Digital Image Processing For Detecting Yellow Lines (Patch Yellow) In Palm Oil Plant Using Sobel Algorithm

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Abstract. Through computer hardware, digital images can manipulate and analyze data is the process and purpose of processing digital images. Where the data from the Digital Image used is edge detection. The use of visual techniques such as image processing can simplify the process of analyzing an object without dealing directly with the object to be observed. Image of palm oil leaves through image processing can be analyzed through the level of the greenness of the leaves and the patterns that exist on the leaves to determine the fertility of oil palm plants. This research uses descriptive analysis method, by collecting leaf samples that need to be analyzed using image processing software, then detected to determine the pattern of the shape of the leaf being attacked. The process of this research goes through the Preprocessing stage of palm oil leaf image, Feature Extraction, System Implementation, System Testing, documentation and report preparation. The difference from the leaves that are attacked by yellow patch yellow, on the surface of the affected leaves there are patterns such as patches, the more patterns, the more severe the disease attack. Spots at each stage of the disease were successfully obtained through image processing based on a single filter.

1. Introduction

The world of digital imagery has brought considerable changes in the development of computer technology. Digitizing data from palm leaf images is one of the developments in the world of imagery [1-5]. Pattern recognition can be utilized in image processing [6-9]. Identification is obtained from differences in leaf patterns that are attacked by the disease. Leaf shape and leaf pattern is an image that will be processed from palm leaf samples. A method is needed to formulate a problem that attacks the leaves of oil palm plants [10]. Processing images on samples of plant leaves that have been stricken with the disease with a digital image method that is processed using a Sobel Filter or Sobel Algorithm. The system is built by taking a sample of the picture on the leaves affected by the disease, then a leaf pattern or picture is processed. Various information about diseases that attack palm oil leaves. Farmers only know the disease that occurs only based on experience experienced, see only from the invisible site and from counseling is done but nothing has been computerized. From the experience experienced by these farmers, farmers can know and understand quickly the diseases that attack their plants. By grouping diseases on the leaves that are attacked through a system that is built, to quickly find out easily new data that occurs about the disease and pests that attack.
2. Methodology

Image processing using a computer to become a higher quality image is much better processed than image processing [11-16]. Improving the quality of a degraded image through the application of image improvement techniques. visually leaf samples taken for analysis using image processing software are the benefits to be obtained from plant leaf analysis [17-20].

This application will receive input or input from the original image of the palm oil plant leaves using the Sobel filter or the Sobel algorithm which in this application is designed to detect leaf disease in oil palm plants. The methodology used in this study consisted of several stages, namely leaf image collecting leaf samples that were attacked by yellow line disease (patch yellow) using a descriptive analysis method. Feature Extraction in plain view. Implementation of the system was carried out by grading the samples of palm oil plant leaves using a Sobel filter.

![System Diagram](image)

**Figure 1. Use case diagram**

System Testing using image processing software that has been obtained will be tested to be adjusted again to the symptoms that occur in leaves affected by the disease.

3. Results and Discussion

3.1. Processing Image Processing Results

After all the processes have been carried out in sequence, then the next step is to take a sample photo stored in one database. then the sample photo is entered into the image processing software using a single filter. This test will get several mean values, standard deviations, medians, min, and max. After obtaining these values, an upgrade/clustering of values will be carried out starting from the smallest value to the largest value to distinguish the level of jaundice attack on the leaves of oil palm plants. picture of some samples of palm oil leaf stricken with jaundice, where these samples already have their respective values which are the mean value, standard deviation, median, min, and max:

| Sample Number | Original | Image Processing | Mean | Std Dev | Median | Min | Max   |
|---------------|----------|------------------|------|---------|--------|-----|-------|
| 1             |          |                  | 12.28| 23.55   | 8      | 0   | 255.00|
| 2             |          |                  | 12.61| 19.01   | 8      | 0   | 255.00|
| 3             |          |                  | 12.34| 17.46   | 10     | 0   | 255.00|
| 4             |          |                  | 11.27| 18.53   | 8      | 0   | 255.00|
3.2. Discussion of Image Processing Results

The next step taken is to determine the grade/clustering of leaf samples affected by the disease and then tested. The value obtained is appropriate or not with the symptoms present in jaundice leaves. If the results obtained are by following the symptoms or disease attacks that occur in the leaves, the results of image processing using a Sobel filter are appropriate or correct. Upgrading is divided into several clusters, namely healthy, mild, moderate and severe. The following are some pictures of sample grade cluster of palm oil leaves affected by jaundice, starting from the healthy grade cluster, mild cluster, medium cluster, and heavy cluster:

3.2.1. Healthy Grade Cluster

It is said that the healthy grade cluster with values that have become guidelines or references (found in the previous chapter) is 1-11, 62. From the appendix there are 240 leaf samples, from the leaf sample data there are 102 healthy leaf samples. In healthy leaves, if observed there is a vertical striped pattern with a dark color and clear visible leaf bones. And there are rarely spots on the leaf body spots and the dominant dark leaf body color. The following are some pictures of the results of healthy grade clusters according to leaf number:

| Sample Number | Original | Image Processing | Mean | Grade |
|---------------|----------|------------------|------|-------|
| 1             | ![Original Image](image1.png) | ![Image Processing](image2.png) | 11.27 | Healthy |
| 2             | ![Original Image](image3.png) | ![Image Processing](image4.png) | 10.99 | Healthy |
| 3             | ![Original Image](image5.png) | ![Image Processing](image6.png) | 10.75 | Healthy |
| 4             | ![Original Image](image7.png) | ![Image Processing](image8.png) | 11.19 | Healthy |
| 5             | ![Original Image](image9.png) | ![Image Processing](image10.png) | 11.52 | Healthy |

3.2.2. Light Grade Cluster

Then the light grade cluster, said the light grade cluster with a value that has become a guideline or reference (found in the previous chapter) is 11.63-13.18. From the appendix there are 240 leaf samples, from the leaf sample data there are 71 leaf samples that have mild grade yellow line disease. In RGB (normal coloring) is the initial leaf image that will be detected by the disease using Sobel
filters, mild yellow line disease symptoms are still visible with the eye in the image, while the results of normal color conversion in the light grade yellow line Sobel filter can be seen with a pattern of oval-shaped lines or small circles such as spots/spots. The following are some pictures from the results of lightweight grade clusters according to leaf number:

Table 3. Light Grade Cluster

| Sample Number | Original | Image Processing | Mean  | Grade |
|---------------|----------|------------------|-------|-------|
| 1             |          |                  | 12.28 | Light |
| 2             |          |                  | 12.61 | Light |
| 3             |          |                  | 12.34 | Light |
| 5             |          |                  | 12.58 | Light |
| 6             |          |                  | 12.76 | Light |

3.2.3. Medium Grade Cluster

From the appendix there are 240 leaf samples, from the leaf sample data there are 40 leaf samples that have moderate grade yellow line disease. Symptoms of moderate-grade yellow line disease are still visible with the visible, small brownish-yellow dots and then dry out. The results of the normal color conversion of medium-grade yellow line disease Sobel can be seen with longitudinal lines or small dots scattered on the leaf surface. The more patterns found on the surface of the leaf, the higher the value of the sample data. The following are some pictures from the results of the medium grade cluster according to leaf number:

Table 4. Medium Grade Cluster

| Sample Number | Original | Image Processing | Mean  | Grade |
|---------------|----------|------------------|-------|-------|
| 1             |          |                  | 17.16 | Middle |
| 2             |          |                  | 15.04 | Middle |
3.2.4. Heavy Grade Cluster

In severe grade yellow line disease, the leaf that is affected by the disease will form pale yellow stripe patterns on the surface of the leaf, the pattern eventually enlarges and the center dries, brownish-yellow and often with dark brown borders. The middle part of the yellow line has black spots which are fungal bodies. The adjacent lines join and then form a very large pattern. Sometimes the pattern will be oval or round. The more severe the disease attack, the higher the value of the sample data. From the appendix, there are 240 leaf samples, from the leaf sample data, there are 27 leaf samples that are attacked by severe grade yellow line disease. The following are some pictures of the results of heavy grade clusters by following leaf number:

| Sample Number | Picture Original | Image Processing | Mean | Grade |
|---------------|-----------------|-----------------|------|-------|
| 1             | ![](image1)     | ![](image2)     | 22.03| Weight |
| 2             | ![](image3)     | ![](image4)     | 19.57| Weight |
| 3             | ![](image5)     | ![](image6)     | 21.49| Weight |
| 4             | ![](image7)     | ![](image8)     | 19.39| Weight |
| 5             | ![](image9)     | ![](image10)    | 22.57| Weight |

4. Conclusion

Detection of yellow line disease (Patch Yellow) on the leaves of oil palm plants using image processing methods based on the Sobel filter can be concluded as follows:
a) The Sobel algorithm has been applied to the attack of yellow line disease (Patch Yellow) on the leaves of oil palm plants with mild symptoms reaching 29.6% (71) and 42.5% (102) healthy leaves from 240 leaf samples.

b) The accuracy of the results has been seen in testing the attack of yellow line disease (Patch Yellow) on the leaves of oil palm plants with moderate symptoms reaching 16.7% (40) of 240 leaf samples.

c) Image processing techniques to determine patterns on oil palm leaves have succeeded in attacking yellow line disease on the leaves of oil palm plants with severe attacks of only 11.25% (27) of 240 leaf samples.

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