IMAGE PROCESSING FOR PERCENTAGE ANALYSIS OF VESSELS FOR VESSELS IN CORONARY HEART DISEASE PATIENTS

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Abstract

Cardiovascular disease is the highest cause of death worldwide, for this reason early detection is important to reduce mortality due to heart disease and blood vessels, so that a program is needed to calculate the narrowing that occurs in blood vessels experienced in patients affected by coronary heart disease, so can make it easier for a doctor to analyze and give a medical decision whether to do the ring installation or just administering drugs for blood thinning. This research uses the development of image processing technology from angiographic results by utilizing cropping to determine the area to be analyzed and image segmentation, where image segmentation is in the form of a denoise as a mean filter and increases the transmission of the image to be analyzed and thresholding which is a way of emphasizing the image by changing the image to black and white. Where the narrowing area is obtained from counting the number of logical pixels 1 of the image area that has been blocked and has been reconstructed while the normal area is calculated from the number of pixels having logic 1 plus the pixel area having logic 1, logic pixel 0 is an area of the vessel that is not narrowed. The results showed that the narrowing of the vessels in patients experienced by patients affected by coronary heart can be measured how narrowing is experienced. Of the 11 patient data measured, there were 4 patient data that were compared with the measurement results of the angiography instrument with the highest obtained error value of 3.9% and the lowest error value of 0.1% with an average value of error 1.8% where the error value is still within the tolerance value.

Keywords: image processing, vessels for vessels, coronary heart disease

1. Introduction

Cardiovascular disease is the highest cause of death. The World Health Organization also states that since 1990, more people worldwide have died from coronary heart disease (CHD) than other causes [1]. The emergence of this disease is motivated by lifestyle, poor diet and habits which has an impact on the increasing number of heart disease patients and cardiovascular disorders, therefore early detection is important to reduce mortality due to heart disease and blood vessels, one of the detection methods is examination in the catheterization laboratory [1].

Calculation of narrowing of blood vessels in the heart is done by comparing the narrowing that occurs with the size of the catheter that is inserted into the body, if the catheter is inserted through a vessel in the hand the size is 5000 frames and if it passes through a large vessel the size is 6000 frames.

With the development of image processing technology at this time can be utilized in various fields such as medicine. The presence of this image processing technology provides remarkable progress in these fields, one of which is applied to diagnose an existing disease at this time, from this problem the researchers created an image processing program that is used to analyze the narrowing of blood vessels in the affected patient coronary heart disease by directly calculating the narrowing that occurs, while the weakness is difficult to get the photographic image you want to use for research.

The aim of this research is to apply the thresholding method to detect the narrowing of blood vessels in the coronary heart and analyze the results of the angiography with the thresholding method on the image of patients who have narrowed blood vessels in the coronary heart.

2. Research Method

The research method uses the Matlab® application to determine what percentage of narrowing occurs in the heart vessels in patients with coronary heart disease. Literature study is used to obtain references about the application of matlab, image data from angiographic results in patients with coronary heart disease. With the architecture of the research model as follows:
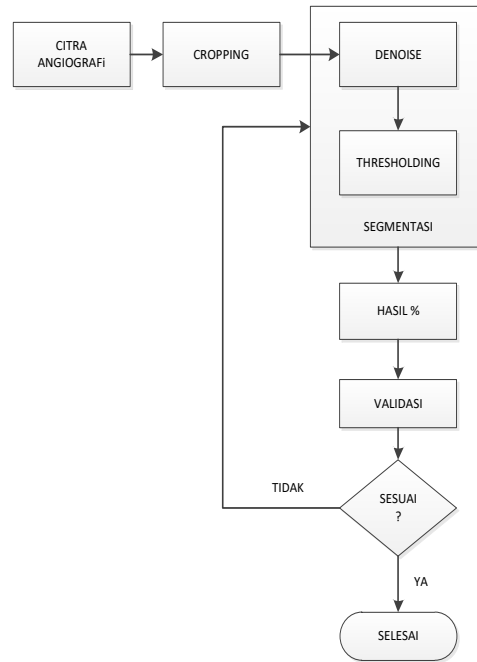
Figure 2.1. Architectural Research Model
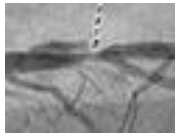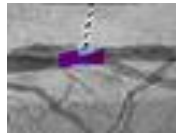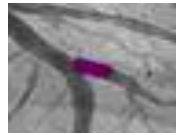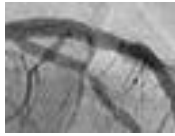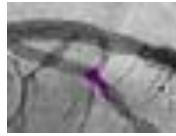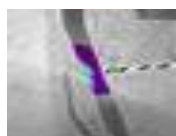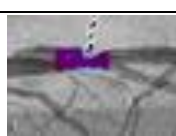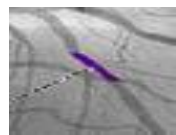
Research Instruments using instruments (materials) images of X-ray aircraft angiography and Matlab® software. While the procedure of conducting research carried out includes taking data from X-ray aircraft angiography results in patients suffering from coronary heart disease in hospital A and making simulation measurements of narrowing of vessels in the heart using Matlab®.

3. Results and Analysis

After conducting experiments from several images taken and measured, the results obtained by researchers are shown in the following table:

Table 3.1 Measurement Results

No	Name	Refinement	Reconstruction Results	% Refinement
1	Patient A			70.65%

2	Patient B			80.45%
3	Patient C			88.68%
4	Patient D			78.12%
5	Patient E			74.31%
6	Patient F			84.88%
7	Patient G			88.71%
8	Patient H			70.72%
9	Patient I			88.61%
10	Patient J			77.93%
11	Patient K			80.95%

From these measurements will be compared with the calculation results obtained from Cathlab, whether the results are in line with expectations or not, here are 4 patient data compared with calculations from the Chatlab tool:

Table 3.2 Recapitulation of Measurement Results

Patient	Chatlab	Program	Error
A	17	17.7	3.9
B	52	52.16	0.3
C	40	40.06	0.1
D	33	34	2.9
Average			1.8

From these results it will explain the direct comparison of the results of program measurements made with results on the Cathlab tool:

a. Patient A

Figure 3.1 Calculation Results Patient A from Cathlab

Figure 3.2 Calculation Results Patient A from Research

From the results of measurements on patient A made directly on Chatlab, the narrowing that occurs in vessels by 17% and from the results of measurements using a program made, the narrowing that occurs in vessels by 17.7%. So the result of the error obtained is (17.7-17) /17.7*100% = 3.9%.
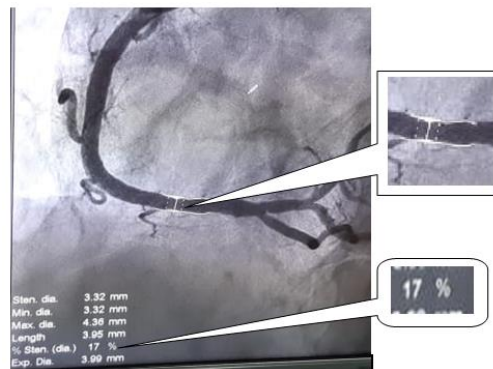
b. Patient B

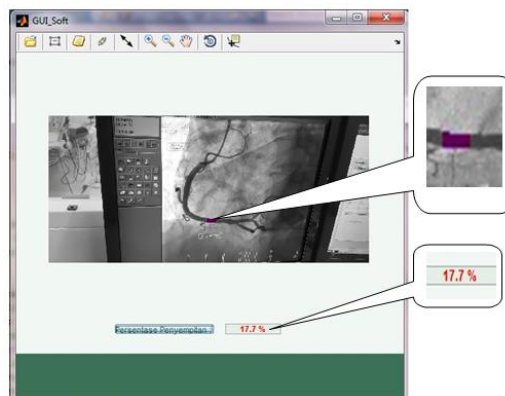Figure 3.3 Calculation Results Patient B from Cathlab

Figure 3.4 Calculation Results Patient B from Research

From the results of measurements on patient B made directly on Chatlab, the narrowing that occurs in vessels by 52% and from the results of measurements using a program made, the narrowing that occurs in vessels by 52.16%. So that the error results obtained are (52.16-52)/522.16*100% = 0.30%.
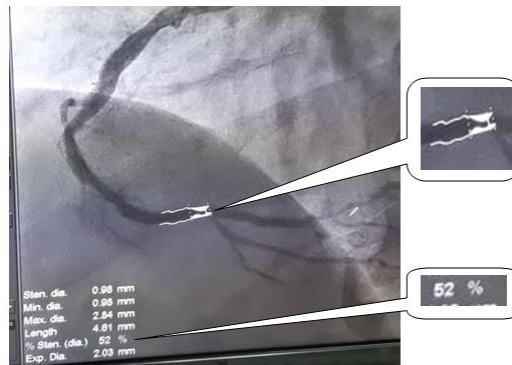
c. Patient C

Figure 3.5 Calculation Results Patient C from Cathlab

Figure 3.6 Calculation Results Patient C from Research

From the results of measurements on patient C made directly on Chatlab, the narrowing that occurs in vessels by 40% and from the results of measurements using a program made, the narrowing that occurs in vessels by 40.06%. So the error results obtained are (40.06-40)/40.06* 100% = 0.15%.

d.   Patient D

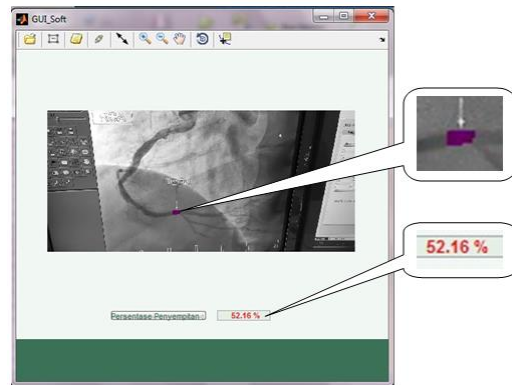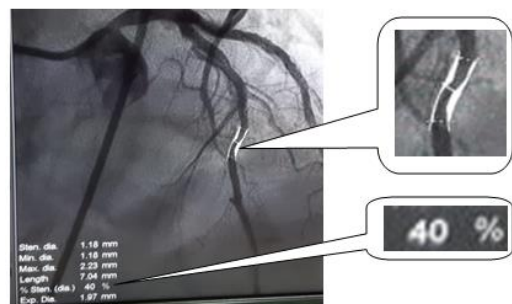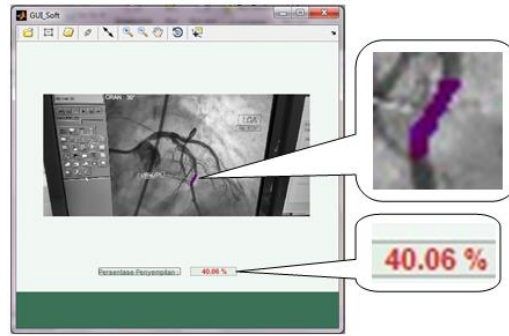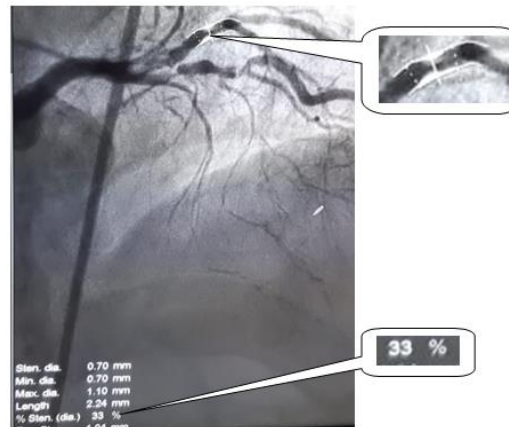Figure 3.7 Calculation Results Patient D from Cathlab
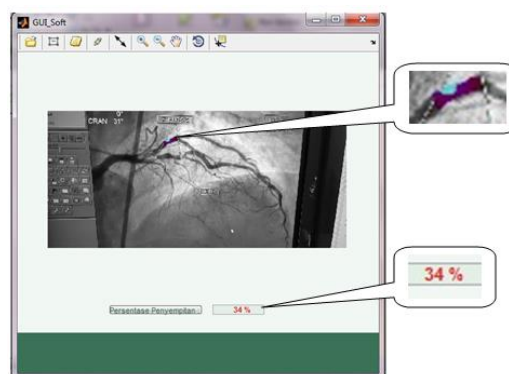

Figure 3.8 Calculation Results Patient D from Research

From the results of measurements in patient D made directly on Chatlab, the narrowing that occurs in vessels by 33% and from the results of measurements using a program made, the narrowing that occurs in vessels by 34%. So the result of the error obtained is (34-33)/34*100% = 2.9%.

4. Conclusion

Image analysis of the results of angiographic images can detect constriction in patients using the process of cropping and segmentation in the form of denoise and tresholding methods.

The tresholding method in this study can be used for analysis of narrowing of blood vessels in the heart with the highest error value of 3.9% and the lowest error value of 0.1% with an average error value of 1.8% where the error value is still within the tolerance value. So the accuracy value obtained is 1.8%.

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