

Plant Disease Detection

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Problem Statement

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- A decorative graphic on the left side of the slide consisting of several overlapping hexagons. There is a large dark teal hexagon, a medium teal hexagon, a small teal hexagon, and a light green hexagon.
- Crop diseases are a major threat to food security, but their rapid identification remains difficult in many parts of the world due to the lack of the necessary infrastructure.
 - India loses 35% of the annual crop yield due to plant diseases.
 - Because of the absence of lab infrastructure and knowledge, early diagnosis of plant diseases is still challenging.
 - Timely disease detection in plants remains a challenging task for farmers.
 - We are proposing a Deep Learning based solution for the identification of plant diseases in the absence of expert.

Using Deep Learning for Image-Based Plant Disease Detection



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Published in: Frontiers in Plant Science 7 (2016)

Link: [Click Here](#)

Using Deep Learning for Image-Based Plant Disease Detection

Used Methods:

Convolutional neural networks(CNN) have been used for object recognition and image classification

Deep learning architecture used:

- AlexNet
- GoogLeNet

Training mechanism:

- Transfer Learning
- Training from Scratch.

Each of 60 experiment will runs for total of 30 epochs.



Using Deep Learning for Image-Based Plant Disease Detection

Dataset:

- A dataset of 54,306 images of diseased and healthy plant leaves to identify 14 crop species and 26 diseases.
- Model's performance was measured by their ability to predict the correct crop-disease pair from 38 classes.
- It is important to note that some images in the PlantVillage dataset have multiple images of the same leaf and there are mappings for 41,112 out of 54,306 images.
- The conducted experiments using various train-test splits including 80%-20%, 60%-40%, 50%-50%, 40%-60%, and 20%-80%, where the corresponding percentage of the dataset was used for training and testing.


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Using Deep Learning for Image-Based Plant Disease Detection

Results:

- AlexNet architecture was able to provide a maximum accuracy of 98.21% and GoogLeNet architecture did the same with 99.34% accuracy.
- The colored samples were most accurate with the max. accuracy of 99.34%, segmented samples' accuracy was 99.25% and grey-scale samples' accuracy reduced to 98%.
- The model trained from scratch provided only max accuracy of 98.36% where as the transfer learning model was more accurate with max accuracy of 99.34%.
- Total 30 epochs were used but all estimation factors achieved saturation after 10-12 epochs.

Soybean Plant Disease Identification Using Convolutional Neural Network



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Published in: The Thirty-First International Florida Artificial
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Link: [Click Here](#)

Soybean Plant Disease Identification Using Convolutional Neural Network

The proposed model:-

- Layer 1: The first layer of CNN model filters the input image with 32 kernels of size 3×3 .
- Layer 2: Max Pooling layer.
- Layer 3: The second layer of CNN model filters the input image with 64 kernels of size 4×4 .
- Layer 4: The last layer of CNN model filters the input image with 128 kernels of size 1×1 .
- Layer 5: Fully connected layer of 512 neurons.
- Layer 6: Softmax layer - produces 4 output classes.



Soybean Plant Disease Identification Using Convolutional Neural Network

Dataset:

- Classifying soybean plant diseases requires a collection of leaf images from the PlantVillage dataset.
- The proposed system was tested on two datasets: Flavia (with 1907 samples of 32 plant species) and Swedish (with 1125 samples of 15 species).
- The dataset consists of 160x160 pixel grayscale images of single leaves against a uniform background.
- A dataset of 12,673 leaf images was obtained, including four classes with healthy leaves.
- The images in the dataset were re-sized to 128x128 pixels to prepare them for training.

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Soybean Plant Disease Identification Using Convolutional Neural Network

Results:

- The best accuracy without any augmentation was achieved using colored samples with max accuracy of 88.20%. Segmented samples' max accuracy was 86% and grey-scale samples' max accuracy was 78.74%.
- Since the validation accuracy is found to be higher than the testing accuracy hence the model is overfitting.
- The image augmentation , L1-L2 regularization and dropouts successfully removed overfitting with max validation accuracy of 99.21% and max testing accuracy of 99.32%, which shows the dataset was very small for the number of parameters used in the model.
- Adding a dropout layer after the Multi-Layered Perceptron with probability of 0.5 results in the best maximum possible accuracy of the model.
- The model is tested for 100-1000 epochs but all the estimation factors achieved saturation after 400-600 epochs.

Future Work

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- Developing a farmer friendly cloud based application for disease detection.
 - Including as many plant diseases as possible that occur in Indian crops.
 - Developing a technique which will suggest the cure for present diseases.