Batik Motifs Detection Using Pattern Recognition Method

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Abstract. *Batik motif is one of the factors that makes batik unique and attractive. There are various kinds of batik motif designs in various areas. Each of these design motifs implies symbols/illustrations that contain certain meanings.The design of the batik motif is used in different events according to the occasions. But unfortunately, not many people understand this, even though local wisdom on the design of batik motifs is one form of cultural heritage of the archipelago that must be preserved. Related to this, development of information technology and multimedia should be used as a solution. However, until now, there is no accurate and fast information system in detecting batik motifs. This study applies pattern recognition methods to find the most appropriate and accurate method for detecting and interpreting batik motifs. The method will be used to build a batik motif detection information system to help users get information quick and accurately.*
Keywords: *pattern recognition, batik motifs, analysis and design of information systems.*

Abstrak. *Motif batik merupakan salah satu faktor yang menjadikan batik unik dan menarik. Terdapat berbagai macam desain motif batik di berbagai area. Setiap desain motif tersebut mengisyaratkan simbol-simbol/ilustrasi yang mengandung makna tertentu. Tentu saja desain motif batik tersebut digunakan dalam acara yang berbeda-beda sesuai dengan keperluanya. Namun sayang, tidak banyak orang yang mengerti hal ini, padahal kearifan lokal pada desain motif batik tersebut merupakan salah satu bentuk warisan budaya nusantara yang wajib dilestarikan. Terkait hal tersebut, seharusnya perkembangan teknologi informatika dan multimedia dapat digunakan sebagai solusi. Namun demikian, sampai saat ini, belum ada system informasi yang akurat dan cepat dalam mendeteksi dan menginterpretasi motif batik. Penelitian ini menerapkan metode-metode pengenalan pola guna menemukan metode yang paling tepat dan akurat untuk mendeteksi dan menginterpretasi motif batik. Metode tersebut akan digunakan untuk membangun system informasi deteksi motif batik untuk membantu pengguna yang tidak mengenal motif batik mendapatkan informasi secara lebih cepat dan akurat.*
Kata Kunci: *pattern recognition, batik motifs, analysis and design of information systems.*

1. Introduction

Batik is a cultural heritage of our nation that should be preserved. Moreover, on the second of October 2009, *batik* has been listed as an intangible world cultural heritage by UNESCO. Historically, *batik* has been perceived as an inclusive art on which special expertise to draw its various motifs although recently, an advanced technology is available to ease *batik* drawing/ depiction. Nevertheless, a wide knowledge about motif varieties is needed since *batik* motifs' complexity. *Batik* motifs have a wide variety. Its wide variety has been influenced by Indonesian Geographics, cultural backgrounds, beliefs, vogue regions, animals and plants, also culture acculturation among several regions. Thus *batik* motifs are grouped into several

geometries and non-geometry groups by *batik* experts in order to simplify the motifs complexion. Each motif is symbolic therefore it generally has its own meaning.

Nowadays, on its progression, *batik* motifs are often perceived no longer symbolic and magical by the public. However, in reality, many are proving that the public still grasps that belief. The public used to associate *batik* motifs with a certain symbol. Those who wear *batik* interpreted it as a representation of their characteristics. A symbolic and magical view of *batik* motifs often perceived by public is probably no longer appeared because of the declining public knowledge of *batik* motifs. It is very unfortunate knowing that recently the public has been a lack of philosophical knowledge of *batik* motifs. Yet *batik* is having great development both domestically and internationally. Moreover, in several parties' philosophy, wearing inappropriate and irrelevant *batik* motifs on special occasions or public ceremony is perceived impolite or even humiliating certain parties. Concerning on that matter, the urgency to develop an information system design to assist the public detecting and interpreting certain *batik* motifs. A contribution from an advanced information technology is used in this study.

Accordingly, those advanced technologies are expected to be able become a solution for the *batik* motifs' problem recognition and interpretation. This research emphasized a comparison of several pattern recognition methods analysis. That analysis would be used for drawing the conclusion to reveal which the fastest and the most accurate method to detect and to interpret *batik* motifs. In the future, the result would become a foundation as a base to design a desktop application of *batik* motifs detector.

According to the previous problem, the main goal of this research is to determine which is the fastest and the most accurate pattern recognition method in detecting and interpreting *batik* motifs. This research also aims to reveal the most accurate pattern recognition method in detecting and interpreting *batik* motifs by making a comparison among those pattern recognition methods.

2. Literature Review

Edge detection has been widely used for a detection in various studies and researches. However, edge detection was not the only method used for motifs interpreting. Several others detection methods were: Canny, Prewitt, Sobel, Morphology, Grading, Template Matching, and Laplace. It is specifically shown in the Table 1.

Table 1. Edge detection similar research comparison

No	Title	Motive	Detection Method	Accuracy
1	Analisis Gaussian dan Edge Connection Dalam Penajaman Deteksi Tepi Menggunakan Metode Canny [1]		Canny	-
2	Analisis Perbandingan Deteksi Tepi Prewitt Dan Canny Pada Pola Batik Tulis Dan Batik Cap Di Kudus Motif Parijoto Menggunakan Klasifikasi Support Vector Machine (Svm) [2]	Parijoto	Prewitt and Canny	100
3	Aplikasi Pengenalan Pola Batik Trenggalek Menggunakan Deteksi Tepi Sobel dan Algoritma K Means [3]	Trenggalek	Sobel	80
4	New Edge Detection Method For Indonesian Batik [4]	Parang, lereng dan udanliris	Canny and Prewitt	-
5	New Edge Detection Method Using Elisabeth Method Case Study Javanese Batiks [5]	Jawa	Sobel and Prewitt	-
6	Penerapan Metode Morfologi Gradien Untuk Perbaikan Kualitas DeteksiTepi Pada Citra Motif Batik [6]		Canny and Morphology Gradien	90.91
7	Pengenalan Motif Batik Indonesia Menggunakan Deteksi Tepi Canny Dan Template Matching [7]		Canny and Template Matching	89.44
8	Pengenalan Motif Batik Menggunakan Deteksi Tepi Canny Dan K-Nearest Neighbor [8]		Canny	66.67

9	Perbandingan Penggunaan Deteksi Tepi Dengan Metode Laplace, Sobel Dan Prewit Dan Canny Pada Pengenalan Pola [9]		Laplace, Sobel, Prewit, and Canny	-
10	Performance Comparison Analysis Features Extraction Methods For Batik Recognition [10]		Canny	80
11	Content Based Batik Image Retrieval [11]	Ceplok, kawung, lereng, Parang, Nitik, Tambal and mega mendung	Canny	90.92

The comparison is provided in Table 1. Similar edge detection research comparison show method variation used to detect the edge and to give a comparison for accuracy. This research used the implementation which is based on the comparison and the algorithm according to the table.

3. Research Methodology

This research focuses on batik motifs that are unique and diverse. The contribution of this research is to give the experimentation data including the method implementation in programming an application for batik motifs detection. The goal of this experiment is to create an optional way other than manual search on batik motifs detection.

Parijoto, trenggalek, parang, lereng, udan liris, Jawa, ceplok, kawung, nitik, tambal and *mega mendung* were several *batik* motifs that are commonly highlighted in several studies. Whilst, this research subjects would be focussed on the common motifs available in todays market place as shown in Figure 1.

Figure 1. Used-Motifs Examples

4. Results and Findings

4.1. Analysis and System Design

Entity Relationship Diagram (ERD) in Figure 2 is resulted from the analysis of *batik* motifs detection system. This ERD is a database that is used to support the application for detecting the batik motifs. There are 4 database tables that are used. The table function is for storing the color data, the men and ladies model, and the batik motifs data.

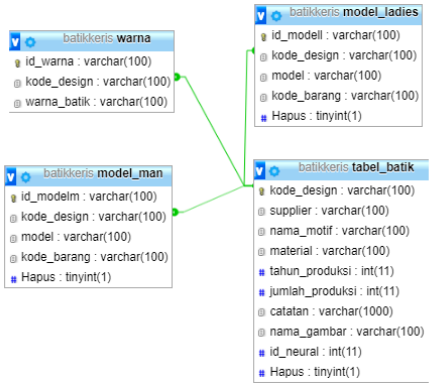

Figure 2. Entity Relationship Diagram

4.2. Software Development

4.2.1. Design and Application

Several functions that could be used by users are shown in Figure 3. Beside those functions, the available data within a system could be shown to users as well. Those data include *batik* list table and *batik* model (motifs). They are designated at the top-left on the system while the data filling and the model form are provided at the bottom.

The details of the data form were supplier name, motifs, material, total, and year production. There would be a direct generating for the design code on this data form that is done by the system. In the model detail, a button for adding, changing, eliminating/deleting model was provided. There would be two choices provided in the model detail filling form. They were: *laki-laki* (male) and *wanita* (female). Other filling forms would be directly generated when users are choosing *a batik model* (motifs). Meanwhile, users could press the button *pilih gambar* (choose image) to have the picture attached. A dialog box will shortly appear after pressing that button. This dialog box is used for getting the file (explore browser) in. After the data input is done, users could "train" the system by pressing the *latih data* (data train) button.

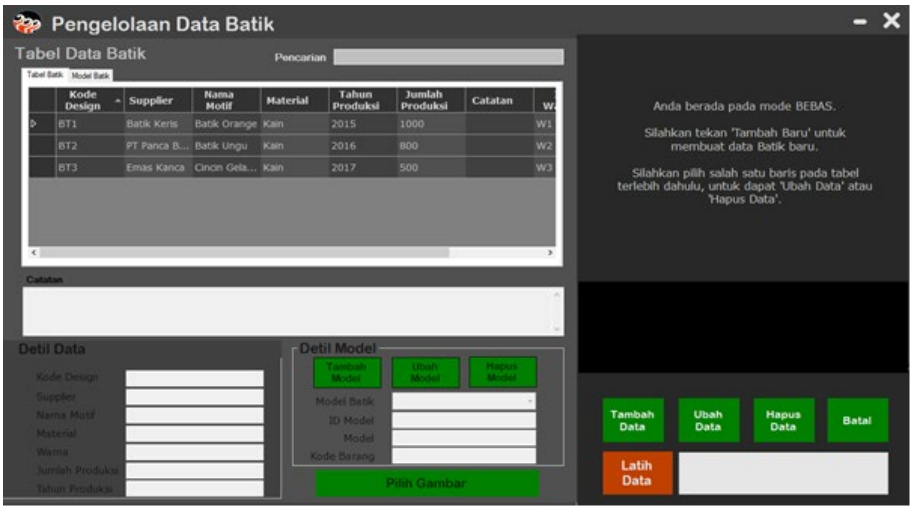

Figure 3. Display Form for *Batik* Data Processing

Image processing of *batik* pattern would be shown in Figure 4. During this process, a specific characteristic of a *batik* motif to be detected or to be interpreted was recorded into the system. That specific characteristic *batik* motif recorded are shown in Figure 5. It's bordered by the red box. That pattern in the red box would be assigned as a *batik* model training pattern using Wavelet Haar algorithm. CTRL + *drag* buttons must be pressed to choose and to mark the specific pattern. The users are suggested to choose three patterns at minimum and six patterns at maximum from specific characteristics that have already been identified from a *batik* motif.

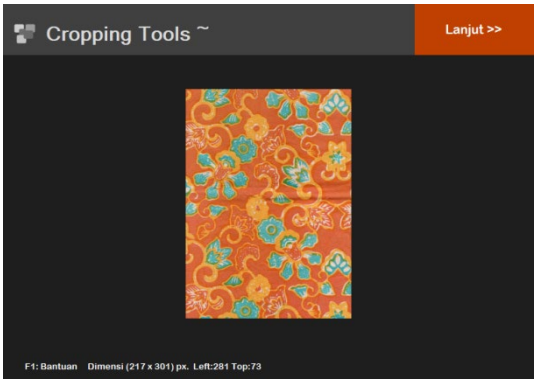

Figure 4. Image Management UI (before unique pattern selected)

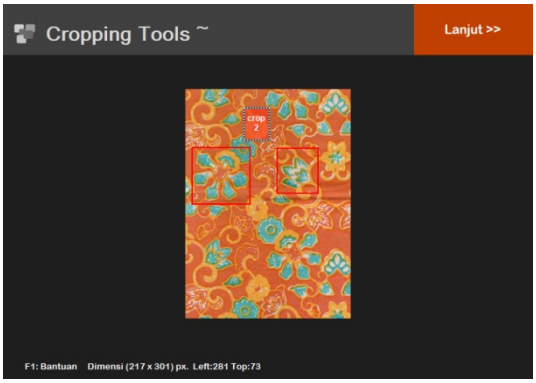

Figure 5. Image Management UI (after unique pattern is selected)

Two main buttons: *"ambil gambar"* (take picture) and *"kenali"* (identify) were shown in Figure 6. These buttons were named after its function. It enabled users to take a picture and identifying the posibility to find the same pattern from here and from the result of pattern detection system training that has been already done before.

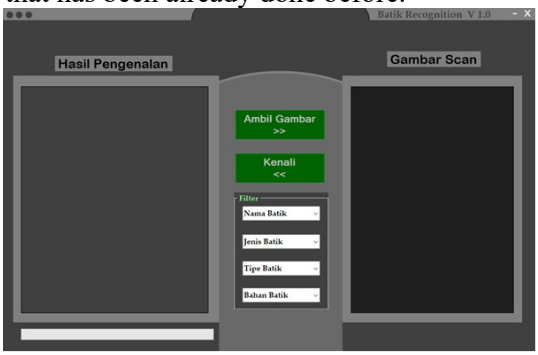

Figure 6. *Batik* Recognition Display Application Form

The result of pattern detection is done by choosing minimum of one specific characteristic pattern of a wanted motif shown in Figure 7, Figure 8, and Figure 9. The result of pattern identification would be shown on the left side. It listed in the order of the result from the highest accuracy percentage. The image is in Figure 7. The Scan Result and Accuracy Calibration are the results of implementing the detection method in the right picture. The results are shown on the left panel and it consists of the 3 closest images pattern to the selected image in the right panel.

Figure 7. The Scan Result and Accuracy Calibration

Figure 8. The Scan Result and Accuracy Calibration (other example)

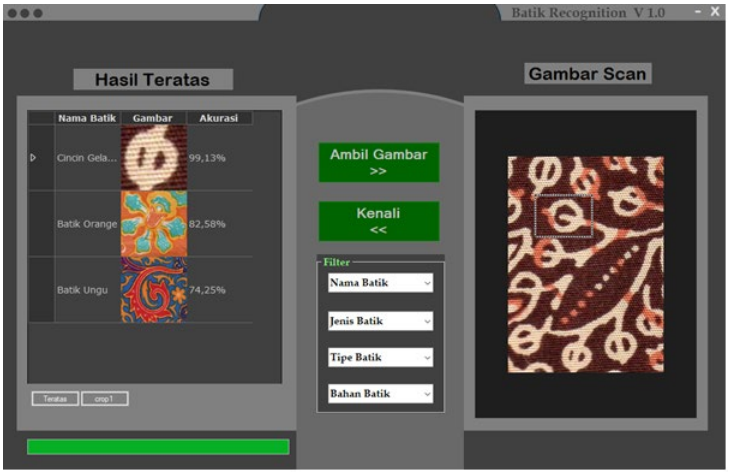

Figure 9. The Scan Result and Accuracy Calibration (other example)

4.2.2. Elaboration Process

The *threshold* function on the algorithm 1 would be used for scoring. If it is greater than the threshold score, the pixel grade would be scored 1. Whereas if it is lesser than the threshold score, it would be scored 0.

```
For i=0 → rows – 1
  For j=0 → cols – 1
    If input(i,j) < tresh_value then output(i,j) = 0
  Else output(i,j) = 1
```

Algorithm 1. Threshold Calculation

Based on its principle, *thresholding* or binarization are defined as a grayscale image segmentation changing. It is done by changing it into two scales: 0 (black) and 355 (white). The threshold score that are used have been making an impact on the image sharpness. In general, thresholding a grayscale image is done for getting binary image as derived from equation: (1), with (x, y) = binary image from grayscale image f(x,y) and T = threshold.

$$g(x,y) = \begin{cases} 0, for\ f(x,y) \leq T \\ 1, for\ f(x,y) > T \end{cases} \quad (1)$$

The second algorithm is used for Wavelet Haar transform operational calculation. For the interpretation, the formula used is LL frequency only. A transformation is a data or a signal changing process into another form for the easier observation. Fourier transformation, for example, changes a signal into several sinus or casinos with different frequencies. Meanwhile, Wavelet transform is changing a signal into several forms of wavelet based on that other named wavelet using various shifting and scaling.

```
For i=0 → rows
  For j=0 → cols/2
     Out(I,j) = 0.5*(source(I,2*j)+source(I,2*j+1)

For i=0 → rows/2
   For j=0 → cols
     Out(I,j) = 0.5*(source(2*i,j)+source(2*i+1,j)
```

Algorithm 2. Wavelet Haar Transformation Calculation Algorithm

Wavelet transform is changing a signal into several forms of wavelet by doing various shifting and scalling. Hence, wavelet coefficient of several scales or resolution could be counted from wavelet coefficient on the next high resolution. This enabled tree structure usages named as pyramid algorithm.

As mentioned before, wavelet transform is a data changing process into several other forms that are simplified in order to make an observation easier. Its process could be done by

implementing convolution using the levelling and repetition process. This process is often used for decomposition, detection, recognition, image retrieval, and other several related process.

There were several wavelet transform types. However, recently *Wavelet Transform* and *Discrete Wavelet Transform* (DWT) 1-dimension (1-D) transformation, and *wavelet* 2-dimension (2-D) transformation would be highlighted. W*avelet* 1-D transformation divided a signal into two frequencies; high frequency and low frequency by repeatedly using low-pass filter and high-pass filter. Low frequency is divided into two frequencies; high frequency and low frequency again. This process is done until the decomposition is no longer possible to be done. The original signal could be recovered by decomposed-signal reconstruction using *Internal Discrete Wavelet Transform* (IDWT).

In the third algorithm, the function of *input training data* is used for an image data input that would be used in data training. *Batik* image data would be recorded in the form of array 1 dimension with the size 1x256.

```
Get batik image for training
Get Image_thresholding
Get DWTProcess
Get Reshape matrix 16x16 to array 1x256
Get InputTraining Data to Neural Network
```

Algorithm 3. Input the image file for training

```
Get Training New Batik
   Setting treshold
   Setting maxIter,epsilon,alpha,beta
Get Testing BatikInput
Result Batik recognition
```

Algorithm 4. Algorithm for testing

In the fourth algorithm, the *batik* detection execution through the functions that has been formulated before is shown. This short overview shows how the algorithm detected *batik* motifs.

5. Conclusion and Suggestion

Based on the analysis, some conclusions are drawn. Firstly, a fast *batik* motifs detection application is successfully developed. Secondly, Backpropagation Neural Network which is used and developed through Wavelet Haar has resulted good accuracy.

For further research, the batik recognition can be developed by applying several types of wavelets such as Daubechies, Meyer, or Morlet to get better accuracy. The batik pattern recognition can also be done using deep learning for better accuracy even though with complex computing.

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