's key for crops to live well, mainly in places like India where many farm. Old ways need experts to look at plants and cost a lot, so folks look into using computers to check images. Main steps are getting the image, prepping it, pulling out key bits, and then sorting them with brain-like networks. They cut out sick spots in leaves by checking the edge or the shade of areas. They try different light types to see better under all skies. Even if hopeful, new ways still struggle with being fast and easy to change. There's on-going work to make this disease spotting fast, cheap, and right.

Adil, M. A. A., Ahamed, M. K. U., Rahman, M. M. U., Uddin, M. A., Talukder, M. A., Hasan, M. K., Sharmin, S., Debnath, S. K., & Islam, M. M. (2023). Deep Crop: Deep learning-based crop disease prediction with web application. *Journal of Agriculture and Food Research*, 14(4), Article 100764. Deep Crop: Deep learning-based crop disease prediction with web application The review shows big steps in plant disease checks using deep learning, with strong results. Yet, these need more computer power as they go deeper. Other models like VGG-16 and VGG-19 use big frameworks. The study worked with large data from the Plant Village database, which holds many plant photos like tomatoes, peppers, and potatoes, getting good hit rates on many crop diseases. The books show that we need easy, big plan ways to help farmers, mainly where it's hard to find farm pros. Auto spot set-ups by using deep thought cut down how much we lean on old ways to find crop sickness. Scores help us check the models. Random Forest did the best with a top score of 98%, doing better than other plans like Logistic

Regression SVM and KNN. We can put this system in farms, nurseries, and gardens to find sickness, making it a low-cost, big plan fix. Plans for the future are to make the model spot more sickness and make the computer work faster.

Gavhale K. R. & Gawande U. (2014). Plant leaves sickness seen by using pics. *IOSR Journal of Computer Engineering*. Spotting sickness on plant leaves with pics is the key. It matters a lot for crop lasting, more so in places like India where farm work is key. Old ways that lean on expert look are costly and slow, so study on fast pic methods starts. Main acts are getting pics ready, pulling out traits, and sorting them with brain-like nets. Cut methods like area-led ways, edge cuts, and dark-light setting are used to pick out sick plant parts. Ways that use many color parts bring up right calls in many lights. Though hopeful, new ways still hit snags in quick working and shifting with need.

Sakr, N., Elmogy, M., & Mahmoud, Y. (2023). [Plant Leaf Disease Detection Using Machine Learning Algorithms]. In *World Internet of Things Meeting*. Deep Crop: Web app for crop sickness prediction using deep learning. Other setups, such as VGG-16 and VGG-19, showed strong results but needed big tech power due to their deep designs. The work used huge data sets like the Plant Village store with lots of pictures of plants such as tomatoes, peppers, and potatoes. It got high score rates for telling crop diseases apart which helps grow more crops and aids earth-friendly farm ways. New work aims to make these builds better, making them fast, right, and good for real use (RP1).

Mahmoud Y. Sakr N. & Elmogy M. (2023). [Plant Leaf Illness Spotting with Help of Machines]. In *Notes from the World Meet on Net Things*. Plant Leaf Illness Spotting with Help of Machines Looks at the key job of finding and knowing plant issues fast to cut crop harm and up the yield in farming. Plants face a lot of health risks like spots from bacteria, late wilt, and Septoria leaf spots which really bring down how much they produce. Early and fast illness catching is key for good handling. The work uses machine ways and deep learn plans, mainly Random Forest for picture sorting and ResNet-50 for illness spotting in videos. The process involves setting up data sets, pulling out features such as color, shape, and texture, and training models with supervised learning. We use measures like accuracy, precision, recall, and F1-score to check the models. Random Forest achieved the top accuracy of 98%, doing better than other methods like Logistic Regression, SVM, and KNN. This system can be used in farms, nurseries, and gardens to spot diseases, giving a cheap, scalable fix. Plans for the future include growing the model's power to spot more diseases and making it run faster.

## III. RELATED WORK

The use of deep learning in finding crop diseases has quickly expanded. Many experts have looked at varied methods and ways to help farmers spot plant diseases sooner. Here are the main ideas made easy.

### A. AI in Agriculture:

AI is now useful in farming, much like in health care. It uses pictures to find sick plants, making it simple to spot diseases. This works by seeing the signs of illness in the images.

**B. Machine Learning for Disease Detection:**

Simple machine learning ways, like Support Vector Machines (SVM) and K-Nearest Neighbors (KNN), were used to sort out healthy and sick leaves by looking at changes in color and feel made by illness. These ways worked well in set conditions, but they had to have certain details set by hand (such as colors or feels), which made them take more time and hard to use in many different places.

**C. Deep Learning Advances:**

Deep learning, like CNNs, made big steps in finding plant diseases. Unlike old ML ways, CNNs find key points by themselves, so diseases in plants are named right more often. Many studies show that CNNs are very good at this. For example, some models got 99% right in spotting apple leaf diseases, proving how great deep learning is.

**D. Applications on Specific Crops**

For plants such as rice, wheat, and tomatoes, experts made tools to find certain plant sickness. For instance, CNN got taught to see leaf rot in rice or rust in wheat. This helps keep an eye on these plants in a big way.

**E. Mobile Apps and Real-Time Detection:**

Some works have made phone-based sickness find tools. They let farmers take photos and see answers at once. These tools use a light CNN for fast checks in the field.

**F. Challenges and Limitations:**

Lots of studies use small data sets. This can stop a model from finding diseases in new, real places. It gets hard for the model to work the same in other spots or with other kinds of plants.

**G. Future Directions:**

Next tasks may aim to get big and mixed data sets, try many CNN models to stop too much fitting, and build easy tools for farmers. This can help find crop sickness soon and cut down on lost crops.

H. Deep Study Set-Ups VGG-16:- Holds 16 layers good for seeing plant sickness but it works slow. VGG-19: Like VGG-16 but has 19 layers giving a bit more right hits. ResNet-50[1]. Works with 50 layers which helps with big hard info and fixes deep drop problems. It hits well and tweaks easier[4].

I. Set-Up Face-Off Look over VGG-16, VGG-19, and ResNet-50. Look at their layer count, size, hit rate, and how fast they learn.

J. Test Set-Up System:- Tests run on a computer with 8 GB GPU, 8 GB RAM, and an Intel Core i5. Code Talk: Uses Python, HTML, CSS, and JavaScript. What to Watch: Check True Positive (TP), True Negative (TN), False Positive (FP), and False Negative (FN).

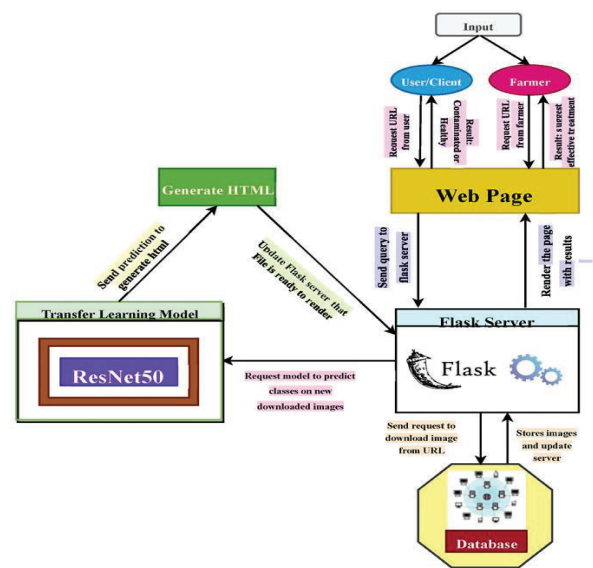


Fig 1 Flow Diagram of System working

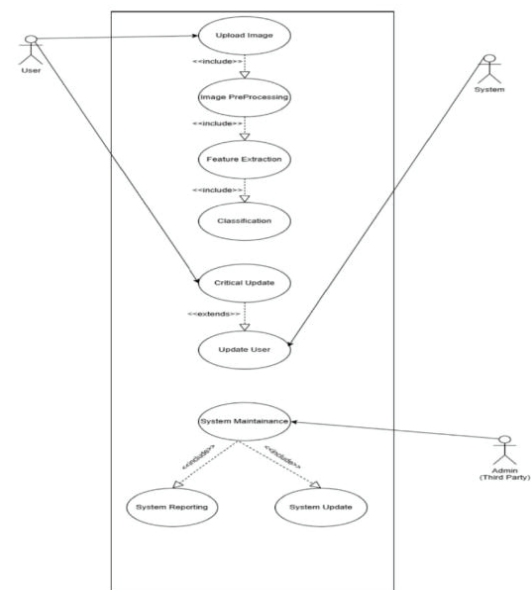


Fig 2 Use case diagram

**IV. METHODOLOGY**

A. Get Crop Photos:- Take photos of crop leaves such as potatoes, tomatoes, and peppers with cameras or phones. Use Free Data: Find and use free sets like the New Plant Diseases Dataset on Kaggle to teach and check the model.[2]

B. Clean Photos:- Take out any unwanted noise in the pictures. Change Photos: Make changes like turning, sizing, and sharing the photos to help the model work better.[5]

C. Teach the Model:- Use ready-made models to make training fast. Train on known good data and check with a different test group.[4]

D. Find Key Parts:- Photos go through many steps to pick out key parts. They are made flat and linked to thick layers for the end sort.[4]

E. Making the Model Gather and ready pictures. Put together layers to pull out main parts. Connect these parts to whole linked layers for finding disease.[5]

F. Testing the Model Data Split- Use 80% of pictures to train and 20% to test. Validation: Test the model's right rate with the test data. Final Check: Use test score to find if leaves are good or sick.[2]

G. Checking How It Did Metrics Used:- Check model right rate, precise hit, recall, F1-score, and losses. Pick the top model for end use.[5]

## V. SYSTEM SET-UP

Here's a look at the parts of the system's design: Frontend (UI/UX). HTML: Sets up what you see in the app, like parts for adding images and areas to show results. CSS: Makes sure the layout looks good and works well on all devices. JavaScript: Deals with putting up images without waiting and showing results in real time.



Fig 3 Home Page



Fig 4 Second Page

### A. Backend (Python Flask) Flask Routes

They deal with HTTP requests from the front. Key paths are for uploading an image (/upload image) and for making a disease guess (predict disease). Machine Learning Link: Flask runs a model that learned before. It uses this to guess the disease from the image you give.

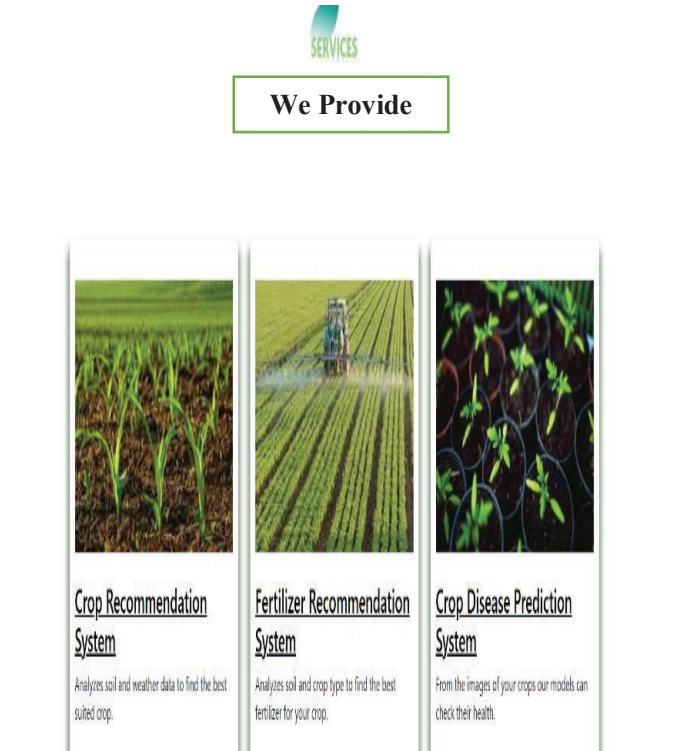


Fig 5 Service Page

## Crop Disease Prediction System

Our models provide you an easy, fast and efficient way to detect diseases in your plants.

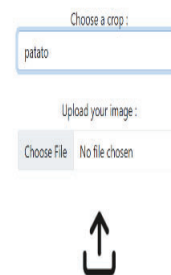


Fig 6 Detection Page

### B. Model Integration

Put model together Basic meaning written down like this The machine learning setup gets kept in a saved file (say, .h5). It goes into memory when we need it to make guesses.

## VI. RESULT ANALYSIS

A. Accuracy and Performance:- Accuracy and Doing Well: The system was very good at finding diseases in many kinds of crops. It did better than old ways of doing things. Models like VGG-16, VGG-19, and ResNet-50 worked very well. ResNet-50 was the best at handling hard data.

B. Efficiency:- The system found diseases early. This allowed quick action. It helped stop losing of crops and made the best use of resources.

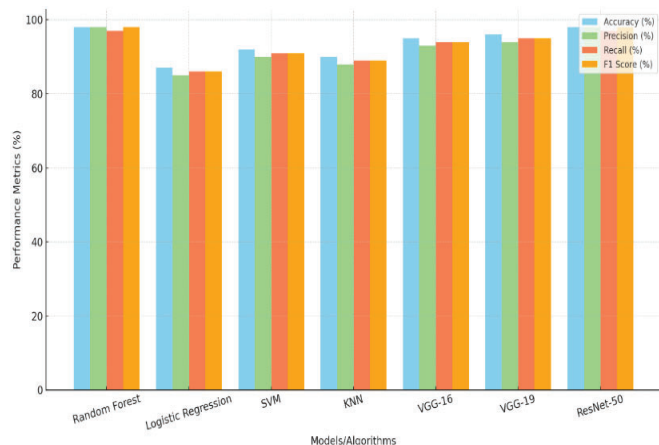


Fig 7 Disease Accuracy Graph

Easy to Use:-

The simple setup made it easy for farmers with little tech know-how.

3. Effects on Farming:- The system helps exact farming by using tech like smart machine learning, IoT, and picture handling. It helps make more and better food and stable money for farmers.

Model/Algorithm	Accuracy (%)	FI Score	Description details
Random Forest	98	0.98	Highest accuracy among ML methods, efficient Classification of multiple Diseases.
Logistic Regression	87	0.86	Moderate accuracy
SVM	92	0.91	Performs well with high Dimensional data but Slower in raining.
KNN	90	0.89	Effective for small dataset But less scalable.

Fig 8 Test Cases and Result

C. Money and Earth Gains: The system cut down the need for too much use of bug-killing sprays. This helps farming last long and brings down harm to the earth. These solutions are now used all the time and much more steadily.

## RESULTS OF PREDICTION



00a55069-3fa3-405b-8d87-4d3408a6ed98\_\_RS\_NLB\_3645.JPG

**Prediction: Northern Leaf Blight**

[Back Home](#)

Fig 9 Result Page

## VII. CONCLUSION

In our study, we built a full crop illness spot system. It uses high-end tech like machine learning and image work to lift farming work and last. The system spots many crop illnesses early. This lets us act fast and cut down on likely lost crop.

### Key Findings

**Accuracy and Quick Work:** The model used can spot diseases well, doing better than old ways of finding them. This helps farmers make smart choices and helps with good disease control.  
**Easy to Use:** With a clear interface, the system lets farmers of all skill levels use the tool well. This is key for many in farming to start using it.

**Money and Green Up sides:** Spotting sickness early lets farmers treat just the needed areas, cutting down on too much bug spray and less harm to nature. The system also helps make farming more money, showing it can work well in farming.

**Effects on Farming:** This study shows we need tech in farm work to fight crop sickness. By using a plan that puts together data, machine learning, and field checks, the people in charge can make crop health and sickness care better.

**What Next:-** This research sets up a strong way to find crop sickness, but more work needs to be done. Future work should look at: **More Data:** Adding more kinds of crops and sicknesses will make the model work better in various places and weather. **Watching All the Time:** Making tools to watch crops all the time with drones and IoT things can help find and manage sickness faster.

In the end, adding a crop disease check set-up is a key move up in farm tech. By taking on crop sickness issues, this set-up can be crucial in keeping food safe and backing lasting farm ways as the weather shifts and more people live in the world.

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