Spatial and topology feature extraction on batik pattern recognition: a review

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Received 25 September 2021; accepted 8 December 2021; published 13 January 2022

ABSTRACT

Batik is an Indonesian cultural heritage that has been recognized by UNESCO as an international cultural heritage on October 2, 2009. Patterns of batik produce geometric shapes unique, the number and name of the batik patterns make it difficult to recognize each motif. The objective classification of batik is split image into classes according to the pattern motif motive so easy to recognize in accordance with its feature. Batik can be classified based on the shape of the motive, namely geometric motifs, geometric motifs and motifs non specific. Spatial information is an important aspect of image processing such as computer vision and recognition structure / pattern in the context of modelling and resolution of the uncertainty caused by the ambiguity in the low-level features. Shortcomings inherent in combining two colours and spatial features are not adaptive pattern recognition process of the region across multiple images and histogram matching is not appropriate to capture the colours on the image content. This study discussed a model of spatial features and feature combinations topology with the aim to improve the validation batik image pattern recognition so that the level of the pattern recognition motif batik image could be better. Some of the features that have been used include colour features and spatial features. In addition, this paper discusses the possibility of combining the features in pattern recognition. This paper proposes a combination of features that will be able to improve the validation of image pattern recognition of batik.

KEYWORDS
Batik
Pattern Recognition
Spatial
Topology Feature

1. Introduction

Batik is an Indonesian cultural heritage that has been recognized by UNESCO as an international cultural heritage on October 2, 2009. In order to preserve batik as one of the world's cultural heritage can be carried through in Indonesian batik pattern recognition [1]. The uniqueness of batik originated from the production process known as "mbatik", motives and values contained in each motif. Cultural values and high artistic value has made batik into products of high economic value in this modern era. However, other than as an economic product, batik has the characteristics of the motif and the decoration. And decorative motifs are born and constructed of human cognitive processes derived from nature and surrounding areas [2]. Patterns of batik produce geometric shapes unique, the number and name of the batik patterns make it difficult to recognize each motif. Classification of data is needed to identify the characteristics of the objects contained in a database and categorized into different groups [3]. The objective classification of batik is split image into classes according to the pattern motif motif so easy

to recognize in accordance with its feature. Batik can be classified based on the shape of the motive, namely geometric motifs, geometric motifs and motifs non specific.

Spatial information is an important aspect of image processing such as computer vision and recognition structure / pattern in the context of modeling and resolution of the uncertainty caused by the ambiguity in the low-level features. Merging feature colours and spatial features ever done [4]. Shortcomings inherent in combining two colourss and spatial features are not adaptive pattern recognition process of the region across multiple images and histogram matching is not appropriate to capture the colourss on the image content. This study proposes a model of spatial features and feature combinations topology with the aim to improve the validation batik image pattern recognition so that the level of the pattern recognition motif batik image could be better.

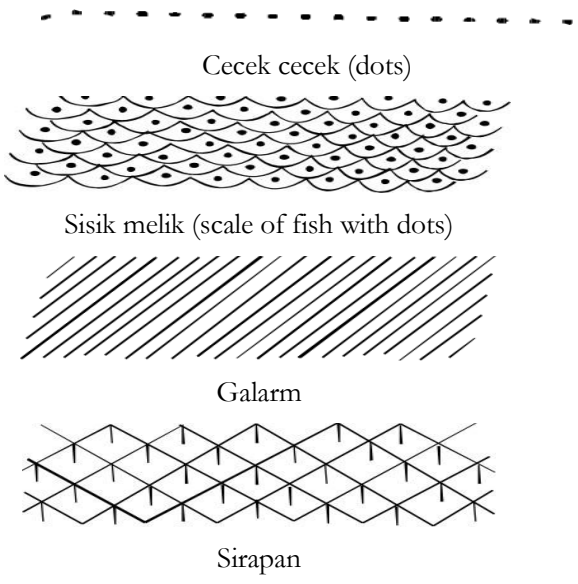
2. Batik

Batik is an Indonesian cultural heritage that has been recognized by UNESCO as an international cultural heritage on October 2, 2009. In order to preserve batik as one of the world's cultural heritage can be done through the introduction of Indonesian batik pattern. The uniqueness of batik originated from the production process known as "mbatik". Cultural values and high artistic value has made batikinto products of high economic value in this modern era. Etymologically Batik is an abbreviation of two syllables taken from the word Amba and point. Amba means writing. Batik is the same as the writing point. The points in the Java language called isen.

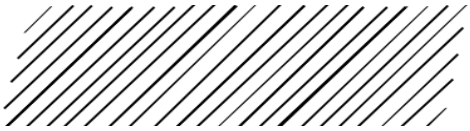
There are about 400 types of batik of Yogyakarta, 350 of which have been patented. Motif as it proves that the Yogyakarta batik potential as a cultural icon. There was Yogya batik motifs classic among them is the motive machete, geometric motifs, latticework motif, motifs creeper, water plant motifs, floral, animal motifs, and others. Each motif etched on top of batik full of philosophy. For example, Sido Mukti means the wearer is always filled with love in marriage. Truntum means love blossomed. Queen Ruth Roman Cement symbolizes loyalty and a wife, etc.

Batik motif consists of two parts, namely main ornament motif and isen.

- The main ornament is a decoration that has a meaning, so that the composition of the ornaments ina motif that makes the soul or sense than the motif itself. Additional ornament has no meaning in the formation of motive and act as filler field. Smaller and simpler shapes. In one motive can be filled one or several filler ornaments
- Isen motive is in the form of dots, stripes, dots and dashes joint that serves to fill the ornaments of motive or filler ornaments field between them. Isen there are various motives and is still growing, such as: cecek, cecek Pitu, melik scales, cecek shredded, cecek Savu leaves, scales gringsing, galaran, rambutan, sirapan, minced gori, and so on. Figure Isen Isen batik can be seen in Figure 1.



Vol. 16, No. 1, Januari 2022, pp. 1-7 ISSN 2086-8138 (print) | 2745-7249 (online)



Hangam

Fig 1. Isen isen Batik

Batik motifs are divided into two major groups, namely geometric motifs and non-gemetri, there are motifs on the last non-geometric pattern motifs specific pattern [5]. Special motif contains motifsthat can't be inserted into another class.

3. Method

Pattern recognition can be viewed as a classification process that aims to extract patterns based on certain conditions and separating a class with another class [6]. Pattern recognition can also be regarded as a process of searching in a data structure. The success of a pattern recognition system developed by four repetitive elements [7], element pattern recognition system can be seen in Figure 2.

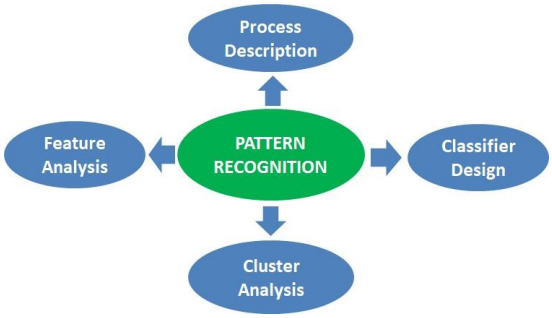


Fig 2. Elements of Pattern Recognition Systems

Pattern recognition can be viewed as a classification process. The ultimate goal is the ability to extract the optimal pattern based on certain features and to separate one class to another class. Utilization pattern recognition can be found in various fields of natural science research as iris pattern recognition [8], Navigation Mobile Robot [9], fuzzy reasoning [10], Intelligent Industrial Equipment [11], biometric identification [12], medical diagnostics [13], engineering technology [14], and in other areas. Pattern recognition system design must consider the application domain to be built. Until now, the best universal pattern recognition system has never existed. The basic components of the system are a pattern recognition pre-processing, feature extraction and classification process [6].

Pattern recognition becomes a very important field in this ten years period. This happens since the development of automated systems and computer-based systems in large-scale data management. The main purpose of pattern recognition systems is to help people in analysing very large data sets and extract the knowledge contained in the data set. Many algorithms have been developed in building applications of pattern recognition systems, especially in static pattern recognition. Process information is also developed into a non-deterministic, so that began to be used in the processing of fuzzy approach

Research on batik pattern recognition [15] aims to cluster and batik image classification based on colours, contrast and motif. The method used to perform clustering and classification is HVS systemon colours cluster, the cluster system wavelet contrast and texture shape on clusters based motif. The results obtained in clusters rather good colours and contrast. For 3 clusters and classification process based motif pretty good. In that study accuracy needs to be improved. To improve the accuracy of the proposed pattern recognition method capable of automatically classifying classic batik into sub-classesbased on the ornament shape and texture [16]. The method used is to combine the two methods of shape and texture feature extraction. The results of the observation of the data processed batik colourssare no high intensity and low intensity. Batik edge has a clear edge with high contrast values and fuzzyedges low contrast value.

In terms of the size of the edges are thicker edge batik patterns (clear) and thin (unclear). Ornaments consist of small size (fine texture) and large (coarse texture).

Results obtained ornament batik with large size and high contrast produces a thick edge and easy to recognize, while batik ornament with a small size with low contrast would be difficult to recognize. Two good images that have high contrast and low with a small image size will produce a complex edge. This is caused by the main ornament batik influenced by edge isen so that its shape is difficult toidentify. Cement and Lung batik pattern scrolls are still difficult to detect because the main ornament batik mixed with isen. Utilization of texture classification method in pattern recognition will be good for most images but may not be good for some other image [16]. One of the important processes in pattern recognition is feature extraction. Extraction of features on other batik pattern recognition is done in the study of the properties of the most basic statistics of the image histogram obtained from the output generated from feature detectors [2]. The point is to find the statistics of the output to the input of the detector in the form image pieces. Piece of the image means sub images (windows) are obtained randomly from batik image. The feature is a random variable and for each piece of input obtained from a random variable. Batik feature extraction using high-level statistical method by finding non-singular linear transformations of multivariate data thus transformed variables are independent. The results obtained are Batik image features can be established by means of independent inter-motif and capable of forming new motif batik image.

Batik pattern recognition by using Rotate Wavelet Filter and combine it with artificial neural networks [17]. The purpose of these studies to inventory and identify the data batik based motif. Rotate Wavelet Filter is used for feature extraction batik will be recognized and artificial neural network is used to classify images based on motives. Wavelet used to define the feature space multi resolution produce energy and standard deviation with the image size of 128 x 128 pixels. The results of image recognition batik using neural networks have batik image recognition accuracy of 79%.

Research about batik by adding a discrete Wavelet Transform features and derived features of Grey Level Co Occurrence Metric with Wavelet Filter Rotate feature [18]. For classification using Fuzzy C Means (FCM). The experiment was carried out several times on different images to get an idea of the quality of the use of Fuzzy C Means in recognition motif multi label. From these experiments we conclude that the Fuzzy C Means method could reasonably be used to identify multi-label batik.

Some of the features used in batik pattern recognition accuracy levels vary. The use of Gabor features has 59.74% accuracy rate. There are 46 images capable batik image recognizable from 77 available. Features histogram has an accuracy rate of 48.05%, is only able to identify 37 images of 77 images to be recognized batik. Feature number edge has a higher degree of accuracy than the two previous features, namely 66.25%, were able to identify 51 images of 77 images to be recognized batik. Merging two Gabor features and edge number produce accuracy rate of 64.94%, was able to identify 50 images of 77 images that will be identified [1].

Intelligent system for classification Batik with the results of feature extraction and classification are performed on batik image have high identification accuracy, which is 100% on the image sizedecreased from 256 x 256 pixels to 128 x 128 pixels. The introduction of this feature is done by finding the shortest distance test images to the reference image. Of all scale distances obtained then searched the minimum distance or shortest distance. The result of this is the closest distance batik pattern image can be classified and identified in accordance with the group [19].

The demand for image classification is increasingly rise causing the user wants the image retrieval process faster and more precise [20]. Fuzzy Decision Tree for classification on the image and obtained more precise classification. The image can be identified by colours, shape, texture and spatial features [4]. Pattern recognition based on colours and spatial features done by dividing the image into a 3 x 3 grid and gained 9 regions, then calculated each histogram value for each region of the entire image. Histogram intersection is used to match the correspondence between regions (histogram matching). Disadvantages merging colours feature and spatial features are not adaptive to the Region across multiple images and histogram matching is used very well to capture colours image content. Colours image pixels can be recognize as a point in 3D colours space. The coordinates in the 3D colours space is the colours pixel values. Usually a small number of objects in the image, therefore the reflection characteristic of each object in natural light into a consistent and produces clusters in 3D Colours Space. If the cluster is formed in 3D colours space will be available a few clusters. Each cluster will beinterconnected with the dominant

colours in the image. An example is the mean colours as one of the representative sample of clusters that can be used to define the colours feature. Features colours obtained can represent colours image information. Centroid example spatial location of the colours region in image coordinates and population clusters in the image to define the other features, namely the spatial distribution information of the colours image. Two of these features can be used to capture the image of the colours content in conjunction with the spatial distribution of colours in the image. The input image is represented as a primary RGB colours image.

Point data representation in pattern recognition can be used to exploit Tree topology like in the code book vector [21]. The technique used to use classification criteria based on Artificial Neural Network based on the type of topological relationships between neurons. Technique is used to produceimage features based on Tree-Based Topology Oriented SOM. Image classification can also be done by using Support Vector Machine (SVM) by combining feature-QTRL PCA [22]. PCA-QTRL feature is a two-dimensional image features obtained from combining two methods of Principal Component Analysis-Modular PCA (statistical Methods) and Quad Tree Longest Run (Topological Methods.

Using 4000 data and dividing the data as 4000 training data and testing the data obtained in 2000 on the pattern of handwritten recognition accuracy reaches 98.10%. [23], using the topology feature for the introduction of 2-dimensional image. Image extraction is done by exploiting the model topology using Morse function. Image recognition techniques using skeleton algorithm produces a model of image recognition in skeletal graph.

Image feature extraction is done by Colours (colours correlative representative method) and Texture (Autoregressive texture models). Image feature extraction method using Mathematical Morphology Correction technique used in image segmentation. The process of identification based on the colours of the object in the image and sometimes inefficient [24].

In a study [25] shows how to extract spatial texture features and spatial edge features and comparedto its image has been extracted. Features are extracted and stored in a database along with the image. Features the same colours as the colours histogram (colours histogram) are often used for image pattern recognition, but cannot indicate the colours feature similarity to human sensitively.

Merging feature topology and geometry generates multilevel image description [26]. From the graph topology by using the differences in each level gained parts of the image information. There is a method using region segmentation to extract the feature distribution of each region. The methods divide each region and extract the features of the region. Segmentation requires considerable processing time and makes the wrong region, thereby reducing the accuracy of the image pattern recognition process. Another method does not perform segmentation. How to divide the region into m x n block spatial features that can reduce processing time. After dividing the image m x n blocks, will be extracted texture features of each block. Co Occurrence Matrix used for the extraction time is faster. Co Occurrence Matrix is a matrix that represents the intensity of the relationship between the two pieces of pixels in an image at a certain condition. Texture features obtained by calculating the statistical value of the Co Occurrence Matrix include contrast, correlation, inverse different moment, variance and entropy.

Colours and texture are features that indicate the representation of different regions. Brightness change is an edge that can be easily extracted in image processing. Effective edge features to distinguish the matrix region Co Occurrence edge features, but the statistical value Co Occurrence others were hiding edge features. The solution of the matrix can be calculated Co Occurrence to edge image by means of an emphasis on edge features.

Research about the topology features by combining Principal Component Analysis-Modular PCA (statistical Methods) and Quad Tree Longest Run (Topological Methods) design were classified by using Support Vector Machine (SVM) [22]. In another study has shown Quad Tree-Based Sub-Image is more informative than the Fixed Partition Sub-Image. Quad Tree combined with Longest Run generates Quad Tree Longest Run. For execution QTLR features, each digit in the cover image of the bounding box then normalized 32 x 32 pixels and convert to binary based on threshold values. Topological feature extraction is done by [23] in a study that aims to develop an algorithm to calculatethe skeletal graph and then find the topology of the object. Object topology is one important object attributes that describe how different parts of the objects surface that are interconnected with each other. The method used is based on how to

find a topology on skeletal Reeb graph modification by finding the critical points of the distance function. This combination of features is a popular method for improving the performance of object classification. [27], presents a weighting scheme is simple and effective for a combination of features is based on the idea of a dominant-set cluster. This reflects the expected accuracy of the kernel of the discriminatory power of the kernel matrix and thus the weighting matrix used in the kernel in a combination of features.

4. Conclusion

Batik can be recognized by its topology and texture. The shape topology in batik will produce topological features and the thickness of the pattern will produce textile features in the batik. The combination of texture features and topological features has an influence on the accuracy rate of batik pattern recognition.

Acknowledgdement

This work supported and funding by RISTEKDIKTI Indonesia in the scheme "Penelitian Dasar" in 2019.

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