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Brain image analysis by using support vector machine (svm) method

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ABSTRACT

Research on image analysis of the brain with Support Vector Machine method had been carried out through image processing using matlab software. The CT Scan image data was entered using the “imread” command then pre-processing was performed to eliminate noise with the mean method (multiplication operation between matrix components). After the pre-processing, image histogram analysis was carried out to find out the distribution of pixel intensity values on the image. The final step was calculating the mean and standard deviations specified with all pixel value calculation on every brain image. Value calculation the mean and standar deviation were carried out to 7 normal images and 7 brain tumor images. Mean and standar deviation calculation were used as a parameter to determine normal class and brain tumor class with SVM classification. The calculation results of he normal images have mean values with the range from 65.45 until 88.50 and standard deviation values with the range from 44.41 until 49.50, where as the brain tumor images have mean values with range from 69.46 until 93.29 and standard deviation values with range from 50.05 until 61.60. Therefore, the results of this study show that the mean and standar deviation of brain tumor images is greater than the normal images.

Keywords: Brain Tumor, CT Scan, Histogram, Mean and Standard Deviation

INTRODUCTION

Brain tumor is a tissue mass formed due to the uncontrolled growth of brain cells [1]. The presence of tumors at an early stage is very difficult to diagnose because the tumor boundary is generally still unclear, having low contrast, and sometimes similar to normal tissue. CT Scan (Computed Tomography Scanning) is a diagnostic supporting device utilized to examine organs such as the central nervous system, muscles, bones, throat

and abdominal cavity [2, 3]. Examination of brain tumor is mostly done by using a CT Scan [4].

Reading of brain CT Scan images was visually performed by doctors by observing the image [5]. While the determination of the location or area of object on CT Scan image that is affected by brain tumors cannot be done by means of human's view or judgment, human valuation is not always right, then it is very worrying that the results of the diagnosis are inaccurate [6]. Hence, we need a technique that can evaluate, recognize, and detect

the location or area of brain attacked by a tumor. Picture 1 (a) and (b) show normal image and image

of brain tumor [7].

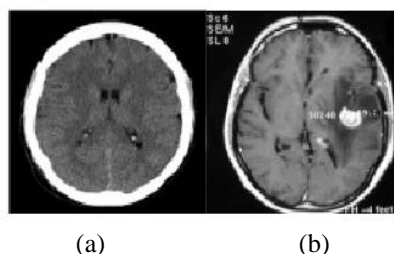


Figure 1. Brain Image (a) Normal (b) Brain Tumor [7]

Support Vector Machine (SVM) is a pattern recognition method aimed to find the best hyperplane [8]. The SVM method can be used to analyze brain tumors by determining the mean and standard deviation as parameters in normal class and brain tumors class distinguishing.

MATERIALS AND METHODS

Materials used in this study are 7 normal brain images and 7 brain tumor images from medical CT Scan. The process of implementing the mean and standard deviation methods with the SVM classification is described as follows:

Pre-processing

Pre-processing were carried out to improve the image by removing noise on each slice by using mean filtering method (intercomponent matrix multiplication). Noise is a pixel that interferes with image quality, for example there are black or white spots that appear randomly in the image [9].

Image Histogram

Image segmentation based on histogram had been performed in order to find out the distribution of pixel intensity values [9]. Relative appearance of intensity in image. The width the histogram peak shows the contrast range of the image [9]. A good image has a histogram with a gray degree that is evenly distributed at each pixel value [10].

Calculate Value Mean and Standard Deviation

Mean and standard deviation values are determined with all pixel value calculation on every brain image. Mathematical formula of mean and standard deviation used in this study can be seen on the following equations:

The value of the mean pixel of a brain tumor image:

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n} \quad (1)$$

and its standard deviation:

$$S^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1} \quad (2)$$

Furthermore, the results from mean and standard deviation calculation were made into an inner parameter to determine brain tumor class and normal class with SVM classification.

RESULTS AND DISCUSSION

The first step in analyzing brain image is pre-processing to eliminate noise following by histogram analysis. The histogram analysis had been performed in order to find out the distribution of pixel intensity values. The normal (a) and brain tumor (b) outcomed by images pre-processing and histogram analysis are shown in Figure 2.

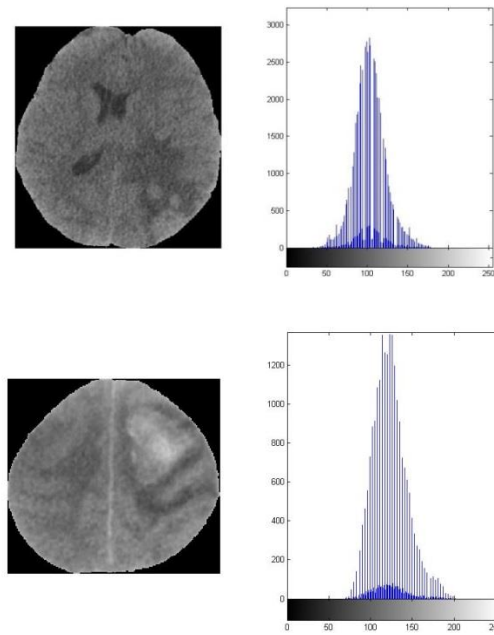


Figure 2. Pre-processing and histogram analysis of brain image (a) Normal (b) Tumor

Subsequently, 7 normal images and 7 images of brain tumors were determined by the mean and standard deviation values sought in the program in

each image. Mean and standard deviation values of normal (N) and brain tumor (T) images are represented in the following Table 1.

Table 1. Mean values and standard deviations

No.	Image name	Mean Value	Standard Deviation Value
1.	N1	65.45	44.41
2.	N2	80.76	45.93
3.	N3	74.11	49.72
4.	N4	71.77	49.53
5.	N5	80.77	46.33
6.	N6	84.70	48.38
7.	N7	88.50	49.20
8.	T1	85.38	50.05
9.	T2	77.35	52.81
10.	T3	83.21	55.91
11.	T4	74.56	61.60
12.	T5	77.20	58.22
13.	T6	69.46	57.84
14.	T7	93.29	55.93

Data in Table 1 show that the normal images have mean values with the range from 65.45 until 88.50 and standard deviation values with the range from 44.41 until 49.50, where as the brain tumor images have mean values with range from 69.46 until 93.29 and standard deviation values with range from 50.05 until 61.60.

CONCLUSION

The normal images have mean values with the range from 65.45 until 88.50 and standard deviation values with the range from 44.41 until 49.50, where as the brain tumor images have mean values with range from 69.46 until 93.29 and standard deviation values with range from 50.05 until 61.60. The mean

and standar deviation of brain tumor images is greater than the normal images. Thus, a normal brain can be distinguished from brain tumor by using the mean and standar deviation values of its image.

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