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A Review Application Of Image Segmentation On Statistical Texture Analysis

Sabiq Adzhani Hammam[1], Tito Waluyo Purboyo[2] and Randy Erfa Saputra[3]

[1]*College Student, Faculty of Electrical Engineering, Telkom University, Bandung, Indonesia.*

[2]*Lecturer, Faculty of Electrical Engineering, Telkom University, Bandung, Indonesia.*

[3]*Lecturer, Faculty of Electrical Engineering, Telkom University, Bandung, Indonesia.*

Abstract

Image processing is becoming very important. A lot of data from an image is then removed, which will be used for identification or coverage. One of image processing technique that is often used today is image segmentation. Image segmentation is used as the first step to separate objects from the background, so the object can be processed for other purposes. Texture analysis is the development of science from image segmentation. The first part of this paper describes the segmentation of images in general, then continued with an explanation of image segmentation in general. Then explain the image segmentation. There are many application could be used for image segmentation based on obtained method: Segmentation On Cancer, Segmentation On Medical Resonance Image, and Segmentation On Texture Batik. The last part of this paper will explain the future work on image segmentation.

Keywords: Image Segmentation, Texture Analysis, Medical Resonance Image, Cancer, Batik

INTRODUCTION

Image segmentation is a stage that was first performed before the image analysis stage in the process of image recognition of a particular input. The function of image segmentation that divides the image of its territories (region) based on the similarity in its kind in the form of textures, colors, shapes, and etc. Implementation of common image segmentation among others can be found in facial recognition application, fruit quality detection, canned food industry, batik industry, and so forth. Many methods are used for image segmentation in texture statistical analysis. From several methods, the application of image segmentation could be applied in many fields like medical image, cancer, and texture. Text -based on images segmentation, grouping it using repeating patterns of pixels in the image. The texture is a function of the spatial variation in pixel intensity in the image. Based on its structure the texture can be divided into macrostructural textures and microstructures. The macrostructural texture has periodic pattern repetition of an area, usually present in man-made patterns and tends to be easily represented mathematically. While the texture of microstructure has a loop that is not clear so it is not easy to provide a comprehensive texture definition. The difficulty in the process of grouping the usual image textures is to define the texture boundaries since the boundaries between textures are often unclear. So the process of segmentation is needed to perform the separation or grouping objects properly so the next result obtained good results. In addition, there are two things that refer to image segmentation based on statistical analysis of textures, namely: (1) Analysis of surface roughness level and (2) pattern structures analysis and orientation. These two things have become the basis for the development of image segmentation based on statistical analysis of textures. The purpose of image segmentation is to recognize patterns of the image. Image segmentation methods need development that is in it to be able to process further using image segmentation based on statistical analysis of texture. By using the development of the results of image segmentation can be implemented in the process of classification and identification of an image.

Concept of Texture Image Segmentation

In general, the concept of image segmentation is to partition an image into regions or components that do not overlap. These regions should be homogeneous and uniform like Gray Levels and its texture. Segmentation is also commonly done as a first step to implementing object classification. After image segmentation is implemented, the features contained in the image can be taken and classified.

The process of segmentation includes two activities: Pre-processing and feature extraction based on statistical methods contained in the texture. This process is a preliminary process to get the feature value contained in the image taken and used for the process of pattern recognition and classification.

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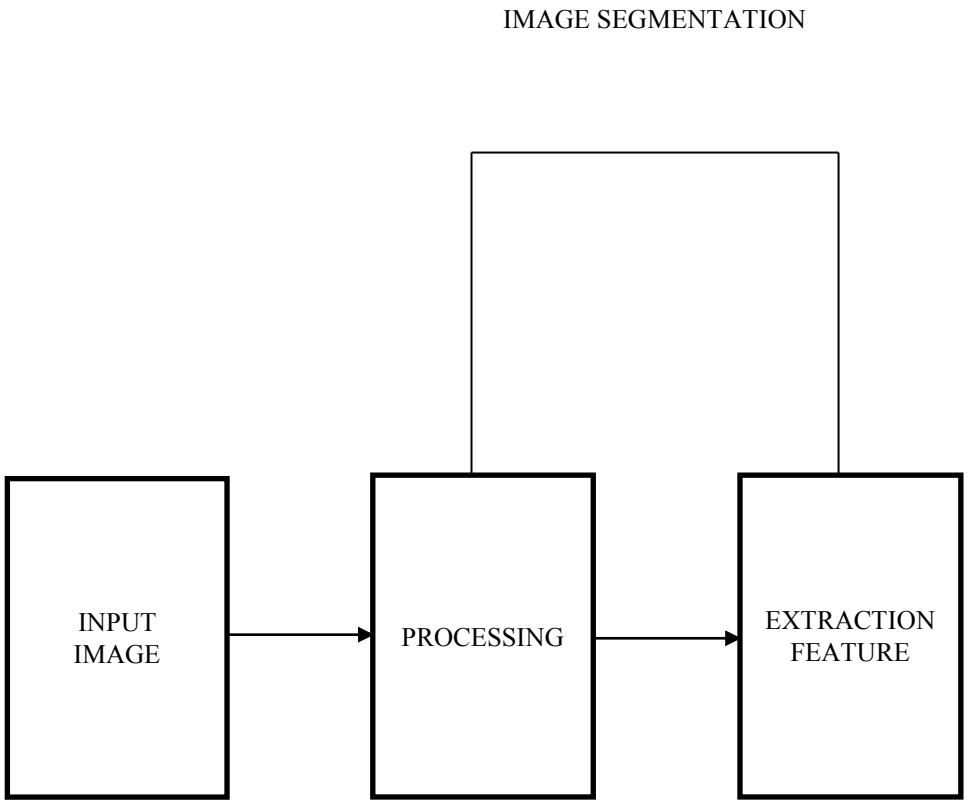

Figure 1: Stage Of Image Segmentation

In the figure 1, pre-processing in the image segmentation, there is a process of converting the original image into a grayscale image to get the matrix value of the image that has the intensity of gray level color level between 0-255. The matrix value of the grayscale image is reduced by its intensity level using image normalization in order to facilitate the feature extraction process. The pre-processing imagery will search for feature values using feature extraction based on statistical methods.

The most widely used segmentation technique in computer vision is some kind of approach. Especially in the segmentation of the image, namely:

Segmentation Based On Region

Segmentation Based on Region is used to try to find partitions of pixel images to match the coherent image properties such as brightness, color, and texture.

Segmentation Based On Contour

Segmentation Based On Contour first steps is edge detection, then connecting process that tries to take advantage of continuity of curve.

Segmentation Based On Edge

Segmentation Based On Edge is generally based on discontinuity and similarity of pixel intensity. Discontinuity serves to partition the image in case of sudden changes in intensity, while similarity serves to partition the similarity in certain properties.

Segmentation Based On Hybrid

Segmentation Based On Hybrid aims to gain segmentation with closed and continuous areas.

Texture Image Segmentation On Statistic Texture Analysis

In general, texture analysis refers to repetition the texture of the image or commonly called the texture element. The terms of the formation of image texture:

1. The existence of primitive patterns of one or more pixels. These primitive patterns can be a point, a straight line, a curve, an area and others that are the basic elements of a form.
2. Primitive patterns appear repeatedly with a certain distance and direction so that it can be predicted or found characteristic repetition.

Note before, intensity variations are more important than color, so for statistical texture analysis used a gray-level image, obtained from the luminance component of the color image. A frequent approach to statistical texture analysis based on statistical characteristics is the intensity distribution of an area, which can be measured by the intensity histogram and the nth moment of the mean:

$$\boldsymbol{M_n = \sum_{i=0}^{L-1}(i-\mu)^n p(i)}$$

Where is the independent variable for the i-h intensity, L-1 is the maximum intensity of the image (= 255 because L = 2n, for the gray level image n = 8 bits) and p (i) is the normalized histogram in the region of analysis μ is the mean value intensity.

$$\mu = \sum_{i=0}^{L-1} i \, . \, p(i)$$

Using the above equations, the variables measured in the analysis of statistical texture characteristics are shown in the following table:

Application Of Image Segmentation Methods

Image Segmentation On Breast Cancer

Breast cancer is the second most common cause of death among women. With image processing technology, early detection of breast cancer can be prevented by using existing techniques on image processing that is segmentation. Segmentation is the first step to detect breast cancer. Before segmenting, a mamography image is required. A mamography image is an important tool in radiologist science and is dedicated to detecting breast cancer. However, according to radiologist if only using mamography image alone still detection failure, 10% to 30%. Therefore, it is necessary various methods for detection of breast cancer one of them is segmentation to breast cancer mammographi image.[3]

In segmentation testing on breast cancer used 640 mammography images. Then do the pre-processing method based on wavelet transform and Wiener filtering to eliminate noise and improved image quality. After that is applied segmentation method based on the genetic algorithm used for segmentation of suspicious region. Results of the experiment showed results Overlap Measure Area (AOM) of 0.79 and a degree of False Positive (FP) / image is then obtained sensitivities 1.35 amount 95%. With the results of such detection shows that this method can help radiologist in detecting breast cancer.

Table 1: Characteristic Texture

Moment	Formula	Texture Characteristic
Mean	$\mu = \sum_{i=0}^{L-1} i \, . \, p(i)$	Calculate Average Image Area Intensity
2nd Moment or Standart Deviation	$\sigma = \sqrt{M_2}$	Calculate Average Image Area Contrast
Smoothness or Roughness	$R = \frac{\sigma}{1 + \sigma}$	Calculate smoothness or Roughness Region surface. R = 0, the surface intensity is flat or homogeny region. R approaches 1, the surface of the region is rough or has variations in intensity or high contrast
3rd Moment or Skewness	$M_3 = \sum_{i=0}^{n}(i-\mu)^3$ p(i)	Measure the level of histogram symmetry or bias of intensity distribution to the position of the mean value of M skewness 0, the intensity distribution <m. Positive skewness, the histogram tends to extend to the right, as opposed to the left-leaning
Uniformity	$U = \sum_{i=0}^{n} p^2(i)$	Measure Uniformity of intensity values. U maximum (U = 1) if all pixels in the area have the same intensity value
Entropy	$E = -\sum_{i=0}^{L-1} p(i) Log_2 p(i)$	Measurethe level of randomness intensity. E max if the pixels in the area have a random value E = 0 if all the pixels have the same intensity

Image Segmentation On Lung Cancer

Lung cancer such as carcinoma, adenocarcinoma and squamous cell carcinoma is the highest type of lung cancer among other lung cancers. The detection of lung cancer at the wrong time causes the survival of lung cancer patients to decline. This is related to their cellular characteristics in which general lung cancer has 4 stages. The need for image segmentation, in this case, is used for early steps in early detection, providing accurate results, releasing overall features of lung cancer and finding out whether or not the cancer cells came out of the specimen. In lung cancer segmentation image file used is image file Computerized Tomography (CT).[4]

The process of CT image segmentation in lung cancer uses the thresholding and watershed segmentation technique used to produce the resultant output. Segmented images can be processed and identification of lung cancer cells.

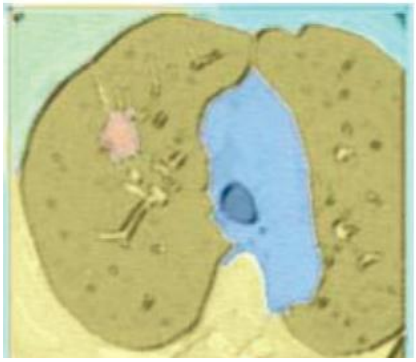

Figure 1: Image After Segmentation

The peach color on the lung CT image above shows the affected part of cancer. It is known that the size of cancer cells in normal lung CT images is 20mm and if more than 20mm can be ascertained there are cancer cells in the lungs. Thus, the segmentation of CT images using thresholding and watershed segmentation techniques is well used for early detection of cancer cells in the lungs.

Segmentation On Medical Image

Image segmentation is an important stage for most of the Medical Resonance Image (MRI) tasks. If you have a good segmentation of MRI it will be advantageous in medical science as information in the implementation of surgical illness, 3-D image visualization, and early detection. The most commonly used segmentation technique in MRI is watershed segmentation. The advantage of the watershed segmentation technique is the quick-to-complete, simple, deep-processing, and highly intuitive segmentation method. In addition, watershed segmentation is able to partition an image with less contrast and does not need to do post-processing. In addition, to improve the quality of watershed segmentation, K-Means Clustering is used to generate primary segmentation before segmenting watershed.[5]

In the application of segmentation in MRI image using 50 2-D images got image segmentation map. Then both methods are compared to divide the partition of each region that has been segmented. There are 44 segmentation results that generate 90-95% initial partitions that have been combined and have 6 segmented image yields that produce 85-90%. The use of K-Means Clustering and Watershed segmentation techniques to reduce excess segmentation in MRI imagery.

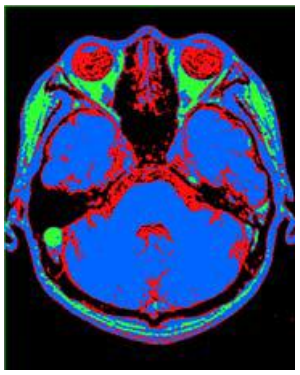

Figure 2: MRI After K-Means Clustering

In figure 2, it is the result of segmentation of K-means clustering that produces the image of primary segmentation. The above MRI image results have not been combined with the watershed segmentation technique.

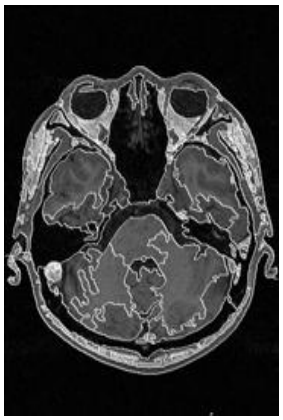

Figure 3: Final Segmentation

In Figure 3, the final segmentation of the MRI image combines the segmentation results of K-means Clustering and enhanced the quality of segmentation by watershed segmentation.

Segmentation On Batik

Batik is a fabric that is not uniform but contains variations in color intensity to form a repetitive pattern. So that the image

on batik can be in segmentation using the specified segmentation technique. Because the pattern of batik texture is progressing very rapidly so that new batik patterns emerge. So, for now, the image segmentation of batik is the hardest job, the thing that makes it difficult is the image of batik natural color is very different from the special coloring technique. However, the image that has a structured pattern can be segmented.[1]

The image segmentation is performed to identify the batik image testing and training. Segmentation technique used is the Hidden Markov Tree (HMT), the technique is used to classify between interscale clustering and interscale persistence. The result of batik image segmentation using HMTseg algorithm release 80% accuracy by testing 20 batik images stored in data set and 10 batik image that will be determined its type.

Segmentation On Bone Image

Image segmentation on the bone is used for biomedical analysis purposes. Cartilage image analysis would be a mistake to process all bone cross-section taken from bone specimens.[6] New advances in technology make analyzes of bone imagery easier for biomedical work. The results of image segmentation on bone are used to determine changes in bone, whether bone imagery displays suspicious regions or displays the perfect region on bone imagery.

Table Application Image Segmentation

Table 2: Table Comparison Application Image Segmentation of Practical Use

Application Image Segmentation	Type	Information
Segmentation On Breast Cancer	Cancer	Segmentation on breast cancer with 1,35 FP/Image and 95% sensitivity
Segmentation On Lung Cancer	Cancer	Segmentation on lung cancer show affected of cancer with lesion size over 20mm
Segmentation On Medical Image	Medical Image	Segmentation on medical image got 44 images with 95% initial partitions and 80% of 6 images segmented from initial partitions
Segmentation On Texture Batik	Texture	Segmentation on texture batik with technique Hidden Markov Tree(HMT) and get 80% accuracy
Segmentation On Bone Image	Medical Image	Segmentation on bone images to determine changes in bone, whether bone displays suspicious regions or perfect region on bone image

FUTURE SCOPE

Application of image segmentation in certain fields can be a reference to conduct further research on the implementation of image segmentation to other fields. It is expected that the Application of image segmentation is not only applied to Medical Image, Cancer, and Texture but in various aspects of life that will continue to be developed. To the future, image segmentation techniques will develop in such a way and generate new image segmentation techniques.

CONCLUSION

The advantage Application of image segmentation is that the segmented image can produce an accurate identification and precise classification of the image. In this paper has been described a various application of image segmentation to various fields, namely: Medical Image, Cancer, and Texture. The segmented image will output the results of the data that makes the instructions for the next process.

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