VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI-590014

Project Report Phase I
PLANT DISEASE DETECTION USING MACHINE LEARNING

Submitted by

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Under the Guidance of

Dr. RAVIKUMAR H C
(Asst. Professor, Dept. of ECE)

Department of Electronics and Communication Engineering
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Signature of the Guide **Signature of the coordinator** **Signature of the HOD**

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ABSTRACT

The detection of illness on crops is one of the laborious and crucial duties in agricultural activities. It takes a lot of time and requires specialized labour. Detection of plant disease through automatic technique are beneficial as it requires a huge amount of work, monitoring in big farm of crops, and at early stage itself to detect symptoms of diseases means where they appear on the plant leaves. In this study, an effective method for crop disease identification using machine learning and image processing techniques are proposed. This proposed approach has a 75% accuracy rate for detecting 20 distinct illnesses in 4 popular types of plants. We are using integrated techniques to improve accuracy above 75% through this model.

Keywords:

Image processing,VGG-19, Convolution Neural Networks, Machine learning,Plant disease detection.

INTRODUCTION:

In India about 70% of the population relies on agriculture. Identification of the plant diseases is important in order to prevent the losses within the yield. It's terribly troublesome to observe the plant diseases manually. It needs tremendous quantity of within the plant diseases, and conjointly need the excessive time interval. Hence, machine learning labour, expertize models can be employed for the detection of plant diseases. In this project, we have described the technique for the detection of plant diseases with the help of their leaves pictures. Machine learning is a sub part of artificial intelligence which works automatically or give instructions to do a particular task. The main aim of machine learning is to understand the training data and fit that training data into models that should be useful to the people. So it can assist in good decisions making and predicting the correct output using the large amount of training data.

The colour of leaves, amount of damage to leaves, area of the leaf, texture parameters are used for classification. In this project we have analyzed different image parameters or features to identifying different plant leaves diseases to achieve the best accuracy. Previously plant disease detection is done by visual inspection of the leaves or some chemical processes by experts. For doing so, a large team of experts as well as continuous observation of plant is needed, which costs high when we do with large farms. In such conditions, the recommended system proves to be helpful in monitoring large fields of crops. Automatic detection of the diseases by simply seeing the symptoms on the plant leaves makes it easier as well as cheaper.

The proposed solution for plant disease detection is computationally less expensive and requires less time for prediction than other deep learning based approaches since it uses statistical machine learning.The past scenario for plant disease detection involved direct eye observation, remembering the particular set of disease as per the climate, season etc. These methods were indeed inaccurate and very time consuming. The current methods of plant disease detection involved various laboratory tests, skilled people, well equipped laboratories etc. These things are not available everywhere especially in remote areas. Detection of disease through some automatic technique is helpful because it reduces an oversized work of watching in huge farms of crops, and at terribly early stage itself it detects the symptoms of diseases means that afterthey seem on plant leaves.

There are several ways to detect plant pathologies. Some diseases do not have any visible symptoms, or the effect becomes noticeable too late to act, and in those situations, a sophisticated analysis is obligatory.

However, most diseases generate some kind of manifestation in the visible spectrum, so the naked eye examination of a trained professional is the prime technique adopted in practice for plant disease detection. Variations in symptoms indicated by diseased plants may lead to an improper diagnosis since amateur gardeners and hobbyists could have more difficulties determining it than a professional plant pathologist. An automated system designed to help identify plant diseases by the plant's appearance and visual symptoms could be of great help to amateurs in the gardening process and also trained professionals as a verification system in disease diagnostics.

Advances in computer vision present an opportunity to expand and enhance the practice of precise plant protection and extend the market of computer vision applications in the field of precision agriculture. The problem of efficient plant disease detection is closely related to the problems of sustainable agriculture andclimate change In India, Farmers have a great diversity of crops. Various pathogens are present in the environment which severely affects the crops and the soil in which the plant is planted, thereby affecting the production of crops,Various disease are observed on the plants and crops .The main identification of the affected plant or crop are its leaves.The various colored spots and patterns on the leaf are very useful indetecting the disease. On the other hand, deep architectures like CNN (Convolutional Neural Networks) have also been heavily used in studies that are concerned with plant disease detection.

VGG-19 is a convolution neural network that is trained on more than a million images from the database. The network is 19 layers deep and can classify images into 1000 object categories, such as keyboard, mouse, pencil and many animals. As a result, the network has learned rich feature representations for a wide range of images.

LITERATURE SURVEY:

1. In paper [1], use of efficient image processing techniques can be seen. Image is being captured and compared with data sets. Majorly, here they have implemented a system where users are linked to e-commerce platform to check different pesticides with rate and how to use it for betterment of crops. Paper also helps greenhouse farmers in efficient manner. Object detection algorithms like SSD, DSSD and R-SSD are used. Partitioning leaf into four clusters using Euclidean distances by K-means segmentation. Later using the neural network detection also based on back propagation methodology. Crops like fruit crops, vegetable crops, cereal and commercial crops are involved and for each type suitable algorithm is used mostly focused on fungal diseases. For fruit and cereal crops: k-means clustering, vegetable crops: Chan-vase method, commercial crops: grab-cut algorithm. Has four phases: Image Acquisition-> Image Segmentation-> Feature Extraction-> Classification. MATLAB is used for the feature extraction and image recognition. Built an end-to-end Android application with TF Lite and for 14 species of crops in an efficient way.

2. In paper [2], by deep learning techniques and programming services, used Plant Village open database for the datasets. Deep siamese convolutional network is developed for solving problem of the small image databases. Applied transfer learning approach and train deep classifier. They compared four models and weights of which solved ILSVRC (ImageNet Large Scale Visual Recognition Challenge) they are: VGG19, InceptionV3, ResNet50 and Xception. Used only three plant classes: Healthy, Esca, Black rot. Binary classification helped them improve model. For loss function have utilized a binary cross-entropy loss technique. Used prepared embedded to train the T-SNE method, which is the common technique to visualize high dimensional data and developed an efficient system.

3. In Paper [3], Alternaria leaf spot, Brown spot, Mosaic, Grey spot and rust are five common types of apple leaf diseases that severely affect Apple yield this paper proposes a deep learning approach that is based on improved Convolutional Neural Networks (CNNs) for the real time detection of apple diseases In this Paper the Apple Leaf Disease Dataset (ALDD)

will be studied. The real time detection model is based on the single shot multibox detector(SSD) for apple leaf diseases is proposed. Here the VGG-INCEP Model is used. ALDD is performed by 1.Data Collection, 2.Image Annotation, 3.Data augmentation. Dropout regularization randomly leaves neurons in network during each of it's iteration of training in order to minimize the variances of the model and simplifying the network which helps in the prevention of over fitting of model.

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4. In Paper [4], Plant diseases pose the biggest danger to crop productivity, which has an impact on food security and lowers farmers' profits. The key to preventing losses through appropriate feeding strategies to cure diseases early and prevent the fall in productivity/profit is identifying the diseases in plants. Using the KNN technique, the tomato leaf is categorised as healthy or unhealthy in the first stage. Later on in the second step, they use the PNN and KNN approaches to categorise the sick tomato leaf. For classification purposes, attributes like GLCM, Gabor, and colour are used. According to the 2011 census, almost 70% of the population derives their livelihoods directly or indirectly from the agricultural sector, which is the foundation of the Indian economy. With India's overall economic growth, agriculture's economic contribution to GDP is continuously shrinking. Improved efficiency and implemented different algorithms together for an effective design of the model.

5. In paper [5], techniques like deep learning and image processing are used. CNN, Fast RCNN, Faster RCNN, and Mask RCNN, and image processing techniques such as image pre-processing, segmentation, feature extraction etc. Have used LeNet Architecture model for designing the system. Use of Relu performs an element-wise non-linearity operation. Dropout regularization randomly drops neurons in network during each iteration of training to reduce the variance of the model. K-means cluster algorithmic rule is applied for classifying. Feature extraction is an extra added feature. Six types of data augmentation methods used for image flipping, gamma correction, noise injection, principal component analysis (PCA) color augmentation, rotation, and scaling methods to increase performance.

6. In paper [6], developed an android application that helps farmers in identifying plant disease and uploading a leaf image to the system and plant disease detection using image processing

and machine learning. Using the Open CV and then the image classification in the process. Main algorithm used here is CNN. The given system uses re sizing, Gaussian filtering to segment the leaf area, then finally CNN classification to detect the type of leaf disease. Uses SVM classifier and the concept of cuckoo search. Detection of unhealthy leaves include few steps like RGB image acquisition. Converting the image input from RGB to HSI format. Masking and removing all the green pixels. Segmenting the components using Ostu's method. Computing the texture features by use of color-co-occurrence methodology and finally classifying the plant leaf disease using Genetic Algorithm mainly.

7. In paper [7], they merged IoT-based technology with a device learning system. Through heated leaves, this investigation aimed to identify potentially dangerous plants. Using CNN-enabled technique, the worst scenario for the great majority of less developed countries was lessened. For this study, they modelled the IoT community-based totally Plant health Detection device and looked at the astonishing invisible types of plant leaves that cannot be identified without difficulty with inside the leaves. In this research paper, they investigated and developed an IoT-community device with a CNN model that could efficiently detect invisible micro subjects within the plant by attaining 95% accuracy with the look at. They employed an image-based approach to train the model for the detection of illnesses in leaves. They employed a CNN technique and an IoT network infrastructure. This typical overall performance detection has a 90-5 accuracy rate. The algorithm is implemented with help of training data and classification of the input image dataset. The test input image is compared to that of the trained data for purpose of detection and prediction analysis.

8. In paper [8], the feature extraction is performed on images that are dithered, RGB, HSV, and YIQ. In the suggested approach, feature extraction from RGB images is added. a brand-new automated technique for identifying disease symptoms in digital images of plant leaves. Different plant species' illnesses have been mentioned. A handful of the illness names in this system have been classified. This work carries out the disease recognition for the leaf image. It is still being researched and analysed how to use image processing to find cotton leaf diseases. For segmentation, the k means clustering technique is employed. The suggested approach

incorporates the k-means idea, which will separate the leaves into many clusters. The survey for identifying diseases on cotton leaves has been completed. The comparison of various leaf disease detection methods is mentioned. In this system, SVM and k-means clustering have been applied. The identification of various leaf diseases using various data mining techniques is a potential study area. Illnesses in several plant species have been mentioned. Only a few of the disease names in this system have been assigned a classification. In this system, the SVM classification principle is applied.

9. In paper [9], Without employing any transfer learning techniques, they offer a new Deep CNN-based architecture that focuses on fewer parameters and requires less processing power to analyse with higher accuracy. Using accessible datasets, they conduct experiments where they apply their approach and contrast it with current machine learning, neural network, and transfer learning techniques. The comparison shows that their suggested strategy outperforms a lot of competing strategies. Improved model based on existing system and introduced new techniques also.

10. In paper [10], In order to identify and categorize the signs of plant diseases, numerous developed/modified DL architectures are used in conjunction with a number of visualization techniques. Additionally, a number of performance indicators are employed to assess these structures and methodologies. The experimental results declared that the InceptionV3 model performs much better than the Mobile-Net model in terms of accuracy, efficiency and validation loss. This article offers a thorough justification of the DL models used to depict various plant diseases. Additionally, several research holes are found that might be filled to increase transparency for identifying plant diseases even before their symptoms are plainly visible.

PROBLEM STATEMENT

1. Having diseases in plants is quite natural. If proper care is not taken in this area then it affects product quality, quantity and productivity.
2. These problems need to be solved at initial stage to save crop wastage.
3. This machine learning automatic detection model helps to prevent the worse to come.

OBJECTIVES:

The Major objective of the mini project are:

1. To study and learn existing Machine learning methodologies
2. To study and learn about existing plant diseases.
3. To learn image processing and training techniques.
4. To provide much accurate results in detection of plant leaf disease.

METHODOLOGY:

In the initial step, the RGB images of all the leaf samples were picked up. The step-by-step procedure ofthe proposed system:

- RGB image acquisition;
- Convert the input image from RGB to HSI format;
- Masking the green-pixels;
- Removal of masked green pixels;
- Segment the components;
- Obtain useful segments;
- Evaluating feature parameters for classification;
- Configuring SVM for disease detection.

Colour Transformation: HSI (hue, saturation, intensity) colour model is a popular colour model because it is based on human perception. After transformation, only the H (hue) component of HSI colour space is taken into account since it provides us with the required information.

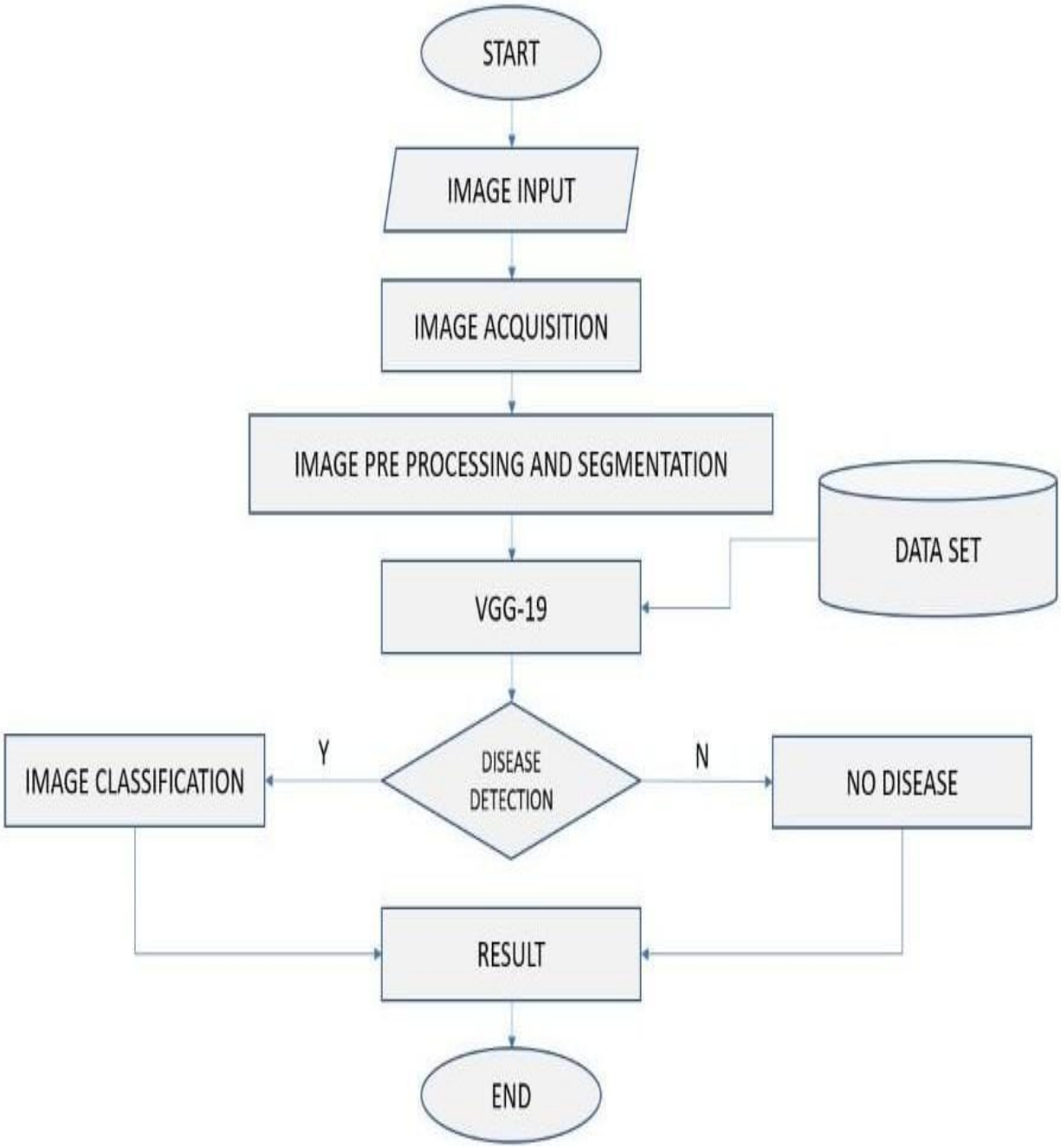
Masking Green Pixels: This is performed as green colour pixel represent the healthy region of a leaf.Green pixels are masked based on the specified threshold values.

Segmentation: The infected portion of the leaf is extracted by segmenting the diseased part with other similar coloured parts (say, a brown coloured branch of a leaf that may look like the disease) which have been considered in the masked-out image, are filtered here. All further image processing is done over a region of interest (ROI) defined at this stage.

Classification: From the previous results we analyze and evaluate the features like the area of the leaf, percentage(%) of the leaf infected, the perimeter of the leaf, etc., for all the leaf

images, and pass it to theSVM classifier.

FLOW CHART



TOOLS:

Google Colab

LIBRARIES:

- Numpy
- Pandas
- Matplotlib
- keras

CONCLUSION

This research conducts a survey of various methods for detecting leaf disease. The primary cause of decreased production of fruits and vegetables in the leaves is illness. Each has some benefits and some restrictions. Utilizing Deep Learning and Image Processing methods to solve that problem. For accurate results, many authors employed those methodologies and various datasets. After studying the methods, it is clear that there are numerous ways to identify plant diseases. We are using VGG-19 and k-means clustering and few improved deep learning techniques to improve model efficiency.

REFERENCES

1. Plant disease detection using image processing. Mr.V Suresh , D Gopinath, Mohana Krishnan published on March 2020.ISSN:227-0181.

2. Disease Detection on the plant leaves by Deep_learning. P.Goncharav, G.Ososkov, I.Nestsiarenia published on January 2019.DOI: 10.1007/978-3-030-01328_16.

3. Real-Time Detection of Apple Leaf Diseases Using Deep Learning Approach Based on Improved Convolution Neural Networks. Peng Jiang, Yuehan Chen, Binliu pulished on May 17 2019.DOI:10.1109/ACCESS.2019.2914929.

4. Tomato Plant Leaves Disease Classification Using KNN and PNN. Balakrishna Kem-pegowda, Mahesh Rao published on January 2019.DOI: 10.4018/IJCVIP.2019010104

5. Plant Leaf Disease Detection. Sneha Patel, Dr.U.K Jaliya, Pranay Patel published on April 2020. DOI: 10.46501/IJMTST.

6. Detection of Plant Leaf Disease Using Image Processing Approach. K.Saraswati published on May 2021 IJSDR.ISSN: 2455-2631

7. Plant Leaf Health Detection Enabled CNN Scheme in IoT Network. K.Veera Inba Priya Darshini, Dr. P. N. Sundararajan published on August-2022
   ISSN: 2278-0181 .

8. Leaf Disease Detection using Image Processing. Sujatha R , Y Sravan Kumar and Garine Uma Akhil published on 23 November 2017.
   ISSN: 0974-2115

9. Identification of plant leaf diseases using a nine- layer deep convolution neural network. Geetharamani, Arun Pandian published on June 2019.
   DOI: 10.1016/compeleceng.2019.04.011

10. Residual Deep interpretable architecture for plant disease detection Dhruvil Shah Vishvesh Trivedi and Vinay Sheth Aakash Shah, Uttam Chauhan published on June 2022. DOI: 10.1016/j.inpa.2021.06.001