The Use of Orthogonal Decomposition Pattern Short Wave for Sumba's Fabric

Yustina Rada, Harrizki Arie Pradana

***Abstract*—**Ikat Sumba weaving has a diversity of style that is unique and appealing. Patterns or designs woven cloth image depicts symbols of ancestral cultural attributes of the people of Sumba with their respective meanings that cannot be found in other countries. But in its use, not many people especially young people and tourists who know how the origin of the fabric Sumba. Moreover, to know more about the various types of motives and philosophy. From this background, the author would like to develop an Application Recognition Motif Cloth Sumba by applying the method based on similar texture image retrieval using wavelet. Kind used wavelet is Haar wavelet decomposition to function. This application is expected to provide specialized services and information to the public both local and foreign people who want to get information about local woven fabrics Sumba.

***Keywords*—**Haar wavelet, texture, Sumba's woven fabric pattern.

I. Introduction

Imagery database is currently very widely used, from time to time its use continues to grow with more and more people are utilizing their usefulness. Its use varies depending on the application. Along with the continued development of the size of the base image data, the traditional methods commonly used in image retrieval is no longer possible to use, for example image search by keyword, sometimes the keyword (text) which we entered does not fit the image we expect that with provide keywords alone are not enough, should be developed with other methods for retrieving images that can be used as a substitute or added to the keyword system. For that developed a new method that Haar wavelet [1].

Sumba is one of the islands located in eastern Indonesia, precisely in the province of East Nusa Tenggara (NTT). The beauty of Sumba Island itself is already well known to every corner of the world, is evidenced by the many foreign tourists who come to enjoy the exotic island of Sumba [2].

Sumba Island has a lot of diversity of culture and tourism, one culture is no less interesting is the area Sumba woven fabric itself. Said to be interesting, because at every motif woven area will describe the culture at one of the area corresponding to the origin of manufacture of woven fabrics itself.

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Lack of information created in a variety of media to make the public cannot get information about the area Sumba woven fabric needs to be made clear that the alternative media to inform the promotion of regional Sumba woven fabric, so that the public and tourists can find local motifs woven fabric Sumba.

The formulation of the issues contained in this research is to find the image of homogeneous texture in the image and also to enter the library of image (base image data). Then, the use of wavelet decomposition function to get the value of wavelet coefficients, and the last step to get calculating the value of the distance between the image obtained from the value of the average (mean) and standard deviation of the results of wavelet decomposition functions. Boundary problem for the present study were, the image of the database used in the form of texture image and the non-textured with JPG or JPEG format that is in the current directory, then structural color for texture images are Red, Green, Blue (RGB) and homogeneous. The number of image texture that is used by 2 pieces of imagery, with the level of similarity that is different. The last is the number of results displayed image as much as 18 pieces of the image with the highest similarity value.

The purpose of this study was to test the effectiveness of using wavelet decomposition function in the process of matching the image against a database of images, especially the texture image (image with homogeneous texture). Getting the image of a texture similar to the texture image query with the same degree of truth with a similar image by the human eye sight and the last is to build an application program on a texture image by using wavelet decomposition functions.

II. Literature Review

The discovery occurred in early 1998 when Daubenchies create orthonormal wavelet family and compact support, the result is an inspiration from Meyer and Mallat [3]. A wave or wave is usually defined as an oscillation function of time (space) with the existing system. The system is defined as a unit consisting of one or two components or sub-systems that interact to achieve a goal. Of the many studies, could mean that the Haar wavelet transformation, there are two processes that should be carried forward transformation (decomposition) and inverse transformation (reconstruction) [4]. Forward transformation is useful to break the image. While the inverse transformation is the opposite, namely to reshape the image fragments from the process forward into a normal image (reconstruction) [5].

The division of the signal into high-frequency and low frequency in the filtering process high-pass filter and low-pass

filter called decomposition. The decomposition process starts by passing the signal from passing through high-pass filter and low-pass filter [6]. Each step in the transformation into account collection Haar wavelet coefficients and the set average. If a data set s_0, 〖〗 s _1, ..., s_ (N-1) contain elements N, there will be N / 2 average and N / 2 values of coefficients. The average is stored in the lower half of the unity of N and the coefficients are stored in the half on top.

The average becomes the input for the next step in the calculation of wavelet, which for iteration i + 1, N_ (i + 1) = N i / 2. Iteration-iteration continues until an average of single and single coefficients are calculated. It will replace a set of data origin of the elements of N to the average obtained, followed by a set of coefficients which measure is the increase in power of two (e.g., 2 ^ 0, 〖2〗 ^ 1, 〖2〗 ^ 2, ..., N / 2) [7].

A. Texture

According to [8], the texture analysis performs an important place in many tasks such as machine vision, scene classification, shape determination and image processing. The major application domains in texture analysis are Texture classification, Texture segmentation, Shape recovery. The problem in texture classification is that textures in real world are often not uniform due to variation in orientation, scale and other visual appearance [8].

B. PSNR (Peak Signal to Noise Ratio)

According to [9], PSNR is one of the parameters that can be used to quantify image quality. PSNR parameter is often used as a benchmark level of similarity between reconstructed image and the original image then the larger PSNR will produce better image quality.

C. Wavelet

Wavelet is a mathematical tool which is able to perform a function in the decomposition of the hierarchy. Wavelet can be used to describe a model or the original image into a mathematical function regardless of the shape of the model is an image, a curve, or a field [10]. The wavelet transform is a conversion function that can split function or signal in the frequency component or a different scale, and can further be studied each of the components with a specific resolution in accordance with the scale. Wavelet has many types depending on the function that uses as Haar wavelet, Wavelet Symlet, Deubechies Wavelet, Wavelet Coifflet, and so forth. In this research method used is the Haar wavelet.

D. Haar Wavelet Transformation

Wavelet transform data from spatial domain to the frequency domain and then store each component in accordance with the scale resolution. Wavelet has orthogonal basis in certain vector space. The simplest wavelet transform is the Haar wavelet [11]. General functions of the Haar wavelet can be seen in the equation 1.

$$\{\Psi_{k+1}(l)\}_{l=0}^{2^{k+1}-1} \quad (1)$$

where,

$$\{\Psi_k(l)\}_{l=0}^{2^k-1} \quad approx.signal \quad (2)$$

and

$$\{W_{k,l}\}_{l=0}^{2^k-1} \quad detail\ signal \quad (3)$$

As for the operator approximation (averaging) and operator details, as follows:

$$\Psi_k(l) = \frac{\Psi_{k+1}(2l)+\Psi_{k+1}(2l+1)}{2}, 0 \le l \le 2^k - 1, \quad (4)$$

$$W_{k,l} = \Psi_{k+1}(2l) - \Psi_{k+1}(2l+1), 0 \le l \le 2^k - 1. \quad (5)$$

E. Haar Wavelet Transformation for Image Decomposition

In image processing, correlation signal into sub-sampled signal is also called the decomposition process. Signals process decomposition with the Haar wavelet method can be used in the transformation of the image by applying wavelet decomposition in 2D. 2D wavelet decomposition process established through 1D Haar wavelet transformation.

The general shape of 1D Haar wavelet transformation is shown in Figure 1. The wavelet transform 1D can be extended to form a 2D wavelet transform using wavelet filters were separated. 2D wavelet can be calculated by applying a 1D transformation to all lines of the input image (the image length or dimension x), and then repeat it on all columns (the width of the image or dimensions) [12].

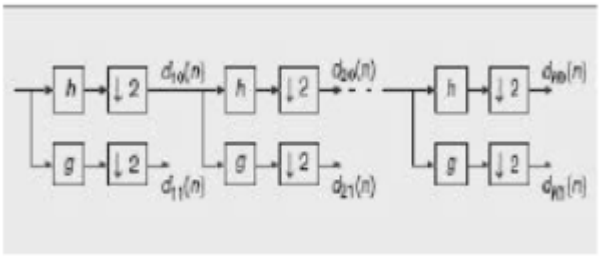

Fig. 1 Haar Wavelet 1D Decomposition

As an example, in Figure 2, which shows the first level (K = 1) of the wavelet transform 2D, with a corresponding notation in the image 4.

LL	LH
HL	HH

LL : *low-pass* result of the row and column
LH : the results forwarded to the *low-pass* to *high-pass* line against column
HL : *high-pass* result of the line followed by a *low-pass* against column
HH : *high-pass* result of the row and column

Fig. 2 Wavelet Decomposition at 2 Dimension on level 1

To make the process of Haar wavelet decomposition, then used the averaging method (average) and differencing (difference or difference) for each row and column of the image. Mathematically we can formulate a method of averaging and differencing.

F. RGB Color Model

In the RGB model, each color shows the spectral components of the primary red, green and blue. This model is based on a Cartesian coordinate system. The image that is represented in the RGB color model consists of three components of the image, respectively for each primary color (R, G, B). When displayed on a monitor RGB, three combinations of this image are in the phosphor screen to

produce a color composite image. The number of bits used to represent each pixel in RGB space called pixel depth. Note that the RGB images where each image of red, green, blue is the 8-bit image. Under conditions of each color pixel RGB then, triplet of values (RGB) has a depth of 24-bit (3-layer image with the number of bits per layer). A full-color image is often used to express the image of 24-bit RGB color. The total number of colors in a 24-bit image is (2 ^ 8) ^ 3 = 16,777,216 [13].

G. *Motive and Meaning of Sumba's Fabric*

On Sumba cloth, there are a variety of motives and meanings contained therein. For more details in about a variety of motifs Sumba, can be seen in Table 1.

Table 1. Motive and Meaning fabrics Sumba Ikat Weaving

No	Nama Kain	Keterangan
1.	Hinggi Kombu 	Dye: Kombu or Noni roots Used: as everyday clothing, clothing visit or visits, party wear traditional marriage or death, is now also used as souvenirs for the guests, acquaintances, or friends. Wear during ritual "marapu". Element motifs: horses, chickens. Philosophical meaning: shades horse is a symbol of virility, courage, prosperity and agility; chicken complexion symbolizes awareness, virility, a sign of life, it is expected the wearer look good and be respected.
2.	Hinggi Kawuru 	Dyes: indigo or indigo. Used: as everyday clothing, clothing visit or visits, party wear traditional marriage or death, is now also used as souvenirs for the guests, acquaintances, or friends. Wear during ritual "marapu". Motif elements: chicken, horses. Philosophical meaning: horse shades are placed on the cloth background blue color is a symbol of grandeur, greatness, pride, and social status.
3.	Hinggi Kombu 	Dye: kombu or noni roots. Use: as a body, had been wrapped in a sacred ritual. Philosophical meaning: magic, where the human figure in its clawed position waist is a symbol of the clan who has the task to resolve the rooftops.
4.	Kombu fabric Shrimps pattern 	Dye: kombu or noni roots. Used: as everyday clothing, clothing visit or visits, party wear traditional marriage or death, is now also used as souvenirs for the guests, acquaintances, or friends. Wear during ritual "marapu". Motif elements: shrimp. Philosophical meaning: the style shrimp is a symbol of the attitude of a leader who behaves mature or adult.

III. RESEARCH METHODOLOGY

The process flow system was first conducted by entering data in the form of image on Sumba's fabric cloth, namely Hinggi Kombu. Once the data is contained in a single folder cloth, the Haar wavelet decomposition process is done by using MATLAB. The results of the decomposition are then forwarded for part of the image to get approximation with its output forwarded by finding the mean and standard deviation, so the output is issued or produced was almost the same as the results of the data fabric first entered due to the higher value MSE greater the difference between the two images being compared. For more details, the overall process flow system in Figure 3.

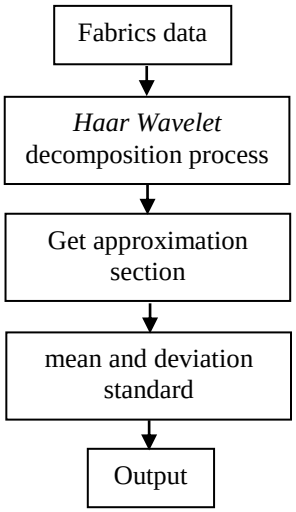

Fig. 3 Overall process flow system

The method used in the making of this study are:

1. Library Research Methods
   This method is used to search the literature or literature sources related to and reinforce the existing theories and obtain real data.
2. Data Collection Techniques
   The method used for the process of collecting data relevant to the process of triangulation, such as interviews, observation or observation, and documentation.
3. Data Analysis
   Analysis of the data in this study using quantitative methods conducted jointly with the way the data collection process to the stage of data collection, data reduction, data presentation, and decision-making or verification using MATLAB software version R2012b.

IV. RESULTS

Analysis of the old system work process flow for tourists or visitors who want to know the places producing woven fabric Sumba area:

1. The tourists or visitors coming to the island of Sumba who wish to buy or know the places manufacture of woven fabrics area by visiting the Office of Tourism East Nusa Tenggara province or hotels and inns that provide information about tourism and tourist spots producing woven fabric area.
2. The tourists can directly ask the locals about the places manufacture of woven fabrics area that they need.

Here is the algorithm of the program:
1. Read the variations of wavelet image;
2. The image is read and variations of wavelet-specified, then enter the picture;
3. Enter the level of decomposition;
4. Enter wavelet variation;
5. Decomposition calculated by MSE and PSNR parameter; and
6. Show results enter and plot.

Following the process by programming algorithm, it can be seen the results as shown in Figure 4.

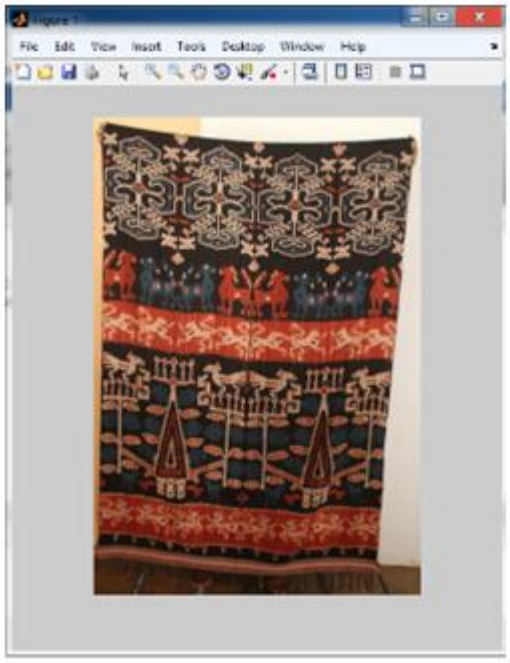

Fig. 4 Results Data Output be in the form of Image

Afterwards, see a comparison of the RGB colors that occur after the calculations performed MATLAB. The result can be seen in Figure 5.

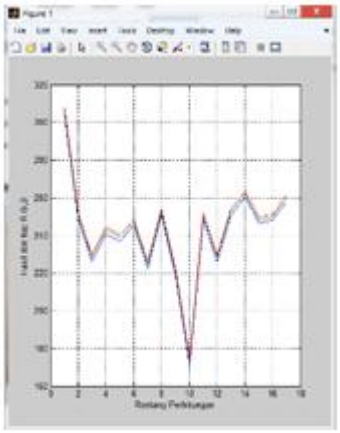

Fig. 5 RGB Color Comparison

After seeing the results of the comparison of RGB color, then the next is following the data presenting from RGB to the total and mean. These results can be seen in Figure 6. In Figure 6, it is clearly written comparison between the total and the mean on each color, either red, green, and blue. The results of the three colors are not too far away.

	Red	Green	Blue	total	mean
2	304.0769	306.3561	307.8214	918.2544	306.0848
3	248.4026	250.3293	251.7834	750.5153	250.1718
4	226.0983	228.2317	229.7723	684.1023	228.0341
5	240.6445	242.7778	244.3498	727.7721	242.5907
6	236.9181	239.1004	240.6765	716.695	238.8983
7	245.379	247.2161	248.6277	741.2228	247.0743
8	222.4987	224.516	226.0406	673.0553	224.3518
9	250.8519	252.8004	254.2334	757.8857	252.6286
10	218.068	220.0013	221.4539	659.5232	219.8411
11	171.1623	173.1393	174.6945	518.9961	172.9987
12	248.4026	250.3293	251.7834	750.5153	250.1718
13	226.0983	228.2317	229.7723	684.1023	228.0341
14	250.6846	252.4926	253.8839	757.0611	252.3537
15	260.1037	261.8931	263.2825	785.2794	261.7598
16	246.4849	248.308	249.7148	744.5078	248.1693
17	248.2499	249.9993	251.3339	749.5831	249.861
18	257.8956	260.1464	261.7321	779.7741	259.9247

Fig. 6 The Results of RGB Total and Mean

Further, it is looked at the analysis and standard deviation of PSNR. These results can be seen in Figure 7.

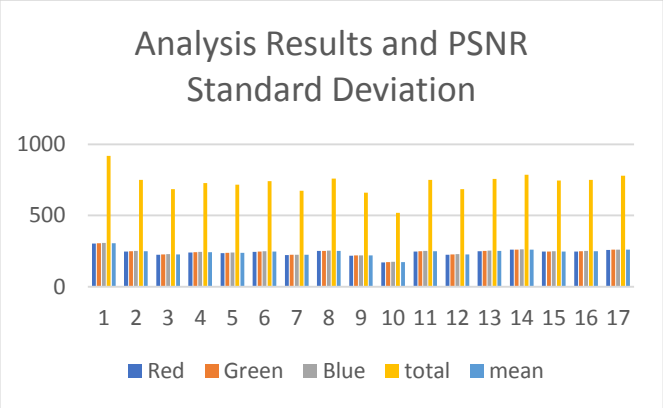

Fig. 7 Analysis Results and PSNR Standard Deviation

The results in Figure 4, is the result of the wavelet transform using the Haar wavelet method, where there are several parameters of measurement error or error in image processing. Two of the most common parameters used are Mean Square Error (MSE) and Peak Signal to Noise Ratio (PSNR).

In Figure 5, it can be seen that the results of the comparison between the R, G and B is not too far away, and at a certain point wavelet density very close distance. Although it is not always correlated with human visual perception, MSE is a good measure to measure the similarity of two images. Suppose we have two images f and g with dimensions as large M x N, the greater the value of MSE, the greater the difference between the two pieces of image comparison.

One more parameter measurement error is as good as Pict Signal to Noise Ratio (PSNR). Can be seen in Figure 6 the results of the R, G, B indicates that the overall total of R, G, B when averaged the results are more inclined to color G (green).

From Figure 7, it can be concluded that the total of the R, G, B greatly affect the mean will happen to PSNR is not very far from the range of R, G, B. Another case like MSE, PSNR larger value indicates a closer approximation to the units used PSNR is decibel (db).

V. Conclusion

From the experiments, can be concluded as follows that the results are obtained the wavelet transform using the Haar wavelet, where there are several parameters of measurement error or error in the processing of the image, but not affected by the dimensions of an image. Two of the most common parameters used are Mean Square Error (MSE) and Peak Signal to Noise Ratio (PSNR). Otherwise, the results of the comparison between the R, G and B is not too far away, and at a certain point wavelet density is very close distance. Although it is not always correlated with human visual perception, MSE is a good measure to measure the similarity of two images. The total of all the R, G, B when averaged the results are more inclined to color G (green). The total R, G, B greatly affect the mean will happen to PSNR, which is not very far from the range of R, G, B. Another case like MSE, PSNR larger value indicates a closer approximation to the units used PSNR is decibel (db).

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