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BREAST TUMOR DETECTION USING HAAR-LIKE FEATURE METHOD ON ULTRASONOGRAPHY (USG) IMAGING

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Abstract— Breast tumor can be diagnose by using ultrasound examination (USG). USG is very important to obtaining images of structure, pattern, shape and size of lesion. A pattern is an undefined entity that can be identified using its feature. From the available methods, Haar-Like Feature is the most appropriate method for analyzing textures. This method uses a trainer method called cascade trainer that functions as an input parameter for the detection function. Breast tumor detection is done by calculating the difference number of each pixel in ROI area at a nearby location and obtained an accuracy of 81.17%.

Keywords— Breast tumor; ultrasonography; haar-like feature; cascade trainer; thresholding segmentation; spatial resolution;

I. INTRODUCTION

Breast is a female organ that often found abnormalities such as a mass or node called a tumor. Breast tumors are grouped into benign and malignant or cancer. The diagnosis of breast tumor can be done by triple test approach that is clinical, mammography, and fine needle aspiration citology [1]. Because mammography facilities doesn't exist in all regions so ultrasonography (USG) can be used as an alternative. Breast tumor detection through ultrasound image still has the disadvantage that some medical practitioners such as radiologist specialist still rely on visual observation in image reading so that only get subjective result so as to make possible mistake in making the diagnosis. A good imaging must followed by a good image analysis process, to obtain an accurate and informative diagnosis. Therefore, we need a computer software system that can identify breast tumor effectively, quickly, and accurately. Ultrasound examination is essential for obtaining images of structure, pattern, shape and size of lesion. A pattern is an undefined entity and can be identified using its feature. Feature extraction can be done with several methods such as Haar-Like Feature, gabor filters and artificial neural networks.

From the available methods, Haar-Like Feature is the most appropriate method for analyzing textures. This method uses a trainer method called cascade trainer that functions as an input parameter for the detection function. Related studies that used Haar-Like Feature in object detection through feature extraction and produce good results. Feature extraction with image reading stage, determination of ROI (region of interest), ROI image improvement, wavelet decomposition and identification obtained 86% accuracy with error ratio of 14% [2]. In the face recognition system, Haar-Like Feature gives a specific indication of an image. The characteristics used include skin color, facial texture, and facial geometry. In this system generated an average error value of 2% [3]. The process of object detection using the Haar-Like Feature method can also be done by classifying an image after the previous classifier is formed from the training image. This method produces an accuracy of 95% [4]. Ultrasound breast tumor detection is performed by calculating the difference in the number of each pixel in an adjacent ROI area at a particular location. Haar-Like Feature Method is a method that uses statistical model (classifier). The approach to detecting objects in an image combines the four main concepts of data training, simple rectangular features, integral images, and cascade classifier so that during the detection process can produce high accuracy so that the decision will be obtained the best decision for patients [5]. The purpose of this study was to develop the Haar-Like Feature method to detect the type of tumor in the image of breast ultrasound automatically.

II. METHOD

The initial process in this study used the cascade trainer function. All imagery to be used is added to the training program consisting of 3 (three) stages:

1. Menginput positive image and determine the Region of Interest (ROI) on each image,
2. Input negative image. A negative image is an image that has no object to be recognized,
3. Train the image that has been inputted to the cascade trainer.

The output of the cascade trainer function is an XML file (Extensible Markup Language). This file functions as an input parameter on the cascade object detector function. Next, segmentation of the tumor image by thresholding operation produces a binary image, with the object represented by pixels of value 1 (white), while the background is represented by a pixel of 0 (black). After that performed morphological operations that aim to improve the results of segmentation and eliminate the noise that appears. The image of the morphological operation output is then calculated. Broad calculation is done by counting the number of pixels that make up the object in the binary image and then divided by the spatial resolution of the image. The image spatial resolution is represented by Equation 1.

$$\text{Spatial resolution} = \frac{\text{number of pixels}}{\text{unit length}} \quad \textbf{(Equation 1)}$$

III. RESULT AND DISCUSSION

Breast tumor detection on ultrasound images of Haar-Like Feature method is done through two processes, namely the training process and the test process. In the training process, all input images are trained on the cascade trainer with positive image input stage, determining the region of interest (ROI) and negative image input. In each positive image is determined the area that will be the focus to be processed ie the location of the tumor. ROI stage can be seen in Figure 1. After ROI in each image is determined, then negative image input and train all images using feature type Haar and obtained an XML data that serves as the input parameter on the cascade object detector function.

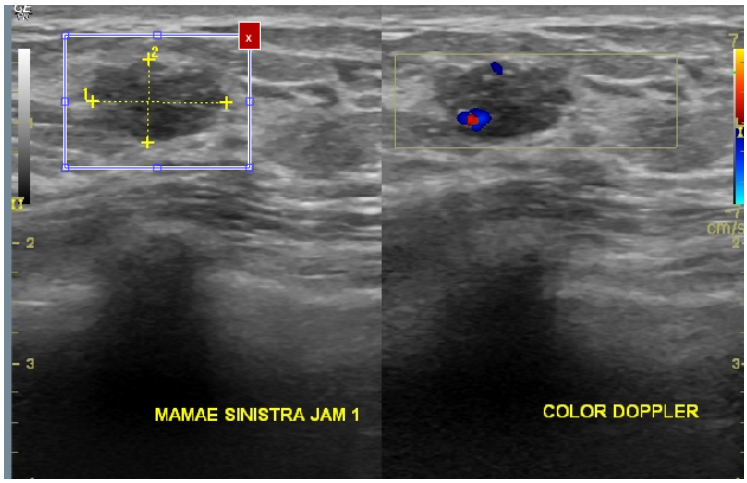

Figure 1. Determination of ROI on cascade trainer

In the test process segmentation stage is performed on the image of the tumor with thresholding operation that produces binary image, with the object represented by pixel which is worth 1 (white), while the background is represented by 0 pixels (black). An example of the result of the thresholding segmentation stage in the test image is shown in Figure 2.

Figure 2. Image result of thresholding segmentation

Table 1. Methods verification and results of tumor area calculations

Image	Diagnosis		Tumor Area (cm^2)		Error Percentage (%)
	Doctor	Method	Doctor	Method	
Uji1	Tumor	Tumor	4,21	4,25	4
Uji2	Tumor	Tumor	2,44	2,38	6
Uji3	Tumor	Tumor	0,36	0,30	6
Uji4	Tumor	Normal	0,77	0	77
Uji5	Tumor	Tumor	0,17	0,17	0
Uji6	Tumor	Tumor	0,21	0,21	0
Uji7	Tumor	Tumor	0,22	0,22	0
Uji8	Tumor	Normal	0,46	0	46
Uji9	Tumor	Tumor	0,19	0,19	0
Uji10	Tumor	Tumor	3,33	3,51	18
Uji11	Tumor	Tumor	0,51	0,72	21
Uji12	Tumor	Tumor	0,81	0,81	0
Uji13	Tumor	Tumor	0,14	0,14	0
Uji14	Tumor	Tumor	0,32	0,21	11
Uji15	Tumor	Tumor	0,06	0,12	6
Uji16	Tumor	Tumor	0,13	0,17	4
Uji17	Tumor	Tumor	0,47	0,52	5
Uji18	Tumor	Tumor	2,17	2,20	3
Uji19	Tumor	Tumor	0,19	1,02	7
Uji20	Tumor	Tumor	4,35	4,23	12
Uji21	Normal	Normal	0	0	0
Uji22	Normal	Normal	0	0	0
Uji23	Normal	Normal	0	0	0
Uji24	Normal	Normal	0	0	0
Uji25	Normal	Normal	0	0	0
Uji26	Normal	Normal	0	0	0
Uji27	Normal	Normal	0	0	0
Uji28	Normal	Normal	0	0	0
Uji29	Normal	Normal	0	0	0
Uji30	Normal	Normal	0	0	0

The next stage of morphological operations that aims to improve the results of segmentation and eliminate the noise that appears as well as image processing based on the size and shape of the object. The image of the morphological operation output is then calculated. Calculation of the extent of the tumor is done by counting the number of pixels that make up the object in the binary image. The calculation of the extent of tumor in breast ultrasound image is shown in Table 1.

According to Table 1 obtained an accuracy of 81.17% and an error of 18.83%. This value indicates that Haar-Like Feature method can be used to detect tumor in breast ultrasound image. From 30 test images, there are 2 images of the diagnosis of the method isn't suitable with the doctor's diagnosis, this mismatch is caused by several factors, namely the error when determining thresholding segmentation and the lack of the number of training image inputted during the training process at the cascade trainer. Because in principle the success rate of the Haar-Like Feature method depends on the amount of training images, the more the number of training images used the higher the accuracy of the method and vice versa.

IV. CONCLUSIONS

Has been implemented Haar-Like Feature method to detect the tumor on breast ultrasound image. From the results of the method verification obtained accuracy of 97%. Based on the value of accuracy can be concluded that the Haar-Like Feature method can be used to detect tumors in the image of breast ultrasound.

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