

ISBN : 978-1-4799-9861-6



2015 ICITACEE

THE 2nd INTERNATIONAL CONFERENCE ON INFORMATION
TECHNOLOGY, COMPUTER, AND ELECTRICAL ENGINEERING

October 16 - 18th, 2015

PROCEEDINGS

“ **GREEN TECHNOLOGY** STRENGTHENING IN INFORMATION TECHNOLOGY,
ELECTRICAL, AND **COMPUTER ENGINEERING** IMPLEMENTATION ”



IEEE

Comparison Methods of Noise Elimination for Pregnancy Image Processing

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Abstract— Information fetal development in the womb can be seen through a scanning process with ultrasonography technology. The resulting image of the process of two-dimensional ultrasonography has not been able to provide complete information. This paper describes several necessary processes to make the image of the ultrasonography can be identified precisely and accurately to provide information needed by pregnant women. The process of digitizing and compress image will generate noise. The noise will affect the value of the feature vector of images. Therefore necessary several efforts to eliminate noise. Noise removal process performed through the filtering processes. This paper describes the comparison of the results of the elimination of noise using several filtering methods. The filtering methods that used consist of filter of median, mean, gaussian, low pass and high pass. The results show the median filter by windows size of 3x3 with speckle noise give the best performance with the smallest MSE of 0.000241.

Keywords— *ultrasonography image, noise, filtering.*

I. INTRODUCTION

Ultrasound investigation is the supplement investigation which carried out on pregnant women. Prior to ultrasound existed, a new fetal heartbeat can be heard on gestational age 16-18 weeks. While the ultrasound, on the age of 6-7 weeks of pregnancy can be detected [1]. Along with the development of technology today, ultrasound development is also becoming more sophisticated, ultrasound shown in a variety of dimensions, including ultrasound two, three, or four dimensions.

Each has advantages and disadvantages for the types of ultrasound, more higher dimensions shown on the monitor will give impact on more expensive the price of equipments. This will cause the investigations using ultrasound are also more expensive. With these problems, the type of 2-dimensional ultrasound is still widely used gynecologist, because it is still considered a representative to investigate pregnant's condition. However, the two-dimensional display makes the layman can not understand the information that is displayed on the monitor [2].

Sensors and transducers are used in ultrasound equipment can produce two-dimensional an image scanning consisting of rows of dots low intensity. Physical limitations of humans (fatigue, carelessness, neglect) can influence the results

interpretation, while interpretation errors can be minimized by using a computer-based program on digital image processing [3]. The development of ultrasound has found since about 1960 by Professor Lan Donald. Since then, in line with advances on computer technology, the development of ultrasound is also progressing rapidly, ie in the presence of ultrasound 2, 3 and 4 dimensions.

Ultrasound imaging to analyze the fetal head is needed by medical personnel, this is done to evaluate growth and predict age of the fetus. The process of detection of the sex of the fetus supported by a development of the current technology, can be designed a system of identification of the sex of the fetus on ultrasound image [4], so that the implementation of this study will be able to reduce the error diagnosis of fetal sex on a 2-dimensional ultrasound image.

The image segmentation, especially in the field of medical imaging or medicine is necessary, because in this area a lot of data retrieval in the form of images that must be interpreted by a doctor, for example radiology images, ultrasound images, and other medical images. Digital image processing is digital processing and interpretation of remote sensing image with help of a computer [5].

The main goal of image processing is to process an image for producing images that are better suited to certain applications compared to original image [6]. While the purpose of image segmentation is to divide the image into several parts / different segments associated with objects on the field. Another opinion was also expressed that the image segmentation is the image processing aimed to separate the object (foreground) with the background (background) [7]. Image segmentation is also very important as one of the stages of image processing in the field of medicine [8]. In addition [9] investigated the medical image detection ultrasonography with dynamic programming.

This paper presents a comparison of data image processing of pregnancy using several filter methods. The purposes of the comparison are to get the right filter to the image of the pregnancy data.

II. METHOD

In this experiment starting from image data collection pregnancy. Then proceed with the processing of image data. Image data processing is done with the following steps (1) conversion of the data in digital form, (2) continued by the conversion of the data in the form of RGB, (3) RGB form is then converted in gray form, (4) Selection filter through comparison using multiple filter methods to obtain the most clear image data, (5) Compare the filter size that is most appropriate on the type of image data of pregnancy, due to more larger size of the window will increasingly blur the image.

Comparison of methods for noise elimination consist of a method median filter, mean filter, gaussian filter, low pass filter and a high pass filter. Image processing method performed is shown in Figure 1 :

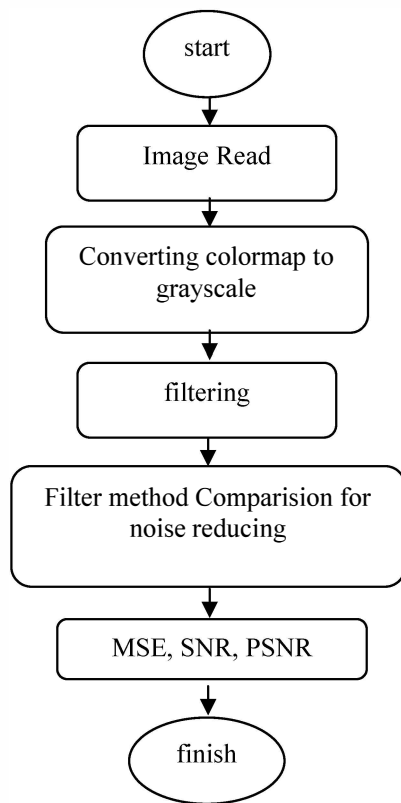


Fig.1. Image processing model

III. RESULTS AND DISCUSSIONS

Based on the data of digital images will be used for processing the images in digital form. In this paper, the image processing performed as Figure 2 below:



Fig. 2. The basic image

The data in Figure 2 will be converted into the form of BCG. The size of Figure 2 is [1280 1108]. Based on these data will performed conversion of the form of BCG to gray. Conversion data from BCG to gray will produce the image shown in Fig. 3



Fig. 3. Conversion BCG to gray

Other way Fig. 4a and Fig. 4b present the original data of RGB and gray images respectively.



Fig. 4a. Original RGB image

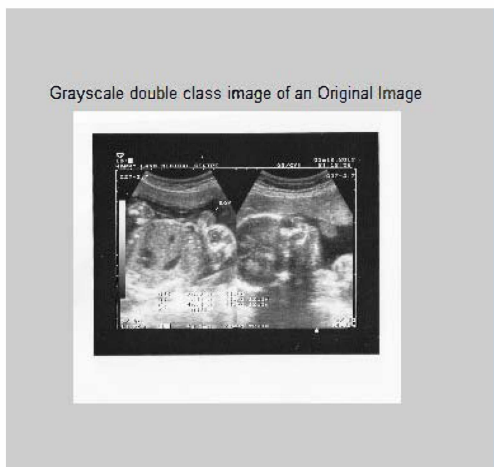
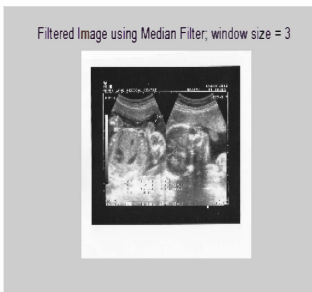
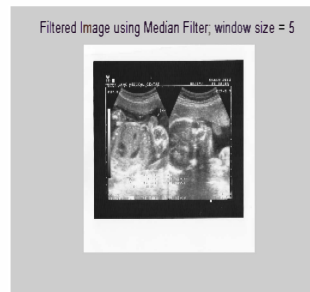


Fig. 4a. Original grayscale image

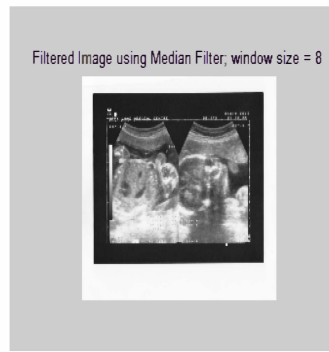
The next step is determining the fit images to determine the size of filter. Due to more larger size of the window will increasingly blur the image. In the experiments obtained the filter size of 3 x 3, 5 x 5, 8 x 8, and 10 x 10 respectively. Comparison results show that using the median filter of 3 x 3 will produce the more clear image. Fig. 5a, Fig.5b, Fig.5c and Fig.5d show the images results using the median filter of 3x3, 5x5, 8x8 and 10x10 respectively.



a. Window 3x3



b. Window 5x5



c. Window 8x8



d. Window 10x10

Fig.5. Comparison of images based on window size of median filter

Comparison of mean square error (MSE), signal to noise ratio (SNR), and peak signal to noise ratio (PSNR) based on window size of median filter showed in Table 1.

TABLE I. COMPARISON MSE, SNR, PSNR

Window	MSE	PSNR	SNR
3	0.000241	84.31480	94.96852
5	0.000862	78.77416	89.42788
8	0.003260	72.99864	83.65236
10	0.004513	71.58585	82.23957

After getting the size of the fit median filter, next steps are to compare the use of several filters. This experiment will use High Pass Filter, Low Pass Filter and Laplacian of Gaussian filter. Fig. 6 show the result Laplacian of Gaussian filter.

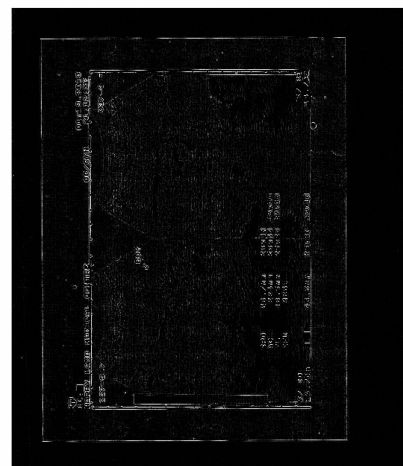


Fig. 6. The Optimisation Image using Max-Min Method

The next step perform optimization in order to produce images that fit on screen. Results of utilization the max-min method to get the image that fit on the screen can be seen in Fig. 7 below

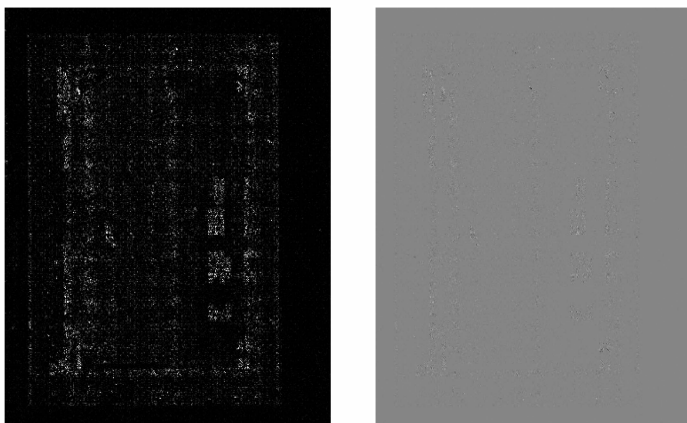


Fig. 7. The Optimisation Image using Max-Min Method

Edge sharpening is conducted to eliminate several noises that should not appear on the image. Therefore necessary the sharpening edges to remove noises that are still attached to the image. Fig.8a and Fig.8b show the results of sharpening edge.

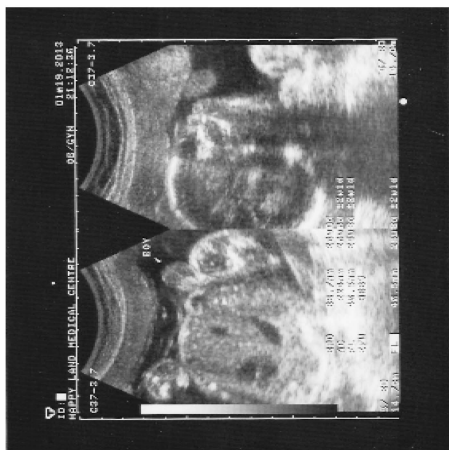


Fig.8a. Edge sharpening

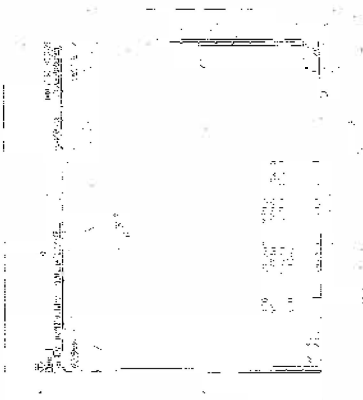


Fig.8b. Elimination several noises

IV. CONCLUSION

Comparison of several methods of filters have been carried out including a comparison of average size of the filter types have shown the results. The filter with average of 3 x 3 showed better results. The results show that more larger size of the window will increasingly blur the images. Several filtering methods conducted to obtain the clear image consist of median, mean, gaussian, low pass and high pass filter. Based on the experiment, the median filter by size windows of 3x3 with speckle noise showed the best result with the smallest MSE of 0.000241.

Acknowledgment

The experiments were by grant from PIU-IDB Project Universitas Negeri Yogyakarta. The authors would like to thank the anonymous reviewers for their precious suggestions for this paper.

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