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Implementation of One Orde Extraction for Identification of Coal Batik Method with Back propagation Method

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***Abstract*—The coastal areas of Java Island covering the cities of Brebes, Cirebon, Pekalongan, Lasem and Madura have various patterns of batik motifs. Based on the pattern of coastal batik motifs can be distinguished into batik geometric a non-geometry. Classification of coastal batik motif using Backpropagation algorithm by determining the value of learning rate and momentum during training data. Input data used in the form of statistical characteristics obtained from the formation of GLCM values. Statistical characteristics used include mean, standard deviation, curtosis, skewness and entropy. While the best learning rate is obtained on the number 0.5 and the momentum 1.0 on the geometry of batik motif. While the best non-geometric motif of learning rate is obtained on the number 0, 5 and momentum 1.0. The number of neurons used in the training of both motives affects the epoch value (the number of iterations) and the resulting error.**

***Keywords*— canny detection, thresholding otsu, glcm, backprogation, batik motif pesisir**

I. Introduction

Based on the field of fine arts, batik is included in the two-dimensional painting where the cloth is the media painting. UNESCO has recognized batik as the original artwork of Indonesia's cultural heritage in 2009 [1]. In Java Island batik growing rapidly in the northern coastal area of Java Island or commonly called coastal batik and the Yogyakarta and Solo kraton environment or commonly called batik hinterland. Coastal batik is growing rapidly in the city along the northern coast of Java, including Brebes, Cirebon, Pekalongan, Lasem and Madura. According to Nian S. Djoemana, the broad range of decorative batik is divided into 2, namely geometry and non geometry decorative [2].

Batik motif has four basic elements in it, namely line, texture, color and field [1]. With the motive image processing on batik can be analyzed to then classified based on the four elements it has. With the

classification will help the identification of characters in the object image stored in the database, so as to minimize the error of inserting objects in different groups [3].

Batik motif can be classified based on texture characteristics by looking for similarity of texture characteristics. The feature equation is obtained by calculating the adjacent pixel values in the matrix. Gray level co-occurance matrix (GLCM) method is one of the methods for feature extraction based on characteristic characteristics. GLCM values that can be used include mean, standard deviation, curtosis, skewness and entropy. Value of five variables are used as the value of input in the classification process with backpropagation algorithm. Thus, batik as Indonesia's cultural heritage can be preserved not only in physical form but also in digital form. So that batik motif that has never existed and then can be developed into a new batik motif.

II. Review of Related literature

In image processing, feature extraction steps are needed to facilitate image analysis in the next process. Batik feature extraction is taken based on texture pattern on the motif. Each pattern has specific characteristics that can be classified into groups of geometric patterns and non-geometric patterns. To get the value of a specific characteristic, we can calculate the distance and angle between pixels adjacent to the batik motif pixel matrix. The probability or probability of the same neighborhood pixel will be grouped in the same group of methods included in Gray Level Co-occurrence Matrix (GLCM) [4]

Extraction of batik motif features with Gray Level Co-occurrence Matrix (GLCM) method by Yaltha shows that GLCM performs well [5]. In distance testing and orientation, accurate data are obtained at the distance of 2nd pixel and direction at 45 ° angle. Another study by Anita [6], for the identification of batik image in the extraction process is used characteristic extraction by calculating GLCM characteristic which include contrast, homogenity, energy (correlation) and correlation. Next use backpropagation to classify batik motifs based on geometric pattern.

The backpropagation algorithm belongs to the neural network learning nerve learning algorithm popularized by Rumehalt and Mc Celland [7]. The backpropagation work system adopts the system

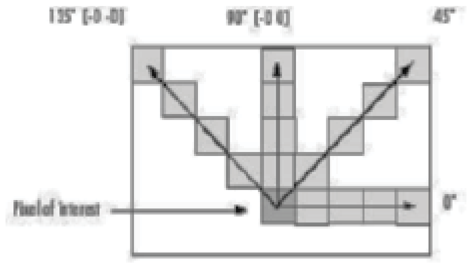

Figure 1. GLCM Orientation

Nerve work in humans. Learning method (learning) adopted backpropagation included in supervised learning. The value assigned to the input neurons is the knowledge used as the reference to be mapped into the desired group defined in the output neurons.

Learning process will continue to be done as long as the desired condition is not met, until it reaches the smallest error value. Therefore backpropagation is appropriate for classifying complex patterns [8]. The classification of batik with backpropagation successfully gives 100% accuracy value to classify geometry motif and 91, 9% for non-geometric batik motif [6].

Stages in this research include image acquisition, image processing pre-processing, and feature extraction with gray level co-occurrence matrix method and then feature classification by doing training data and data testing with artificial neural network back propagation algorithm

III. Result and Discussion

Stages in this study include image acquisition, image processing pre-extraction, feature extraction with gray level co-occurrence matrix and subsequent feature classification by performing training data and data testing with artificial neural network back propagation algorithm.

a. **Image Acquisition**
Collecting data digital image of coastal batik motif and stored in file format extension jpeg.

b. **Pre Image Processing**
Cropping is done to equalize the image size with a resolution of 8 x 8 pixels. Then greyscaling by converting RGB image to greyscale form.

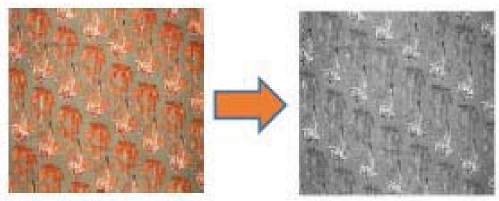

Figure 2 Display of image greyscaling results

c. **Feature Extraction**
One example of a method using characteristic feature extraction is GLCM because it proves as a powerful feature descriptor or characteristic in representing texture characteristics of an image [8]. In image processing, feature extraction steps are needed to facilitate image analysis in the next process. Batik feature extraction is taken based on texture pattern on the motive. Extraction of batik motif features by GLCM method by Yaltha shows that GLCM performs well [6]. In distance testing and orientation, accurate data are obtained at the distance of 2nd pixel and direction at 45 ° angle.
The relationship between the angles between the two pixels shown in Figure 2. The relationship between the angles between neighboring pixels [7].

The statistical calculation of gray-level distribution is by measuring the contrast, granularity, and roughness of an area of the relationship between the pixels in the image. In this study using the characteristic statistics of the order one which is a method of taking the characteristics based on the characteristics of histogram image by ignoring the relationship between neighboring pixels. One-order texture analysis is better at presenting the image textures in measurable parameters, such as skewness, standard deviation, curtosis, and entropy. The five values of the GLCM feature then become the input value in the classification process.

The result of calculation of GLCM value shown by Table 1 and Table 2 below.

Table 1. The result of GLCM value formation on batik motif of geometry

Citra	Mean	Standard dev	kurtosis	skewness	entropy
imgeo1	873.375	1319.849	10.1238	2.3325	1.2623
imgeo2	938.4375	1408.4183	7.4431	1.793	2.1558
imgeo3	821.2734	2030.006	17.8547	3.858	1.3951
imgeo4	905.25	954.2284	2.7418	0.86953	1.2866
imgeo5	895.7813	1673.2357	6.5037	2.1608	1.733
imgeo6	930.0586	1339.0612	3.4862	1.3196	2.1984
imgeo7	896.543	1348.7447	2.6609	1.1706	2.1069
imgeo8	959.4609	3156.5474	134.9656	10.625	1.0532

Table 2. The result of GLCM value formation on batik motif non geometry

Citra	Mean	Standard dev	kurtosis	skewness	entropy
imgngeo1	914.9766	2076.0944	15.2619	3.5511	2.0110
imgngeo2	992.7109	2612.8250	18.7283	4.0037	0.4899
imgngeo3	986.9023	2219.8991	13.2245	3.1324	1.2357
imgngeo4	964.2188	1925.9442	14.9091	3.0834	1.7428
imgngeo5	1395.2695	2516.7700	6.2113	2.1252	0.7889
imgngeo5	760.0781	1650.8635	10.1538	2.8000	1.2311
imgngeo7	892.6875	2233.8074	84.1422	8.3966	2.7736
imgngeo8	1583.2266	2300.1738	3.9668	1.4758	2.2712

The five characteristics are then used as input values on the classification. For the training phase use 70% of training data consisting of and testing phase using 30% data testing.

d. Classification

Backpropagation adopts a learning supervised learning algorithm where the learning process is done during training data. The input data on the input neurons is used as training data to be continued to output neurons as output data. Each network is given a weight, if the output value is not in accordance with the expected value then there will be weight improvement and propagated back spread to the neuron network before. Iteration occurs until it reaches the lowest error value.

Here is the back propagation work step:

1. Stage 0: Load initiation for weighting (w);
2. Stage 1: repeat steps 2 to 9 until the desired iteration condition is met;
3. Stage 2: repeat steps 3 through 8 for each pair of training data

Feed forward

4. Stage 3: each input unit (X_i, i = 1,2, ..., n,) at the input of the neurons receives the signal and forwarded to the next units - in the hidden layer neurons;
5. Stage 4: each unit in the hidden layer neurons multiplied by the weight and summed by the weighing factor is then added with the unclear value.

$$Z\_inj = V_{0j} + \sum_{i=1}^{n} (X_i V_{ij}) \qquad (3.1)$$

Generating activation with sigmoid function:

$$f = \frac{1}{1 + \exp(-f(x))} \qquad (3.2)$$

If $Zj = f(z\_in\,j)$ then,

$$Zj = \frac{1}{1 + exp}(-Zin\_j\ ) \qquad (3.3)$$

Next the signal is sent to the output unit (output neurons);

6. Stage 5: each unit of output (Yk, k = 1,2, ..., m) multiplied by weighing and summed factors

$$Z\_ink = W_{0k} + \sum_{i=1}^{n} (X_i W_{ik}) \qquad (3.4)$$

Re-count the activation function

$$y_k = f(y\_in_k) \qquad (3.5)$$

Backpropagation and error correction

7. Stage 6: Each output unit (Yk, k = 1,2, ..., m) receives the target pattern according to the input value at the training data and calculates the error value

$$\delta_k = (t_k - y_k) f'(y_{in\_k}) \qquad (3.6)$$

Because using the sigmoid activation function, then:

$$f'(y_{in\_k}) = f(y_{in\_k})(1 - f'(y_{in\_k}) \quad y_k = (1 - y_k) \qquad (3.7)$$

Compute the weighing factor for the value

$$Wkj\ \Delta Wkj = \alpha.\partial k\ .Zj \qquad (3.8)$$

Calculate correction repairmen,

$$\Delta Wok = \alpha.\partial k \qquad (3.9)$$

And use the value of δk on all previous layers

8. Stage 7: any weighting value that connects the unit of output and unit
9. Hidden layer ($Z j, j = 1, .. p$) multiplied by delta and summed as input on next layer unit,

$$\delta_{in\_j} = \sum_{i=1}^{m} (\delta_k W_{jk}) \quad (3.10)$$

Then multiplied by the derivative of the activation function to to determine the error value,

$$\delta_{in\_j} = f'(\delta_{in\_j}) - (y_{in\_j}) \quad (3.11)$$

Counting the weighting improvements to fix Vij

$$\Delta V_{ij} = \alpha . \partial_j . Xi \quad (3.12)$$

Counting the unclearly improvements to fix Voj

$$\Delta V oj = \alpha . \partial j \quad (3.13)$$

Fixed the unclearly and weight

Unclearly repairmen and weighing *(j = 0 .., p)* on each unit of output *(Yk, k = 1, .., m)*

$$Wjk\ (new) = Wjk\ (old) + \Delta Wjk \quad (3.14)$$

Fixing unclearly and weighing *(j = 0, ..., n)* on the hidden layer unit *(Zj, j = 1 ,, .., p)*

$$Vjk\ (new) = Vjk\ (old) + \Delta Vjk \quad (3.15)$$

10. Test iteration

Back propagation algorithm uses the concept of learning / training with the aim that inputs initialized on the input layer produce the appropriate output or desired. Therefore, the value of learning rate is required where the value of learning rate ranges from 0.1 to 1.0. In addition it requires an activation function, to determine the output value of a neuron in accordance with the process performed on the input. In this case the activation function used by the back propagation algorithm is a binary sigmoid function that has a range between 0 to 1.

Table 3 and Table 4 below show the relationship of learning rate and momentum with the number of neurons to produce the minimum net error value.

Table 3. Show learning rate non- Geometry Motif

Non - Geometry Motif				
Number of neuron	*Learning rate*	*Momentum*	*Iterasi*	*Net error*
10	*1.0*	*0.1*	*10233*	*0.14371*
12	*1.0*	*0.1*	*22490*	*0.1278*
20	*1.0*	*0.1*	*24652*	*0.33569*
22	*1.0*	*0.1*	*16155*	*0.21068*
25	*1.0*	*0.1*	*9325*	*0.19467*

Table 3. Training data with learning rate 0.5 and momentum 0,1 on geometry motif

Table 3 shows that the value of learning rate of 0.5 and momentum of 0.1 with the number of neurons as much as 12 on the geometry motif feature e gives the smallest net error value of 0.00997**.** While in 1.0 and momentum 0 on the number of neurons 12 gives the smallest net error value of 0.12.

Table 4. Shows *learning rate Geometry Motif*

Geometry Motif				
Number of neuron	*Learning rate*	*Momentum*	*Iteration*	*Net error*
10	0.5	*0.1*	*10233*	*0.14371*
12	0.5	*0.1*	2202	0.016422
20	0.5	*0.1*	46741	0.016422
22	0.5	*0.1*	2388	0.09887
25	0.5	*0.1*	11644	0.44773

Table 4. Training data with learning rate 1.0 and momentum 0.1 on the geometry motif

The training results of non-geometric batik motif features are shown in Table 5 and Table 6 below.

Table 5. Training data with learning rate 1.0 and momentum 0.1 on non-geometric motifs

Non-Geometric motifs				
Number of Neuron	Learning rate	Momentum	Iteration	Net Error
12	0.5	0.1	2202	0.02247
20	0.5	0.1	46741	0.016422
22	0.5	0.1	2388	0.09887
25	0.5	0.1	11644	0.44773
30	0.5	0.1	2882	0.057436
40	0.5	0.1	8048	0.079793
50	0.5	0.1	5058	0.065296
60	0.5	0.1	1199	0.348121

Table 6. Training data with learning rate 1.0 and momentum 0.1 on non-geometric motifs

The number of neurons used in back propagation affects learning or training, the number of neurons produces too few inaccurate net errors and the number of neurons causes too much unstable learning / training phase. The amount of data used also affects how many neurons will be training.
Improvements in the value of weight and bias continue to be done if there is still an error value generated by the output. If there are no more fixes and the weight value will no longer change (stable) then iteration will be stopped. The graphs in Fig. 5 and 6 shows the epoch (number of iterations) achieved in training validation and testing on geometry and non-geometry motifs. Epoch on batik motif geometry shows best results in point 4 as well as for validation. While the epoch for non-geometric motif is stable at point 6.

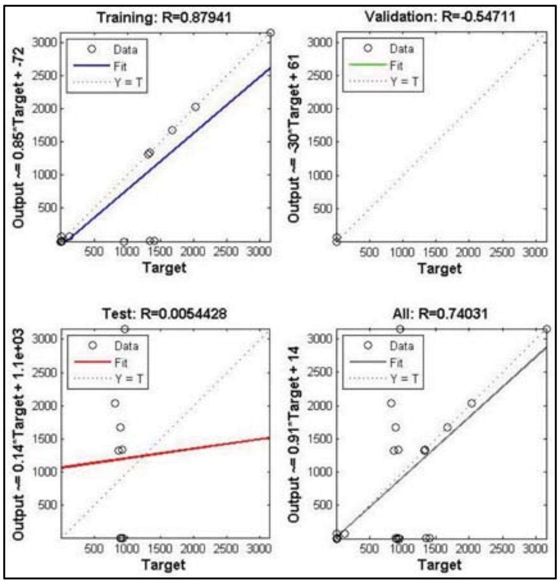

Figure 3. Graphic result of classification of non-geometric batik motif

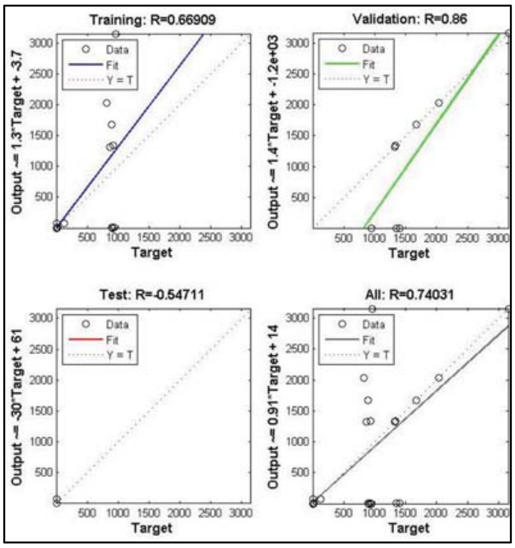

Figure 4. Graphic result of batik geometry motif classification

IV. Conclusion

Non-Geometric motifs				
Number of neuron	Learning rate	Momentum	Iteration	Net Error
12	1.0	0.1	49173	0.355252
20	1.0	0.1	3411	0.188532
22	1.0	0.1	3848	0.333699
25	1.0	0.1	2182	0.340964
30	1.0	0.1	55831	0.459814
40	1.0	0.1	7056	0.181231
50	1.0	0.1	2143	0.11519
60	1.0	0.1	829	0.213

Based on the above experiments, the conclusions obtained are GLCM feature extraction by searching statistical features in this study yield five statistical features namely means, standard deviation, skewness, kurtosis and entropy. Where the five characteristics can be analyzed as input value on the classification with back propagation algorithm. The value of the learning rate affects the rate at the training process. Besides the number of neurons used to adjust the amount of data trained. The numbers of neurons that are too much or too little cause the iteration to get longer and become unstable. Classification with back propagation algorithm produces best accuracy on the number of neurons 12, learning rate 0.5 and momentum 0.1 for batik motif geometry while the best non-geometric batik motif accuracy on the number of neurons 20, learning rate 0.5 and momentum 0.1. The value of statistic characteristics obtained in this study is still too generated so it requires a long process to get the best accuracy value on the classification

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