

Identification of Leaf Disease Using Image Processing Technique

Ankit Wagh¹, Ritwik Chumble², Santosh Kangane³, Pranav Bakare⁴

BE Students, Department of Information Technology

K. K. Wagh Institute of Engineering Education & Research, Nashik, India

Abstract: *The increased availability of smartphones has made it easier for taking technology to every individual. Technology can play important role in the field of agriculture to improve outcomes. Plant disease is one of the important reasons for the decrement of yield. Bridging technology with agriculture can give revolutionary change. It is challenging to monitor the disease of plants manually. It consumes important time, resources, and need efforts. Hence faster image processing technique is used as a solution for it. Disease detection using image processing involves multiple steps like the acquisition of images, pre-processing, segmentation, feature extraction, and classification. This paper discusses a faster image processing technique using the KNN method. This algorithm gives an asymptotically faster method for image processing.*

Keywords: Image Processing, Classification, Convolution, Template Matching, Disease Detection

I. INTRODUCTION

The increasing population is the reason for many problems like malnutrition, poverty. It is observed that still many people in the country don't get two-time food every day. India being a cultivated country and the majority of the population depending on agriculture needs to give a solution for this problem. Plant Diseases are responsible for both reduction in total yield as well as the quality of the crop. Most of the diseases are observed on plant leaves. Study of diseases refers to change in plant leaf after getting harmed due to certain disease. Image processing can be used for the detection of these diseases and taking action to avoid loss in yield. Different symptoms are observed on plants leaf when it is harmed due to different types of diseases. This paper gives the introduction to faster image processing for plant disease identification.

The performance of plant disease detection depends on the accuracy of image processing algorithms. Existing algorithms cannot give the necessary results. The existing system may lack time complexity and efficiency while identifying the plant's disease. Template matching tries to answer one of the most basic questions about an image: Is there a certain object in that image? If so, where? The template is a description of that object (and hence is an image itself) and is used to search the image by computing a difference measure between the template and all possible portions of the image that could match the template.

This paper is divided into four sections. Section II presents study on different types of potato diseases. Section III presents process of identifying plant's disease and its stages. Section IV presents related work that has already been done on plant's disease detection. Section V describes about KNN algorithm. Section VI compares existing KNN algorithm with existing algorithms. Section VII summarizes work in form of conclusion.

II. DIFFERENT TYPES OF POTATO PLANT DISEASE

This section briefly explains different types of diseases that occur on potato plants. The purpose of this section is to explain to readers about plant disease. The images of three frequently occurring diseases are shown in fig.1. We describe each section briefly.

1. **Alternaria:** Alternaria causes lesions on the leaves which often have a target spot appearance of concentric rings. These usually (but not always) appear a few weeks after emergence and start as very small black or brown spots on lower leaves which then coalesce.

2. **Verticillium Wilt:** Leaflets can curl, turn pale green or yellow and become desiccated, sometimes starting at the tips.
3. **Potato Leafroll Virus (PLRV):** A slight rolling and red/orange tinge can occur in the upper leaves. Secondary symptoms, those following the year of infection, vary. The bottom leaves may roll and the leaves are dry and brittle and have a papery feel.

III. PLANT DISEASE IDENTIFICATION PROCESS

This section explains the processes for disease identification using image processing.

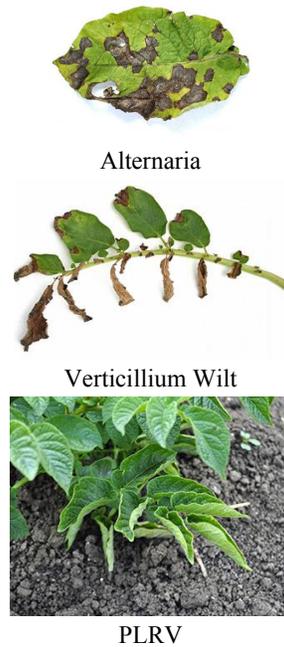


Figure 1

3.1 Image Acquisition

Image acquisition is to be carried out by means of smartphone camera. This image is in form of RGB (Red, Blue, Green). This RGB leaf image is to be used for creation of colour transformation structure.

3.2 Image Pre-processing

Noise in image or other object removal is done in by using image pre-processing techniques. Methods like cropping of image, filtration are applied on captured image.

$$f(x) = 0.2989 * R + 0.5870 * G + 0.114 * B \quad (1)$$

After enhancement of RGB image by increasing contrast, it is converted to grey image using colour conversion by using equation (1). For distributing intensity value cumulative distribution function is used.

3.3 Segmentation

1. Partitioning of image into various part of same feature having some similarity is objective of image segmentation. There are various methods for doing segmentation, some of which includes k-means, clustering etc.
2. **K-means algorithm:** Classification of object based on a set of features into K number of classes can be done using K-means algorithm. The sum of the squares of the distance between the object and the corresponding cluster is minimized for classification of image.

3.4 Algorithm

1. Randomly pick centre of K cluster. One can use trial and error for picking centre.
2. Assign each pixel in the image to the cluster that minimizes the distance between the pixel and the cluster center.
3. Again compute the cluster centers by averaging all of the pixels in the cluster. Repeat steps 2 and 3 until convergence is attained.

3.5 Feature Extraction

For identification of an object, feature extraction plays an important role. In plant disease detection various features are taken into consideration for example: colour, texture, morphology, edges etc.

Leaf colour extraction using H and B components:

The input image is enhanced by using anisotropic diffusion technique to preserve the information of the affected pixels before separating the colour from the background. To distinguish between grape leaf and the non-grape leaf part, H and B components from HIS and LAB colour space is considered. A SOFM with back propagation neural network is implemented to recognize colours of disease leaf.

3.6 Classification

A. K-nearest Neighbour

Decision of K and separation metric connected essentially dictate the execution of a KNN classifier. The gauge is influenced by the affectability of the determination of the area measure K, on the grounds that the sweep of the nearby locale is dictated by the separation of the Kth closest neighbour to the question and diverse K yields distinctive restrictive class probabilities.

In the event that K is little, the nearby gauge will in general be extremely poor attributable to the information meager condition and the boisterous, vague or mis-labelled focuses. With the end goal to additionally smooth the gauge, we can build K and consider a substantial locale around the question. Shockingly, an extensive estimation of K effectively makes the gauge over smoothing and the arrangement execution debases with the presentation of the anomalies from different classes. To manage the issue, the related research works have been done to enhance the arrangement execution of KNN.

Step for KNN (k-Nearest Neighbours Algorithm)

1. Start.
2. Input RGB image to HSV image.
3. Read value of K.
4. Type of distance (V)& training data.
5. Compute the distance between input sample and the training samples.
6. Find the K nearest neighbours (v) to the training data.
7. Set maximum label class of K to trained data.
8. If data is not classified give training for input image for classification.
9. If data is classified apply KNN classifier.
10. Predict the disease name.
11. Stop.

IV. DATA SET DESCRIPTION

Kaggle is an open-source repository that provides Plant Village Dataset [1] for research purposes. The dataset comprises approximately 55,000 well-labelled images of healthy leaves and infected leaves of various fruits and vegetables like apple, blueberry, cherry, grapes, peach, pepper, orange, tomato, and potato, etc. Every folder of the fruit

and vegetable has two types of images i.e., coloured and grayscale. Every crop contains more than one type of leaf disease and for classification, each type is considered as a separate class of disease. Dataset is divided into two types in which each image has a leaf picture with background and without background.

V. PLATFORM UTILIZED

This solution is focused mainly to bring ease in plant disease detection with fast and efficient use, therefore platform used for this is an android which ensures that this application can be used by farmers easily. It also involves cloud technology from where captured image is compared with images in data set. This also ensures time to time updating of data set and can protect crop from newly emerging diseases.

VI. COMPARISON WITH TRADITIONAL AND CNN ALGORITHM

6.1 Traditional Machine Learning

Traditional machine learning for classification use features extracted from images instead of the image itself. The success of these methods heavily depends on the extracted image features (such as LBP [4]). In This study we use LBP variants for features and k-nearest neighbour (KNN) algorithm for classification.

6.2 Convolution Neural Network

We train a CNN to extract features and classify images at the same time. Such a network comprises one or more convolutional layers followed by one or more fully connected layers one or more convolutional layers followed by one or more fully connected layers. CNNs have some advantages over fully connected networks. They are easier to manipulate, train and control the values of their few parameters. With the same number of hidden layers, CNNs have been shown to be more useful than the traditional fully connected networks.

VII. ACKNOWLEDGMENT

We are deeply grateful to our institute and all staff for giving us guidance throughout writing this paper and giving their valuable comments.

VIII. CONCLUSION

It is very important for growing population that they are provided with sufficient food. Detection of plant disease is therefore very important for increasing yield of crop. Previously used methods are time consuming and having less efficiency. Our technique can help farmers in detecting diseases in their early stages and in enhancing their crop yields. A combination of image processing and machine learning techniques can give opportunities to researchers to address problems in various domains that affect to society directly or indirectly.

REFERENCES

- [1] Jitesh P. Shah, Harshadkumar B. Prajapati, Vipul K. Dabhi, "A Survey on Detection and Classification of Rice Plant Diseases." In 2016 IEEE International Conference on Current Trends in Advanced Computing, 2016.
- [2] Divyansh Tiwari, Mritunjay Ashish, Nitish Gangwar, Abhishek Sharma, Suhanshu Patel, Dr. Suyash Bhardwaj, "Potato Leaf Diseases Detection Using Deep Learning." In International Conference on Intelligent Computing and Control Systems, 2020.
- [3] Aiman Moldagulova, Rosnafisah Bte. Sulaiman, "Using KNN Algorithm for Classification of Textual Documents." In 8th International Conference on Information Technology, 2017.
- [4] M. P. Vaishnav, K. Suganya Devi, P. Srinivasan, G.ArutPerumJothi, "Detection and Classification of Groundnut Leaf Diseases using KNN classifier." In International Conference on Systems Computation Automation and Networking, 2019.
- [5] Sachin D. Khirade, A. B. Patil, "Plant Disease Detection Using Image Processing." In International Conference on Computing Communication Control and Automation, 2015.

- [6] Mohamed Abbas Hedjazi, Ikram Kourbane, Yakup Genc, "On Identifying Leaves: A Comparison of CNN with Classical ML Methods." In 25th Signal Processing and Communications Applications Conference (SIU), 2017.
- [7] Amri Danades, Devie Pratama, Dian Anggraini, Diny Anggriani, "Comparison of Accuracy Level K-Nearest Neighbor Algorithm and Support Vector Machine Algorithm in Classification Water Quality Status." In IEEE 6th International Conference on System Engineering and Technology, 2016.