**Minor Project**

**Abstract and Contribution**

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**Abstract**

This project aims at quantification of infection patterns on tomato leaves due to various pathogens using image processing and machine learning techniques.Raters are prone to tiredness , which might eventually lead to inaccurate measurements.A lot of resources are required to constantly train the raters.They often require some reference to quantify disease severity e.g Standard Area Diagram. Raters can’t cover a large area and as such many plants are left with no inspection at all. Some plant diseases show symptoms after a long time. Till the time we are able to see the symptoms, most of the harm is done.So, the best alternative to visual estimation is using images to carry out the quantification. Images can be analysed in visual or non-visual spectrum. Visual spectrum is that part of the light spectrum in which humans can see objects. Other techniques include capturing images in the hyperspectral or multispectral forms. But it requires sophisticated sensor technology which is currently out of our scope and reach. So we will work with images captured using a camera in the visual range. By using image processing techniques we will segment out the diseased portion of the tomato-leaves and quantify the disease severity in them either using the nominal or percentage scale. We will mainly be using ROI segmentation and binary thresholding to achieve this. After thresholding quantification will be carried out, which involves calculating the fraction of the diseased pixels to the healthy pixels.This fraction can then be converted to a percentage value, which can be used to estimate the amount of disease present on the leaf. The real challenge in this research is the availability of accurate measurements of the diseased pixels in the image which we can refer to in order to validate our results. Ground truth validation is thus a challenge for us. Though our results might be correct, validation is still needed to confirm them. We also proposed our own solution, in which we apply k-means clustering to the leaf image. Then after forming the clusters, we visualized the a-channel of the clusters in gray-scale. Then, we segmented the leaf after analysis of the a\* -channels in the clusters.

**Contribution of individual members**

**Aahan Singh**

* Researched an algorithm to convert rgb color image to hsv color image, also wrote code to achieve the same.
* Carried out segmentation and quantification of the images in h channel.
* Researched papers related to k-means clustering for plant disease.
* Developed the algorithm to convert the image into k-clusters and also on how to extract information from the clustered image using a-channel.
* Maintained the excel sheet for the quantification results.

**Sarthak Sharma**

* Researched an algorithm to convert rgb color image to lab color image, also wrote code to achieve the same.
* Carried out segmentation and quantification of the results in the a-channel.
* Developed the algorithm to visualize the elbow curve.
* Developed the algorithm to segment the diseased portion from the clustered image and also applied morphological operations to remove unwanted borders from the image.
* Maintained the segmented image results in a directory.