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Color Feature Extraction and Euclidean Distance for Classification of Oryza Sativa Nitrogen Adequacy Based on Leaf Color Chart (LCC)

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Abstract---*Oryza sativa is a rice-producing plant which is one of the main commodities in various countries including Indonesia. In the process of maintaining the quality of rice plants in order to have good growth and high yields, an adequate supply of nitrogen (N) is needed. The most obvious and commonly seen symptom of N deficiency is a reduction in the green color of the leaves (chlorosis) [3]. Leaf color is an indocator that is useful for indicating the N fertilizer requirement of rice plants [3]. Currently a simple tool that can be used to measure the color of the leaves of rice plants as a determinant of the amount of N fertilizer is the Leaf Color Chart (LCC). However, the problem in this LCC is that the tool is still manual and the assessment / classification process is carried out using color estimates based on eye sight. This creates uncertainty because everyone has different estimates. Based on these problems, it is necessary to have an automatic classification system of rice leaf color that can help farmers in determining the category of rice plants based on LCC. In this study, the color classification system of rice leaf images was carried out by extracting RGB (Red, Green, Blue) image features of rice leaf images. While the classification process is done by finding the color similarity between the image of rice leaves with the LCC scale using the Euclidean Distance method. The results obtained from the color classification system of rice leaves in this study have an accuracy rate of 75%.*

Keywords---*Oryza Sativa, Feature Extranction, Euclidean Distance.*

I. Introduction

Oryza Sativa is a rice-producing plant which is one of the main commodities in the world including Indonesia. Based on the latest data released by the Central Statistics Agency (BPS) in 2017 the amount of rice consumption in Indonesia in the year reached 29,133,513 tons [1]. A serious effort is needed so that the consumption of large amounts of rice can always be fulfilled, one way is to maintain the quality of rice plants from the time of suitable planting to harvest. In the process of maintaining the quality of rice plants in order to have good growth and high yields, an adequate supply of nitrogen (N) is needed. The most obvious and commonly seen symptom of N deficiency is a reduction in the green color of the leaves (chlorosis), which is generally somewhat evenly distributed throughout the entire leaf. Therefore, growth and yield of plants, especially rice, are closely related to the green color of the leaves [3].

Leaf color is an indocator that is useful for the N fertilizer needs of rice plants. Leaves that are pale or yellowish green indicate that the plant lacks N. Currently a simple tool that can be used

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to measure the color of leaves of rice plants as a determinant of time and the amount of fertilization N is the Leaf Color Chart (LCC) distributed by the Crop Resources and Management Network (CREMNET) - IRRI [2]. However, the problem in this LCC is that the tool is still manual and the assessment / classification process is carried out using color estimates based on eye sight. This creates uncertainty because everyone has different estimates. Based on these problems, it is necessary to have an automatic classification system of rice leaf color that can help farmers in determining the category of rice plants based on LCC.

One solution that can be used for the development of classification systems is to use digital image processing. Because LCC is closely related to color, the method that can be used is the extraction of color features to obtain color values from rice plants and the color scale on LCC.

The process to determine the LCC scale that is most similar to the color of leaves of rice plants is to use the color similarity method, and one algorithm that is widely used for the similarity process is Euclidean Distance. The existence of a system of color classification of rice leaves based on LCC is expected to help rice farmers in determining the current condition of their rice plants.

II. literaturE review

Oryza Sativa

Oryza sativa belongs to the Graminae family which grows scattered in the tropics and wet subtropics and temperate regions including Asia, mostly African, South and Central American countries, Australia, and Japan [6].

Rice vegetative organs consist of roots, stems and leaves. The stems are composed of books and segments, where each book has 1 leaf that extends and tapers at the edges. Roots in the form of root fibers that grow to replace the temporary roots. Generative organ formation begins with the formation of the panicle primordia, where the first initiation takes place on the main stem followed by chicks with the same pattern [6].

Nitrogen in Plant Production

The N nutrients present in almost all soil are insufficient for crop needs, therefore additional N must be given to maintain or increase yields. Of all the nutrients supplied to the soil, so far N fertilization has the most influence in increasing crop production. There is no doubt that N fertilization is an important factor in crop production. The most obvious symptom of N deficiency is yellowing of leaves (chlorosis) due to loss of chlorophyll, the green pigment that plays a role in the process of photosynthesis, which is distributed rather evenly throughout the entire leaf. N deficiency is characterized by low growth rates and stunted plants [3]..

Leaf Color Chart (LCC)

The leaf color chart (LCC) was first developed in Japan, and then researchers from the Zhejiang-China Agricultural University developed a better LCC and calibrated it for indica rice, japonica and hybrids. This tool later became a model for LCC which was distributed by the Crop Resources and Management Network (CREMNET) - IRRI for rice plants; a tool that is simple, easy to use, and inexpensive to determine the time of N fertilization in rice plants. LCC is a suitable tool to optimize the use of N, with various sources of N fertilizer; organic-fertilizer, bio-fertilizer or chemical fertilizer. LCC

consists of four shades of green, from yellowish green (No. 2 on the card) to dark green (No. 5 on the card). LCC can be used with high accuracy and validity to measure leaf color [3].

III. research method

Feature Extraction

Feature extraction is the process by which certain interesting features in an image are detected and represented for further processing. This is an important step in computer vision and digital image processing (digital image processing) solutions because it marks the transition to pictorial to alphanumeric data representation. The resulting representation can then be used as input for pattern recognition and classification techniques [4].

Euclidean Distance

Euclidean Distance is the matrix most often used to calculate the similarity of two vectors. The Euclidean Distance formula is the root of the square of difference 2 vectors (root of square differences between 2 vectors) [7]. Two feature vectors can be compared with each other by calculating the distance between them, or vice versa, determining the degree of similarity. There are many distance measurements used in the classification of visual patterns. If the two feature vectors a = (a1, a2, ..., an) T and b = (b1, b2, ..., bn) T, the following is the equation for measuring the most widely used distance [4].

$$d_E = \sqrt{\sum_{i=1}^{n} (a_i - b_i)^2}$$

Information :

$\boldsymbol{dE}$ = *Distance* / Jarak *Euclidean*

n = number of vector

$\boldsymbol{ai}$ = input image vector

$\boldsymbol{bi}$ = comparison image vector

Classification flow system

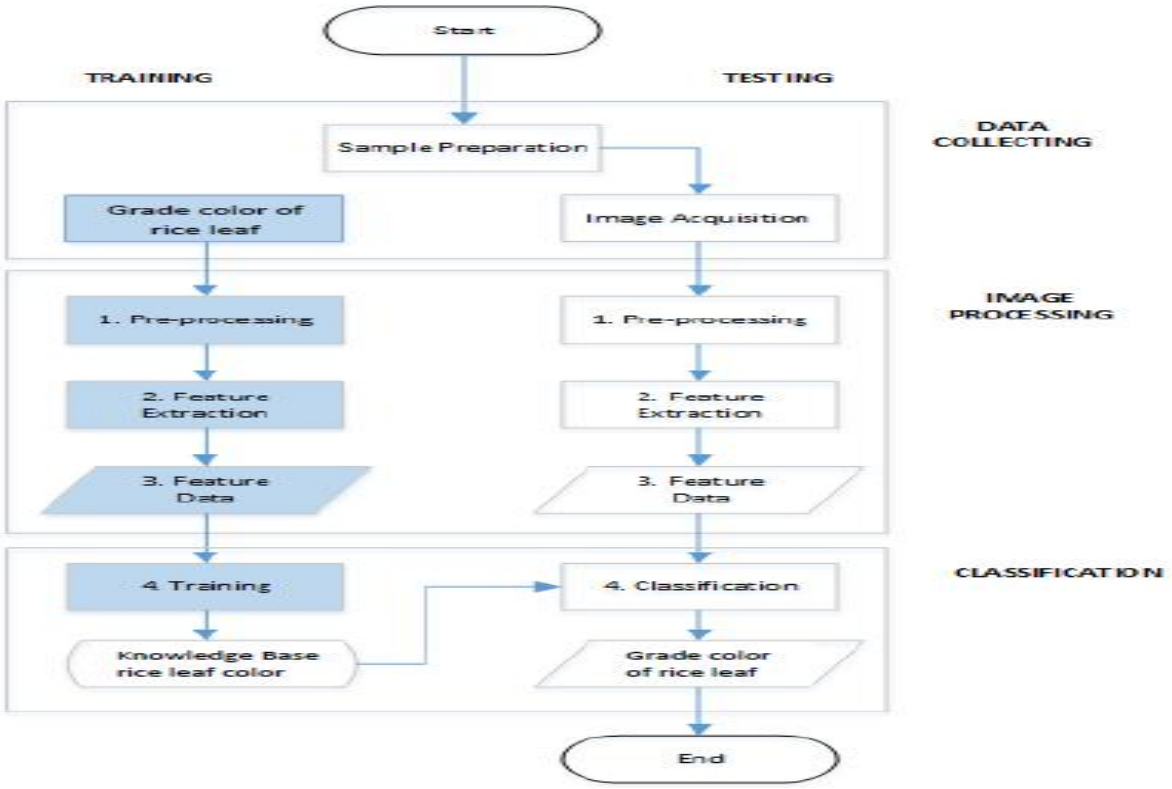


Fig 1. Classification System Flow

Alur sistem klasifikasi

1. Image capture
   a. Select the image of rice leaves to be classified in color

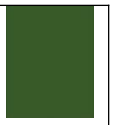
2. Pre-Processing
   a. The selected rice leaf image will pass the pre-processing stage, which is to change the image size to (233 x 1297) pixels. The size is adjusted to the color image in the training data.
   b. The image that has passed the resizing process will be displayed in the application complete with the location / path where the image is stored on the computer system used.

Fig 2. Rice leaf image

3. Selection of training data
   a. Select the folder where the LCC imagery will be stored as a reference for the color classification of rice leaves.

b. The color image in the folder consists of 4 colors with size 233 x 297 pixels

Table 1. Color standard LCC

LCC Image				
LCC Scale	2	3	4	5

4. Feature Extractions

a. The image features to be extracted are the Green (G) color features

Table 2. LCC scale color feature extraction

LCC Scale	LCC Images (233x297)px	Mean of *Green (G)*
2		166,1174
3		135.8613
4		104.6702
5		89.7320

5. Color classification

a. The color classification process is done using the Euclidean Distance method.

b. The value calculated by the Euclidean Distance formula is the average value of the colors of the images of the rice and all the images of the training data.

Table 3. Color feature extraction of rice leaves

No	Rice leaves (233x297)px	Green (G)
1		148.1706

Table 4. Similarity Process

LCC Scale	Mean of Green (G) LCC	Mean of Green(G) rice leaves	$d_E = \sqrt{\sum_{i=1}^{n}(a_i - b_i)^2}$
2	166,1174	148.1706	17.9468
3	135.8613		12.3093
4	104.6702		43.5004
5	89.7320		58.4386

c. The smallest euclidean distance value is considered to have the highest similarity / degree of similarity.

Table 5. Sorting number

LCC Scale	Mean of Green (G) LCC	Mean of Green(G) rice leaves	$d_E = \sqrt{\sum_{i=1}^{n}(a_i - b_i)^2}$
3	135.8613	148.1706	12.3093
2	166,1174		17.9468
4	104.6702		43.5004
5	89.7320		58.4386

6. Classification Result

Fig 3. Classification Result

IV. RESULT

System testing is done is testing accuracy. This test aims to measure the extent of the accuracy of image recognition in the system / application that has been made. Tests carried out a total of 20 times the experiments on the image of rice leaves.

Tabel 6. System test results

No	LCC Scale (Manual)	Classification System	Remarks
1	LCC 3	LCC 3	True

2	LCC 3	LCC 3	True
3	LCC 2	LCC 3	False
4	LCC 4	LCC 4	True
5	LCC 3	LCC 3	True
6	LCC 2	LCC 2	True
7	LCC 2	LCC 3	True
8	LCC 2	LCC 2	True
9	LCC 2	LCC 3	False
10	LCC 2	LCC 3	False
11	LCC 2	LCC 2	True
12	LCC 3	LCC 2	False
13	LCC 3	LCC 3	True
14	LCC 3	LCC 3	True
15	LCC 3	LCC 3	True
16	LCC 2	LCC 3	False
17	LCC 2	LCC 2	True
18	LCC 3	LCC 3	True
19	LCC 2	LCC 2	True
20	LCC 3	LCC 3	True

Table 7. Recap of test results

Test data = 20	
Classification True	Classification False
15	5

$$\text{Acuracy (\%)} = \frac{\text{Number of true}}{\text{Number of test}} \text{ x } 100\%$$

$$\text{Acuracy (\%)} = \frac{15}{20} \text{ x } 100\%$$

$$\text{Acuracy (\%)} = 75\%$$

The results of 15 trials of rice leaf color classification based on LCC show that the number that was correctly calcified was 15 out of a total of 20 trials, then based on calculations with the formula, the accuracy rate was 75%.

V. CONCLUSION

Based on the discussion of the research results that have been described, the conclusions of this study are:

1. System of color classification of rice leaf images is done by extracting color features using the RGB color feature extraction method (Red, Green, Blue). The color value taken is Green (G)
2. The method used to classify the color of rice leaves based on LCC is Euclidean Distance.
3. Rice Leaf Image Classification System using color feature extraction and euclidean distance methods in this study has an accuracy rate of 75%.

VI. RECOMENDATIONS

Future studies are recommended to try to use another similarity algorithm. It is intended to find the best algorithm, which can be used for the classification of color of rice leaves based on the LCC scale.

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