Identification of Pekalongan Batik Images Using Backpropagation Method

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Abstract. Batik is an Indonesian cultural heritage that was recognized by UNESCO in 2009. One of the famous batik producing regions in Indonesia is Pekalongan City, Central Java. Pekalongan Batik has a distinctive characteristic compared to other regions, namely from the aspect of color and motif. Pekalongan batik uses bright colors and flora motifs. However, there are some batik craftsmen who still use dark colors. Identify Pekalongan's typical batik motifs become an obstacle for tourists that are visiting Indonesia. There needs to be an automatic identification system to recognize Pekalongan Batik motifs. The automatic identification system of batik images can contribute to the development of technology in the field of artificial intelligence. This research was conducted by collecting image data taken through observation, interviews and literature review. The image data obtained are four batik motifs. 5 images will be taken from each motif and will be implemented into the system using Matlab R2014a. The next process is feature extraction using the Gray Level Co-Occurrence Matrix (GLCM) method to get information in the batik image. The author then identifies image using the Backpropagation method to obtain the epoch value, learning rate, and accuracy value based on the identification process. The tested system obtained the highest accuracy of 91.2% with epoch 100 and learning rate 0.03 on Sogan batik, 89.6% accuracy with epoch 100 and learning rate 0.02 on Jlamprang batik. 87.2% accuracy was obtained from Cap Kombinasi batik and Tiga Negeri batik with epoch 100, the learning rate was 0.01 and 0.04 respectively. The results of identifying images of Pekalongan batik can be implemented in a more interactive application.

1. Introduction

Batik is a typical Indonesian clothing that has high value. Batik is spread in almost all parts of Indonesia, each region has different characteristics from each other, especially in their style and motives. [1]

At first, batik art only existed in the palace environment. This is one way to show the existence of aristocrats in the artwork produced [2]. But over time now, the art of batik has spread widely in the wider community, even the profession as a batik craftsman has become the livelihood of most people, especially women both at home and in large factories.
The term batik comes from the Javanese word, "amba", which means writing and "nitik" which means giving a point [3]. Batik formula refers to the technique of using beautiful or stamped materials and then the process of dyeing fabrics against fabric dyes. The process of describing batik motifs uses "Malam" or candles painted or superimposed on cloth. The wax is used to cover fabric fibers so that the dye of the fabric during the coloring process will not enter the pores of the fabric and produce batik motifs. Batik cloth not only stores the aesthetic value of decorations and color combinations, but more than that. Batik motifs save symbols and philosophy depending on the origin of batik cloth and based on the diversity of the community. Batik in its simplest sense is patterned images, motifs and patterns made specifically using dyeing hat techniques by writing, stamping or tasting on cloth (mori, cotton, teteron, or silk). [2]

People still don't know much about the developments and batik motifs between Indonesia and other countries because there is no computerized data collection and there is no application to analyze batik especially Pekalongan traditional batik as shown in Figure 1. A very reliable pattern recognition method is applied for the introduction of batik motifs by applying texture feature extraction features of Pekalongan batik images. This study will discuss how to design and build an image feature extraction system using the GLCM (Gray Level Co-Occurrence Matrix) method so that it can be used for the batik classification process for the data collection process. Samples of Pekalongan batik will be tested so that information about batik is known.

![Figure 1](image-url)

**Figure 1.** Example of Pekalongan Batik pattern used in this study

Figure 1 is an example of the image of Pekalongan batik that will be the object of research. There are four Pekalongan batik motifs, the first are the Sogan batik motif, the second Jlamprang motifs, the third three-country batik motifs and the last are the combination batik motif. Each number of batik motifs will be taken for the object of system training and also as a media for testing the identification system of Pekalongan batik to determine the feasibility of identification systems.

2. Theory
2.1. Image
Image is a picture, resemblance, or imitation of an object. Images can be in the form of photos, video signals (images on TV) or are digital in nature that can be directly stored in storage media. Images that can be processed by a computer are called digital images. Each image can be obtained by image
acquisition, namely the process carried out to obtain digital images to imaging. Imaging is a way to change the visible image (photos, images, or sculptures) [4].

2.2. Batik
October 2 is a national batik day. UNESCO has confirmed batik as a masterpiece of oral humanity heritage and not objects to Indonesia [5]. One of the cities of batik craftsmen is Pekalongan City. Pekalongan City has a creative industry that has been able to promote the image of its city, the creative industry is the batik industry, through batik crafts [6]. Initially, batik had a limited variety of motifs and colors, and some motifs could only be worn by certain groups. [7]. But with the development of time makes each region has a diverse development.

2.3. Image Processing
Image Processing is a field of study about how an image is formed, processed, and analyzed so as to produce information that can be understood by humans. Image processing aims to:

1. improve image quality, seen from the radiometric aspect and geometric aspects. Radiometric aspects consist of contrast enhancement, image restoration, color transformation while geometric aspects consist of rotation, scale, translation, geometric transformation
2. carry out the process of withdrawing information or description of objects or the introduction of objects contained in the image.
3. To select the optimal feature image for analysis purposes
4. do data compression or reduction for the purpose of data storage, data transmission, and data processing time.

2.4. GLCM (Grey Level Co-Occurrence Matrix)
GLCM is a feature extraction method that uses texture calculations in the second order that takes into account two pixel pairs of original images, while in the first order uses statistical calculations based on the pixel value of the original image and does not pay attention to pixel density. Co-Occurrence can be interpreted as a joint event, meaning the number of events at one pixel level that is adjacent to the other pixel values based on distance (d) and orientation of an angle (Θ). Distances are represented as pixels while the orientation is represented in degrees. The orientation is formed from four angles with 45° intervals, namely 0°, 45°, 90°, and 135°, and the distance between pixels is determined by 1 pixel. These four directions are as in Figure 2.

![Figure 2. Four-way degree of grayness](image-url)
Figure 2 describes Orientation in four angles with 45° angles, namely 0°, 45°, 90°, and 135° while the distance between pixels is usually set at 1 pixel.

Introduction Patterns can be said as the ability of humans to recognize objects based on the characteristics and knowledge they have observed from these objects. The purpose of the introduction of this pattern is to classify and describe the pattern through the knowledge of the properties or characteristics of the object. Can the pattern be said as a defined identity and can be given an identification or name. Image processing represents existing techniques for manipulating and modifying images. The procedure of image processing reflects the most important part in the construction of an identification system [8].

2.5. Artificial Neural Network (ANN)
Artificial Neural Network (ANN) is an information processing system that has characteristics resembling biological neural networks (JSB) Artificial Neural Networks are created as a generalization of mathematical models of human understanding [9]. Like the human brain, neural networks also consist of several neurons, and there is a connection between these neurons. Neurons will transform the information received through the output connections to other neurons. In neural networks this relationship is known as the weight name. This information is stored at a certain value on that weight.

In neural networks, neurons will be collected in layers called neuron layers. Usually neurons in one layer will be connected to the layer before or after except the input layer and output layer. Information provided on a neural network will be propagated from layer to layer, through from the input layer to the output layer through a hidden layer.

3. Methodology
The identification of batik images is designed as depicted in Figure 3

![Figure 3. Flowchart system identification training](image-url)
Taking batik images in *JPEG or *PNG format is 256 x 256 pixels, then preprocessing by changing into gray scale image. Feature extraction is done to find information contained in batik images regarding the value of the GLCM parameter.

After the GLM parameter values appear, Classification is processed using the Backpropagation method which will conclude the name of the batik and the accuracy of the test. Figure 4.

**Figure 4.** Flowchart system identification testing

### 4. Data and Database Acquisition
This study uses objects of batik imagery as a result of personal documents during research at batik craftsmen in Pekalongan City. The camera becomes a tool that serves to capture the characteristics of Pekalongan batik images. Data taken images are stored in * JPEG and * BMP files. The data obtained will be divided into two parts for the training and testing process. The data obtained in the form of images of Pekalongan batik motifs as shown in figure 5.

**Figure 5.** Sample Data Batik Pekalongan
Figure 5 is one example of the Pekalongan batik motif that will be used in the training process. The name of the motif is Jlamprang batik which is a traditional batik motif that is very typical of Pekalongan City. The image is taken based on several camera points of view to test whether the system

5. Initial Process and Feature Extraction
The initial stage of the whole process of introducing Batik Pekalongan is to process it. This stage provides the components needed in the training and introduction process which includes hardware connections and processes that are carried out before entering the segmentation stage. This stage includes: image retrieval, image conversion from RGB format to grayscale format [10].

The next process is to extract features using the GLCM method to obtain information about the image of Pekalongan batik as an object of research, but the image needs to be resized to be smaller but quite representative of the truth. data [11]. The batik image data used in this study will reduce the original yellow resolution to 30 × 20 pixels. Furthermore, the image is said to be a matrix measuring 30 × 20 that is converted into a pattern in the form of a matrix measuring 600 × 1 [12].

The pattern of initial processing of batik images can be seen:

$$\Psi = \frac{1}{M} \sum_{m=1}^{M} \Gamma_m$$  \hspace{1cm} (1)

The mean image pattern $\Psi$ and the pattern with the average reduction $\Phi$.

$$\Phi_i = \Gamma_i - \Psi$$  \hspace{1cm} (2)

$\Phi$ i is a pattern of feature extraction that will be used as input to the classification of Artificial Neural Networks.

6. Artificial Neural Networks and End Processes
The technique of identifying Pekalongan batik uses a network of artificial conditions. The Multi Layer Perceptron consists of input layers, there is one hidden layer and the output layer, the layer process can be seen in the illustration in Figure 5. Training algorithms use backpropagation where the complete algorithm can be seen in books written in Fauset [13]. In this study the training rate was set $\alpha = 0.5$.
Figure 6, y k, z j and xi respectively are output values from the output layer, hidden layer, and input layer. Wjk is the weights between the output layer and the hidden layer, and Vij is the weights between the hidden layer and the input layer.

7. Result

The system for identifying the characteristics of batik images can be tested after the system has been trained first using the image of Pekalongan batik used in the system training process. The image of batik used in training is 4 batik motifs of each of 5 different images so that there are 20 training images. Testing is done by providing new image data that has not been 'known' by the system or in other words not the data that has been used in the training process. The experimental results used the backpropagation neural network classification technique as shown in Table 1:

| Name of Motif       | Original image | Epoch Value | Learning Rate Value | Accuracy Value (%) |
|---------------------|----------------|-------------|---------------------|--------------------|
| Cap Kombinasi Tulis | ![Image]        | 100         | 0.01                | 87.2%              |
| Jlamprang           | ![Image]        | 100         | 0.02                | 89.6%              |
| Sogan               | ![Image]        | 100         | 0.03                | 91.2%              |
| Tiga Negeri         | ![Image]        | 100         | 0.04                | 87.2%              |

Table 1 explains the results of the batik image identification system that contains the accuracy of the images of Pekalongan batik. Symmetrical batik patterns and sharp colors can increase the value of the accuracy of an identification process due to its motives that can be better understood by object recognition systems.

8. Conclusion

Produce a system that can be used to identify the image of Pekalongan batik using Backpropagation Artificial Neural Network. Sogan’s motive is the result with the highest level of accuracy that reaches 91.2 %% in testing the value of age = 100 and the level of learning = 0.03. The second level of accuracy was 89.6% with age 100 and learning level 0.02 in Jlamprang batik. The last level of 87.2% was obtained from the Cap Combination batik and Tiga Negeri batik with the age of 100, the learning level was 0.01 and 0.04. High and low accuracy values can be caused by structured motives and the sharpness of batik colors will help increase the value of accuracy.
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