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Image Segmentation Using Gabor Filter and K-Means Clustering Method

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ABSTRACT

Segmentation in digital images is a process to separate an object from a background so that the object can be processed for other purposes. Often also used in supporting technology related to the image to find the desired result point and solve the problem of image segmentation. Segmentation is an important step in processing object recognition in image images, so some areas like health, chemical industry, and some other fields desperately need this technique. The purpose of this research is to analyze the result of image segmentation using Gabor Filter and K-means Clustering method which is used to assist the initial process of image segmentation. Several studies have been produced and developed in relation to this field and produce quality output. This is a challenge for researchers to continue the research history of advanced image processing to improve the quality of research results obtained and increasingly shows the seriousness of interest of researchers in this field including the field of image processing. In the image segmentation research, the segmentation used the K-means Clustering method, while the feature extraction method uses Gabor filter.

I. INTRODUCTION

The modern era is like the use of computers is a common thing and even can be said to be a vital need for human life. This is natural because computer advantage can be relied upon to help facilitate human work. Digital image processing requires a preprocessing process which will then be used for other processes. The process is segmentation. Segmentation is the first step and becomes an important key in an object recognition (object recognition). The segmentation process is a process to separate between one object with another object. Segmentation is the first step and becomes the key. Image segmentation is a clustering technique for an image, is a process of dividing the image into regions having similar features such as grayscale, texture, color, motion[1].

Image segmentation based on texture feature imagery, grouping it using repeating patterns in pixels in the image. The texture is a function of the spatial variation of pixel intensity in the image. Based on its structure the texture can be divided into macro structure textures and microstructures. The macro structure texture has periodic pattern repetition in a segmentation. Achieve this method has one weakness that is the excessive segmentation (over segmentation). Therefore, before making a transformation, a preprocessing is required and one of the techniques used is noise reduction. Noise Reduction is a process of reducing the noise of a signal, usually appearing as a result of poor sampling or due to transmission lines during data transmission. Some types of noise that usually encountered are salt and pepper, impulse, and Gaussian. There is two kinds of noise reduction in the intensity filtering, namely high pass filtering and low pass filtering process segmentation method to separate an object from the background, so that the object can be processed for other purposes.

The digital image is a matrix consisting of lines and columns where each pair of row index and column index declare an image point. The value of each matrix represents the point brightness value. With the processing of the segmentation, each object in the image can be taken individually so that it can be used as a process input. Segmentation is the process of partitioning the image into several regions or objects. Image segmentation is an important basic work, done to separate objects, which will then be used in the process of image analysis.

II. RELATED RESEARCH

Image Based Image Segmentation Based on Texture Features Using Gabor Filter Method and K-Means Clustering. The purpose of this research is to analyze the result of segmentation with Gabor filter method and K-means Clustering where this method is used to assist the initial process of image segmentation based on the texture feature of each dataset[1].

The K-Means method is also used to find tumors in the medical system both on images of common diseases and on special illness images, medical images that often require grouping of CT Scans of microscopic images, diagnostic images and so on. This research concept is very effective to use in dataset because it is often the pattern of the medical image that is very difficult to be understood by ordinary eye

without a tool, while the tool itself works based on certain cluster method that can translate the image into a diagnosis decision assistant. The research on medical data generates something useful for the health field and makes it one of the increasing factors of medical treatment that has large-scale data.

Similar research also suggests that image segmentation is of paramount importance in research in the field of image processing in the medical field, this becomes very important when paramedics require decisions that require certain actions in patients, this study leads to detection of tumor disease indicated by the detection Abnormal tissue in the body [16], this study claims that the K-means method has a simpler things on processing than the fuzzy method, of course with better and more efficient results. So important the research field of image processing that can not be separated from daily life.

A. Image Segmentation

Image segmentation technique is based on two basic properties of gray level values, discontinuities, and similarities between pixels. In the first form, image separation is based on the abrupt change in the gray level. Examples that use such an approach are line detectors and edge detectors in images.

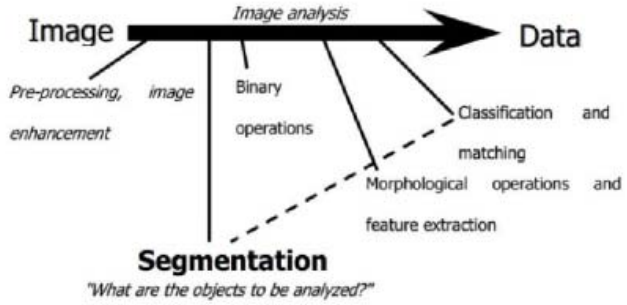


Figure 1. Process Segmentation

The second way is based on the similarity between pixels in an area. Examples that use such an approach are line detectors and edge detectors in images. The second way is based on the similarity between pixels in an area. Included in this second way are :

1. Mining by the histogram.
2. Growth area.
3. Separation and merging of areas.
4. Grouping or classification.
5. Graph theory approach.
6. A knowledge-based or rule-based approach.

The process of image segmentation can be done by applying the existing methods. Many methods can be used such as Gabor Filter method, GLCM method, Wavelet method, Region Growing method, K-means Clustering method, Mean Shift Clustering method, and so on. This research uses Filter Gabor method because it has similarity as detecting an edge in an image but this method is expected more to be used in representing texture feature. While the method of K-means Clustering in this research is used to classify a data into several clusters (clusters). Each cluster has a centroid that represents the cluster.

Based on the technique used, segmentation can be divided into four categories, are :

1. Techniques of thresholding.
2. Boundary method.
3. Area-based methods.
4. Hybrid methods that combine boundary and area criteria.

Segmentation can be done as a first step to implementing object classification. After image segmentation is implemented, the features contained in the object are taken. Next, through the classification, the type of object can be determined.

B. *Segmentation K – Means Clustering*

Segmentation is a technique for dividing and categorizing image into several parts of the region, where each region has similarity attributes but the result of attributes are not the same.

K-means clustering is one of the non-hierarchical data clustering methods that classify data in the form of one or more clusters / groups. The data that have the same characteristics are grouped in one cluster / group and the data having different characteristics are grouped with other clusters / groups so that the data in one cluster / group has small variation level. Here's the Formula K-Means Clustering.

$$d_{ij} = \sqrt{\sum_{k=1}^{p} \{x_{ik} - x_{jk}\}}$$

Formula :

d_{ij} : Distance Object of Between i and j.
P : Dimension of Data.
X_{ik} : Coordinate of Object i on Dimension k.
X_{jk} : Coordinate of Object j on Dimension k.

There are many methods in the development of clustering machines that make many choices for researchers who need methods according to the dataset clustering, clustering is often used for unsupervised data (grouping pixels with common characters) and being a reference to any problem that concerns data in this case image, K -Means Clustering in image image classification groups each pixel cooled and included in the Cluster parameter.

1. The value of K must be determined first (k = number of groups).
2. Determining the random value that is the center of the group.

3. Calculate the distance of the matrix using euclidean distance.
4. Move the center of the group.
5. Return to step 3 until there is no change.

The application of K-means Clustering uses the theories that have been proposed. As follows:

1. Distance space is used to calculate the distance between data and centroid.
2. Data allocation using K-means Cluster method.

C. Feature Extraction

Extraction features are generally grounded by two pixel criteria, a). Similarity and b) The proximity of pixel values. The similarity criteria are based on the gray value range of the feature corresponding to the treshold to separate the image data background. So the extraction feature can be interpreted as a process to get distinguishing features that distinguish an object from another object.

D. Citra Red, Green, Blue

Image is another term for images as one of the multimedia components that play a very important role as a form of visual information. The image has characteristics that are not owned by text data, that is rich image with information. From a mathematical point of view, the image is a continuous function of the light intensity in the dwimatra plane. Light source illuminates the object, the object reflects back part of the beam.

Figure 2. Result Citra RGB color dased.

The image as the output of a data recording system can be, among other things:

1. Optical in the form of photo.
2. Analog is a video signal like the image on the television monitor.
3. Digital that can be directly stored on a magnetic tape.

E. Image Decomposition

Process of image image processing a filtering is a technique used to improve image image quality. A filter used in this process is an example of a Gabor filter. The Gabor Filter Function is specifically used for analysis of image textures containing high frequency orientations and characteristic specifications.

F. Gabor Filter

Gabor filter mainly provides means for better spatial localization. The main intention of employing Gabor filter is for texture segmentation. Filter Gabor is a Gaussian function that is multiplied by the harmonic function.

Filters Gabor focus on a specific range of frequencies. If the input image contains two different texture areas, the local frequency difference between regions will detect the texture in one or more sub-image output filters. The basic Gabor function can perform space decomposition. Each Gabor Filter is determined by the basic Gabor functionality. In general the Gabor 2-D function is defined as follows:

$$g(x,y) = \exp\left(-\left(\left(\frac{a}{2\sigma}\right) + \gamma^2\left(\frac{b}{2\sigma}\right)\right)^2\right) * xcos\left(\frac{2\pi}{\lambda}(xcos\theta + ysin\theta) + \phi\right)$$

Formula:

a = $(x \sin \theta + y \sin \theta)^2$
b = $(-x \sin \theta + y \sin \theta)^2$
σ = Bandwith gives the effect value of the width of an image.
λ = Lambda states the wavelength of an image.
θ = Theta stating the angle of an image.
γ = Gamma the brightness of an image.
ϕ = Phase states the shape of an image.

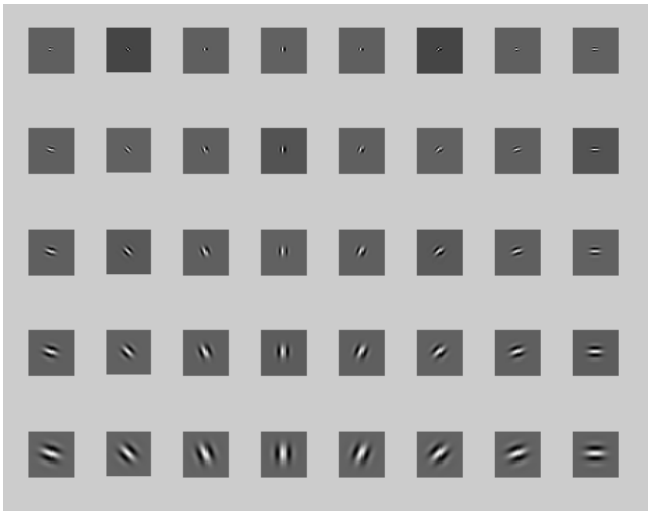


Figure 3. Filter Gabor.

This recurrence process begins by determining arbitrarily the positions of the established group centers. Furthermore, membership of each individual data based on the shortest distance to the centers.

III. IMPLEMENTATION

In this section of the implementation will be discussed about the explanation of steps in processing the dataset, this stage includes the selection of image media as a research dataset and then file processing such as classification pattern

recognition process, measurement methods and results, the quality of information on image segmentation using Gabor Filter And the K-Means Clustering method.

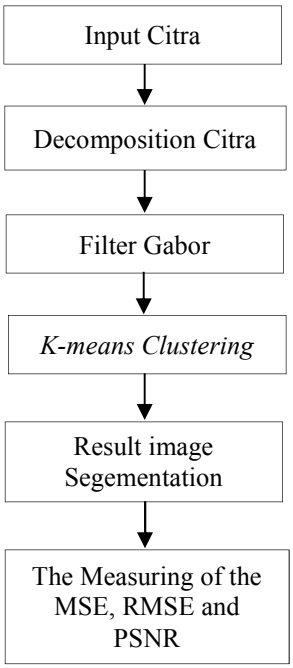


Figure 4. Implementations of step segmentation .

A. Dataset

In this study selected images that have high complexity performance accuracy of K - Means method. The K - Means method takes several steps in the process of classification of text, the stage of making specific color transformation structures, and classification phase, at the stage of the process of analyzing image of rambutan samples for gabor filters.

B. Steps experiment K-means Clustering

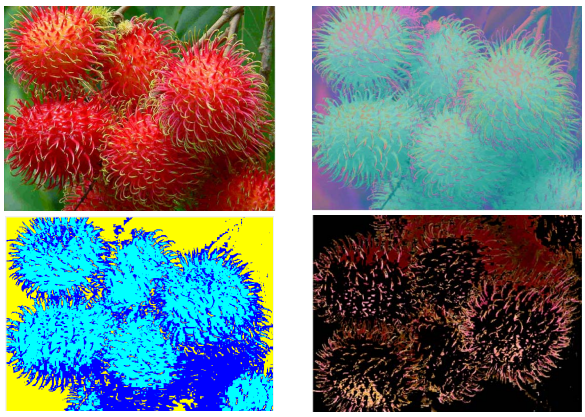


Figure 5. Datatest K-Means Clustering.

The image segmentation process in Figure 1 represents the formation of the row and column vector sizes of the image.

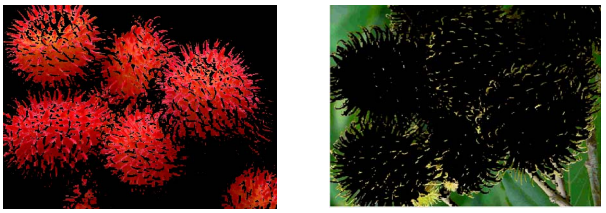


Figure 6. Datatest K-Means Clustering.

Classification using K-Means Clustering good results.

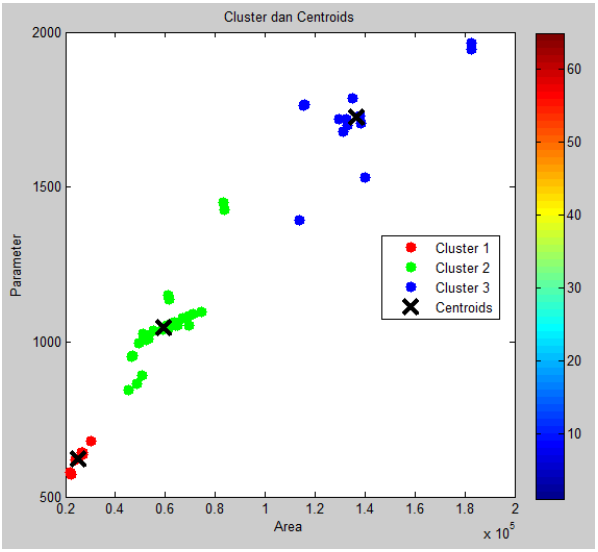
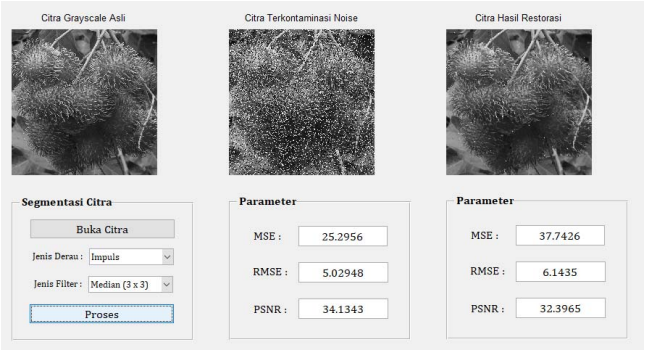


Figure 7. Results iteration of K-means Clustering.

Results iteration:
3 iterations, total sum of distances = 9.23678e+09.
8 iterations, total sum of distances = 9.23678e+09.
4 iterations, total sum of distances = 9.23678e+09.
4 iterations, total sum of distances = 9.23678e+09.
2 iterations, total sum of distances = 9.23678e+09.

IV. THE RESULT OF THE EXPERIMENT

From the result as presented in the previous chapter, the authors can draw the following conclusions:



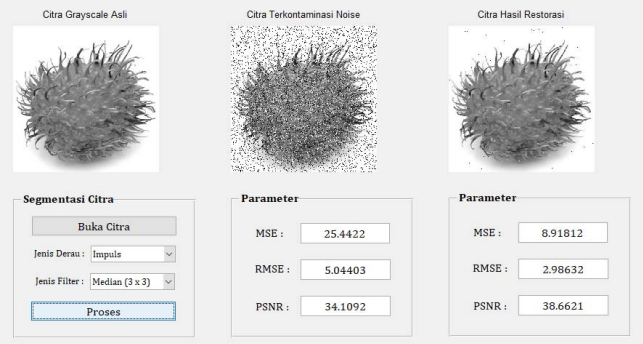


Figure 8. The Measuring of the MSE, RMSE and PSNR.

Research that has been done and test it can be concluded that texture feature extraction can be done using Filter Gabor method and continued with image segmentation process using K-means Clustering method with parameter mean square error (MSE), RMSE and PNSR.

REFERENCES

[1] VijayaLakshmi, Balasubramanian Mohan, Vasudev, "Kernel-based PSO and FRVM: An automatic plant leaf type detection using texture, shape, and color features" (April 2016): 99-112. 2016

[2] Zhen, Wu Zhe, XU, "SIFT Feature Extraction Algorithm for Image in DCT Domain", Texas A & M University, 2013.

[3] Padmo, Amin A.M dan Murinto, "Segmentasi Citra Batik Berdasarkan Fitur Tekstur Menggunakan Metode *Filter Gabor* dan *K-Means Clustering"*. Vol. 10. 2016.

[4] A.K. Jain, F. Farrokhnia, "Unsupervised Texture Segmentation Using Gabor Filters", Pattern Recognition, Vol. 24, 1991, pp. 1167-1186. 2014.

[5] Galar, Mikel Derrac, "A survey of fingerprint classification Part I: Taxonomies on feature extraction methods and learning models", Informatic engineering. 2015.

[6] Mater, Alma Universit, Studiorum, "Fingerprint Recognition : Enhancement , Feature Extraction and Automatic Evaluation of Algorithms" Internetional Conference on Computer Information System and Industrial Management Applications, IEEE 2012.

[7] Sughandi Vij, Dr. Sandeep Sharma, Chetan Marwaha,"Performance *Evaluation of Color Image Segmentation using K-Means Clustering and* Watershed Technique," IEE E - 31661, 2013.

[8] Zhen, Wu Zhe, XU. "SIFT Feature Extraction Algorithm for Image in DCT Domain". N. Seo, Texture Segmentation using Gabor Filters, ENEE731 Project, 2013.

[9] Witeti, "Identifikasi Sel Kanker Prostat Menggunakan Metode Segmentasi Berdasar Ukuran Objek Pada Citra". Teknik Elektro Universitas Diponegoro. Semarang. 2013.

[10] Zhang, Liankuan Weckler, "Individual leaf identification from horticultural crop images based on the leaf skeleton*"*, 27 (1-2), 59-68. 2016.

[11] L Amia Jaafar Belaid, Walid Mourou, "I*mage Segmentation: A Watershed Transformation Algorithm*, on Image Anal Sterol". 2013.

[12] Dariusz Malyszko, Slawomir T. Wierzchon, "Standard and Genetic *k*-means Clustering Techniques in Image Segmentation," Internetional Conference on Computer Information System and

[13] Industrial Management Applications, IEEE 2016. Sughandi Vij, Dr. Sandeep Sharma, Chetan Marwaha,"Performance Evaluation of Color Image Segmentation using K Means Clustering and

[14] Watershed Technique," IEE E – 31661, "Suman Tatiraju, Avi Mehta. "Image Segmentation using k-means clusteing, EM and Normalized Cuts". 2013.

[15] Piyush M Patel Brijesh N Shah, Vandana Shah, "Image segmentation using K-mean clustering for finding tumor in medical application" -. IJCTT Vol. 4 2231-2803. 2013.

[16] M Masroor Ahmed, Dzulkifli Bin Mohamad. Segmentation of Brain MR "Image for Tumor Extraction by Combining Kmeans Clustering and Perona-Malik Anisotropic Diffusion Model. International Journal of Image Processing". Vol. 2. 2014.

[17] Suman Tatiraju, Avi Mehta. "Image Segmentation using K-Means clustering, EM and Normalized Cuts International Journal of Image Processing". Vol. 2. 2014.