PES UNIVERSITY

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100-ft Ring Road, Bengaluru – 560 085, Karnataka, India

UE22EC342AC1 – DIGITAL IMAGE PROCESSING

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Report on

AGRICULTURE CROP MONITORING USING VEINS ANALYSIS

Submitted by

ANUSHKA KESHRI (PES1UG22EC042)

SPOORTHI N (PES1UG22EC811)

Course Instructor: Dr. Shikha Tripathi

Department of Electronics and Communication Engineering

ABSTRACT:

Our report presents a dual-method approach for an alyzing leaf health by detecting abnormal vein widths and segmenting diseased areas using HSV-based color segmentation. The vein analysis identifies irregular structures and color segmentation highlights unhealthy regions. This approach aims to detect early pest detection precisily.

INTRODUCTION:

As we know, Plants are vital for sustaining life, and their health directly impacts agricultural productivity. So, Detecting early signs of pest damage is necessary manual inspection, time-consuming, and also prone to human error.

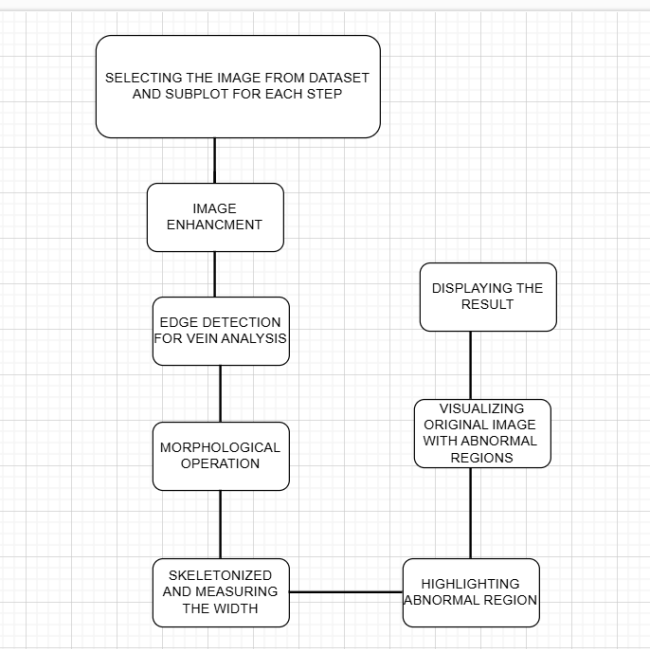
This project we use vein analysis and HSV - based segmentation to automate pest damage detection. Vein irregularities often indicate early plant stress, while colour-based segmentation effectively identifies diseased regions. Together, these methods provide a comprehensive solution for assessing leaf health and aiding precision agriculture.

THEORY AND ALGORITHM:

Vein Analysis:

Abnormal vein structures that is thinning or thickening are indicative of plant stress caused by pests or diseases. Skeletonization and width measurement of veins enable the identification of irregular patterns.

FLOWCHART:

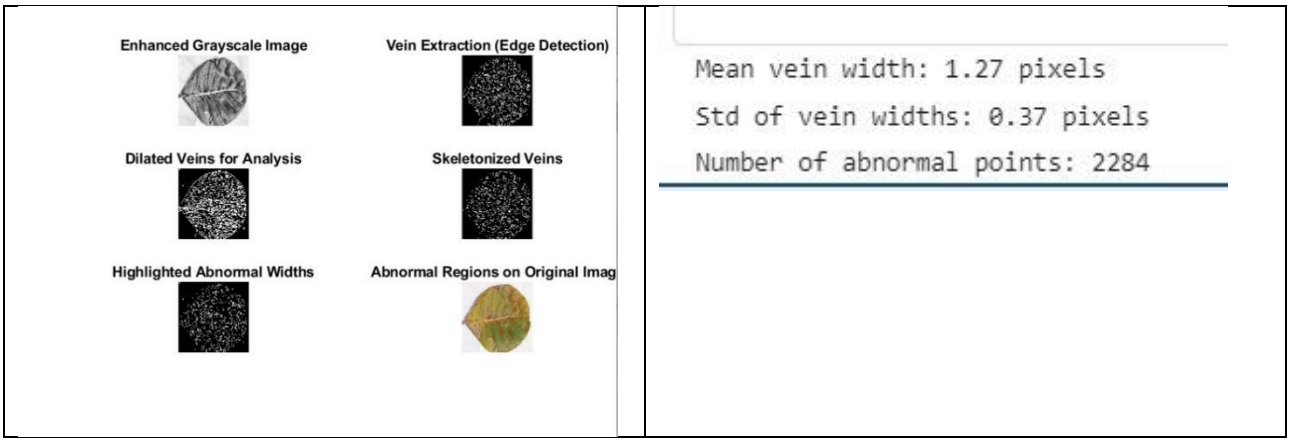


CODE:

```
folderPath = 'C:\Users\91993\Downloads\Cashew anthracnose';
% Get list of all images in the folder
imageFiles = dir(fullfile(folderPath, '.jpg')); % Change '.jpg' if your images have a different format
% Preallocate a cell array to store images
numImages = length(imageFiles);
images = cell(1, numImages);
% Loop through each image and load it
for i = 1:numImages
    imgPath = fullfile(folderPath, imageFiles(i).name);
    images{i} = imread(imgPath);
end
% Display an example image to verify
imshow(images{1});
title('Example Image from Dataset');
% Begin image processing on the first image
img = images{1};
```

```
% Step 1: Convert to Grayscale
gray_img = rgb2gray(img);
figure;
imshow(gray_img);
title('Grayscale Image');
% Step 2: Image Preprocessing (Enhancement)
% Enhance contrast using adaptive histogram equalization
enhanced_img = adapthisteq(gray_img);
figure;
imshow(enhanced_img);
title('Enhanced Grayscale Image');
% Step 3: Edge Detection for Vein Extraction
% Use Sobel or Canny edge detection to extract veins
edges = edge(enhanced_img, 'Canny');
figure;
imshow(edges);
title('Vein Extraction (Edge Detection)');
% Step 4: Morphological Operations to Enhance Veins
% Perform morphological operations to thicken the vein structures
se = strel('line', 2, 90); % Structural element for dilation
dilated_img = imdilate(edges, se);
figure;
imshow(dilated_img);
title('Dilated Veins for Analysis');
% Step 5: Vein Pattern Analysis
% Use regionprops to find connected components in the vein structure
props = regionprops(dilated_img, 'Area', 'Perimeter');
vein_areas = [props.Area];
vein_perimeters = [props.Perimeter];

% Displaying analysis results
fprintf('Number of vein segments: %d\n', length(props));
fprintf('Average vein area: %.2f\n', mean(vein_areas))
fprintf('Average vein perimeter: %.2f\n', mean(vein_perimeters))
```

Output screenshot:



HSV Colour Space Segmentation:

The HSV (Hue, Saturation, Value) color space is particularly effective for segmenting healthy and unhealthy regions of leaves based on their chromatic and intensity features.

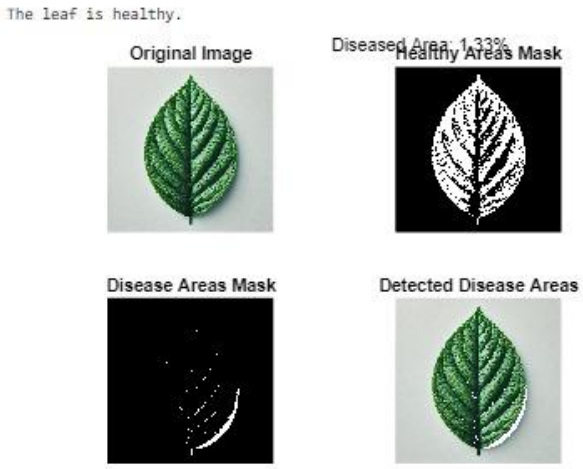
CODE :

```
img = imread("C:\Users\hp\OneDrive\spoorthi\healthy leaf.jpg");
hsvImg = rgb2hsv(img);
hue = hsvImg(:, :, 1);
saturation = hsvImg(:, :, 2);
value = hsvImg(:, :, 3);
healthyMask = (hue > 0.2) & (hue < 0.4) & (saturation > 0.3) & (value > 0.2);
diseasedMask = ~healthyMask & (value < 0.5) & (saturation < 0.4);

% Display original image
figure;
subplot(2, 2, 1);
imshow(img);
title('Original Image');

% Display healthy areas mask
```

```
subplot(2, 2, 2);
imshow(healthyMask);
title('Healthy Areas Mask');

% Display diseased areas mask
subplot(2, 2, 3);
imshow(diseasedMask);
title('Disease Areas Mask');

% Highlight diseased areas on the original image
highlightedImg = img;
highlightedImg(repmat(diseasedMask, [1, 1, 3])) = 255; % Highlight diseased areas in
white

% Display the highlighted image
subplot(2, 2, 4);
imshow(highlightedImg);
title('Detected Disease Areas');

% Calculate the percentage of diseased area
diseasedPercentage = sum(diseasedMask(:)) / numel(diseasedMask) * 100;

% Display the result in the command window
if diseasedPercentage > 4% Adjust threshold as needed
    disp('The leaf is diseased.');
else
    disp('The leaf is healthy.');
end
```

Output screenshot:

- **For healthy leaf**



- **For diseased leaf**

RESULTS:

- Accurate segmentation of healthy and diseased leaf areas.
- Quantification of the diseased area as a percentage.
- Classification of the leaf health status.

OBSERVATION:

1. Diseased regions were segmented using HSV thresholds.
2. Marking of healthy and unhealthy areas was achieved.
3. The code calculated a diseased area percentage and classified leaf health accurately**.**

CONCLUSION:

- The method do pest damage detection more effictively, reducing manual effort.
- Fine-tuning thresholds and preprocessing steps enhance robustness across datasets.
- The system is scalable for use in agricultural monitoring applications.

OBJECTIVE:

project integrates HSV-based segmentation with vein-level analysis for pest detection. The use of dynamic thresholds ensures adaptability, and the overlay provides a clear representation of affected regions.

NOVELTY: -

- This project uniquely combines vein structure irregularities or color-based segmentation to enhance detection accuracy.
- The vein analysis identifies structural abnormalities which helps giving,indicative of pest-induced stress, while HSV segmentation highlights visual discoloration caused by disease or pests.
- The use of skeletonization and distance transforms allows precise vein width measurement.

INDIVIDUAL CONTRIBUTION:

➢ Anushka Keshri:

- Implemented the vein analysis algorithm, including skeletonization, vein width measurement, and abnormality detection.
- Enhanced the preprocessing pipeline for feature extraction across image qualities.

➢ Spoorthi N:

- Designed and implemented the HSV segmentation algorithm for healthy and diseased region identification.
- techniques to overlay results on the original image for better result .

➢ JOINT CONTRIBUTION:

- Conducted testing and validation of both methods on dataset of leaf images.
- Integrated the outputs from both codes, ensuring giving higher accuracy.
- Fine-tuned thresholds and preprocessing parameters to improve system robustness

REFERENCES:

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