**PLANT DISEASE DETECTION SYSTEM**

**A Major Project Synopsis Submitted to**



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**SYNOPSIS**

1. **TITLE**

Plant Disease Detection System

1. **INTRODUCTION**

Basically, the project deals with the identification of disease in soya bean plant. In the early stages, so as to prevent the spread of the disease at extreme levels.As an introduction to the project we are using image processing to scan the leaf image and using Machine Learning, will be training the dataset.

Agriculture is one of the most important activities for developing countries, contributing to the production of food and raw material. In addition, agriculture provides employment opportunities for a large portion of a country population and represents a large part of the national income (FAO, 2017). Despite the importance and productivity growth in recent years, agriculture in 2050 will have to produce almost 50 percent more than it did in 2012 to meet the demand of the world population (FAO, 2017). To increase productivity, proper management of a crop, including pest control, is crucial. Annually, plant pests cause crop losses of 20 to 40 percent of production (FAO, 2017). The losses caused by invasive insects cost the global economy around US$70 billion annually (Bradshaw et al., 2016). The main consequence of invasive insects is the herbivory and injury that result in a functional reduction of the total leaf surface of the plant. The loss of leaf area, namely defoliation, affects the photosynthesis and energy production of the plant, which decreases its nutrition and consequently the final production of the crop. In this way, it is important to monitor the defoliation level to take preventive actions. For soybeans in the vegetative stage, it is recommended to start treatments when the defoliation level reaches 30% (Kogan et al., 1977). In most cases, defoliation level is estimated visually by experts using a guide (examples of leaves and their respective defoliation level) (Kogan et al., 1977). Another common way is to use the grid counting method (Kvet and Marshall, 1971), in which the expert positions the leaf in a grid and counts the number of squares that overlap the leaf in order to estimate its area. Therefore, defoliation level estimation using the above techniques is a time-consuming and subjective task. In addition, the defoliation level is generally overestimated by these techniques, which leads to unnecessary insecticide applications (Wilhelm et al., 2000). Also, leaf area meters devices, such as the LI-3000A and LI-3100 (Barclay et al., 2000; dos Santos et al., 2016), are currently available to automatically estimate the leaf area. To estimate the defoliation level, these devices need to calculate the leaf area before and after herbivory. Although the leaf area after herbivory can be correlated to the defoliation level, it does not estimate the damaged area, especially when it occurs at the edges.

* 1. **PROJECT BENEFITS**
* To train a CNN Model
* Early detection of diseases
* Analysis of plant diseases
* Study the Deep Learning Models
* Connecting Technology to serve it for a better future
  1. **PROJECT SCOPE**
* For the farmers to detect the diseases more efficiently.
* A source of income.
* People working in the plants, to provide them with more accurate results.
* In the research fields, to obtain more accurate results with less efforts and time.

1. **PROBLEM STATEMENT**

Crop cultivation plays an essential role in the agricultural field. Presently, the loss of food is mainly due to infected crops, which reflexively reduces the production rate. To identify the plant diseases at an untimely phase is not yet explored. The main challenge is to reduce the usage of pesticides in the agricultural field and to increase the quality and quantity of the production rate. Our project is used to explore the leaf disease prediction at an untimely action.

Agriculture plays an important role in the economy of several countries, contributing from the production of food and income to the generation of jobs. To improve productivity in agriculture, proper crop management should be accomplished through pest control. One approach is to monitor the defoliation level, that is, the percentage of leaf damaged by insects.

1. **OBJECTIVES**

* To train a CNN Model
* Early detection of diseases
* Analysis of plant diseases
* Study the Deep Learning Models
* Connecting Technology to serve it for a better future

1. **INTENDED USER**

The intended users are the crop cultivators.

**6. EXISTING SYSTEM**

**Anand H. Kulkarni et al.** designed a methodology for detecting plants diseases early and accurately. He used diverse image processing techniques, where Gabor filter was used for features extraction and Artificial Neural Network (ANN) based classifier was used for classification with achieving a recognition rate of about 91%[2].

**P. Revathi et al.** used homogeneous techniques such as sobel and canny filter to identify the leaf edges. Those extracted edge features were then used in classification to identify the disease spots. The proposed work is based on Image Edge detection Segmentation techniques in which, the captured images are processed for enrichment first. Then R, G, B color Feature image segmentation is carried out to get target regions (disease spots). Further, image features such as boundary, shape, color and texture are extracted for the disease spots to recognize diseases and control the pest recommendation. The three parts that constitute the research work are- the cotton leaf spot, cotton leaf color segmentation, Edge detection based Image segmentation, analysis and classification of disease. [3].

**Tushar H Jaware et al.** proposed a novel and improved k-means clustering technique to solve low-level image segmentation. The improved algorithm uses noise data filter and hence, the clustering results improved significantly. The impact of the noise data on K-means algorithm dropped effectively and the obtained clustering results were more accurate.[4].

**Al-Hiary et al. 2011** followed the approach as- first the digital images were obtained using the digital camera. Then image processing techniques, such as image enhancement, segmentation, color space conversion and filtering, were applied to make the images suitable for the next steps. Then, important features were extracted from the image and used as an input for the classifier[7].

The Convolutional Neural Network (CNN) – a neural network based on human visual system was first inspired by **Hubel and Wiesel 1962** and it is being currently applied to a large number of pattern recognition problems by the researchers.

**Di Cui et al.**, Study explains the image processing techniques for multispectral images to detect the rust on plant leaf and also about the frequency with which the disease would spread and grow in amount . He used the dataset which contained the images collected from a greenhouse of research institute. The explained method used the concept to evaluate centroid for each image for further processing[1].

**Sanjay B. Dhaygude et al.** used the Spatial gray-level dependence matrices (SGDM) method for extracting the statistical texture features. He followed the procedure as first, the RGB images of the leaf were obtained. The images were then converted into Hue Saturation Value (HSV) color space representation. After the transformation process, the Hue component was taken for further analysis. Then the further steps including segmentation were applied.[5]

**Dheeb Al Bashish, et al.** developed neural network classifier based on statistical classification and could successfully detect and classify the diseases with a precision of around 93%. The proposed methodology was based on image processing and comprised of four phases which are as follows- (a) create a color transformation structure for the RGB leaf image. (b) Images were segmented using K-means clustering (c) texture features for the segmented infected objects were calculated and (d) in the fourth phase, the extracted features were passed through a pre-trained neural network [6].

**Sharada P. Mohanty et al. (Mohanty, Hughes, and Salathe 2016)**, used the existing deep CNN architectures, i.e AlexNet (Krizhevsky, Sutskever, and Hinton 2012) and GoogLeNet (Szegedy et al. 2015) to classify plant diseases. They used a public dataset of 54,306 images of diseased and healthy plant leaves that were collected under controlled conditions, the CNN was trained to identify 14 crop species and 26 diseases (or absence thereof). The models achieved 99.35% accuracy. When tested on a set of images taken at a different environment than the images used for the training, however, the model’s accuracy dropped to 31.4%. Overall the result demonstrates the feasibility of deep CNN for plant disease classification[14].

1. Naik and Sivappagari [8] have presented the plant leaf
2. disease detection by incorporating the concepts of genetic
3. algorithm, neural network and support vector machine. Here,
4. support vector machine is used for the detection and
5. classification of leaf diseases. Genetic algorithm has been
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23. classification of leaf diseases. Genetic algorithm has been
24. used for the image segmentation.

**Naik and Sivappagari** presented the plant disease identification detection by incorporating the concepts of genetic algorithm, neural networks and support vector machine. They used SVM for the detection and classification of leaf diseases and the genetic algorithm for image segmentation[16].

**Dandawate and Kokare** used the Support Vector Machine (SVM) concept for the detection and classification of soyabean plants as healthy or infected by diseases. They implemented the SIFT approach that could automatically recognize the plant species by their leaf shape. This system had an accuracy of about 93.79%.

Neural Network was used to observe the results. MATLAB was used as an experimental software.

* 1. **PROCESS FLOW**

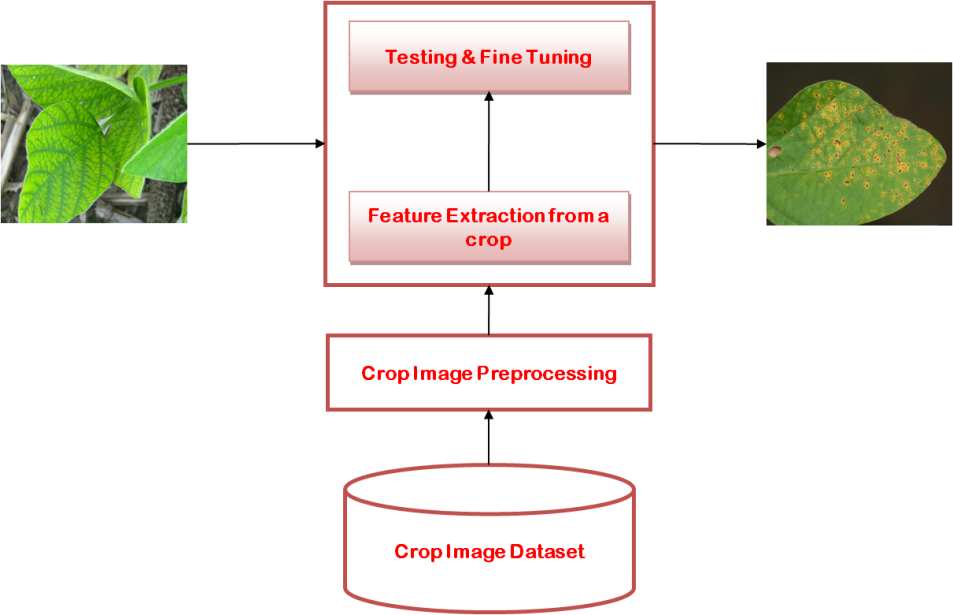
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Fig 1: Plant Disease Detection System diagram

* 1. **LIMITATIONS**
* Not 100% accurate dataset
* Maybe, for every disease, it could not be identified.

**7 PROPOSED SYSTEM**

The project focuses on the use of machine learning to process an image. And then to test it for any disease.

Accordingly a dataset will be trained, for drawing conclusions.

In this section, we describe the proposed method for estimating defoliation in soybean leaves using convolutional neural networks (CNN). Basically, the proposed method can be described in three steps: (i) image preprocessing, (ii) generation of synthetic defoliation, (iii) CNN modeling and training. First the input image is resized to a fixed size of 256 *×* 256 pixels that corresponds to the CNN input size. This resizing aids in the image standardization, besides contributing to the computational cost. The colored image is then binarized by applying the Otsu thresholding (Bangare et al., 2015) so that the image contains only two regions corresponding to the leaf and the background. Finally, the image is rotated at a random angle in order to make our method invariant to rotation.

*CNN modeling and training:* Given a set of images generated by the synthetic defoliationmethods, we trained a convolutional neural network. Due to the recentresults, three architectures have been evaluated: AlexNet (Krizhevskyet al., 2012), VGGNet (Simonyan and Zisserman, 2014) and ResNet (Heet al., 2016). These architectures were proposed for classification problems,that is, given an input image the objective is to classify it intoone of the known classes. To adapt an architecture to a regressionproblem, we have removed the softmax layer that returns the classprobabilities and added a fully-connected layer with one neuron and a sigmoid activation function to estimate the defoliation level. Also, we have trained the architectures using Root Mean Square Error (RMSE) loss function instead of cross-entropy.

* 1. **SYSTEM FEATURES**
* The system is the part of Deep Learning.
* System is in high demand nowadays because of its processing.
  1. **PROCESS FLOW**

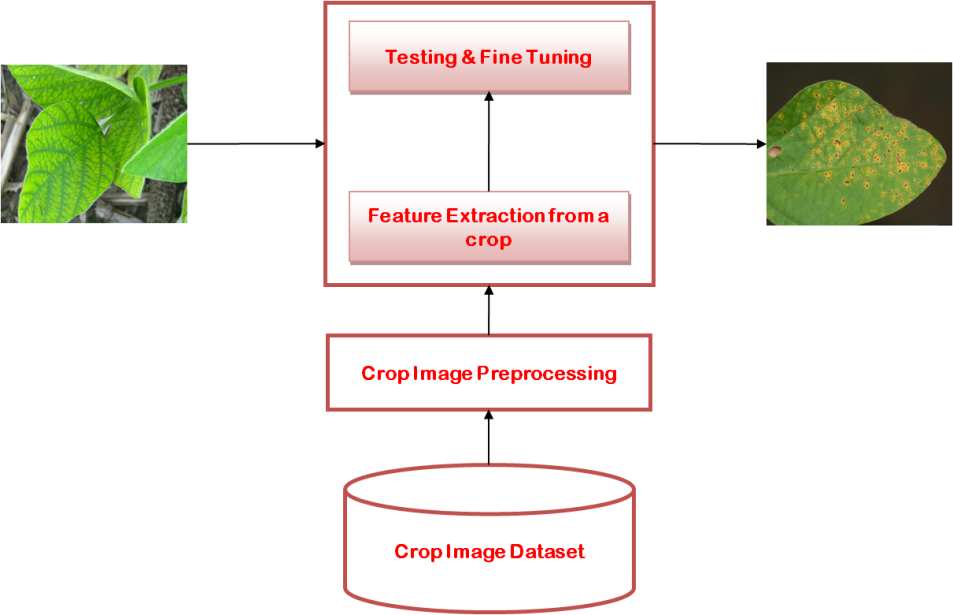
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Fig 2: Plant Disease Detection System diagram

**7.3 HARDWARE REQUIREMENT**

* System:              >i3 1.84 GHz.
* Hard Disk:         1 TB.
* Monitor:            15 VGA Color.
* Ram:                 4-8 GB.

**7.4 SOFTWARE REQUIREMENT**

* Operating system: Windows 7/8/10.
* Coding Language: C++/Java
* Database: SQL SERVER 2008

**8. EXPECTED OUTCOMES**

* User can differentiate between healthy and ill plants .
* Fast and detailed results.
* The strategy of recognizing reduces the manual workload.

**9. CONCLUSION**

Developing this project will help us connect with people, solving problems

Not solely, but building upon this project would be a help to the people who work on the soyabean crop.

Previously, NNs have been used for data mining purposes only but its various applications with hyperspectral data are now showing significant promise for disease detection. More often than not, like many other technologies, researchers have been confronted with emerging challenges in NN applications. For example, detection of three different categories of diseases manifestation viz. pre-symptomatic, symptomatic and asymptomatic diseases from a single plant requires best trainer sets for accurate classification.

Estimating defoliation is a crucial step in the adoption of insect-pest control strategies. To automate this process, this paper proposed a completely automatic method to estimate the defoliation level using convolutional neural networks (CNNs). In the proposed method, we replace the last layer of the CNNs (responsible for classification) by a layer to perform the regression of the defoliation level. Since CNNs require many examples for training, we also proposed approaches for generating images with synthetic defoliation to train our method. In the experiments, we have evaluated three CNN architectures (AlexNet, VGGNet and ResNet) that were trained only with synthetic images generated by the proposed approaches. We found that AlexNet estimated defoliation adequately with root mean square error of only 4.57, which is an expressive result for leaves with severe defoliation. In the proposed method analysis, it was observed that the internal layers reconstructed the missing parts of the leaf to perform the defoliation estimation. In addition, visualization of the last layer projected for two dimensions showed that the proposed method extracted information directly related to the defoliation level. As part of the future works, we intend to extend the method to color images and include new methods to generate synthetic defoliation. We also intend to evaluate the influence of including real images in training.

**9.1 LIMITATIONS**

* Internet is required.
* Can only work on the requirements.

**9.2 FUTURE ENHANCEMENTS**

This project can be implemented by food explores across the globe.

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