

## Classification of Batu Bara Songket Using Gray-Level Co-Occurrence Matrix and Support Vector Machine

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### Abstract

Songket is a traditional woven cloth from the Melayu and Minangkabau tribes. Songket can also be classified from the brocade woven family and woven with gold or silver thread. Songket cloth's beauty is the Indonesian people's wealth and preservation. Batu Bara Regency is one of Indonesia's regions with several Songket motifs characteristics. Public knowledge of Batu Bara Songket motifs is still minimal, and the differences between one motif and another are still unknown. This research provides information about the variety of Songket fabrics by classifying six types of Batu Bara Songket motifs, namely the Bunga Tanjung motif, Pucuk Betikam motif, Pucuk Cempaka motif, Pucuk pandan motif, Tampuk Manggis motif and Tolab Berantai motif based on the extraction of the Gray Level texture feature. The Co-Occurrence Matrix includes four parameters: Contrast, Correlation, Energy, and Homogeneity, as well as a classification method with a Support Vector Machine. The feature extraction values process as input for classification using a Support Vector Machine. The highest accuracy achieved in this study was 57%, using 60 training data and 30 test data.

Keywords: Classification; Batu Bara Songket Motif; Gray Level Co-Occurrence Matri; Support Vector Machine

### Abstrak

*Songket merupakan jenis kain tenunan tradisional yang berasal dari suku melayu dan Minangkabau. Songket juga dapat digolongkan dari keluarga tenunan brokat dan dapat ditenun dengan benang emas dan perak. Keindahan kain songket merupakan kekayaan masyarakat Indonesia yang harus terus dilestarikan. Kabupaten Batu Bara merupakan salah satu wilayah di Indonesia yang memiliki beberapa ciri khas motif kain songket. Pengetahuan masyarakat akan motif-motif songket Batu Bara masih minim dan perbedaan antara motif yang satu dengan motif yang lain masih belum diketahui. Penelitian ini dibuat dengan tujuan untuk memberikan informasi tentang ragam kain songket dengan mengklasifikasi enam jenis motif songket Batu Bara yakni motif bunga tanjung, motif pucuk betikam, motif pucuk cempaka, motif pucuk pandan, motif tampuk manggis dan motif tolab berantai berdasarkan ekstraksi ciri tekstur Grey Level Co-Occurrence Matrix meliputi empat parameter yakni Contrast, Correlation, Energy, dan Homogeneity, serta metode klasifikasi dengan Support Vector Machine. Nilai ekstraksi ciri tersebut selanjutnya akan diproses menjadi masukan untuk klasifikasi menggunakan Support Vector Machine. Akurasi tertinggi yang dicapai dalam penelitian ini sebesar 57 %, dengan menggunakan 60 data latih dan 30 data uji.*

Kata kunci: Klasifikasi; Motif Songket Batu Bara; Grey Level Co-Occurrence; Support Vector Machine

### INTRODUCTION

Indonesia is a country that is rich in unique and distinctive cultural heritage diversity. Every nation or tribe has a culture (Tahir et al., 2017). A diverse cultural heritage can become essential for Indonesia, and its preservation is mandatory. One

manifestation of the results of this cultural process is the creation of works of art that all Indonesian ethnic groups own. Indonesia's diverse traditional fabrics result from cultural processes, geographical differences, flora, fauna, lifestyle differences, and livelihoods producing various traditional fabrics. Indonesian Traditional Fabrics are in great demand

in national and international markets (Johan Wahyudi & Ihdahubbi Maulida, 2019). One of the ethnic cultures in Indonesia is Malay, especially in North Sumatra (Rigitta, 2021).

Songket is a traditional Malay and Minangkabau woven fabric in Indonesia, Malaysia, and Brunei (Nurhalimah et al., 2020). Songket belongs to the brocade woven family. Weaving Songket cloth by hand using gold and silver threads is generally worn on formal occasions. The beauty of Songket can attract domestic and foreign tourists who like Indonesian traditional cloth art (Salamah & Kusumanto, 2017).

Batu Bara Regency has a type of Songket with its characteristics (Abdiansyah, 2018). Public knowledge of the Batu Bara Songket motifs is still minimal, and the difference between one motif and another is still unknown. The lack of automated data collection is the cause of this, and no application can analyze the types of Batu Bara Songket motifs, which can help the community to provide knowledge to the public about the Batu Bara Songket motif and is no longer wrong in recognizing the Batu Bara Songket motif.

Several studies regarding the classification of Songket motifs based on texture have several times in previous studies, such as the feature extraction study using the grey-level co-occurrence matrix (GLCM) method. The Gabor filter for image classification of Pekalongan batik (Surya et al., 2017), other studies on the classification of Songket cloth in Lombok use GLCM and moment invariant as well as linear discriminant analysis (LDA) (Nurhalimah, 2020), feature extraction of Songket images based on texture using the grey level co-occurrence matrix (GLCM) method (Amalia, 2018), application of a speeded-up robust feature on the random forest for classification of Palembang Songket motifs (Yohannes et al., 2020).

This study has advantages over previous research, namely using grounded theory through qualitative analysis using Songket cloth objects that are observed and interacted with based on the participants' views. This research was made to provide information about the various types of coal Songket cloth that previous researchers have not studied by classifying six types of Batu Bara Songket motifs, namely six types of Batu Bara Songket motifs. Namely Bunga Tanjung Motif, Pucuk Betikam Motif, Pucuk Cempaka Motif, Pucuk Pandan Motif, Tampuk Manggis Motif, and Tolab Berantai Motif.

*Gray Level Co-Occurrence Matrix (GLCM)* method is a method for extracting image textures. Texture extraction to retrieve essential information from an image before it is used for the following process, using feature extraction methods

considered optimal in research (Ramadhani & Bethaningtyas Dyah, 2018). The *Gray Level Co-Occurrence Matrix (GLCM)* method is an adequate texture descriptor and has better accuracy and computation time than other texture extraction methods (Widodo et al., 2018).

The *Support Vector Machine (SVM)* method is a machine learning technique. They learn by using a pair of input and output data as the desired target. It is called supervised learning, and the advantages of the *Support Vector Machine (SVM)* method are in recognizing and classifying an object (Anggraini, 2017). *Support Vector Machine (SVM)* is a classification method with high generalizability and input space dimensions (Neneng et al., 2016).

## RESEARCH METHODS

### Types of research

The author's research is a type of grounded theory through the analysis of qualitative and quantitative methods.

### Time and Place of Research

This research was conducted precisely at the "Yusra" craftsmen of Batu Bara woven cloth. Padang Genting Village No. 6 district Talawi and the place for system design in the computer laboratory of the Faculty of Science and Technology, State Islamic University of North Sumatra. Research Time in November 2021 to March 2022.

### Research Target / Subject

The research target in this study is the Batu Bara community, who do not know much about the types of Batu Bara songket motifs.

### Procedure

The process carried out to research the classification of Batu Bara Songket motifs based on texture with the *Gray Level Co-Occurrence Matrix (GLCM)* and *Support Vector Machine (SVM)* methods, namely through several stages of designing the analytical method.

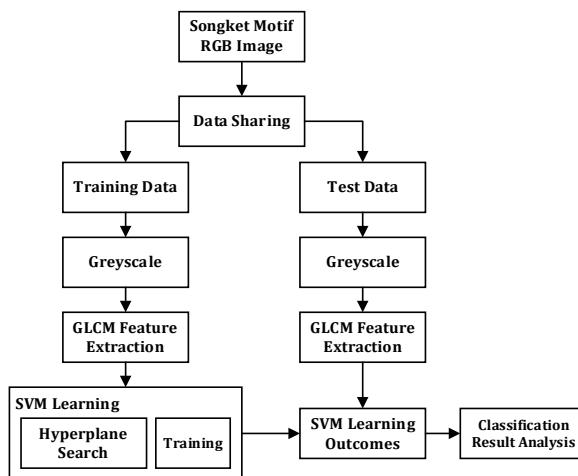


Figure 1. Songket Motif Classification System Planning Diagram

Figure 1 shows that the diagram uses input as an RGB Songket motif image. The image is divided into two parts: the training and test data images. Then the training and test data images are changed from RGB to grayscale. After that, the GLCM feature extraction is sought, which consists of contrast, entropy, energy, and homogeneity features. For training data, multiclass SVM learning is used in the hyperplane separator of the six types of Songket motifs. The last stage is to test the system on the test data images and analyze the results of image classification on the hyperplane function that has been obtained.

The steps taken in the GLCM calculation are as follows the formation of the initial GLCM matrix from pairs of two parallel pixels corresponding to the directions  $0^\circ$ ,  $45^\circ$ ,  $90^\circ$ , and  $135^\circ$ . The following form a symmetrical matrix by adding the initial matrix GLCM with its transpose values, normalizing the GLCM matrix by dividing each matrix element by the number of pixel pairs, and then feature extraction, namely *contrast*, *Homogeneity*, *energy*, *correlation* (Widodo et al., 2018).

#### Contrast

$$= \sum_{i1} \sum_{i2} (i_1 - i_2)^2 p(i_1, i_2) \dots \dots \dots (1)$$

#### Homogeneity

$$= \sum_{i1} \sum_{i2} \frac{p(i_1, i_2)}{1 + |i_1 - i_2|} \dots \dots \dots (2)$$

#### Energy

$$= \sum_{i1} \sum_{i2} p^2(i_1, i_2) \dots \dots \dots (3)$$

$$\text{Correlation} = \sum_i \sum_j \frac{(i - \mu_i)(j - \mu_j)p_{(i,j)}}{\sigma_i \sigma_j} \dots \dots \dots (4)$$

In the process of classifying Songket motifs using SVM, in research, in this case, the SVM multiclass approach that It uses is a classification method "one against all." In this method,  $k$  binary SVM models are built, with  $k$  being multiple classes. Each classification of the model it wants to use uses total data to find solutions to problems. SVM classifies two classes between one class and others seen as one class. The class for a data sample is directly determined by this method. When the data sample is not included in the group containing the set class but in a specific class, then that class is a class from the sample data in question (Pitoyo, 2020).

Table 1. SVM Classification with One-Agains-All method

| $y_i = 1$ | $y_i = -1$  | Kernel Hypothesis      |
|-----------|-------------|------------------------|
| Class 1   | Not class 1 | $F1(x) = (w^1)x + b^1$ |
| Class 2   | Not class 2 | $F2(x) = (w^2)x + b^2$ |

..... (5)

Table 1 shows test results on test data that produce a decision function with the maximum value given a value of  $y_i=1$  (true), while other decision functions give a value of  $y_i=-1$  (false).

Accuracy :

$$\text{Accuracy} = \frac{\text{Correct classification number}}{\text{Amount of data}} \times 100 \% \dots \dots \dots (6)$$

#### Data, Instruments, and Data Collection Techniques

Songket motif image data collection is divided into training and test data. The training data consists of 60 samples of Songket motif image data, and the test data consists of 30 samples of Songket motifs. The total sample data is 90 images of the Songket motif.

The data collection technique used in this study is :

#### 1. Interview

Figure 2. is an interview technique that was conducted by seeking information and knowledge sourced from experts engaged in fields related to this research, namely with Mrs. Hj. Ratna, one of the craftsmen who also opened a Songket business in the Batubara district, so the author gets relevant data references and knows the names of the Batu Bara Songket motifs.



Figure 2. Interview with Mrs. Hj. Ratna

## 2. Observation

The technique is an observation of data collection techniques by observing directly an object to seek information and knowledge related to research.

|       |               |                |                |
|-------|---------------|----------------|----------------|
| Image |               |                |                |
| Motif | Bunga Tanjung | Pucuk Betikam  | Pucuk Cempaka  |
| Image |               |                |                |
| Motif | Pucuk Pandan  | Tampuk Manggis | Tolab Berantai |

Figure 3. Sample image of Batu Bara Songket

In Figure 3. It is an example of a sample of Batu Bara Songket images, where each Songket sample shown in Figure 3. has 30 image data. The six types of Songket motifs are Tanjung Flowers, Betikam Shoots, Cempaka Shoots, Pandan Shoots, Tampuk Manggis, and Tolab Berantai.

## 3. Library Studies,

Namely in this study also used literature studies taken from scientific articles, books, and others.

### Data analysis technique

This analysis is needed to determine what kind of software will be produced. The needs analysis in this study is as follows:

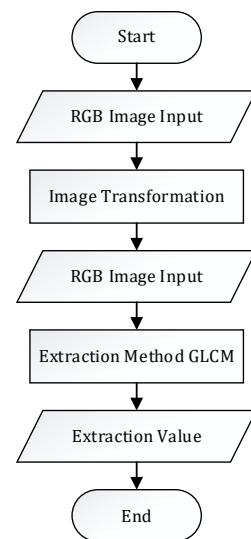


Figure 4. GLCM Feature Extraction Flowchart

From the flowchart Figure 4. The above explains the stages in the GLCM feature extraction method, namely as follows :

- a. Input the RGB image of the Batu Bara Songket motif.
- b. Then the image is changed from RGB to grayscale.
- c. After that, look for the GLCM feature extraction, which consists of contrast, Homogeneity, energy, and entropy features.
- d. Generates image extraction values from the GLCM method.

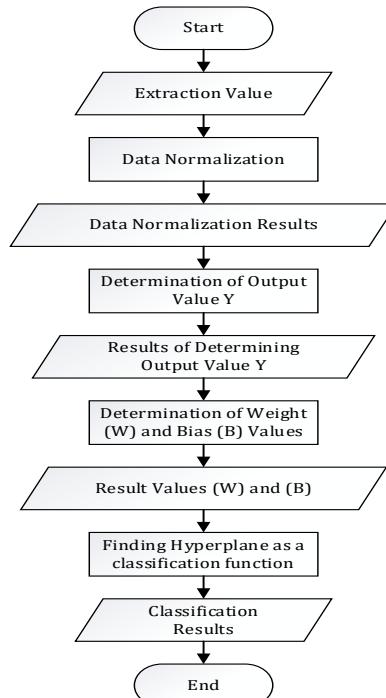


Figure 5. SVM Classification Method Flowchart

From the flowchart Figure 5. above explains the stages in the Support Vector Machine (SVM) classification method, namely as follows:

- After getting the value from feature extraction From the GLCM method, input the GLCM feature data.
- Data normalization was using the equation formula attached to the SVM theory.
- After Normalization, can pay, pay output value (y).
- Then the value of weight (w) and bias (b).
- After all, can be seen, the system looks for hyperplane as a decision function.
- So the classification uses the SVM method.

Output in the Batu Bara Songket motif classification system based on texture using the *Gray Level Co-Occurrence Matrix* (GLCM) method and *Support Vector Machine* (SVM), namely the results of the classification of Songket motif types through a feature extraction process using the *Gray Level Co-Occurrence method Matrix* (GLCM) and the classification process uses the *Support Vector Machine* (SVM) method.

## RESULTS AND DISCUSSION

### Testing

Based on the existing image samples, a testing process on these images. At the testing stage, the digital image is in (\*.jpg) format with a size of 512x512 pixels. The system testing process using the MATLAB application see in the process below:

#### 1. Application Initial Screen

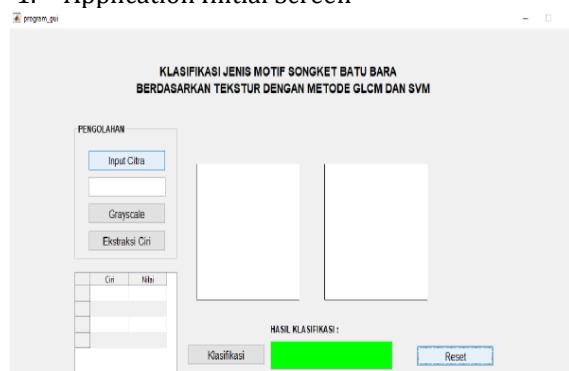


Figure 6. Initial Display Form

Figure 6. is the initial form, which is the main page for running the program to be worked on.

#### 2. Image Input Display

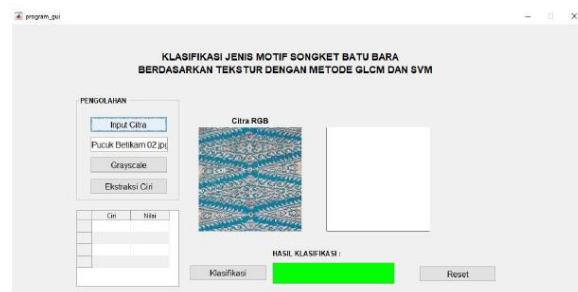


Figure 7. Image Input Display Form

Figure 7. in this form, the image input is by pressing the Image Input button, and then the system will direct it to select the data to be tested, and then the system will automatically display the inputted image and the image file name.

#### 3. Grayscale Display

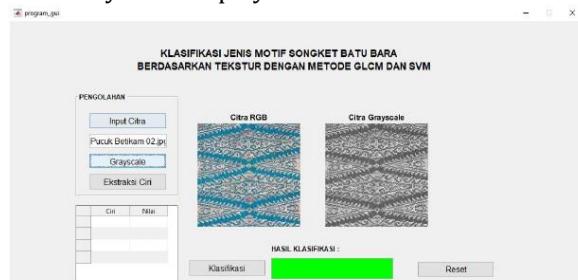


Figure 8. RGB Display Form to Grayscale

In figure 8. this form will be processed using a Grayscale. By pressing the grayscale button, the system will process the RGB file to grayscale and display the resulting grayscale image on axes2.

#### 4. Gray Level Co-Occurrence Matrix (GLCM) Feature Extraction Display

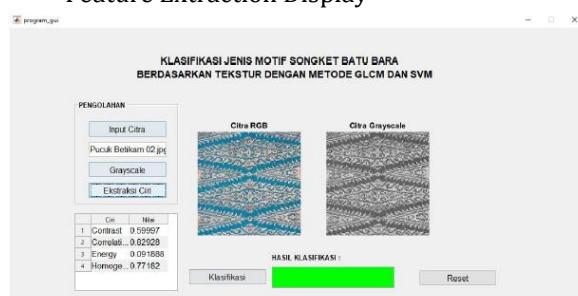


Figure 9. Gray Level Co-Occurrence Matrix Feature Extract Display Form

Figure 9. this form will perform feature extraction on the image by pressing the Feature Extract button. The table will display the feature extraction value of the Gray Level Co-Occurrence Matrix (GLCM).

## 5. Classification Result Display



Figure 10. Image Classification Results Display Form of Batu Bara Songket Motifs

Example 10 The supplied image's classification results show on this form's display. Clicking the classification button will cause the system to display the supplied image's classification

findings automatically.

## System Test Results

Based on test data on the image of the type of Songket Batu Bara motif that has been, if there is, in this case, a testing process will be carried out on the motif image Songket Batu Bara with format (\*.jpg). In the process of testing the motif classification Songket below, there are 30 test data with 5 data from each type of Songket motif, 5 test data for Bunga Tanjung, 5 test data for Pucuk Betikam, 5 test data for Pucuk Cempaka, 5 test data for Pucuk Pandan, 5 test data for Tampuk Manggis, and 5 test data for Tolab Berantai. From the result testing of as many as 30 test data. The following are the results of system testing of each image of the Songket motif tested to obtain a classification of the type of Coal Songket motif, see table 2 below:

Table 2. Data Testing

| No. | Decision Function<br>SVM MultiClass One<br>Against All | Score<br>yi | Types of Batu Bara<br>Songket | Classification<br>Result | Information |
|-----|--|-------------|-------------------------------|--------------------------|-------------|
| 1.  | $f1(x)=\text{sign}(w1.x1 + w2.x2 + w3.x3 + w4.x4+b)$   | 1           | Bunga Tanjung                 | 'Motif Bunga Tanjung'    | True        |
| 2.  | $f1(x)=\text{sign}(w1.x1 + w2.x2 + w3.x3 + w4.x4+b)$   | 1           | Bunga Tanjung                 | 'Motif Bunga Tanjung'    | True        |
| 3.  | $f1(x)=\text{sign}(w1.x1 + w2.x2 + w3.x3 + w4.x4+b)$   | 1           | Bunga Tanjung                 | 'Motif Bunga Tanjung'    | True        |
| 4.  | $f1(x)=\text{sign}(w1.x1 + w2.x2 + w3.x3 + w4.x4+b)$   | 1           | Bunga Tanjung                 | 'Motif Bunga Tanjung'    | True        |
| 5.  | $f1(x)=\text{sign}(w1.x1 + w2.x2 + w3.x3 + w4.x4+b)$   | 1           | Bunga Tanjung                 | 'Motif Bunga Tanjung'    | True        |
| 6.  | $f2(x)=\text{sign}(w1.x1 + w2.x2 + w3.x3 + w4.x4+b)$   | -1          | Pucuk Betikam                 | 'Motif Pucuk Pandan'     | False       |
| 7.  | $f2(x)=\text{sign}(w1.x1 + w2.x2 + w3.x3 + w4.x4+b)$   | 1           | Pucuk Betikam                 | 'Motif Pucuk Betikam'    | True        |
| 8.  | $f2(x)=\text{sign}(w1.x1 + w2.x2 + w3.x3 + w4.x4+b)$   | 1           | Pucuk Betikam                 | 'Motif Pucuk Betikam'    | True        |
| ... | ...  | ...         | ...                           | .....                    | .....       |
| 30. | $f6(x)=\text{sign}(w1.x1 + w2.x2 + w3.x3 + w4.x4+b)$   | 1           | Tolab Berantai                | 'Motif Tolab Berantai'   | True        |

Table 2 shows 30 test data with 5 data from each type of Songket motif. Each test data has a one against all SVM decision functions according to each class. Entering the  $y_i$  value shows the classification results and the types of Songket motifs. If the  $y_i$  value is one, then the classification results are

declared correct by the type of Songket motif being tested. Conversely, if the  $y_i$  value is -1, then the classification results are declared wrong and do not produce output that matches the type of Songket motif in table 3.

Table 3. Classification Test Results

| No  | Image File   | Classification Result | Average Extraction Result   |
|-----|--|-----------------------|---|
| 1.  |  Bunga Tanjung 01.jpg   | 'Motif Bunga Tanjung' | Contrast = 0.055182<br>Correlation = 0.89292<br>Energy = 0.80746<br>Homogeneity = 0.97932 |
| 2.  |  Bunga Tanjung 02.jpg   | 'Motif Bunga Tanjung' | Contrast = 0.054825<br>Correlation = 0.90229<br>Energy = 0.89758<br>Homogeneity = 0.98303 |
| 3.  |  Bunga Tanjung 03.jpg   | 'Motif Bunga Tanjung' | Contrast = 0.044537<br>Correlation = 0.9417<br>Energy = 0.79726<br>Homogeneity = 0.98128  |
| 4.  |  Bunga Tanjung 04.jpg  | 'Motif Bunga Tanjung' | Contrast = 0.081439<br>Correlation = 0.81279<br>Energy = 0.91401<br>Homogeneity = 0.98792 |
| 5.  |  Bunga Tanjung 05.jpg | 'Motif Bunga Tanjung' | Contrast = 0.029251<br>Correlation = 0.91165<br>Energy = 0.76756<br>Homogeneity = 0.98585 |
| 6.  |  Pucuk Betikam 01.jpg | 'Motif Pucuk Pandan'  | Contrast = 0.59997<br>Correlation = 0.82928<br>Energy = 0.091888<br>Homogeneity = 0.77182 |
| 7.  |  Pucuk Betikam 02.jpg | 'Motif Pucuk Betikam' | Contrast = 0.45013<br>Correlation = 0.75828<br>Energy = 0.14618<br>Homogeneity = 0.81243  |
| 8.  |  Pucuk Betikam 03.jpg | 'Motif Pucuk Betikam' | Contrast = 1.4175<br>Correlation = 0.67485<br>Energy = 0.097793<br>Homogeneity = 0.70073  |
| 9.  |  Pucuk Betikam 04.jpg | 'Motif Pucuk Pandan'  | Contrast = 0.4908<br>Correlation = 0.91867<br>Energy = 0.10273<br>Homogeneity = 0.80891   |
| 10. |  Pucuk Betikam 05.jpg | 'Motif Pucuk Pandan'  | Contrast = 0.40894<br>Correlation = 0.85346<br>Energy = 0.11702<br>Homogeneity = 0.82458  |
| 11. |  Pucuk Cempaka 01.jpg | 'Motif Pucuk Pandan'  | Contrast = 0.27883<br>Correlation = 0.92845<br>Energy = 0.12754<br>Homogeneity = 0.86776  |

Continue Table 3. Classification Test Results

| No  | Image File  | Classification Result  | Average Extraction Result   |
|-----|---|------------------------|---|
| 12. |    | 'Motif Pucuk Pandan'   | Contrast = 0.53642<br>Correlation = 0.92068<br>Energy = 0.070588<br>Homogeneity = 0.79759 |
|     | Pucuk Cempaka 02.jpg  |                        |   |
| 13. |    | 'Motif Pucuk Pandan'   | Contrast = 0.47518<br>Correlation = 0.93722<br>Energy = 0.087429<br>Homogeneity = 0.81312 |
|     | Pucuk Cempaka 03.jpg  |                        |   |
| 14. |    | 'Motif Pucuk Betikam'  | Contrast = 2.06<br>Correlation = 0.78755<br>Energy = 0.060153<br>Homogeneity = 0.64077    |
|     | Pucuk Cempaka 04.jpg  |                        |   |
| 15. |    | 'Motif Pucuk Pandan'   | Contrast = 0.26947<br>Correlation = 0.9625<br>Energy = 0.13427<br>Homogeneity = 0.89281   |
|     | Pucuk Cempaka 05.jpg  |                        |   |
| 16. |    | 'Motif Pucuk Pandan'   | Contrast = 0.20786<br>Correlation = 0.98435<br>Energy = 0.20333<br>Homogeneity = 0.91465  |
|     | Pucuk Pandan 01.jpg   |                        |   |
| 17. |   | 'Motif Tolab Berantai' | Contrast = 0.7327<br>Correlation = 0.9424<br>Energy = 0.32664<br>Homogeneity = 0.85992    |
|     | Pucuk Pandan 02.jpg   |                        |   |
| 18. |  | 'Motif Pucuk Pandan'   | Contrast = 0.2666<br>Correlation = 0.97432<br>Energy = 0.30293<br>Homogeneity = 0.90128   |
|     | Pucuk Pandan 03.jpg   |                        |   |
| 19. |  | 'Motif Pucuk Pandan'   | Contrast = 0.27675<br>Correlation = 0.97278<br>Energy = 0.19923<br>Homogeneity = 0.89126  |
|     | Pucuk Pandan 04.jpg   |                        |   |
| 20. |  | 'Motif Pucuk Pandan'   | Contrast = 0.21481<br>Correlation = 0.98068<br>Energy = 0.25459<br>Homogeneity = 0.91031  |
|     | Pucuk Pandan 05.jpg   |                        |   |
| 21. |  | 'Motif Tampuk Manggis' | Contrast = 0.52105<br>Correlation = 0.94653<br>Energy = 0.14224<br>Homogeneity = 0.85553  |
|     | Tampuk Manggis 01.jpg   |                        |   |
| 22. |  | 'Motif Pucuk Pandan'   | Contrast = 0.29603<br>Correlation = 0.95872<br>Energy = 0.13533<br>Homogeneity = 0.88979  |
|     | Tampuk Manggis 02.jpg   |                        |   |
| 23. |  | 'Motif Pucuk Pandan'   | Contrast = 0.56491<br>Correlation = 0.9307<br>Energy = 0.28442<br>Homogeneity = 0.87347   |
|     | Tampuk Manggis 03.jpg   |                        |   |
| 24. |  | 'Motif Pucuk Pandan'   | Contrast = 0.81957<br>Correlation = 0.88644<br>Energy = 0.085617<br>Homogeneity = 0.7813  |
|     | Tampuk Manggis 04.jpg   |                        |   |

Continue Table 3. Classification Test Results

| No  | Image File  | Classification Result  | Average Extraction Result  |
|-----|---|------------------------|--|
| 25. |  Tampuk Manggis 05.jpg   | 'Motif Pucuk Cempaka'  | Contrast = 1.7677<br>Correlation = 0.86206<br>Energy = 0.064323<br>Homogeneity = 0.69035 |
| 26. |  Tolab Berantai 01.jpg   | 'Motif Tolab Berantai' | Contrast = 0.33832<br>Correlation = 0.96599<br>Energy = 0.46026<br>Homogeneity = 0.90777 |
| 27. |  Tolab Berantai 02.jpg   | 'Motif Tolab Berantai' | Contrast = 0.82393<br>Correlation = 0.88715<br>Energy = 0.46915<br>Homogeneity = 0.86199 |
| 28. |  Tolab Berantai 03.jpg   | 'Motif Tolab Berantai' | Contrast = 0.62157<br>Correlation = 0.88225<br>Energy = 0.46947<br>Homogeneity = 0.90785 |
| 29. |  Tolab Berantai 04.jpg   | 'Motif Tolab Berantai' | Contrast = 0.24126<br>Correlation = 0.96976<br>Energy = 0.47912<br>Homogeneity = 0.92227 |
| 30. |  Tolab Berantai 05.jpg | 'Motif Tolab Berantai' | Contrast = 0.37501<br>Correlation = 0.97167<br>Energy = 0.46261<br>Homogeneity = 0.90785 |

Table 3 shows 30 test data with 5 data from each type of Songket motif. There is a Songket image file with the file name according to the name of the Songket motif. The classification results are found in the system according to the class of Songket motifs tested. The system's average classification results are obtained according to the class of Songket motifs tested.

## CONCLUSIONS AND SUGGESTIONS

### Conclusion

Based on the results of tests carried out by classifying the Batu Bara Songket motif based on the image of the Songket motif using the *Gray Level Co-Occurrence Matrix* (GLCM) and *Support Vector Machine* (SVM) methods, the following conclusions were drawn:

In the manual calculation of the *Support Vector Machine* (SVM) classification using the one against-all decision function equation with  $class = \text{sign}(f(x))$ . The function sign is used to check the results of the calculations performed on the test data. The test results on the test data produce the decision with the maximum value given a value of

From the test results of all 30 test data, there are 13 types of Songket motifs that are wrong in the placement of Songket motifs according to their class, so from the results of the classification of Songket motifs, the accuracy results are obtained with a value of 57% with a description of 17 test data that are correct for class placement and 13 incorrect test data in class placement.

$y_{i=1}$ , while the other decision functions are given a value of  $y_{i=-1}$ .

From the results of testing all test data, which are 30 test data, from the results of the classification of the type of Songket motif, the accuracy results with a value of 57% with a description of 17 test data that is correct in class placement and 13 test data are wrong in class placement.

Extraction of Gray Level Co-Occurrence Matrix (GLCM) features of Batu Bara Songket motif images used to classify types of Batu Bara Songket motifs. The distance of neighboring pixels (distance) is one and in the direction of  $0^\circ$ ,  $45^\circ$ ,  $90^\circ$ , and  $135^\circ$ . The resulting feature of the *Gray Level Co-Occurrence Matrix* (GLCM) represents the texture value of the Songket motif image. So that these values are used to classify the types of Batu Bara



Songket motifs using the *Support Vector Machine* (SVM) method, conclusions should be in the form of paragraphs that answer the research objectives. It tells how the researcher's work can advance current knowledge but does not seem to discuss it.

### Suggestion

The addition of the type of Songket motif studied is universal. The use of different methods as a comparison of this study. It expanded using other feature extraction methods, such as color or shape extraction. Image capture of Songket motifs is idealized in terms of lighting. Moreover, it can be developed into a mobile-based application or website so the wider community can use it.

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