

## CONTENT BASED BATIK IMAGE RETRIEVAL

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### ABSTRACT

Content Based Batik Image Retrieval (CBBIR) is an area of research that focuses on image processing based on characteristic motifs of batik. Basically the image has a unique batik motif compared with other images. Its uniqueness lies in the characteristics possessed texture and shape, which has a unique and distinct characteristics compared with other image characteristics. To study this batik image must start from a preprocessing stage, in which all its color images must be removed with a grayscale process. Proceed with the feature extraction process taking motifs characteristic of every kind of batik using the method of edge detection. After getting the characteristic motifs seen visually, it will be calculated by using 4 texture characteristic function is the mean, energy, entropy and standard deviation. Characteristic function will be added as needed. The results of the calculation of characteristic functions will be made more specific using the method of wavelet transform Daubechies type 2 and invariant moment. The result will be the index value of every type of batik. Because each motif there are the same but have different sizes, so any kind of motive would be divided into three sizes: Small, medium and large. The performance of Batik Image similarity using this method about 90-92%.

**Keyword:** CBBIR, Batik, Motif, Wavelet Transform, Daubechies, Edge Detection, Grayscale, Feature Extraction, Texture

### 1. INTRODUCTION

This In general, Batik is a traditional Indonesian clothing that is widely used by the people of Indonesia, either officially or become daily. For each motif batik produced in each region/territory of Indonesia, has different characteristics to one another. Sometime batik is a decorative fabric, which has a very important role in traditional ceremonies, both java culture or in Indonesia. Even at the state where all the invited guests must use the batik. Basically batik is Indonesia's cultural heritage that has been very popular in almost all over the world. However, there are several types of batik fabric shows a very distinctive motifs and occur repeatedly throughout the design. Motifs can serve as feature/characteristic in identifying the origin of batik cloth. Basically, in the search for an image of batik is a process of matching the characteristics of image search with the

characteristics of the target image in the database (query image) (Rangkuti *et al.*, 2011; Naresh Babu, 2010).

Basically, Problems in the content-based search systems is to find a unique feature that can represent the characteristics of the image, so that the feature can be used to accurately identify the image. Visual features that can be extracted from the image data is texture, color and shape. Associated with the image of batik, texture feature is an important feature because the ornaments on batik cloth can be seen as composition of different textures.

Otherwise, the main focus of the study batik image retrieval system based on characteristics is to produce effectiveness in obtaining motif similarities are more relevant to the image Therefore in this study will be developed not only find the texture feature alone but also shapes and colors through the concept of CBIR on images batik. Based on the above references some

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research on processing of image features, this study will design a concept retrieval image batik ornaments and motifs that have a very distinctive, unique and diverse. With the implementation of fuzzy concept for retrieval as the query is done by using image-based features between the query image to databases batik image. Several studies using fuzzy logic to perform image retrieval, is commonly used to represent the image characteristics, aims to improve system retrieval performance (Rangkuti *et al.*, 2011; 2013).

### 1.1. Purpose and Urgency of the Research

This study aims to:

- Improving the ability to recognize characteristic motif, which can lead to some more specific characteristic values for each motif, in order to facilitate the process of grouping
- Generate methods and concepts more precise and efektif on feature extraction stage, in support retrieval process based on the similarity characteristic motif becomes more precise and accurate
- To increase the speed of image retrieval by the similarity characteristic of batik motifs more leverage on certain motifs without is influenced by the color of batik
- To be reference material for search image data that can be developed for use in other cases

### 1.2. Scope of Research

The scope of this study is as follows:

- All the objects in this research ia batik images using JPG, PNG and BMP formats
- For CBBIR system focus only for feature and shape characteristic
- For feature image extraction is performed on the shape and texture characteristics using edge detection and wavelet transform
- In analyzing the texture characteristic using wavelet transform method, supporting of 4 motif feature function such as mean, standard deviation, entropy and energy
- Forms of imagery is not influenced by the position of the image, so expect the image in an upright position
- Image noise does not affect the result

In doing research image characteristics, which are based on similarity includes two things: Accuracy and

time efficiency when are doing retrieval image. On the basis of the results of analysis the imagery batik motif, the appropriate methods and illustrated clearer picture of the texture is wavelet tranform (**Fig. 1**).

In general, the steps to be done to the image of batik motifs using Feature detection algorithm to follow the following criteria:

- Low error rate. Error occurs when there is a critical edge but does not appear, or if there are no edges but appears
- Only one response (1 pixel wide) for each of the edges

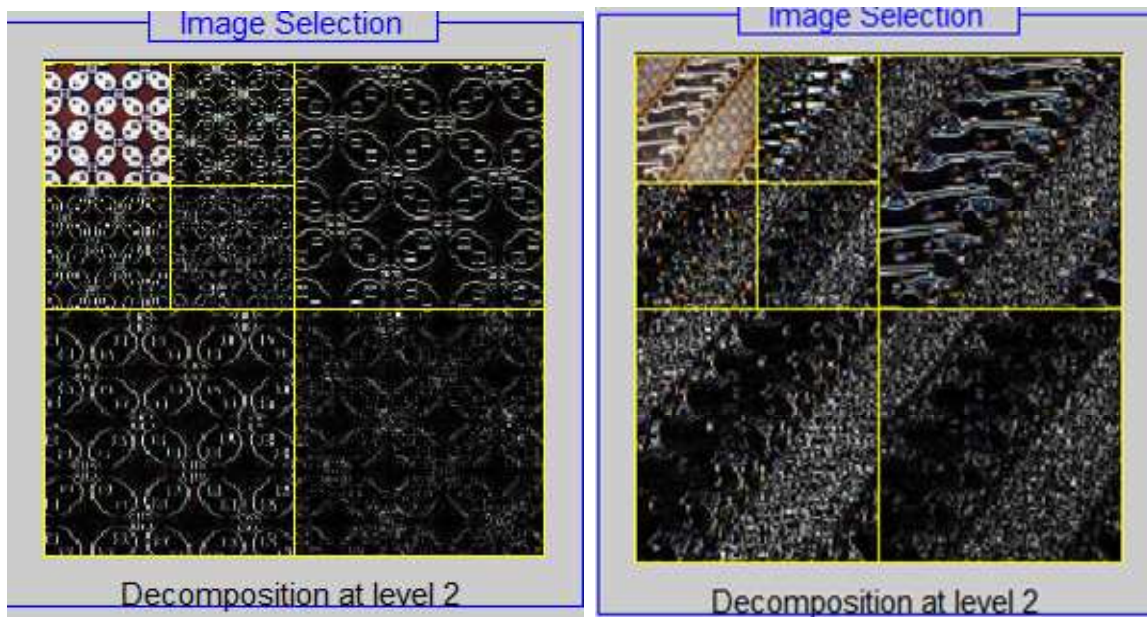
Besides wavelet method for texture detection, the other method is used for detection of shape be using invariant moment. Actually Invariant moment is a vector equation derived third-order moments (covariance) is testing the independence between the variables x and y. Segmentation shape the research is done by grouping the set of grayscale images in vector invariant moments. The segmentation process is done by calculating the shape moments and central moments of the image with the following equation (Vanajakshi, 2012):

$$c_{pq} = \sum_{x=0}^m \sum_{y=0}^n (x - \bar{x})^p (y - \bar{y})^q f(x, y)$$

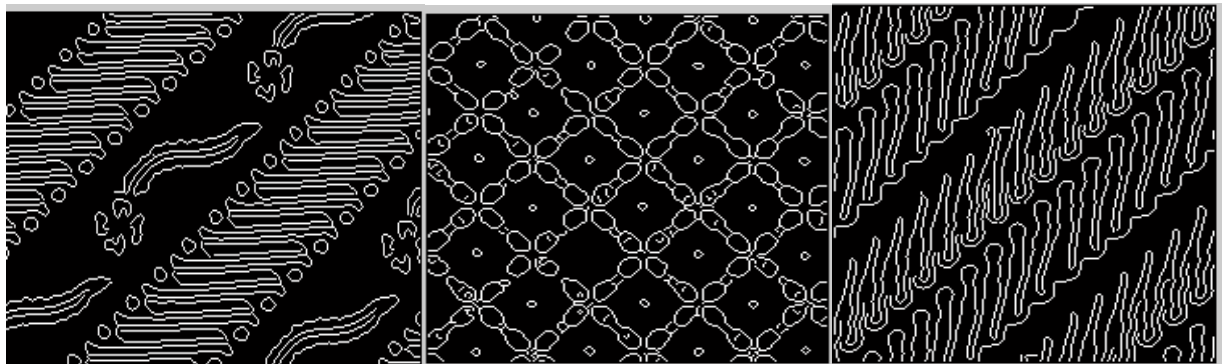
c = central moment,  
f(x,y) = discrete function, mxn discrete points

In **Fig. 3** portray the image of CBIR on batik motif, where there are 2 main process. In preprocessing stage all the batik image will be doing grayscale process, it is to remove the color of image both existing and in the query database. In addition to getting the texture and shape characteristics are more optimal feature extraction process is carried out using the method of edge detection using canny function. Than the processing using wavelet method and invariant moment will be doing extract feature to characterize of shape and texture. (**Fig. 2**)

After process is carried to doing retrieval process and continue the process of sorting. In the retrieval process of calculating the index value of the image in the database and queried, using the Euclidean distance function. The Process continue to retrieve all the image in Database which has value be closed with value in query database. In using the concept of fuzzy logic, to values close resemblance to the image characteristics, will be displayed in sequence.



**Fig. 1.** The Wavelete decomposition structure method of image batik in level of 2



**Fig. 2.** Edge detection of batik image using canny function

Canny edge detection in general operates in image processing batik as follows:

- Smoothing to reduce the impact of noise on edge detection
- Calculate the potential gradient image
- Non-maximum supression of the gradient image to localize the precise edge

The image will be displayed starting from the highest similarity or resembling a query image, to the

lowest similarity. It also includes processes for the process of displaying images corresponding to these similarities, the algorithm used is a threshold algorithm. Where the algorithm, then the focus of the search or retrieval of image data that resembles, or almost the same as the image data stored in the database. To show the similarity of images based on image characteristics through the use of Fagin algorithm and derivatives threshold algorithm. The focus of this research includes two things: Accuracy and time efficiency image retrieval system (Fagin, 1998; 1999).

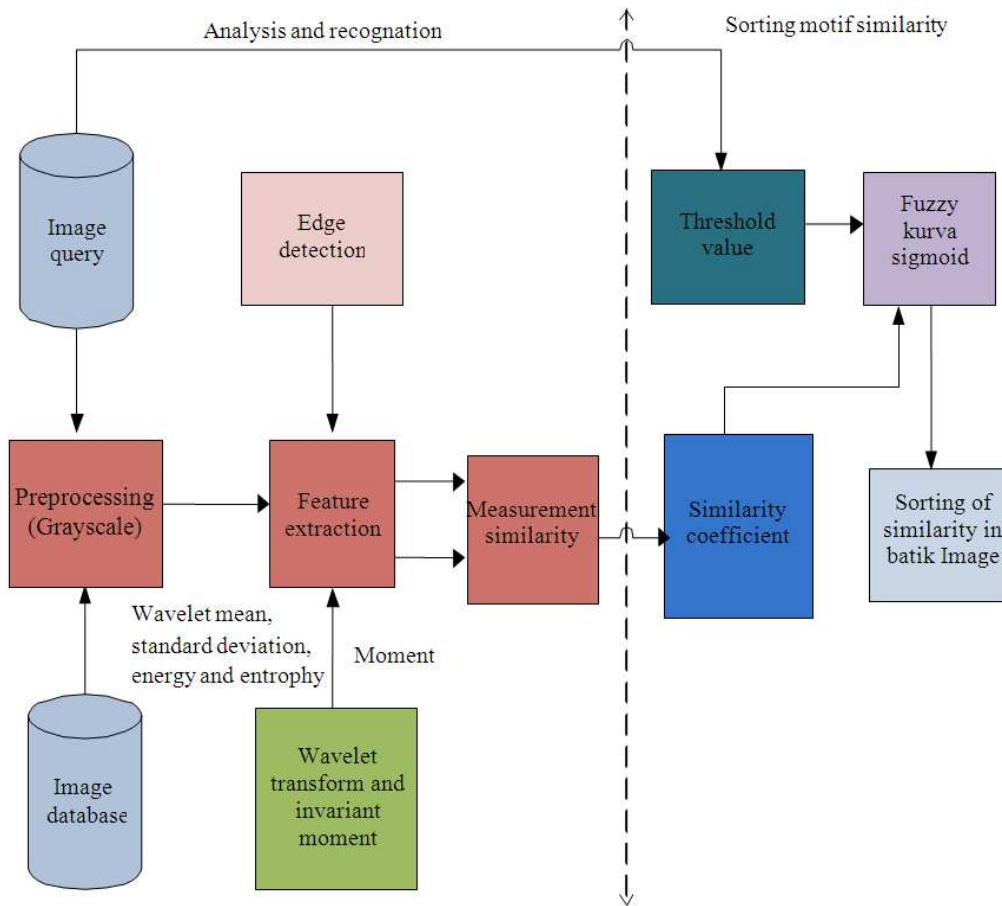


Fig. 3. Potray on the CBIR process on batik image base on the similarty of motif

## 2. SUPPORTING OF THEORY

In this study images batik, there are several motifs that became research material, such as motive “ceplok”, “kawung”, “Slove/parang “Nitik”, “Tambal”, ”Mega mendung” or “lereng”. With the introduction of the automotive, queries can not only be done using the image of an example, but can also be done by entering the name of the motif. In general, a similar motif.

### 2.1. Research History

This study proposed a phase image recognition motif by using several methods and at the same time created classification on the image of batik which is calculated using the value of precision threshold algorithm. As conventional CBIR systems which search image retrieval batik to be most relevant based on the image of an example, the introduction of this motif is likely to be a

more flexible approach (Liu *et al.*, 2008). Generalized Hough Transform will be able to recognize the appearance of multiple motives in the same image. Portray that in performing classification and cluster based image can batik motifs, contrast and color backed by supporters of the algorithm (Sanabila and Manurung, 2009).

The development of research on batik images are generally more focused on methods to represent the image texture characteristics and some focused with shape. To characterize the texture on a particular image using a combined method of wavelet transform is the Discrete Wavelet Transform and Rotated Wavelet Filters (Kokare *at al.*, 2007). This method was developed for the image of a particular motif, as well as to the concept of Canberra Distance CBIR uses image classification process of batik while using multi-layer perceptron based on Log-Gabor and Color Histogram Features (Rahadiani *et al.*, 2009). For other methods of

construction using batik image by using codebook and framework keyblock portray the motif for the classification based on texture characteristics using wavelet packet transform method (Wahyudi *et al.*, 2009). Actually all the above methods are used in retrieval image motif that has similarities traits. The process carried out aiming to improve the performance of image similarity motif, especially the accuracy of the results.

### 2.2. Calculation of Image Similarity

Basically all batik images to be processed using wavelet transform focus with approximation coefficient such as: 1.  $[C,S] = \text{wavedec2}(i,2,'db2')$ ,  $A = \text{appcoef2}(C,S,'db2',2)$  Some support functions in the image of batik motifs on the shape and texture are: Note: Wavedec is wavelet decomposition to get approximation coefficient (appcoef), Db2 = Daubechies of level 2:

- Wavelet Energy:  $\sum_{i,j} P(i,j)^2$
- Wavelet Entropy:  $-\sum_{i,j} P(i,j) \log P(i,j)$
- Standard deviation:  $\left( \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2 \right)^{\frac{1}{2}}$

Some characteristic values generated through the wavelet decomposition process, including obtaining approximation coefficient. This wavelet process can be seen in Fig. 4.

### 2.3. Feature Extraction of Tekstur

In this study some trait or characteristic texture described as Mean, Standard deviation and Energy. The average (mean) is the mean of the distribution of image intensity values of gray. Standard deviation shows the distribution of the intensity values of gray. Energy, which is characteristic to measure the intensity of the concentration of the matrix pair concurrency intensity. While the texture characteristics that have not been used as entropy is used to measure the intensity distribution of random. Contrast is used to measure the strength of the differences in the intensity of the image. Contrast is the opposite of homogeneity, which is to measure the homogeneity of the intensity variations in the image.

#### 2.3.1. Wavelet Transform Analysis

Wavelet transform has the ability to analyze the data in the time domain and the frequency domain simultaneously. Data analysis was performed with the

wavelet decomposition of a signal into different frequency components and then vary each frequency component can be analyzed in accordance with the resolution scale or level of decomposition. It is like a filtering process, in which the signal in the time domain is passed to the High Pass Filter and Low Pass Filter to separate the high frequency components and low frequency. Wavelet is a function of the real variable  $t$ , given the notation  $\psi t$  in the function space  $L^2(\mathbb{R})$ . This function is generated by dilation and translation parameters, which is expressed in the equation (Kokare *et al.*, 2007; Ni Wayan, 2010):

$$\Psi_{a,b}(t) = a^{-1/2} \Psi\left(\frac{t-b}{a}\right); a > 0, b \in \mathbb{R}$$

$$\Psi_{j,k}(t) = a^{j/2} \Psi(2^j t - k); j, k \in \mathbb{Z}$$

Wherein:

- $a$  = dilatation parameter,
- $b$  = translational parameter
- $\mathbb{R}$  = condition  $a$  and  $b$  in integer value
- $2^j$  = dilatation parameter (frequency or scale paramter)
- $k$  = space of time or location parameter
- $\mathbb{Z}$  = condition  $j$  and  $k$  values in integer valu

Below is a graphic illustration of the image decomposition process.

As seen in Fig. 5, an image is processed using the discrete wavelet transform with decomposition level one which divides the image into four sub-bands, namely (Pratikaningtyas *et al.*, 2010; Lechner *et al.*, 2010):

- Approximation Coefficient (LL) which is also called the LL sub-band
- Horizontal Detail Coefficient which is also called the HL sub-band
- Vertical Detail Coefficient which is also called the LH sub-band
- Diagonal Detail Coefficient which is also called the HH sub-band

To get the value of approximation image LL is obtained by lowpass filtering in both directions, include the detail coefficients  $H_n$ ,  $V_n$  and  $D_n$  are obtained via highpass filtering in one or more directions, thus to provide information about a particular scale in either the horizontal, vertical or diagonal direction (Hazra, 2011).

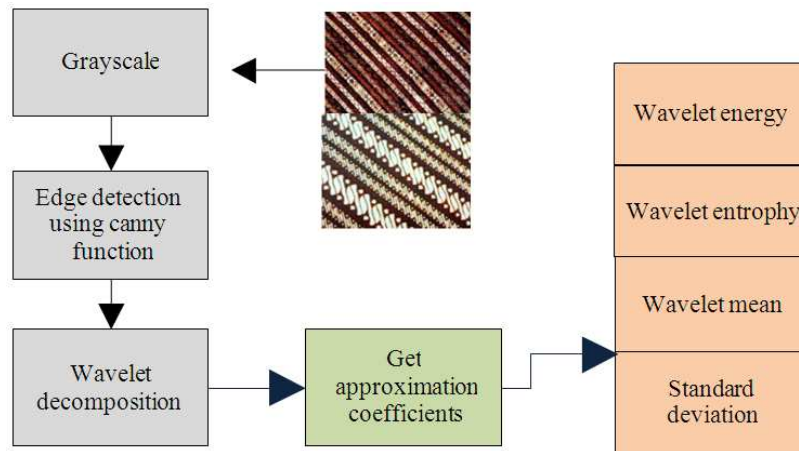


Fig. 4. The feature extraction of texture using daubechies 2 Wavelet transform

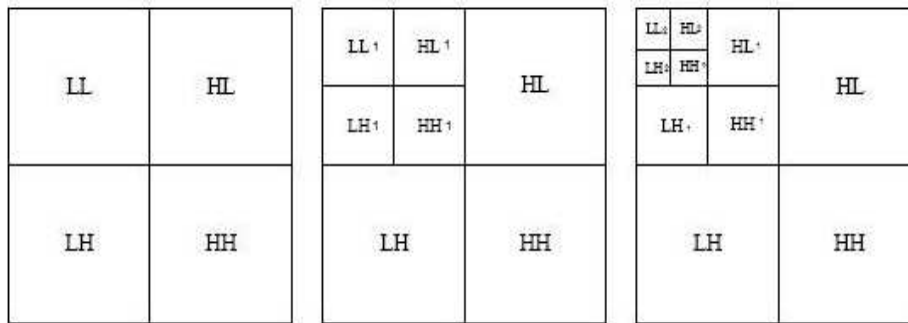


Fig. 5. Image of wavelet decomposition discrete Level 1, 2 and 3

**2.4. Moment Invariant (Pattern form)**

In the process to recognize an object in an image, the segmentation process, often foundered on the problem position of the object, the rotation axis of the object and change the scale of the object. The position of the object to move, rotate and size smaller or larger than the information already possessed the knowledge can lead to errors in the recognition/identification of the object. Moment can describe an object in terms of area, position, orientation and other defined parameters. By getting some information moments, good moments to zero level (M00) and unity (m10 and M01) or central moment and the moment at the level of  $\geq 2$  or invariant moments of the object, the object can be identified even after happen shift (tranlasi), rotation as well as changes in scale. Moment invariant equations used according the formula (Vanajakshi *et al.*, 2012).

**3. RESEARCH METHOD**

**3.1. Framework of Batik Image Analysis**

Actulally, the framework of batik image analysis will be explored in Fig. 6. According of Fig. 6 that carrying out the image analysis process based on the similarity of these characteristics, there are some processes that will be implemented. The process starts from Collecting and Selection batik image, ant than continuing of preprocessing, the feature extraction of shape and texture. To identify the similarity are described such as energy, mean and standard deviation are derived from the decomposition of the sub-band approximation coefficient.

Next step is Measurement of image similarity using euclidean function to get similarity distance between image database and query. Actually this reseach process will be devided to be 5 (five) Main Process, they are.

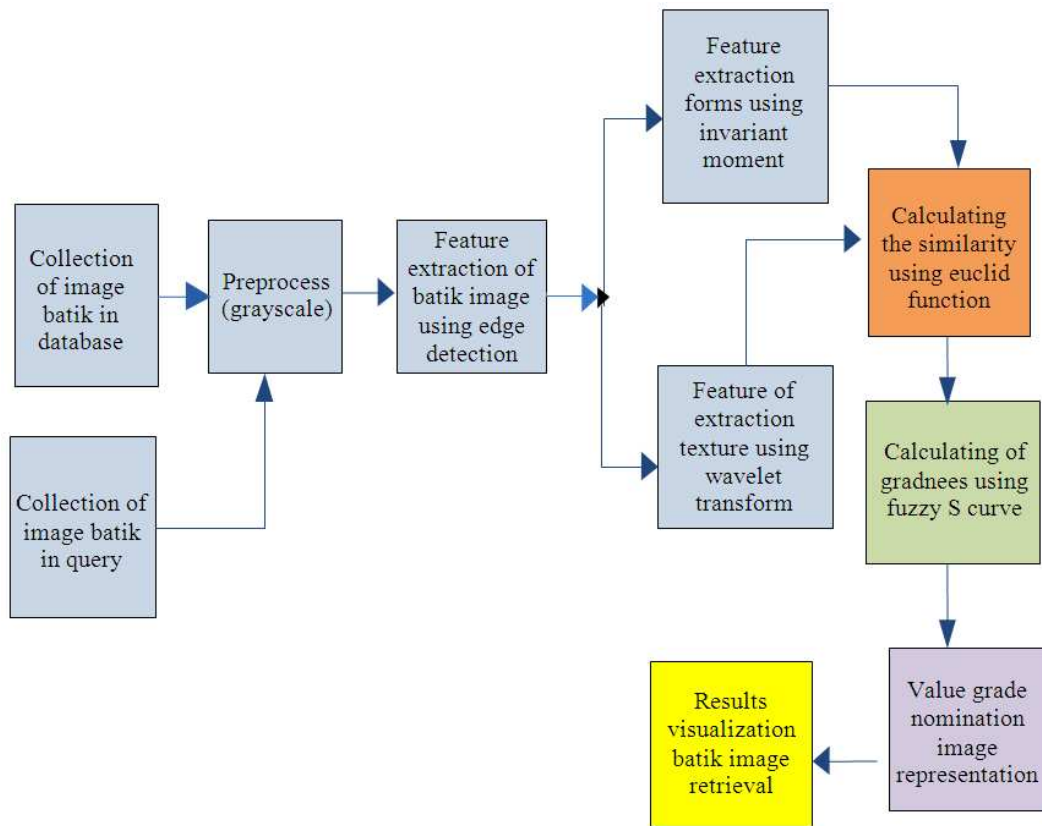


Fig. 6. Framework of batik Image analysis base on similarity

### 3.1.1. Preparation of Collecting and Selecting Batik Image

Doing the collection of batik image is done in several ways such as through the Internet, taking a digital photograph or from an image collection CD-batik, or by selecting the images manually. All the collected images have a file extension of \*. jpg, \*. png or \*. bmp. The research is done of an image of batik that can be used as research material with the condition that the image of the expected batik fits only one object – not a collection of pieces. The batik image must also be clear in shape and texture. Some motif to be studied focused on seven types of ceplok, kawung, lereng, Parang, Nitik, Tambal and mega mendung. All the batik image will be selected base on the condition of the image and include only 8 motifs will be studied.

### 3.1.2. Preprocessing

Preprocessing methods using a combination of Gray Level, cropping, resizing, histogram equalization and

contrast-brightness adjustment to produce the output value from the preprocessing used to improve the performance in recognizing the characteristic texture and shape became more clear and accurate without being influenced by the color image batik., include to remove noise.

### 3.1.3. Feature Extraction

The images are repaired and cleaned of noise with the process of feature extraction using canny edge detection for all the images of batik (in the database and in the query). Canny edge detection will mark the pixels that are changing the intensity gradient significantly and give a zero on the other pixels unchanged signifikan. Tiap pixel intensity gradient characterized by edge detection or the value is 1 then examined to look for possible curve through pikseltersebut. Each pixel in the image representation through voting forms were given 1. And so on until all the pixels in the binary image examined.

After the canny edge detection performed on the batik images are drawn more clearly the motives and

forms the image. Calculation process is then performed on the 6 variable function on all images of batik. The results of this batik images, will be processed back to the Approximation coefficients. using the method of wavelet transform types deaubeches type 2. It is expected that by using this method is more clearly illustrated motif groups, as well as to facilitate the classification of the image motif.

### 3.1.4. Measurement of Batik Image Similarity

To make a comparison between a query image and the images stored in the database, some additional support functions are required. To recall the image based on texture, the wavelet transform is used to compute wavelet energy, mean and standard deviation for all batik image in database and in query. Then proceeds determining the the similarity distance will use Euclidean Function.

### 3.1.5. Sorting and Comparison of Feature Coefficients

A threshold value is taken from the query image and compared with the threshold values of all the existing images in the database through the use of the Euclidean function. With this model the threshold value is determined for the query image and all the images that have a similar threshold value will be displayed in order, sorted by rank. The images are displayed ranging from those that are similar to the original up to those that are somewhat less similar. Stages of sorting using threshold algorithm to the image similarity is:

Step1: Parallel sorted access to each list for each object will be doing: (Fagin, 1998; 1999; Ranguti *et al.*, 2007):

- Get all grades by random access
- Determine fuzzy logic using Min (A1,A2)
- Amongst 2 highest grades where be seen will keep in buffer

Step2: Determine threshold value based on objects currently seen under sorted access  $T = \min(L1, L2)$ .

Objects with overall grade  $\geq$  threshold value then stop else go to next entry position in sorted list and repeat step 1. Due to the threshold value comparison process based on colour and shapeor texture, the fuzzy logic will determine a count where a is the shape and b is the texture. Because the threshold value comparison process based on color and shape, it will be the fuzzy logic with a count  $\mu_{A \cap B} = \min$

$(\mu_A[x], \mu_B[y])$  where a = shape, b = texture. With the of images produced by the CBIR concept, then the order in which to show the similarity of the images will be done by a Threshold algorithm. This algorithm uses a fuzzy logic model in the process stage.

The Threshold algorithm function, which is derived from Fagin's algorithm, will display several images at once based on the resemblance of the images. The display starts from the closest with a ranking of number 1 (one) which has a very similar view, to images with a rank close to 0 (zero) which has very little resemblance at all. For all complete the CBIR process will see this picture below in Fig. 5.

## 4. RESULTS OF TESTING AND DISCUSSION

In determining the performance of the image retrieval system based on colour and shape using the Threshold algorithm, the result will be true and accurate if a number of images that are similar to the characteristic/pattern are identified correctly by the system, although the invisible accuracy can be determined from the resulting percentage.

These images will be identified as having characteristics that resemble or are almost the same as the original image of batik. **Table 1** for the results of the experiments on **Table 1** gives the results of experiments on 300 batik images in the database and 22 query images. By looking at the **Table 1** below, the value of the highest precision when using the value of the centre curve is -8 and the stimulation value is 0.5 at 75%. It is concluded that of the 120 trials using the central curve -10 and -8 and curve stimulation 0.1, 0.3, 0.5, 0.7 and 0.9 then almost all the batik images stored in the database are much like the query images of batik in the database and have average precision and relevancy values of between 88-92% for spesial motive. The result have different motives then the other motives

After we increase the image to study about 300 batik images which they set up in a database and tested against 20 query images of batik. Usually the index database generated in the process of feature extraction increases in size by kilobytes compared to the database increase in size in terms of megabytes. The average time required to perform CBIR based on image feature similarity, with the conditions of shape and texture of the batik image is on average 18-20 sec and to search sequentially in the file index takes 20-25 sec. The time required to perform CBIR for an image search is directly proportional to the increase in the number of images in the database.



**Table 1.** Calculation of similarity for batik images

	Simulation curve				
	0.1	0.3	0.5	0.7	0.9
Centre curve					
-10	70	85	88	80	70
-8	70	85	92	85	75

**Table 2.** Percentage of similarity batik images using several types of wavelets at level 2

Name of batik motif	Kinds of wavelet Level 2			
	Haar	DB 2	Coiflet	Bior
Ceplok	85	90	70	90
Kawung	92	92	72	92
Megamendung	65	70	50	60
Parang	88	88	60	88
Lereng	90	90	80	90
Tambal	85	85	85	85
Nitik	88	90	82	92
Truntum	90	92	85	92
Maximum	90	92	90	92

In **Table 2** describes the results of image processing 8 motif batik by using several types of wavelets on level2. Beside The results portray that kind of Daubechies wavelets that have a characteristic texture similarity around 90-92% and different with the orther.

In **Table 2**, this research also note that the megamendung motives rather difficult to observe the characterize of texture, so that the percentage of similarity is also rather low. For those reasons, this research should be continued, to get the other methods and concepts that can increase the ability to recognize the orther batik motive.

Other Batik Motive describes the results of image processing 8 (eight) motif batik by using several types of wavelets on level2. Beside The results portray that kind of Daubechies type 2 that have a characteristic texture similarity less than and equal 92% and different with the other kind of wavelet mostly less than and equal than 80% especially on the image of the mega mending motives.

## 5. CONCLUSION

A number of conclusions can be drawn as follows:

- To improve the performance of the image retrieval system, the method of an Invariant Moment is used for the shape and wavelet transform method is used

for the texture of the image. As for measuring the similarity of a query image and images in the database, this can be achieved using a Euclidean function. To produce sorting of similar images, this can be done using the concept of rank followed by an aggregation function under

- To calculate the value of precision, having conducted the study using the parameters given, the authors selected a centre curve with a value of -8 and -10 and an S curve parameter with a value of 0.2, 0.5, 0.7, 0.8 and 0.9. The resulting value of the optimal precision averaged at 90-92%
- To determine the speed of the process, execution was carried out for images of 300 kind of Batik image in the database with 20 query images of existing Batik. Using Fagin's algorithm the average time to execute is 20-30 sec. When a threshold algorithm is used it takes an average of 18-20 sec to execute
- We still need more research for mega mending motives to use the other methode or concept. Even we use this method but the result is still under 80%
- The continuation of this research will be continued in order to identify the image that has characteristics tekstrur and more complex shapes such as recognizing motif, blood cells and tumor cells in the field of Bioinformatics and Cultural Informatic

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