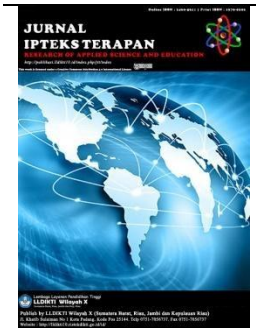

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MEASUREMENT OF BRAIN TUMOR VOLUME USING THE ACTIVE CONTOUR METHOD

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Abstract

This research discusses the importance of developing digital image processing programs to support brain tumor detection via CT-Scan. Manual identification by radiologists can result in errors and inaccuracies in measuring tumor volume. Therefore, this study proposes the application of the active contour method as an alternative that can automatically segment brain tumors and calculate their volume with high accuracy. This method is expected to overcome challenges in medical image analysis, provide efficient solutions, and help improve diagnostics through a reliable automated approach. The experimental results show the potential of the active contour method in increasing the accuracy and efficiency of brain tumor identification, making it a valuable contribution to the development of technology in the field of medical radiology.

Keywords: Brain tumors, CT-Scan, Digital image processing, Automatic segmentation, Active contour

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INTRODUCTION

Brain tumors are often referred to as cancer, also referred to as malignant or non-cancerous, which are referred to as benign (Tsui et al., 2010) . Tumors can also be primary or secondary (Rowden, nd) . Benign tumors are not as aggressive as malignant tumors, namely the growth of abnormal cells without cancer cells. This tumor grows slowly and tends not to spread to other tissues. Malignant brain tumors contain cancerous growth cells and tend to have no clear boundaries. This tumor is considered more dangerous because it grows quickly and can attack other parts of the brain. Doctors can also refer to tumors based on the origin of the tumor cells. If the tumor originates in the brain, it may be called a primary brain tumor. If it originates from another part of the body and spreads to the brain, it can be called a secondary (metastatic) brain tumor. On May 9, 2016, the World Health Organization (WHO) officially changed the names of most types of brain tumors.

Different types of brain tumors can cause varying symptoms depending on the part of the brain involved. Doctors evaluate tumors based on:

CT examination: A computed tomography (CT) examination produces detailed X-ray images of the patient's brain.

MRI examination: Magnetic resonance imaging (MRI) examination uses a strong magnetic field and radio waves to produce detailed images of the brain.

EEG examination: Electroencephalogram uses electrodes attached to the head to record brain activity and look for abnormalities (Suresha et al., 2020).

RESEARCH METHODS

This research was carried out through several stages which are shown in Figure 1.

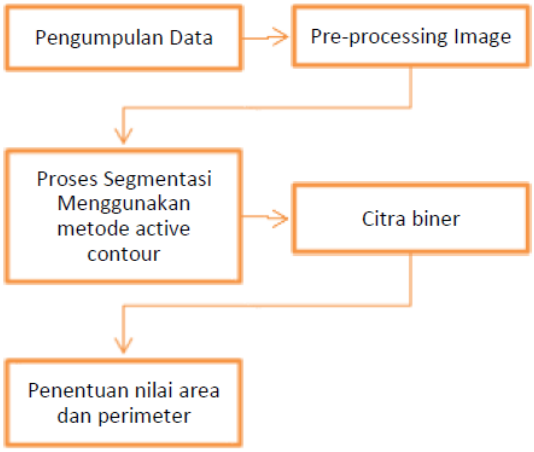

Figure 1, Flowchart of Research Stages

1. Data collection
   In collecting data that has been determined, you must use an object to take good pictures. The object used can be a CT-Scan tool.

2. Image Pre-Processing
   At the image pre-processing stage. The image that has been obtained will be cropped so that the image size is not too large, because if the image is too large it will be disturbed at the segmentation stage.
3. Active Contour Method
   In general, the active contour method is a segmentation method that uses a closed curve model that can move wider or smaller. Active contours can move wider or smaller by minimizing image energy using external energy, and are influenced by the

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characteristics of the image such as lines or edges.

4. Binary Image
   The segmentation image will be converted into a binary image so that it is easier to obtain the area and perimeter of a lung that has been segmented.

RESULT

The sample data used in this research is 12 brain tumor CT-scan image data with the extension .dcm. Dicom is digital imaging and communications in the medical field. Data processing in this research uses the active contour segmentation method. From the segmentation carried out, the results obtained are the area/area and perimeter/perimeter of the area selected for segmentation. The following is the original image, an image selecting the part to be segmented, an image resulting from segmentation, and a binary image from one of the Brain Tumor CT Scan samples.

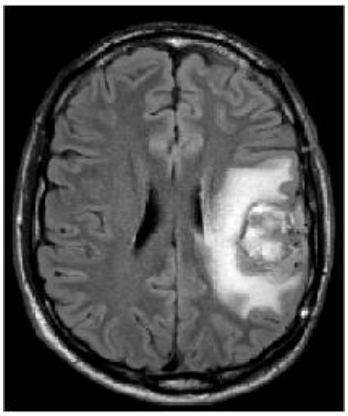

Figure 2, Original Image

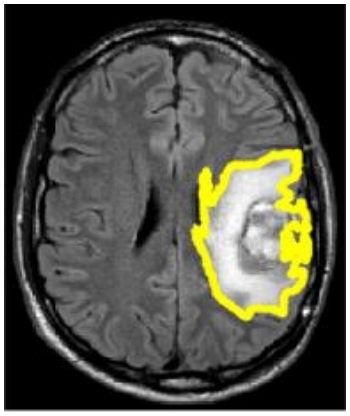

Figure 3, Image Segmentation Results

Figure 4, Binner Image

The following are the results obtained from the Brain Tumor CT scan segmentation process above:

Area = 85.75 cm ^{2} ,
Circumference = 75.55 cm.

This value is obtained from:
Area = area_bw/(res^2)/100
Perimeter = perim_bw/res/10

It is known that the value of the object is:

Area_bw = 15906
Res = 1.3620
Perim_bw = 10290

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Area = Area_bw/res^2/100
= 15906/1.3620^2/100
= 85.74459689 cm ^{2}

Perimeter = perim_bw/res/10
= 10290/1.3620/10
= 75.55066079 cm

The segmentation process requires a process to divide the object areas of an image, into which parts of the brain are categorized as good and which parts of the brain are not good. In this research, the segmentation process was carried out using the active contour method. Because this method uses a closed curve model that can move wider or smaller. In this research, we will group parts of the brain into 2 parts, namely:

1. The brain is categorized as good.

2. The brain is categorized as not good

As in Figure 4, namely the results of a binary image where the white color shows the part of the brain that is not good and the black color shows the part of the brain that is good. After producing a binary image, the area and perimeter of a good part of the lung can be seen from an image.

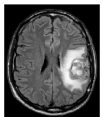
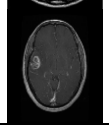
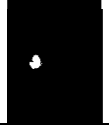
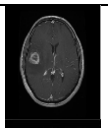
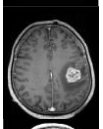
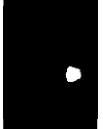
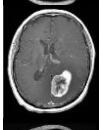
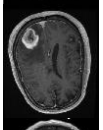
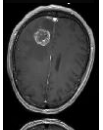
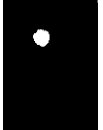
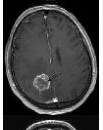
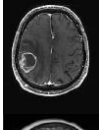
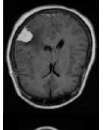
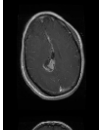
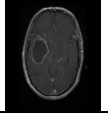
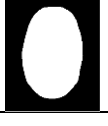
No	Original Image	Binary Image	Wide (cm ^{2})	Around (cm)	Status
1			85.74	75.49	Succeed
2			13.68	18.62	Succeed
3			14.21	17.75	Succeed
4			12.54	13.63	Succeed
5			28.53	21.29	Succeed
6			11.89	15.39	Succeed
7			8.62	19.98	Succeed
8			10.12	13.42	Succeed
9			6.54	9.95	Succeed
10			4.77	9.68	Succeed
11			527.7	156.2	Not successful
12			586.6	87.86	Not successful

Table 1, Image segmentation testing table using the Active Contour method

From the test results it was found that the segmentation process can work effectively on lung images. The level of accuracy for the results of the image segmentation process on lung CT-Scan images using the Active Contour method can be obtained using the following formula:

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$$\%Akurasi = \frac{Jlh\ Sampel\ Berhasil}{Jlh\ Sampel}\ x\ 100\%$$

$$\%Akurasi = \frac{10}{12}\ x\ 100\%$$

$$\%Akurasi = 83.33\%$$

So the accuracy level of the segmentation process using the active contour method is 80%.

CONCLUSION

Based on the discussion above, several conclusions have been obtained as follows:

1. The Active Contour method can be used to segment CT-scans of brain tumors so that you can find out which parts of the brain tumor are no longer good.
2. The segmentation process is carried out by first selecting the area (area) that will be segmented and then to make it easier to see the results of the segmentation, the segmented image is converted into a binary image first.
3. To find out the amount of damage to a brain tumor, a calculation process is added. What is calculated is the area and perimeter of the previously segmented part.
4. The level of accuracy obtained in the segmentation process using the active contour method was 83.33%.
5. Based on research, the process of changing the original image into a binary image is carried out, where the binary image shows that white is the bad part of the brain and black is the good part of the brain.

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