Batik image classification using treeval and treefit as decision tree function in optimizing content based batik image retrieval

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ABSTRACT

This research is to increase the percentage of similarity and to increase the speed of the retrieval of characteristic of batik image which is the texture and shape. In order to obtain an optimal result, the classification process is performed using a decision tree with treeval and treefit function, where the value used is the result of the image feature extraction. For this image extraction, the values that originate from the approximation coefficient that uses the wavelet transform method deubecheuss level 2 and invariant movement. The research is performed on 7 types of pattern and 225 images. The result using 5 types of batik patterns namely lereng, parang, kawung, nitik and truntum using 20 test data on each pattern, has a similarity percentage above 80 - 85 percent. For 2 other patterns which is mega mendung and ceplok using 10 data on each pattern, has a similarity percentage above 30 – 40 percent only. Based on the result, further research is required to using other methods and functions.

Keywords : Batik, treeval, treefit, approximation coefficient, Wavelet Transform, Invariant moment

1. Background

In order to support the development of Indonesia’s culture especially in preserving batik cloth, it is necessary to perform researches that is related to the batik pattern characteristic. Batik is a cultural heritage not because of the batik itself but because of the art in making the batik. The occurrence of the problem in claiming the batik culture is partly caused by the lack of awareness of our nation on the importance of the batik culture preservation. To prevent this problem from happening, it is required to have a complete documentation on Indonesia’s batik. In existing research on Batik image retrieval, currently it is based on colour and shape characteristic and only a few research is using shape and texture characteristic. For that reason this research is using an approach involving two extraction features of Batik Image Retrieval (BIR). Content Based Batik Image Retrieval is an approach for image retrieval based on the information contained in the Batik image itself such as colour, shape and the texture of the image. CBIR comprises of the following steps, preprocess, pattern extraction, indexing and image retrieval.

An image retrieval system is a system to retrieve information in a form of an image by measuring the similarity percentage of the image query that is input by the user and the image stored in the database. The problem in content based searching...
system is to find a feature that can represent unique characteristic of the image, so that it can be used accurately to identify images. The visual feature that can be extracted from the image data are texture, colour and shape [16]. In relation to the batik image, the texture feature is an important feature because of the ornaments on the batik cloth can be seen as a different texture composition. This research however, is also focused on the shape and colour feature of the batik image [18][20..21]. The main focus of this research on batik image retrieval system is to obtain an optimal result in obtaining a pattern similarity which is more relevant to the intended image. Therefore this research will be developed not only to find the texture feature but also the shape similarity through the concept of CBIR on batik image\textsuperscript{27,28}.

Some research has been performed by developing a retrieval system, based on contents of Batik image, some using the Generalized Hogh Transform method to identify a specific pattern in a batik image \textsuperscript{25}. In earlier research it is also developed a retrieval system concept based on Kodebook which is developed using keyblock structure to encode and decode a batik image [28]. An image retrieval concept based on the batik image content that has a special characteristic on the image using filter log-Gabor and colour histogram has also been developed.

1.1 Scope of the Research
The scope of this research is:
- The research object is focused on 7 batik pattern which is ceplok, lereng, parang, nitik, truntum, kawung, and mega mendung. This research is focused on the texture and shape characteristic. In the retrieval process, classification process is performed first using the treefit function to generate the decision tree and the treeval function to form the classification. The research object is batik image which is in a form of an image database and image query with the following specification: having a jpg format and 200 x 200 \textit{pixel in size}, and the image that is input or used as the image query can be an image with no specific sized.

1.2 Objectives and Benefits
The objective of this research is:
1. To develop an accurate image classification method in order to be able to increase the capability in performing batik image processing.
2. To increase the accuracy and speed in the batik image processing by performing classification process using tree fit and treeval functions.
3. To facilitate the batik image retrieval processing from image query that has been grouped into classes based on pattern characteristic in the form of a decision tree using treeval function.

The benefits of this research is as follows:
- By developing a method for image extraction and classification, the accuracy of the image retrieval based on characteristic will be increased.
- The result of this research is expected to obtain a high accuracy and high performance of the batik recognition process.

2. SUPPORTING OF THEORY

2.1 Treefit and Treval Decision Tree
Treefit (x,y) function is to create a decision tree to predict the response y which is predicted by the x value. x can be a matrix with a value for prediction. y is also a vector used as a response of n or an array of character that contain class name n and it is based on value in the x column.

Treeval function is used to create the classification or regression from the decision tree produced by the treefit function, including a matrix X on the prediction value. In order to classify and perform regression based on the creator value (yfit), which is based on the response from one point to obtain the prediction value, and the classification tree based on the class number where tree is to relate the point with the ith data (X(i)) and convert a number of points into class name\textsuperscript{4}.

2.2 Invariant Moment
To identify an object in an image, segmentation process frequently has problems with regards to the object’s position, object rotation and changes in the objects’ scale. Changes or rotation in position, different sizes of objects, whether it is small or large causes error in identifying that particular object. Moment is able to represent an object in many ways such as area, position, orientation and other defined parameters. The purpose using this method is to obtain invariant moments from all objects from a Batik image. Every Batik image will have 7 values of invariant moments. All 7 (seven) value of invariant moments will be used for identification process \textsuperscript{10,20,21}.

2.3 Texture and Shape Characteristic Calculation
At this step, texture feature extraction using type debecheus 2 wavelet transform method in order to obtain decomposition on each Batik image making use of subband LL. In order to obtain an optimal feature extraction, several texture characteristic is such as mean, standard deviation, entropy, correlation, contrast, energy and skewness is used on each Batik image. The representation of the image characteristic is as follows:

- **Mean**: Shows the dispersion of an image including the determination of gray intensity.
- **Energy**: Image characteristic resulted from the image decomposition is obtained by calculating the energy contained in each subband.
- **Entropy**: Basically, entropy is performed to measure the diversity and the intensity of the image. Entropy resulted from wavelet can be regarded as the characteristic of an image. Entropy shows the variety of the measurement of shapes. Large entropy value for images with uniform degree of gray transition and small value if the image structure varies.
- **Standard Deviation**: Shows the grey intensity distribution.

All characteristics will be calculated for each Batik image, resulting in 4 (four) characteristic value related to each Batik image. It is expected that with these 4 characteristic values, extraction process can be more accurate and optimal including to facilitate the classification process that will be used in the next step\(^1,2,20,21,29\).

### 2.4 Collection and Selection of Batik Image

There are 2 rules in the selection of Batik image; the image condition and the image pattern. For the Batik Image selected to be analysed, it is important to have a clear shape and texture, whereas for image pattern to be analysed, there are 12 types of Batik image patterns. The collection of the Batik images is performed by several ways such as Batik image acquisition from the internet, direct from digital photo and from magazines related to Batik images. The Batik images collected will be converted into jpg extension, at the same time performing resizing and normalization. This process is performed in order to obtain the dimension which is easy to view visually and accurately processed by the system, either 200 x 200 or 300 x 300.

### 3. Research Framework

![Research Framework](image)

**Figure 1. Research Framework : Classification Process using Treeva and treefit as function Decision Tree**

#### 3.1 Pre processing

##### 3.1.1 Grayscale Process

Grayscale process is the process to convert colored images to become a grayscaled image. Basically a color image consists of 3 layers which is R-layer, G-layer and B-layer. The grayscale process will convert 3 layers R, G dan B to become 1 layer and the result will be a grayscaled image. In this image there are no colors, having only the degree of grayness. To convert the color image that has r, g and b to grayscale color with a value s. The conversion can be performed by averaging r, g and b. Therefore there will be no more colored image, all are grayscaled images.
3.1.2 Edge detection algorithm using Canny

Edge detection is a process to determine the point location which forms the edges of the objects. Edge detection on an image is a process that form edges from image objects. This method can detect the edges or lines which form image objects and clarification on the edges. Sobel, Prewitt, Robert, Laplacian of a Gaussian, Canny, and other methods are used to detect the edges of the images. Canny algorithm has become a standard algorithm to detect edges and used in many researches21,25.

3.2 Feature Ekstraksi

The result of existing experiments, starting from grayscale processing, binary and canny processes and the result of invariant moment’s calculation is shown in figure 2.

![Figure 2 Preprocessing of Parang pattern and Feature Ekstraksi using Invariant Moment](image)

3.3 Wavelet Transform (Texture Feature Extraction)

Wavelet method is a mathematical function that converts the original image to become an image in the frequency domain, where further can be divided into different subband frequency component. Each component is studied using resolution which is according to scale. According to Sydney (1998), Wavelet is a small wave that has the capability to group image energy, concentrated on a group of small coefficient, whereas the other coefficients only contains a small amount of energy which is trivial and can be ignored without reducing the Information value. The implementation of concept of wavelet transformation on the image decomposition is adapted using wavelet character related to the object in study1,7,8,10,20,14. With several researches the feature extraction on Batik image using wavelet transformation supports the Batik Image Retrieval based on Image features, with sub image frequency researched focusing on low low subband20,21,14. In general, the process starts from preprocessing until extraction using the wavelet transform method and followed by calculating the feature parameter on each of the Batik pattern. The process is shown in Figure 3.

![Figure 3. Chart showing the process of Batik image from preprocessing until Feature extraction.](image)

This chart shows the process start from preprocessing to feature extraction process. Preprocessing step started with grayscale process and binary processing. Then followed by side detection process using the canny algorithm. The next step is feature extraction process using the deubecheus 2 level 2 type wavelet transform method. Wavelet will perform the image decomposition by obtaining the subband LL value13,15. The result of the decomposition is the approximation coefficient, which will be followed
by calculating 4 features in the feature extraction process. The result of this calculation will become the input for the classification process using treeval dan treefit.

### 3.4 Decision Tree using Treeval dan Treefit function

After obtaining the coefficient resulted from the image extraction process using the wavelet transform, classification process is performed using treeval and treefit function. The processes are as follows:

```matlab
Load coefficient image 1, image 2 ... image n
t = treefit(kls, image n); % Create decision tree
sfit = treeval(t,kls); % Find class tasks
sfit = t.classname(sfit); % Obtain class nefficientame
kls(strcmp(sfit, imagen)); % Image Coefficient placement on each class
```

![The result of experimental from the processing a number of motive batik image](image1)

![Comparison of the methods and algorithms of previous studies](image2)

**Figure 4**: The result of Experiment using some batik pattern and the output of the experiment

**Figure 5**: Comparison of using some method and algorithm to optimal the CBIR
In the figure 4.0 describes the results of experiments on 7 of motive batik image. From Experiment results illustrated, the percentage accuracy for image retrieval base on the example image. Each pattern has 10 to 12 types of sample images that have almost the same pattern. In the figure 5.0 describes the results of previous research by the author, the number of batik motif studied including the results of the percentage accuracy for the CBIR process.

5. Conclusion
Based on the experiments performed, the following can be concluded:

1. The result obtained from the prototype application, the precision highest reached is 90% meaning that the identification of Batik image is very high. On some image pattern which is more difficult to be identified such as mega mendung and ceplok, the precision is between 30-40%. This will be a concern for the researcher to find other methods or concepts that can increase the similarity percentage.
2. By implementing the treeval and treefit as decision tree function, the process is 0.2-0.3 seconds faster, where previously the performance is between 0.7 – 0.8 seconds using the same computer configuration.
3. In the previous study, some retrieval process is performed through classification and some are not. However, classification using Fuzzy Neural Network (FNN) and applying the treeval and treefit functions proved that the result is better.
4. This research will be further conducted in order to identify some images that has a more complex characteristics or shapes such as recognizing batik pattern, blood cells, and tumor cells.

References