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CLASSIFICATION OF RICE IMAGE VARIETIES IN KARAWANG CITY USING SUPPORT VECTOR MACHINE ALGORITHM

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ABSTRACT

Rice is a staple food in Indonesia. Rice varieties are very diverse for example such as Inpari, Inpago, Inpara, and others. There are more varieties in this type such as Inpari which has mekongga varieties that are quite popular in Karawang city even the distribution is almost in every city in indoensia. The many rice varieties that are present, causing the problem of mixing the types of rice varieties on the market. Digital image processing can be a solution that classifies rice based on images that can be a solution to recognize types of rice varieties by applying the Support Vector Machine (SVM) algorithm. The purpose of this research is to differentiate mekongga rice varieties from other varieties. so that consumers can easily set it up. This research was conducted using a 70 image dataset. Past several stages such as pre-processing, image segmentation, feature extraction, classification with the Support Vector Machine (SVM) algorithm, then evaluation. The classification of test data from 35 images yields an accuracy of 94.28%.

Keywords: *Rice, Digital Image Processing, Support Vector Machine (SVM).*

1. INTRODUCTION

Based on a review of 2017 staple food consumption carried out by the Central Statistics Agency [1], it shows that national rice consumption in 2017 reached 29.13 million tons or 111.58 kilograms per capita per year. Rice has various varieties such as Inpari (Inbred Rice Fields), Hipa (Hybrid Rice), Inpago (Inbred Rice Gogo), Inpara (Inbred Rice Swamp). In the varieties that have been mentioned, there are various types of varieties again in it such as Inpari has a type of Mekongga varieties that are quite salable in the city of Karawang. This often happens when rice is packaged but does not know what label it should be labeled because farmers grow various varieties and collectors do not separate the grain-based on the variety. This also causes losses, because this superior Mekongga variety has different selling prices. The solution to this problem can be done by recognizing rice based on digital images. Research on Citrus Maturity Classification Based on Color Features Using the SVM Method [2], produces an accuracy of 80%, SVM is one of the most widely used classifiers in medical image analysis[3]–[5], Among the popular techniques are the artificial neural network (ANN) and support vector machine (SVM)[6]–[8], compared the performance of time series forecasting using SVM and ANN. It was found that SVM outperformed ANN models[8], for the case text mining SVM obtained the highest results compared to the two other classifiers using the TF-IDF method[9] and Also, the classification process also used four kernels such as linear, RBF, sigmoid and polynomial. The highest accuracy results are in the comparison of 90% as training data and 10% as testing data while using a

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linear and sigmoid kernel are 0.8060 or about 80%[10].

Therefore, the classification of rice based on the image will be done using the SVM algorithm to determine and distinguish the type of Mekongga rice varieties with other rice varieties, other paper explained that, Another paper explained that in the world of health SVM can do a prediction in detecting heart disease also classification of the age of children based on the group genetic Neuromuscular disease (SMA)[11], effective recommendation system using streaming medical data, historical data on the user profile, and knowledge database to provide users with the best recommendations The results is of 90.6%[12], in the Hybrid Level Set Fast Marching Method (HLSFMM) as distance parameter by entering spatial data Support Vector Machine (SVM) kernel rbf Gaussian can be a supporting technique[13], in the case of pernicious and thalassemia disease some techniques used are Multi-Layer perceptron (MLP), Naïve Bayes classifier, RBF Network, and SVM , the results showed that MPL produced the best Performance among others with accuracy of 89.6% and followed by SVM 85.9%[14], texture-based cervical cancer classification system has been developed, eight features of the texture of GLCM which serves as input into the classifications K-NN and SVM classification obtained 90.0% and 88.3%[5], research using SVM is: In the case of the sentiment of analysis related to online transportation in Indonesia[5], the maturity detection method of Melon fruit[15], Image segmentation with Threshold method on plant Digital imagery [16], and the paper related to rice is: Image processing is capable to determine the moisture content of rice kernel[17], and image processing for rice with backpropagation algorithm[18].

Many consumers are harmed by the rice variety mixing activities carried out in the market so that the absence of this paper can be used as a reference in the differentiation of rice types and the purpose of this research is to differentiate mekongga rice varieties from other varieties. so that consumers can easily set it up.

2. RELATED WORK

Varieties are one of the essential technological components and have a great contribution in increasing production and income for rice farming. Varieties type shows how the varieties are assembled and the method of expanding the seed, so that the seeds are available that can be planted by farmers. There are some superior varieties of rice in Indonesia, such as Inpari (Inbrida Padi Sawah), Hipa (Hibrida Padi), Inpago (Inbrida Padi Gogo), Inpara (Inbrida Padi Rawa). Inpari Is grain inbrida Planted by rice fields. Inbrida is a variety developed from one plant through its pollination so it has a high purity level.

BBPADI [19], Explaining that there were 62 varieties of rice was inpari 32, Inpari IR Nutri Zinc, Jeliteng, Ciherang, and Mekongga Each of these rice has different characteristics. The city of Karawang produces a variety of rice, but currently superior is a type of varieties Mekongga.

Figure 1 Mekongga Rice variety[19]

Atriyan Trisnawan and colleagues [20] to classify the rice varieties based on the form and//rice in the market many human weaknesses possessed in the conception of classification, rice using a sense of vision. Therefore, digital image processing techniques are needed to help analyze rice. This research aims to analyze-each, using the K-means Clustering method based on RGB color. Based on the test results he got the result of 40 UDI No 9 times error with an alignment level of 31 times and gained an accuracy level of 77, 5%.

Chenglong Huang etc [21] To perform the identification of rice varieties, in his studies emphasized that the identification of rice is very important especially for farmers, the method used is the classification of Support Vector Machine (SVM) to discriminate rice varieties with this feature, it is obtained that the level of accuracy is 98.41% and the average precision for SVM as much as 79.74% by using cross-validation, methods can generate accurate identification of rice varieties and can be

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integrated into new knowledge in developing computer vision systems used in the automated rice-evaluated system, the first they do is 1) Rice feature extraction, 2) Multi-SVM classifier, 3) Partition Function, 4) Kernel Function, the technique in its identification is to take some pictures of rice, then make measurements of the image of the rice (weight, gain number, length, width, and area) after that is done calculations using SVM algorithm to get the result of the rice classification , so it can be identified.

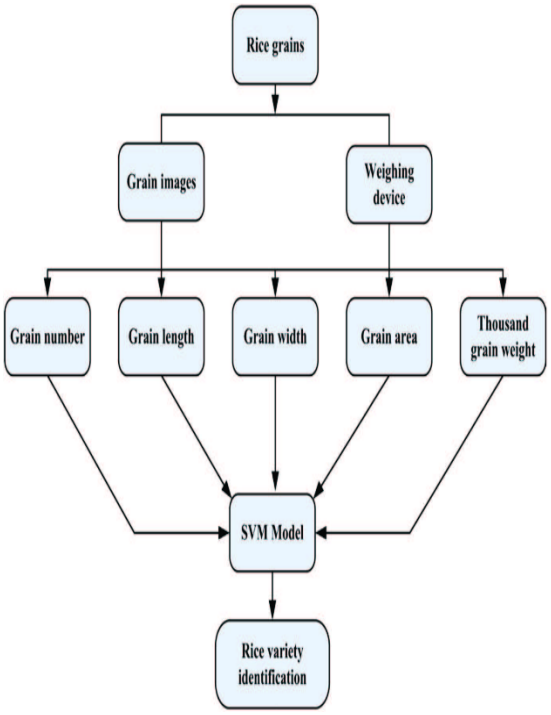

Figure 2 The technical method for rice variety identification[21]

Liu Zhao-yan etc, [22], A digital image analysis based color algorithm and morphology feature was developed to identify six varieties (ey7954, syz3, XS11, xy5968, xy9308, z903) rice seedlings that are widely planted in Zhejiang province. The methodology used in the first way of performing an image acquisition, followed by image segmentation, then feature extraction, and image analysis, at the stage of the selection feature using PCA technique as a tool for the normalization of Feature, which is then the result of the normalization is done image analysis using Neural Network, seven colors and fourteen morphological features used for discriminant analysis. 240 kernel is used as designated training data and 60 kernels as test data defined in neural networks used to identify rice seed varieties When the model is tested on the test data set, the individual accuracies identification is 90.00%, 88.00%, 95.00%, 82.00%, 74.00%, 80.00% for ey7954, syz3, XS11, xy5968, xy9308, z903.

3. Material and methods

2.1. Object of research

The object of this research is the classification of Mekongga rice varieties. Mekongga variety of rice used as the object of this study was obtained from the Karawang Regency Food Office. The dataset used as many as 105 images will be classified into the Mekongga variety class and not the Mekongga variety.

2.2. Research planning

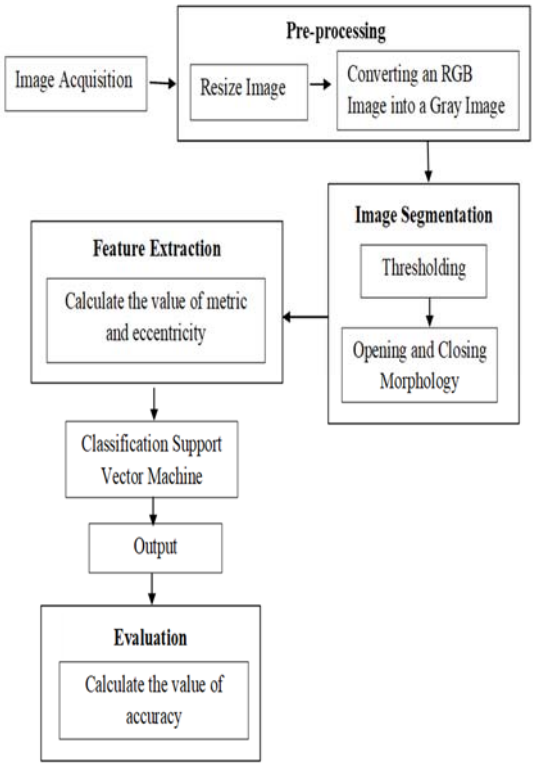

Figure 2 Research Planning

2.2.1 Image Acquisition

Image acquisition is an activity to obtain digital images to determine the data needed. The object of research uses Mekongga rice obtained from the Karawang Food Service. Image capture using Samsung S9 + mobile camera with 12MP, f / 1.5-2.4,

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PDAF specifications. Distance taking the image on the object as far as 7cm, the camera is perpendicular to the object and is done outside the room to get good lighting.

2.2.2 Pre-processing

At this pre-processing stage, data processing will be carried out so that the data is feasible to be processed at a later stage. This stage is carried out aiming to eliminate or overcome some problems such as noise. The following are the steps that will be carried out : (1) Resize Image - This stage is done to delete the unused portion of the image. Besides, so that all images have the same size to be processed in Matlab. (2) Converting an RGB Image into a Gray Image - At this stage, the image is converted into a gray image to simplify the process that will be done next.

2.2.3 Image Segmentation

The image segmentation stage is the process of separating objects from the background in the image. This process is important to do and can improve the accuracy of the image. (1) Thresholding - The method used aims to separate objects from floating types based on differences in grayscale in the image. (2) Opening and Closing Morphology - This stage needs to be done to make the edges of the image more smooth. Also, opening morphology can eliminate small objects in the image.

2.2.4 Feature Extraction

Feature extraction that is applied is the extraction of shape characteristics so that the shape of the research object is detected. The values that will be obtained from this stage are the area, perimeter, eccentricity, and metric values. The extracted feature will be used as a parameter that distinguishes the other objects. The resulting parameter values will be the data that will be processed in the classification. This research will use eccentricity and metric values as parameters.

2.2.5 Classification Support Vector Machine

*T*he classification phase aims to group data with the provisions of the parameters that exist. The processed data will be divided into two classes, namely Mekongga variety of rice and not Mekongga variety. Training data were prepared as many as 70 images of Mekongga variety of rice. Test data were prepared as many as 35 images of Mekongga variety of rice. The parameter values from the feature extraction will be processed for SVM training in Matlab.

2.2.6 Output

This stage generated images after going through the classification process using the Support Vector Machine (SVM) algorithm. The results of the SVM training obtained the parameters used as separators to classify the testing process.

2.2.7 Evaluation

Confusion Matrix is the last stage that is carried out aimed at evaluating the results of research. From various confusion matrix calculations, this study will apply accuracy calculations to determine the level of total accuracy.

4. Result

3.1 Image acquisition

The acquisition of imagery was done on Mekongga's rice varieties research object with the background using black cardboard paper. Shooting using 12MP, F/1.5-2.4, the PDAF specification camera. The object shooting distance is 7cm so far, the camera is perpendicular to the object and done outdoors to get a good exposure. This process generates as many as 105 images. The training data is determined by 70% and the test data is 30% with Mekongga various research objects 53 pictures and 52 images are not varieties Mekongga.

IMG1	

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IMG2

Figure 3 Image Acquisition

3.2 Pre-processing

3.2.1 Resize Image

The original size of the image is 3024x3024 and will go through the process of changing to 300x300. The process of resizing an image is done to remove unused portions. Besides, this process is done so that the image size is more uniform.

A

B

Figure 4 Image size Change from picture A to picture B

Before changing the image size, the initial step is to determine the cutting point of the image to keep the object in the middle. When the image acquisition process, the object is placed with various positions. Therefore, each image will have a features point, a difference in cropping results indicating that the research object in Figure 3 (b) is more obvious than the figure 3 (a).

3.2.2 Converting an RGB Image into a Gray Image

The image is converted into a gray image so that it can be continued at a later stage. Figure 4 is the result of changing the original image into a gray image.

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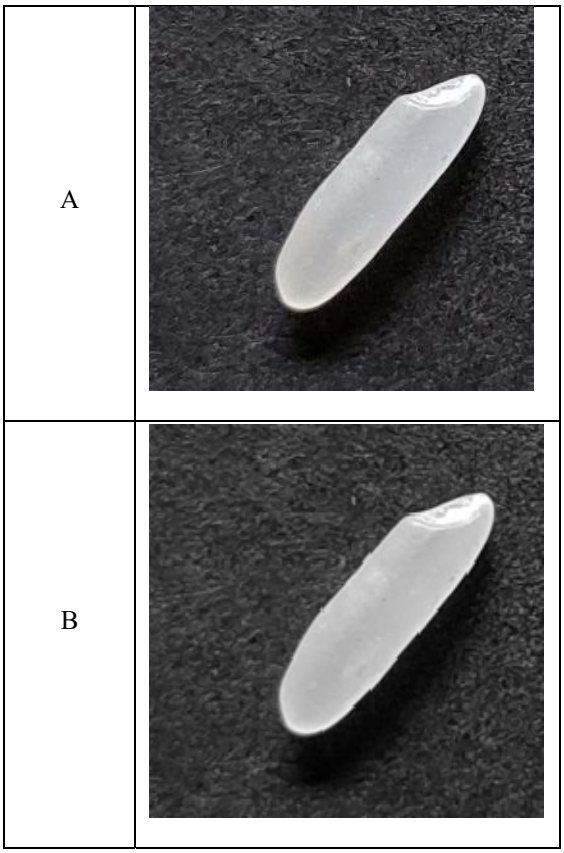
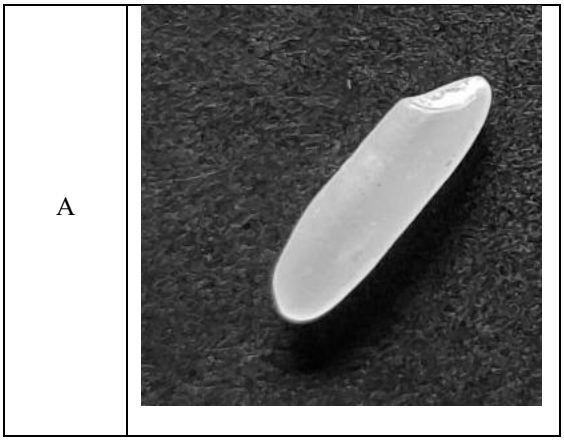


Figure 5 Grayscale Image

3.3 Image Segmentation

3.3.1 Thresholding

The thresholding process in Matlab uses the "binarize" function followed by a threshold value of 0-255 according to image requirements. After becoming a gray image in the previous stage, then a threshold value of 140 is implemented for the entire image and produces an image like in Figure 5.



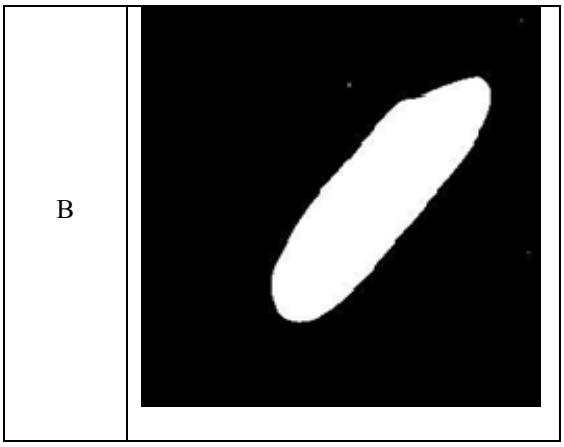


Figure 6 Thresholding

3.3.2 Opening and closing morphology

This stage is eliminated noise and smooths contours on images. As in figure 6.

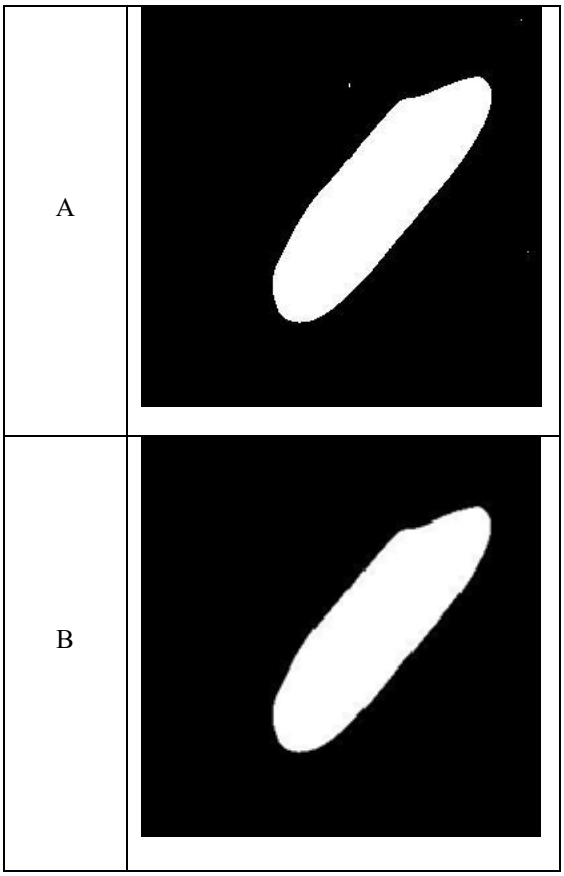


Figure 7 Opening Closing Morphology

3.3.3 Feature Extraction

At this stage produces values in the image such as metric, eccentricity, perimeter, centroid, and so

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on. Eccentricity is the value of the comparison between the distance of the ellipse minor foci with the major ellipse foci on an object. Eccentricity has a range of values between 0 to 1. Metric is the value of the ratio between the area and circumference of the object. Metric has a range of values between 0 to 1. The value of metric and eccentricity are the parameters for the classification stage. Figure 7 is an example of the results of the feature extraction values from one of the images.

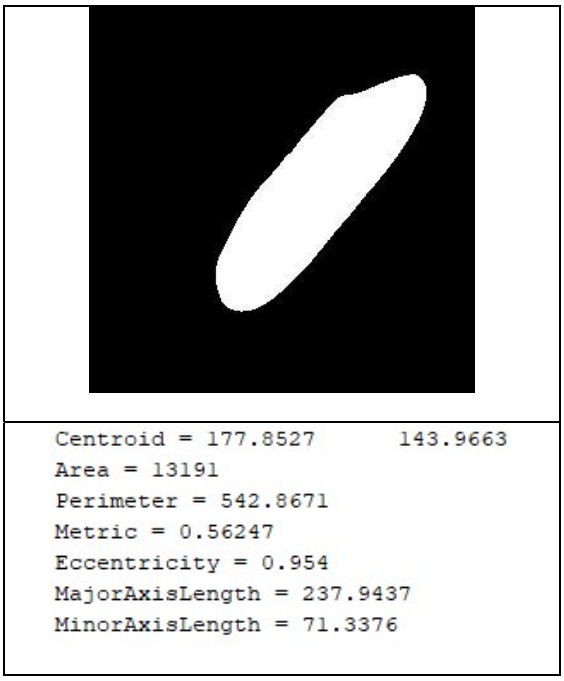

Figure 8 Result Feature Extraction

$$e = \sqrt{1 - \frac{b^2}{a^2}}$$

$$e = \sqrt{1 - \frac{71.3376^2}{237.9437^2}}$$

$$e = \sqrt{1 - \frac{5{,}089.05317376}{56{,}617.20436969}}$$

$$e = \sqrt{1 - 0.0898852783427863}$$

$$e = \sqrt{0.9101147216572137}$$

$$e = 0.9539993300087342$$

Figure 8 Eccentricity sample Calculation

$$m = \frac{4\pi \times A}{C^2}$$

$$m = \frac{4(3.14) \times 13191}{542.8671^2}$$

$$m = \frac{12.56 \times 13191}{294{,}704.68826241}$$

$$m = \frac{12.56 \times 13191}{294{,}704.68826241}$$

$$m = \frac{165{,}678.96}{294{,}704.68826241}$$

$$m = 0.5621863736774919$$

Figure 9 Metric Sample Calculation

Table 1 Feature extraction values

No	Feature extraction values
1.	Area = 16794 Perimeter = 611.5462 Metric = 0.56429 Eccentricity = 0.94872 MajorAxisLength = 262.7737 MinorAxisLength = 83.0638
2.	Area = 14038 Perimeter = 580.0143 Metric = 0.52437 Eccentricity = 0.95616 MajorAxisLength = 250.5 MinorAxisLength = 73.3579
3.	Area = 12603 Perimeter = 541.3696 Metric = 0.54038 Eccentricity = 0.95684 MajorAxisLength = 236.0842 MinorAxisLength = 68.6117
4.	Area = 14807 Perimeter = 574.2325 Metric = 0.56429 Eccentricity = 0.9504 MajorAxisLength = 248.7419 MinorAxisLength = 77.3671

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5.	Area = 14068 Perimeter = 573.8894 Metric = 0.53677 Eccentricity = 0.9572 MajorAxisLength = 249.9214 MinorAxisLength = 72.3342
6.	Area = 13652 Perimeter = 567.0437 Metric = 0.53355 Eccentricity = 0.94966 MajorAxisLength = 238.2414 MinorAxisLength = 74.6368
7.	Area = 13047 Perimeter = 548.0488 Metric = 0.54586 Eccentricity = 0.95907 MajorAxisLength = 243.4158 MinorAxisLength = 68.9268
8.	Area = 13895 Perimeter = 572.4163 Metric = 0.5329 Eccentricity = 0.95521 MajorAxisLength = 246.3715 MinorAxisLength = 72.9074
9.	Area = 13191 Perimeter = 542.8671 Metric = 0.56247 Eccentricity = 0.954 MajorAxisLength = 237.9437 MinorAxisLength = 71.3376
10.	Area = 13640 Perimeter = 556.4579 Metric = 0.55355 Eccentricity = 0.94605 MajorAxisLength = 233.6023 MinorAxisLength = 75.6941
11.	Area = 16059 Perimeter = 590.2325 Metric = 0.57927 Eccentricity = 0.94673 MajorAxisLength = 254.4337 MinorAxisLength = 81.9339
12.	Area = 15304 Perimeter = 590.5757 Metric = 0.5514 Eccentricity = 0.94986 MajorAxisLength = 252.9155 MinorAxisLength = 79.0818
13.	Area = 16619 Perimeter = 611.7128 Metric = 0.55811 Eccentricity = 0.94707 MajorAxisLength = 259.2242 MinorAxisLength = 83.2186
14.	Area = 14981 Perimeter = 583.7788 Metric = 0.5524 Eccentricity = 0.95776 MajorAxisLength = 259.0145 MinorAxisLength = 74.4863
15.	Area = 13820 Perimeter = 567.8965 Metric = 0.53849 Eccentricity = 0.95906 MajorAxisLength = 250.6127 MinorAxisLength = 70.9777
16.	Area = 16924 Perimeter = 609.6468 Metric = 0.57221 Eccentricity = 0.94592 MajorAxisLength = 259.8778 MinorAxisLength = 84.3049
….	…… …….. ……
35.	Area = 14038 Perimeter = 580.0143 Metric = 0.52437 Eccentricity = 0.95616 MajorAxisLength = 250.5 MinorAxisLength = 73.3579

3.4 SVM Classification

Classification using the Support Vector Machine (SVM) algorithm is implemented on training data of 70 images. The type of kernel in the Support Vector Machine (SVM) algorithm which tends to be good for classifying 2 classes is a linear kernel[23]. results of the classification in the training process as shown in Figure 10.

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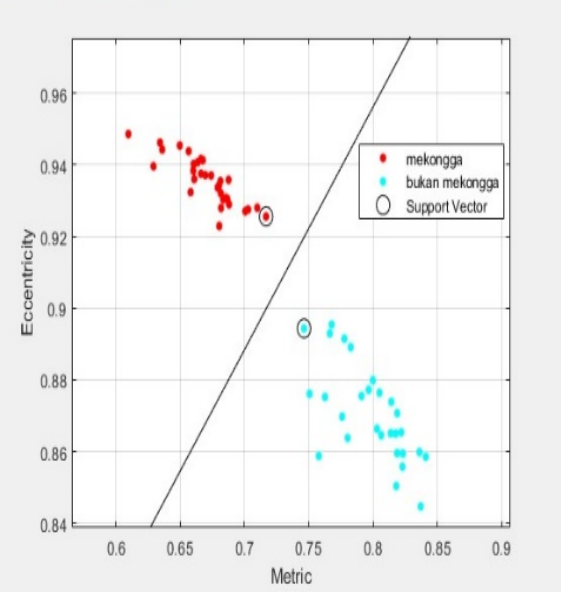

Figure 10 Result Classification of Training

The eccentricity and metric values from the results of the training data will be used as parameters. The parameter values are as in table 2.

Table 2 Parameters

Variety	Parameter eccentricity	Parameter metric
Mekongga	0.922942975 - 0.948584953	0.609563035 - 0.716744599
Not mekongga	0.844697864 - 0.895457363	0.746306243 - 0.841129409

3.5 Output

This stage re-implements the Support Vector Machine (SVM) algorithm on the test data used as many as 35 rice images.

Table 2 Result of Testing Classification

No	Eccentricity	Metric	Class	Predict	Annotation
1	0.937036422	0.674014	1	1	TRUE
2	0.930437425	0.686635	1	1	TRUE
3	0.935483344	0.681251	1	1	TRUE
4	0.934164722	0.680083	1	1	TRUE
5	0.930375368	0.683405	1	1	TRUE
...	.....	.....	.....	.....	.....
18	0.877236232	0.796702	2	2	TRUE
19	0.859857144	0.836239	2	2	TRUE
20	0.876123063	0.750632	2	2	TRUE
21	0.875501870	0.791104	2	2	TRUE
22	0	inf	2	1	FALSE
23	0	inf	2	1	FALSE
35	0.863815034	0.780291	2	2	TRUE

Implementation of the Support Vector Machine (SVM) algorithm with the parameters specified in the test data of 35 images resulted in 33 images of success. To evaluate the support vector machine algorithm, and the accuracy value is 94.28%

5. Discussion

There are many varieties of rice varieties in Karawang that have not been lifted so that crop productivity there is less and invisible, the study of Variates Mekonga is the beginning of this research with the intention that the name of the varieties can be protected, advanced studies that are very necessary as an example is how to increase the production of the varieties, then how to select the most suitable place, there is a good study that can be in comparison with other research-related varieties of similar plants around the world, so it can be taken the best conclusion that can improve the efficiency and effectiveness of a production process and related marketing of this plant.

6. Acknowledgment

This research is supported by the Indonesian Government in the effort to lift local production, especially the government of Karawang Regency, also support from academics in the environment of Singaperbangsa Karawang University, writers also thank many farmers in Karawang district who have been able to cooperate in providing the necessary data during the research.

7. Conclusion

The implementation of the Support Vector Machine (SVM) algorithm in the classification of Mekongga rice varieties with other rice based on the shape characteristics gets quite good results according to the parameters of the metric and eccentricity values obtained from the feature extraction process. The results of the study prove that the Support Vector Machine (SVM) algorithm which is included in this supervised learning can determine and distinguish the types of rice varieties. The confusion matrix in this study is to calculate the accurate value of the implementation of the Support Vector Machine (SVM) algorithm. The results of the classification of Mekongga rice varieties using the Support Vector Machine (SVM) algorithm with a linear kernel produce an accuracy value of 94.28%. The value already reflects satisfactory results but there are still

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some drawbacks that Performance can still be improved when the selection of features can be improved, optimization is also an option in the model for improved accuracy, so it is expected that in the following studies can be added.

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