DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROJECT WORK PHASE I

Preliminary Synopsis Presentation Report

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Title of the Project: PLANT DISEASE DETECTION

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ABSTRACT

Agricultural productivity highly influences the economy of any country, especially in India where agriculture makes up about 20% of the country's GDP. In such situations, if the plant is affected by diseases and it is not treated properly at the right time, it will lead to economic losses and also increases the global food problem. To prevent this from happening, plant diseases must be detected and treated early so as to prevent serious consequences. The existing manual method of detecting plant diseases is time-consuming and not very pocket-friendly to farmers and may sometimes result in incorrect diagnosis as well.

Thus, we can make use of technologies like image processing and deep learning to successfully detect the diseases affecting the plant in the early stages. Most of the plant diseases can be visually seen, so it is convenient to apply image processing techniques to detect and classify them. In our approach, we use the technique of Convolutional Neural Network which uses the concept of hidden layers to classify the different diseases that affect the plants. Our model is successfully able to classify the diseases mentioned in the Apple, Tomato, Potato and Corn subsets of the New Plant Diseases dataset with an accuracy rate of 92%.

LITERATURE SURVEY

N Gobalakrishnan, K Pradeep, C J Raman, L Javid Ali and M P Gopinath**[1]**: uses image processing techniques with machine learning algorithms that are applied in various stages of a plant's life cycle and also come up with treatments for the suitable disease in the plants. In this paper, referred several papers (1-10) à techniques à diseasesà accuracy.

Sammy V. Militante**[2]**, In this paper, CNN architecture is used for disease classification and identification. The methodology in the study involves three key stages: acquisition of data, pre-processing of data and image classification. Steps used in this methodology are : Input Dataset, Image Acquisition, Image pre-processing and Classification. A 96.5% accuracy rate was achieved using 75 epochs during the training of the model. The model also achieved a maximum accuracy rate of 100% when testing random images of plant varieties and diseases.

Abdul Hafiz uses K-Means Segmented Support Vector Machine for Detecting diseases in Chilli Plants**[3]**. In this paper, an Artificial Intelligence based image processing algorithm is proposed to detect diseases on a Chilli plant using its leaves images. The proposed solution focuses on using k-means clustering algorithm for image segmentation and compares different Support Vector Machine (SVM) algorithms for classification. Computed images' features are extracted and used to classify these images into classes. Different parameters and different kernel functions are used to compute different SVM classification algorithms. The results are classified into background, healthy and unhealthy (Cucumber Mosaic) and can differentiate between health and unhealthy plants.

Suma V, R Amog Shetty, Rishab F Tated, Sunku Rohan, Triveni S Pujar**[4]**: uses CNN with artificial Neural Networks(ANN) and Machine Learning Algorithms (image processing techniquesà using 5000 datasets). The Network is trained using the images taken in the natural environment and achieved 99.32% classification ability. This shows the ability of CNN to extract important features in the natural environment which is required for plant disease classification. Image classification, Image Categories, Feature Extraction, and Training Data is carried out. The algorithm is implemented with training data and classification of given image dataset. The test input image is compared with the trained data for

detection and prediction analysis. From the results, it is clear that the model provides reliable results.

Praveen Kumar Joshi**[5]** proposes the use of Support Vector Machine(SVM) algorithm for plant disease detection and classification. To carry out the process, the entire framework is divided into five sequential steps, namely Image Collection, Image Pre-processing, Image Segmentation using Otsu's method, Feature Extraction using Gray-Level Co-Occurrence Matrix(GLCM) and Classification using SVM. Author was successfully able to detect Bacterial Spot, Septoria Leaf Spot, Leaf Mold and Average Mold with an accuracy of 100%, 60%, 80% and 85% respectively.

Md. Arifur Rahman**[6]**: This paper mainly focuses on implementing an improved segmentation technique using a combination of thresholding and morphological operations. For classification, they have used the deep neural network. This method includes four important stages namely: enhancement, segmentation, feature extraction and classification. Their proposed method has achieved 99.25% accuracy in the Plant Village database.

Sharath D M, Akhilesh, S Arun Kumar, Rohan M G and Prathap C**[7]:**The proposed system uses the canny edge detection technique for detection of the disease affected areas in the fruit after the segmentation of the image using grab cut segmentation. After segmentation the edges of the affected fruit area is calculated in terms of pixels. Based on the number of pixel counts, the percentage of infection in fruits is determined and based on the disease with which the fruit is affected, the preventive measures, biological and chemical solutions are provided.

S.Santhana Hari proposes the use of CONVOLUTIONAL NEURAL NETWORK(CNN)**[8]** for detection of plant disease by leaf image. Disease identification is done by using a deep learning method. All the classification was done based upon the images of the crop's leaf, which contains both the healthy and affected leaf. This model has produced an accuracy of about 96.3%. Deeper Network architecture is implemented for the grading of plant species. Their result produced an accuracy of 86.2% which is considered to be less accurate.

Santhosh Kumar.S**[9]**: Literature survey has detailed explanation of the importance of disease detection both to plants and to mankind. To have a meaningful impact of plant diseases & techniques in the area of agriculture, deliberation of proper input is necessary. Research issues addressed here are to develop a systematic approach to detect and recognize the plant diseases that would assist farmers and pathologists in prospect exploration. The paper depicts the importance of image processing in the

agriculture field and considering the type of disease for further research work.

Mercelin Francis**[10]** uses Convolutional Neural Network and deep learning models. (image processing approach). In this paper, Implemented a convolutional neural network to detect and classify whether the leaf is diseased or healthy. Apple and Tomato plant leaves are used to detect whether the plant is healthy or affected by the disease. The achieved accuracy is 88.7 with minimum number of parameters ie. 45K when compared to other existing models. Creating and training a CNN model from scratch is a tedious process when compared to the usage of existing deep learning models for various applications to achieve maximum accuracy. So depending on the application various models can be used or retrained. Therefore in the future work, it is planned to utilize a model efficient than VGG and other existing architectures, such that it gives higher accuracy with minimum size and complexity, so that it can be used in mobile or any other embedded applications.

Endang Suryawati**[11]** evaluates and compares different CNN architectures with varying depths like CNN baseline(2 convolutional layers), AlexNet(5 convolutional layers), VGGNet(convolutional layers) and GoogleNet(not only deep architecture but also wide). Author makes use of the tomato subset of the Plant Village Dataset for the experiment. After the experiment, the Author states the accuracy rate of each of the tested architectures as 84.58%, 91.52%, 89.68 and 95.24 for Baseline, AlexNet, VGGNet and GoogleNet respectively.

Melike Sardogan**[12]**: uses CNN with Learn Vector Quantization(LVQ) Algorithm. Tomato plant leaf is used for disease detection and classificationà 500 datasets. Three different input matrices have been obtained for R, G and B channels to start convolution for every image in the dataset. Each input image matrix has been convoluted. reLU activation function and max pooling have been implied to the output matrix. Total 500 feature vectors which obtained from original images have been used for training and testing operations in the LVQ algorithm. It is concluded that the proposed method effectively recognizes four different types of tomato leaf diseases. To improve the recognition rate in the classification process different filters or different sizes of convolutions can also be used.

Huu Quan Cap, Katsumasa Suwa, Erika Fujita, Satoshi Kagiwada, Hiroyuki Uga, Hitoshi Iyatomi**[13]:** This paper presents a simple and accurate leaf regions detection system with high affinity with other existing disease diagnosis systems. We confirmed that the performance of 78.0% in F1-score is sufficiently acceptable for this task from visual assessment. Precision and recall are trade-off criteria.

Considering the practical application of the whole plant diagnosis schema in, it is not necessary to detect exactly the whole full leaf from the images. In the fact that we need to detect some of, or at least one infected leaf per disease in the image. Conversely, we should not pass completely the wrong area to the classifier followed by especially when the following classifier is not so robust. That is, we need a certain level of precision. Therefore, appropriate control of balance between false positive and false negative is required.

Mrs.Divya Unni ,Anjali K , Arya M S**[14]:** The main approach of this approach is to recognize the diseases. Speed and accuracy are the important characteristics required for disease detection. Hence, the extension of this work will focus on developing the advanced algorithms for fast and accurate detection of leaves with disease. This paper gives the survey on different disease classification techniques that can be used for plant leaf disease detection and an algorithm for image segmentation technique used for automatic detection as well as classification of plant leaf diseases has been described later. Therefore, related diseases for these plants were taken for identification. Using very less computational efforts the optimum results were obtained which also shows the efficiency of the proposed algorithm in recognition and classification of the leaf diseases.

Halil Durmas**[15]** uses the technique of deep learning to classify the different diseases in the tomato subset of the Plant Village dataset. Author compares two architectures namely AlexNet and SqueezeNet. Author makes use of the supercomputer Nvidia Jetson Tx1 for both training and testing. Accuracy results are obtained from Caffe tests. Even though the SqueezeNet model(2.9Mb) is 80 times smaller than the AlexNet model(227.6Mb), it's accuracy is 94.3% as compared to 95.6% accuracy of AlexNet architecture. Hence, Author concludes that the SqueezeNet model is a good candidate for mobile applications of plant disease detection due to its light-weight property and low computational needs.

Mrunmayee Dhakate**[16]** proposes a method for diagnosis of pomegranate plant diseases. This method uses the technique of K-means clustering for segmentation of the images, GLCM for feature extraction and multi-perceptron architecture with back-propagation algorithm for classification of the images. The categories used for classification are Good Fruit, Fruit Spot, Bacterial Blight, Fruit Rot, Good Leaf and Leaf Spot. The proposed method works with an accuracy of 100%, 83.33%, 85.71%, 83.33%, 100% and 87.5% for the mentioned categories respectively. Hence, the Author concludes that the proposed method gives a satisfactory average accuracy of 90%.

SYSTEM REQUIREMENTS

Hardware Requirements :

Hardware Tools	Minimum Requirements
Processor	15 or above
Hard Disk	10GB
RAM	4GB
Monitor	15'' Coloured
Mouse	Optical
Keyboard	122 Keys

Software Requirements :

Hardware Tools	Minimum Requirements
Platform	Windows, Linux or MacOS
Operating System	Windows, Linux or MacOS
Technology	Machine Learning-Python
Scripting Language	Python
IDE	Jupyter Notebook/ Kaggle Notebook

APPLICATION BENEFITS

The people around the world rely on the agricultural sector as one of the most important sectors where crops are the basic need for food. Early recognition and detection of these diseases are crucial to the agricultural industry. This model has achieved its goal to detect and recognize different plant varieties and plant diseases using convolutional neural networks. The trained model can be used to test real-time images to detect and recognize plant diseases.

An additional plant variety and different types of plant diseases may be included in the existing dataset to increase the trained models. Other CNN architectures may also use different learning rates and optimizers for experimenting the performance and accuracy of the model. With the achieved accuracy of 92%, the proposed model can assist farmers to detect and recognize plant diseases.

PLAN OF ACTION

PROJECT PHASE I

September 1-14: We started our search for which domain our product must aim to. We wanted to do something that had a big impact on the society, which led us to our current topic : Plant disease detection. On further discussion with our guide, the idea was finalized.

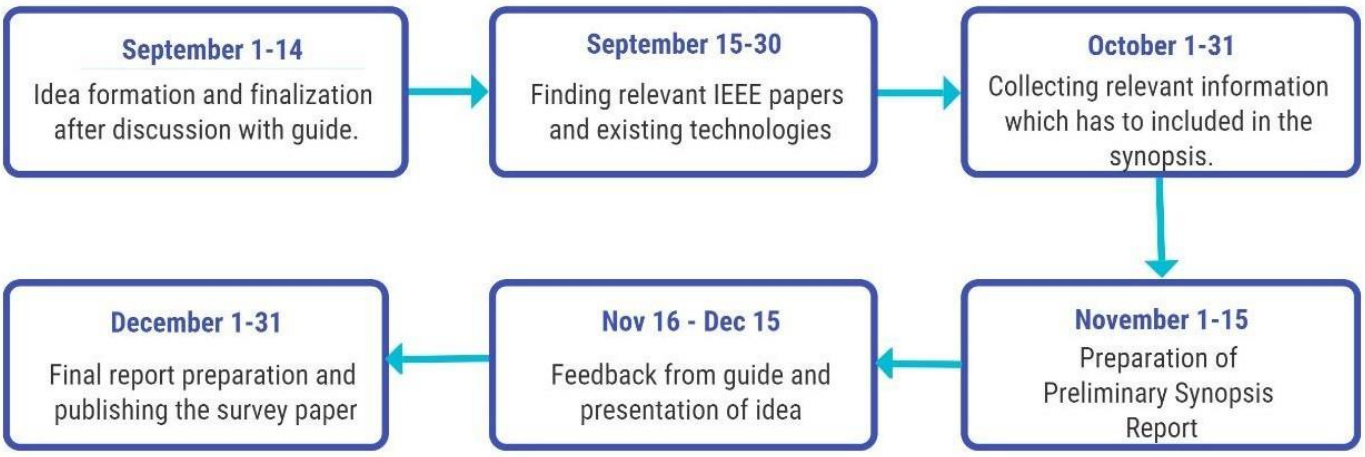
September 15-30: Now that our topic was decided, we started researching for relevant IEEE papers and existing technology. We were successfully able to collect 15-16 published papers which were going form the base of our project.

October 1-31: Once we got the format of the project report/ synopsis, we started searching and collecting relevant information which we could include in our synopsis. We constantly communicated with each other so that everybody was aware of the information and progress of the project.

November 1-15: We came up with the preliminary project synopsis report with all the information that we had collected.

November 16-December 15: Based on the feedback given from our guide, we are going to make the required changes to the report. We will also come up with a power point presentation to present our project idea with the rest of the class.

December 1-31: Once, the preliminary report is finalized, we will come up with the final report in IEEE format(survey paper) which has to be published. In the last step of phase 1 of our project, we look forward to successfully publish our paper.



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