Image Enhancement Segmentation Indonesian's Batik Based On Fuzzy C-Means Clustering

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Image Enhancement Segmentation Indonesian's Batik Based On Fuzzy C-Means Clustering Using Median Filter

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***Abstract*— This research aims at improving the quality of segmentation on the algorithm Fuzzy C-Means (FCM) which is used to classify the patterns of 'Batik' with the background or base color so that two clusters can be achieved by processing using the median filter. To calculate the performance, this research utilized two patterns of Batik which will be clustered with the algorithm FCM, and then being compared with the combination of the median filter using the FCM so that both MSE and PSNR can be achieved. The Batik 1 Cluster 1 with MSE value =248.2652, PSNR = 24.1816, cluster 2 value MSE = 21399.2931, PSNR =4.8268, batik 2, cluster 1 value MSE = 20979.7281, PSNR=4.9128, cluster 2 value MSE = 1672.3475, PSNR =15.8975, using the median filter, batik 1 cluster value MSE = 0.0050, PSNR = 23.0419, cluster 2 value MSE = 0.2917, PSNR =4.9258 whereas batik 2 cluster 1 value MSE = 0.2917, PSNR = 13.8054 and batik 2 cluster 1 value MSE = 0.2917, PSNR = 5.3508.**

Keywords—fcm; batik; median filter

I. INTRODUCTION

In order to participate in supporting the development of Indonesian culture mainly in preserving the batik cloth, there is the need to perform research in the field of the characteristics of the patterns of batik. Batik is the cultural heritage not merely caused by the batik itself, but also the arts of making it. The occurrence of the issues claiming of ownership is caused by lack of our own respects on the importance of preserving the batik culture. As to prevent the issues to re-occur, the needs of complete documentation about Indonesian batik must be fulfilled. All the patterns of batik has the symbolic meanings which can contain about the information on the batik graphics, mainly the characters of shapes and textures.

The patterns of Batik get categorized into two mainstreams, geometry and non-geometry patterns [1]. In the geometry patterns, the basic patterns get shown on the base cloth. Based on the types of the base patterns and types of performance of the base patterns, the geometry pattern get classified into three groups of patterns, there are;*parang*, *ceplok*, and *lereng*.Whereas the non-geometry patterns get classified based on the performance of certain patterns on the cloth. There are four groups of the non-geometry patterns; there are, *semen*, *lunglungan*, *megamendung*, and *buketan*. Besides the two mainstreams, there are also some similar patterns of batik which cannot be identified as either geometry or non-geometry patterns. There are specific patterns or patterns of combination. The specific patterns mostly are combination of two or more patterns. Figure 1 shows several patterns of batik. *Batik Parang* has the base patterns of diamond shapes which consist of slanted lines. The base patterns in the *Batik Parang* commonly called as *mlinjon*. While *Batik Ceplok* has the base patterns the combination of four-squares and circles which commonly consist of lines and well-arranged columns. Basically, the *Batik Lereng* has the regularly slanted lines which are shaped like the *Batik Parang*, but the base patterns of the *Batik Lereng* do not have the ornaments called as *mlinjon*. The characteristics of the base patterns in the *Batik Semen* are the shapes like mountains or places with plantations. Generally, *Batik Lung-lungan*is similar to *Batik Semen, except* that the ornaments in the *Batik Lung-lungan*do not have the shapes like mountains. The base patterns of *Batik Buketan*consist of arrangement of flowers, flower petals and butterfly, birds, or kinds of smaller animals.

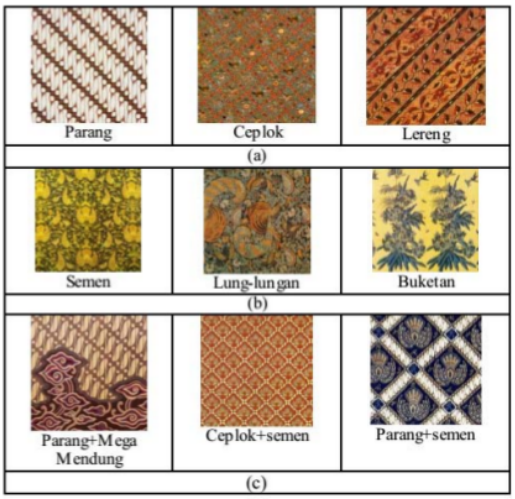

Figure 1. The Patterns of *Batik*

II. Related Works

The research done by Abdul Haris Rangkuti et al [1] had suggested the classification of batik patterns using the treeval and treefit as the function of tree content optimization of the batik figure.

Agus Eko Minarno et al [2] had also suggested the new method of extracting the features of batik which is called the co-occurrence matrix on the sub-band figures. This method was then used to solve the problems in classification of batik which were taken randomly from the internet with various kinds of *noise.*

Nanik Suciati et al [3] had developed a software to identify the patterns of batik automatically by means of the feature called as color-texture-based, research in the graphics of batik using the combination of method K-Means to determine the histogram, color and texture feature of batik by extracting using Color Co-occurence Matrix and differentiation among pixel and scan patterns.

III. Reseach Method

In this research, the choice making strategy used as presented is called Fuzzy C-Means Clustering.

A. *Fuzzy C-Means Clustering*

Fuzzy C-Means (FCM), which is also known as Fuzzy ISODATA, is one of clustering methods which also is a part of the method called Hard K-Means[4]. FCM uses the grouping model fuzzy so that the data can set up the parts of all classes or clusters to form in different level or degree of membership ranging between 0 to 1. The level of membership of certain data in a class or cluster is set by the degree of its membership. Szilagyi et al 2013, had suggested that the fuzzy C-Means to cluster in the level of gray histogram of inputted graphics. By means of the formula as follow:

$$Tfc = (\max(x_i(y=1)) + \min(x_i(y=2)))/2$$

x shows the pixel/data, i = 1,2,..,n; y = label. The value of gray level of the pixel labeled as i in the graphics.

The basic concept of FCM, initially was to determine the centre of the clusters, in the earlier condition, the centre of the clusters might not be accurate. Of each datum has the membership for each cluster. By means of restoring the cluster centers and values of each membership repeatedly, thus it will become visible that the cluster centers will move towards the precise location [5]. The grouping of Fuzzy C-Means (FCM) enables a point of data to belong to several classes but being embedded with different functions. The general Algoritma of FCM is used in image segmentation because of its effectiveness and easy implementation, mainly in the multispectral data. At this point, FCM calculates a membership, which is also called as the fuzzy function membership of each pixel of image for certain number of classes. For instance, the collection of observed intensity in a multispectral image in a pixel j stated as:

$$y_i = \left[y_{j1}, y_{j2,\ldots,} y_{jN} \right]^T, j = 1,\ldots,M$$

y_i, (i = 1, …, N) is the intensity of pixel of the spectral canal to N is the total amount of spectral canals (in RMI, N is commonly the combined amount of TR/TE), and M is the total number of the pixel position. By means of FCM being formulated as minimum iteration between the membership function of fuzzy uj and pixel vector center in each class vk:

$$|_{FCM} = \sum_{i,j} \sum_{k=}^{c} u_k(i,j) - V_k \|$$

$\mathbf{u_k(i,j)}$ is the membership value of the pixel location (i,j) for the class k where the intensity of vector image being observed on the location (i,j), and vk is the K class center. The total number of class AC is assumed to be known already. The q parameter is the exponent of content in each fuzzy membership and to determine the measurement of fuzziness of the classification results. 8 Membership function is calculated of each pixel position for each class of software and its value is ranged from 0 to 1. This is to reflect the degree of similarity between the pixel vector of the mentioned location and the class center point. So the bigger value function closer to 1 provides minimum FCM that the pixel at that position is to the pixel vector center of certain class. And vice versa, the smaller membership value is given when the intensity of the pixel is far from the center.

B. *Filter Median*

A filter median is a type of non-linear filter and is efficient to eliminate salt and pepper noise and Gaussian noise. This helps to maintain the sharpness of the image during the process of sound-making[6]. The potential of filter median depends on the windows of range. For the 3x3 mammography the windows provide the intelligent results. In the filter medium, the output of the component value is determined by the medium of the surrounding pixels such as shown in median Figure 2. Both to evaluate the extreme values and to strengthen of taking outer limits without reducing the sharpness of the graphic.

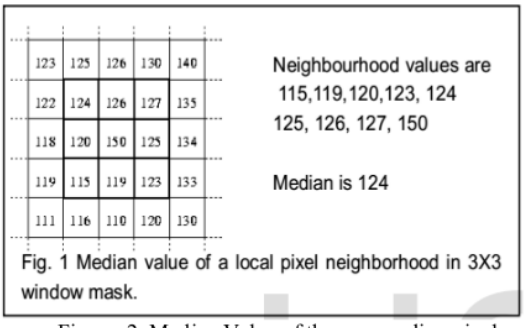

Figure 2. Median Value of the surrounding pixels

This research is aimed to separate the batik patterns from its background or base color, with the following steps:

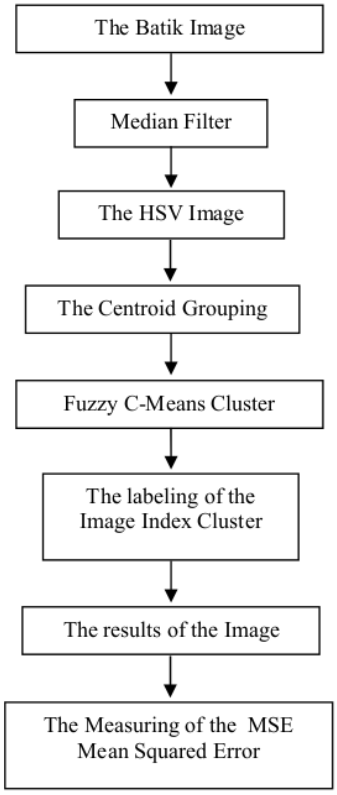

Figure 3. Block Diagram Segmentasi

FCM is used to classify the batik patterns with the background or base color so that there are two clusters derived from the filter process by means of medium filter and then transformed into the format of HSV, being defined the center, and after that the cluster index labeling to determine two clusters and found out the error results by measuring method namely *Mean Squared Error.*

IV. THE RESULT OF THE EXPERIMENT

The results of the experiments can be seen in tables of MSE, PSN and graphic of FCM Batik 1 and 2, as follow:

Table 1. MSE (Mean Square Error)

	Cluster	Batik1	Batik2
FCM	1	248.2652	20979.7281
	2	21399.2931	1672.3475
FCM+Median Filter	1	0.0050	0.2917
	2	0.2917	0.2917

Table 2. PSNR (Peak Signal-to-Noise Ratio)

	Cluster	Batik1	Batik2
FCM	1	24.1816	4.9128
	2	4.8268	15.8975
FCM+Median Filter	1	23.0419	13.8054
	2	4.9258	5.3508

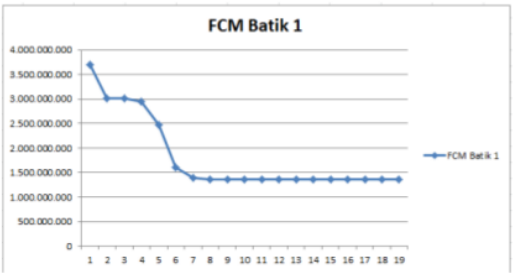

Figure 4. FCM Batik 1, MSE Graphic (Mean Square Error)

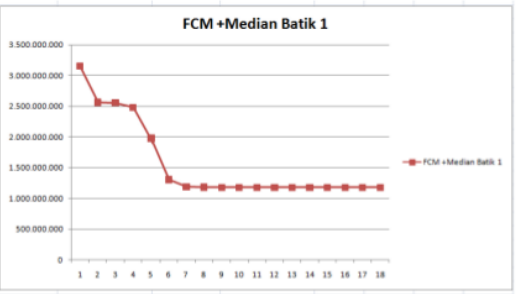

Figure 5. FCM +Median Batik 1, MSE Graphic (Mean Square Error)

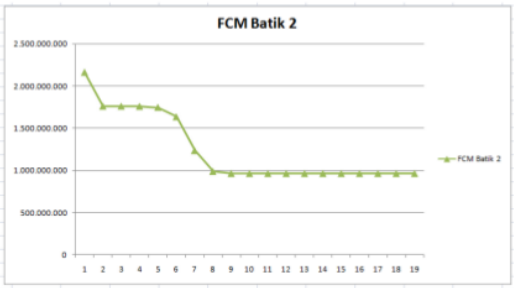

Figure 6. FCM Batik 2, MSE Graphic (Mean Square Error)

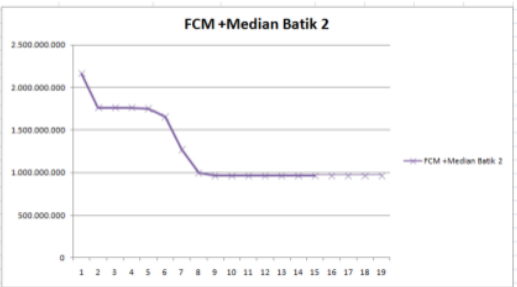

Figure 7. FCM +Median Batik 2, MSE Graphic (Mean Square Error)

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