CHAPTER 4
ANALYSIS AND DESIGN

4.1 Analysis

The noise of USG images can interfere the result of doctor analysis. Filtering is needed in order to clean up the noises. The first algorithm is Midpoint filter that is calculating the minimum and maximum value, then divide it by two in the certain kernel. The second algorithm is Harmonic Mean Filter that is dividing every pixel in the kernel by one then sum it. In this research will test them with many kernel, start from 3x3, 5x5, 7x7, and 9x9. From the results obtained after testing with 59 ultrasound images, the Harmonic Mean Filter algorithm found PSNR quality to be quite good. While the Midpoint Filter algorithm shows a PSNR chart under Harmonic Mean Filter.

These are the result of the research:

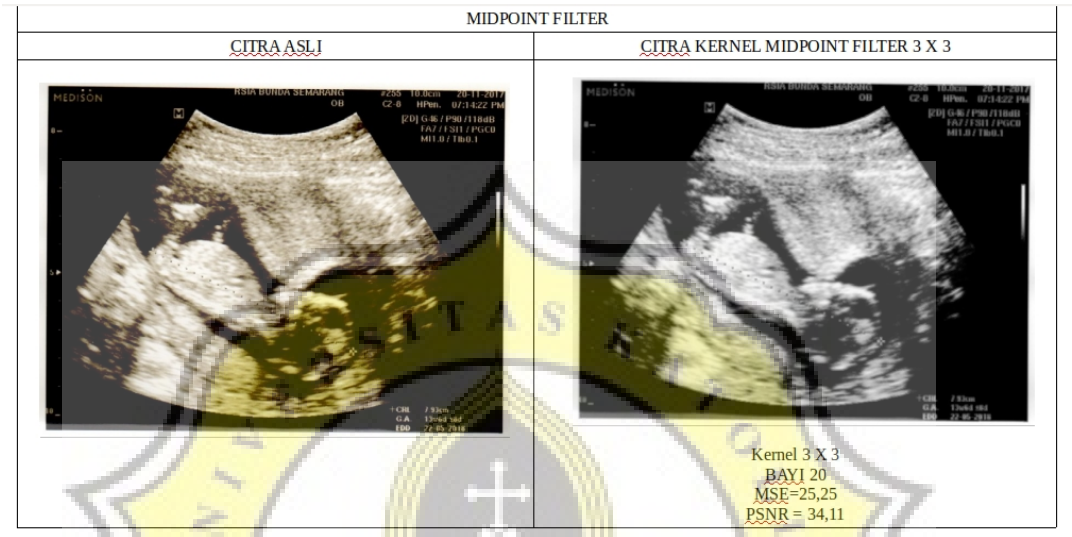


Illustration 4.1: USG Midpoint Filter 3 X 3

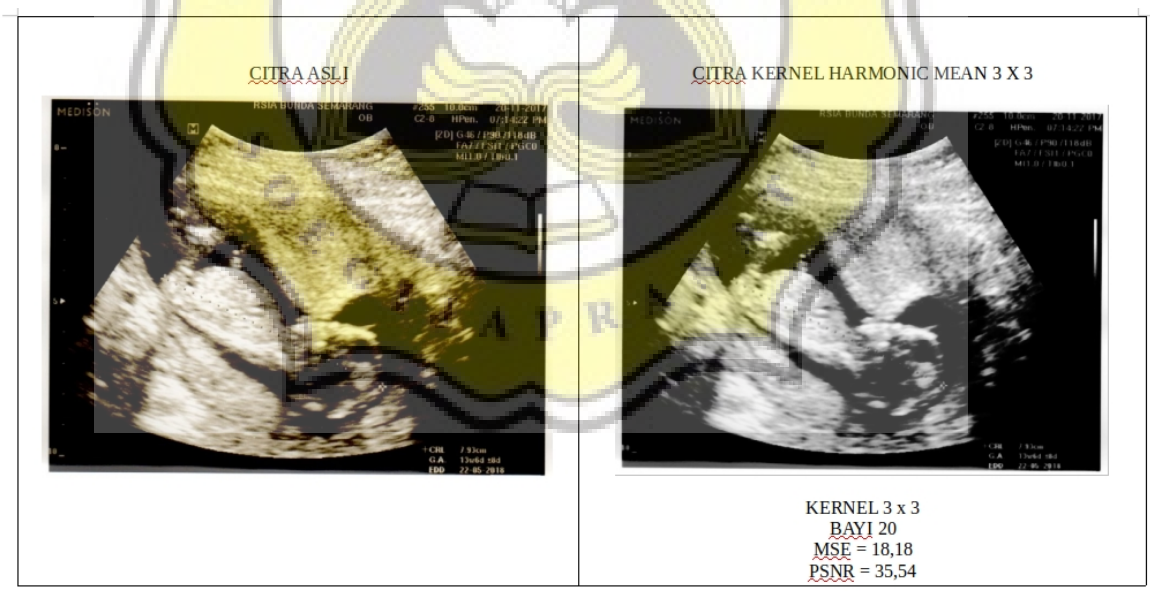


Illustration 4.2: USG Harmonic Mean Filter 3 X 3

Illustration 4.1 uses Midpoint Filter and Illustration 4.2 uses Harmonic Mean Filter. USG images use 3x3 kernels. After the filtration, the result is Midpoint Filter PSNR value is 34,11 db and Harmonic Mean Filter PSNR value is 35,54 db.

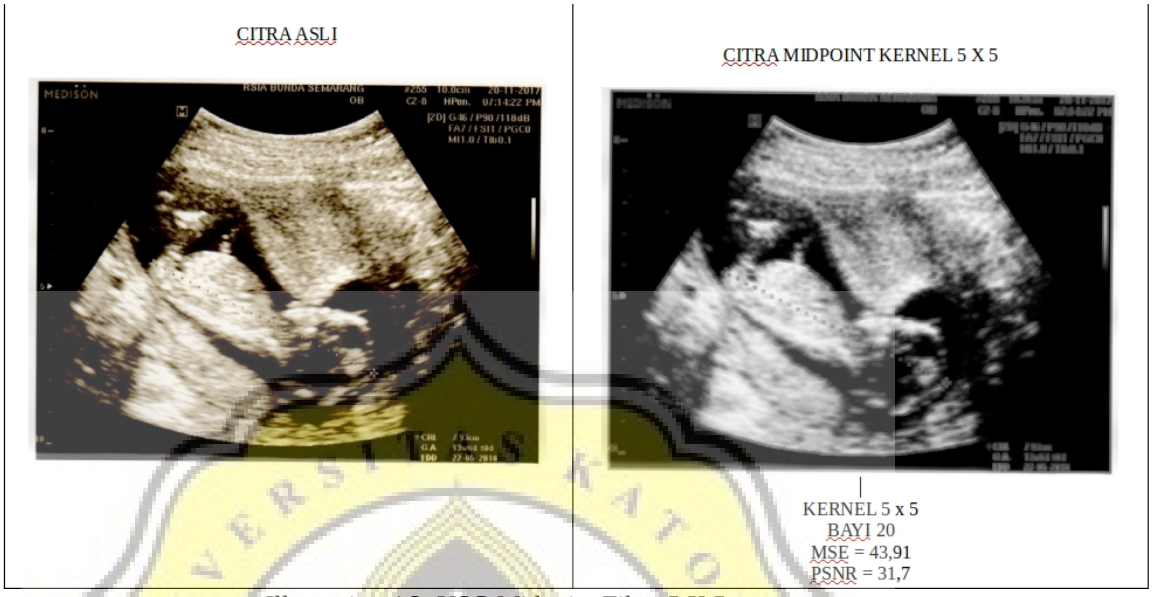


Illustration 4.3: USG Midpoint Filter 5 X 5

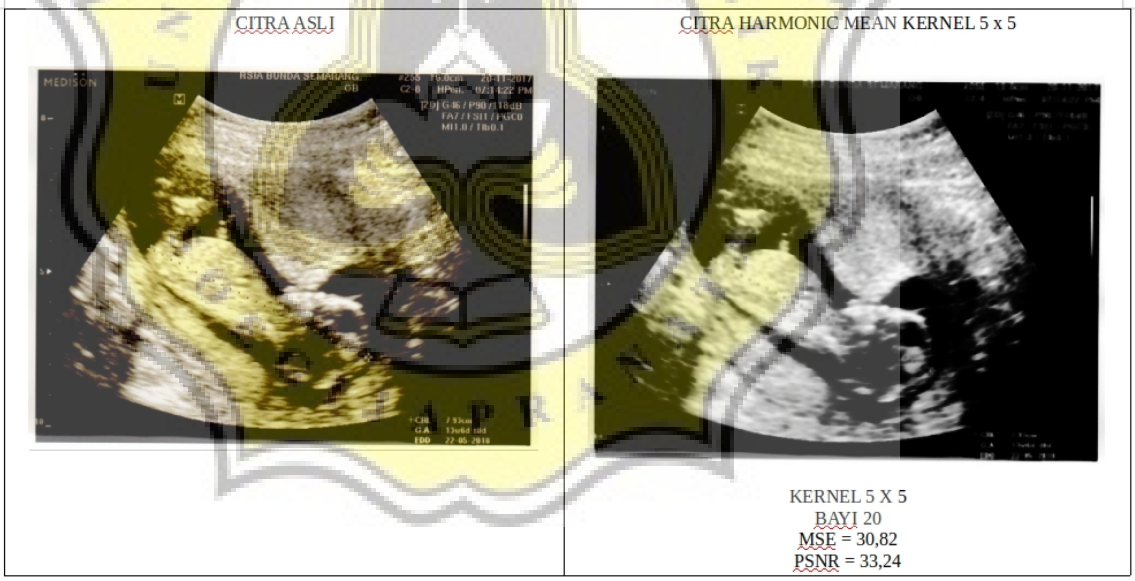


Illustration 4.4: USG Harmonic Mean Filter 5 X 5

Illustration 4.3 uses Midpoint Filter and illustration 4.4 uses Harmonic mean Filter. USG images use 5x5 kernels. After the filtration, the result is Midpoint Filter PSNR value is 31,7 db and Harmonic Mean Filter PSNR value is 33,24 db.

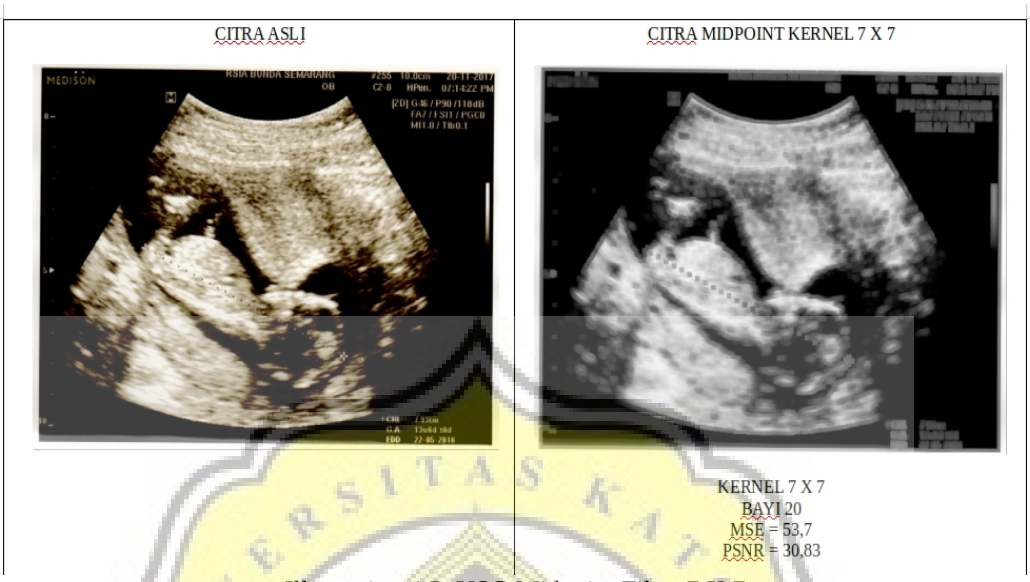


Illustration 4.5: USG Midpoint Filter 7 X 7

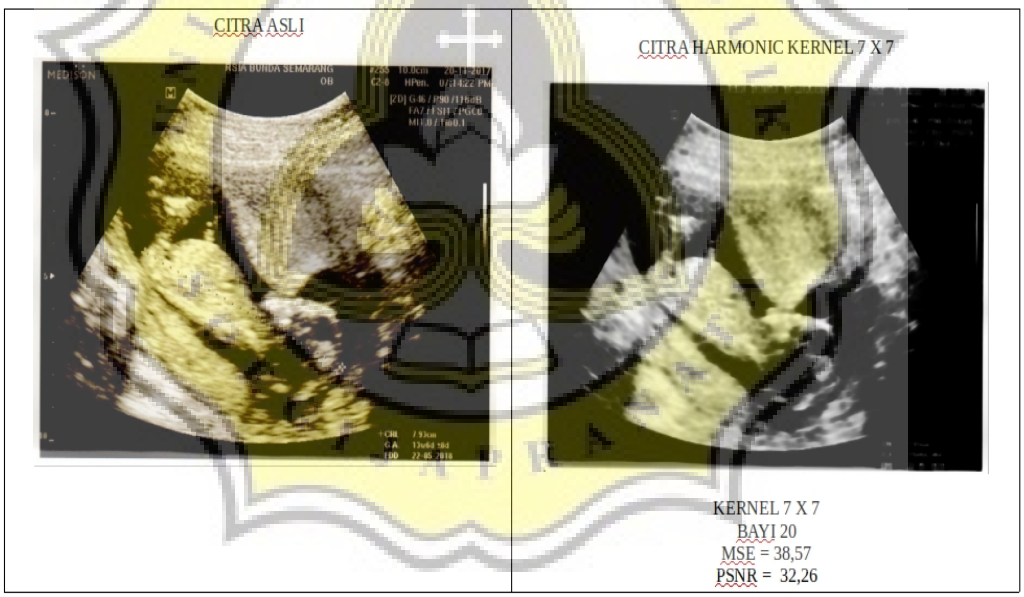


Illustration 4.6: USG Harmonic Mean Filter 7 X 7

Illustration 4.5 uses Midpoint Filter and Illustration 4.6 uses Harmonic Mean Filter. USG images use 7x7 kernels. After the filtration, the result is Midpoint Filter PSNR value is 30,83 db and Harmonic Mean Filter PSNR value is 32,26 db.

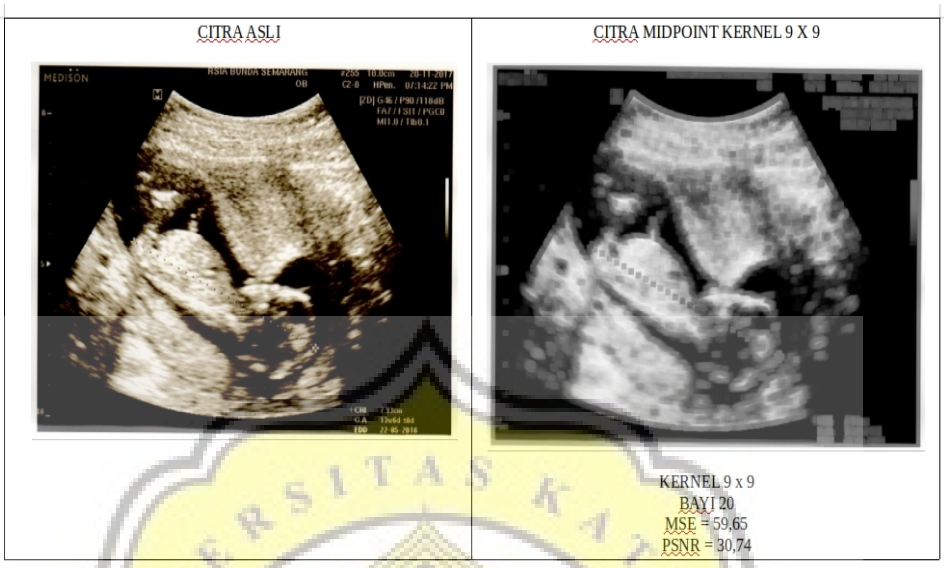


Illustration 4.7: USG Midpoint Filter 9 X 9

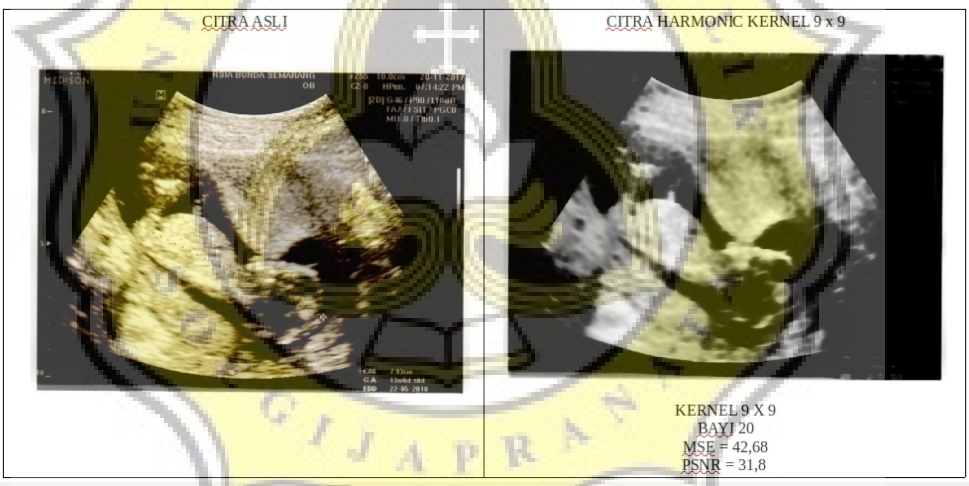


Illustration 4.8: USG Harmonic Mean Filter 9 X 9

Illustration 4.7 uses Midpoint Filter and Illustration 4.8 uses Harmonic Mean Filter. USG images use 9x9 kernels. After the filtration, the result is Midpoint Filter PSNR value is 30,74 db and Harmonic Mean Filter PSNR value is 31,8 db. The conclusion from the testing is PSNR value in the Harmonic Mean Filter algorithm is higher than the Midpoint Filter algorithm one. Visually, the result of Harmonic Mean Filter is better than Midpoint Filter. The testing above is from the 1 of 59 USG images sample.

MSE and PNSR Graphic Data:

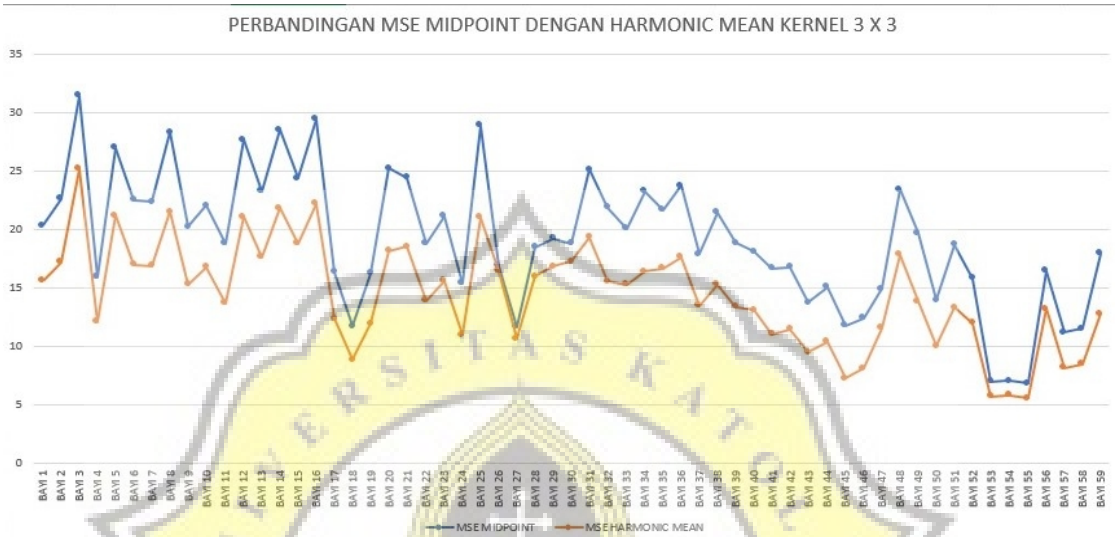


Illustration 4.9: MSE Kernel 3 X 3

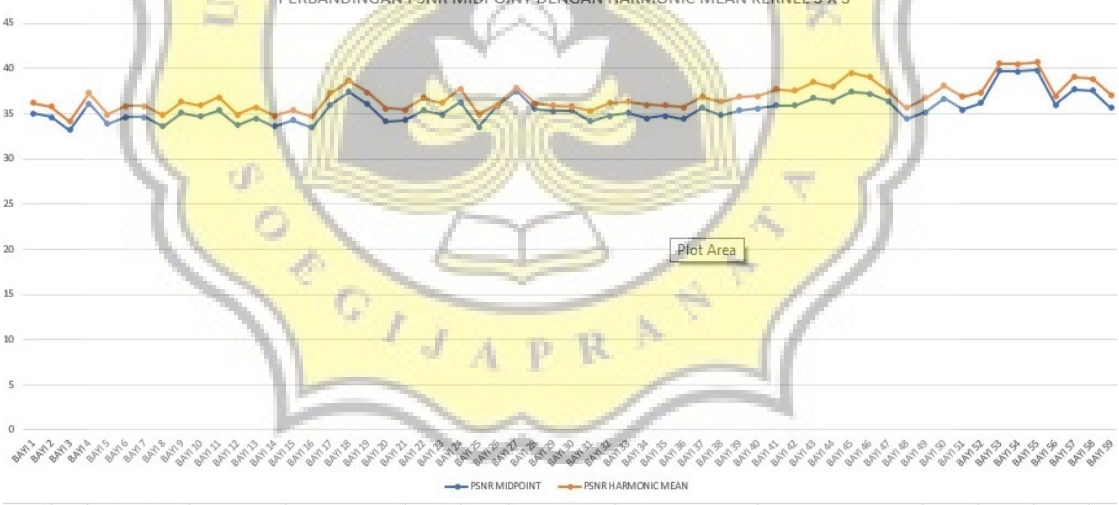


Illustration 4.10:PSNR Kernel 3 X 3

Both of illustration 4.9 and 4.10 use Midpoint Filter and Harmonic Mean Filter in 3 X 3 kernels. The MSE graphic of analysis result from the 3 X 3 kernels shows that the level of filtering error of Midpoint filter algorithm is higher than Harmonic Mean Filter with 59 USG sample images. While the analysis result of PSNR in 3 X 3 kernels shows that Harmonic Mean Filter algorithm is better than Midpoint Filter.

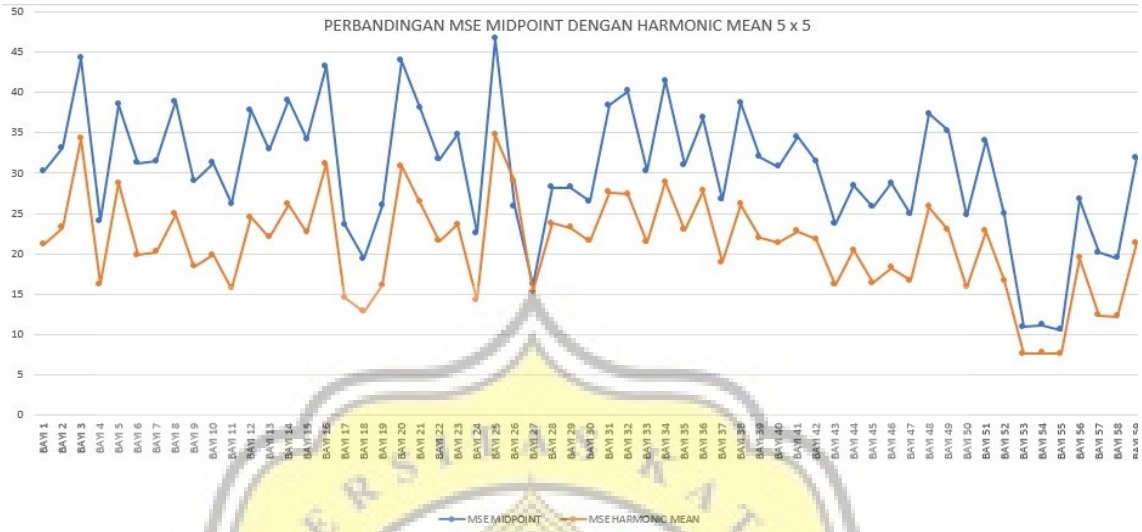


Illustration 4.11: MSE Kernel 5 X 5

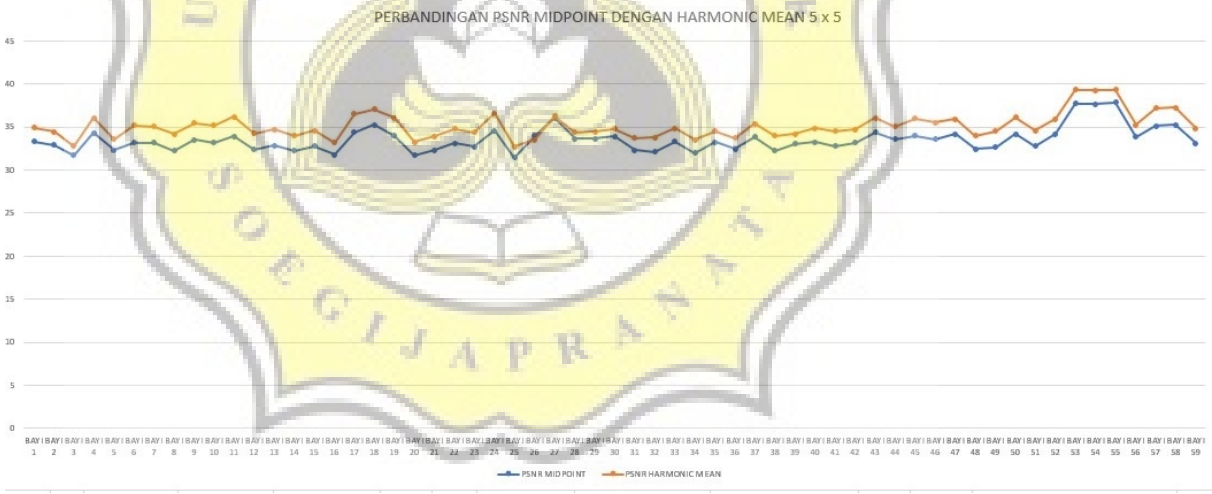


Illustration 4.12: PSNR Kernel 5 X 5

Both of illustration 4.11 and 4.12 use Midpoint Filter and Harmonic Mean Filter in 5 x 5 kernels. The MSE graphic of analysis result from the 5 X 5 kernels shows that the level of filtering error of Midpoint filter algorithm is higher than Harmonic Mean Filter with 59 USG sample images. While the analysis result of PSNR in 5 X 5 kernels shows that Harmonic Mean Filter algorithm is better than Midpoint Filter.

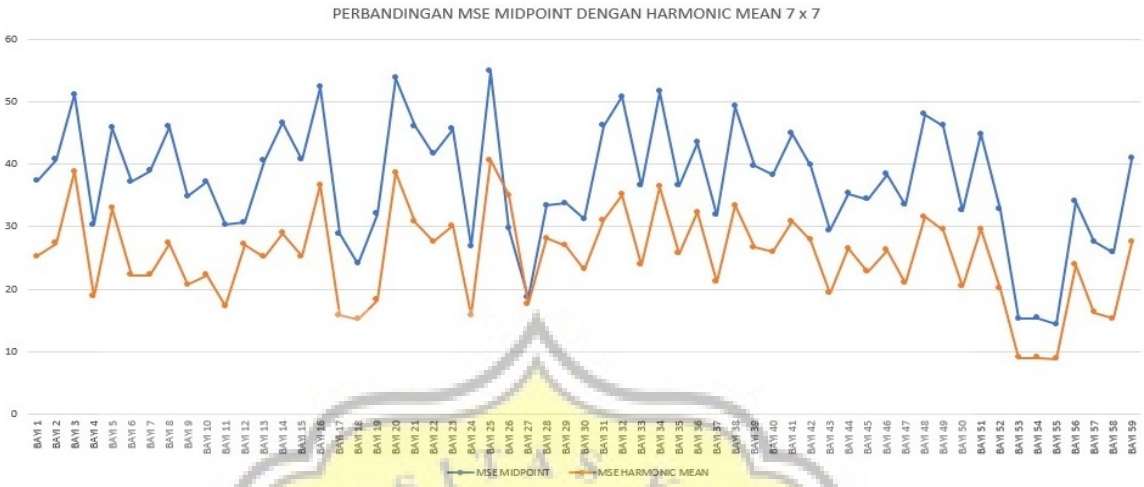


Illustration 4.13: MSE Kernel 7 X 7

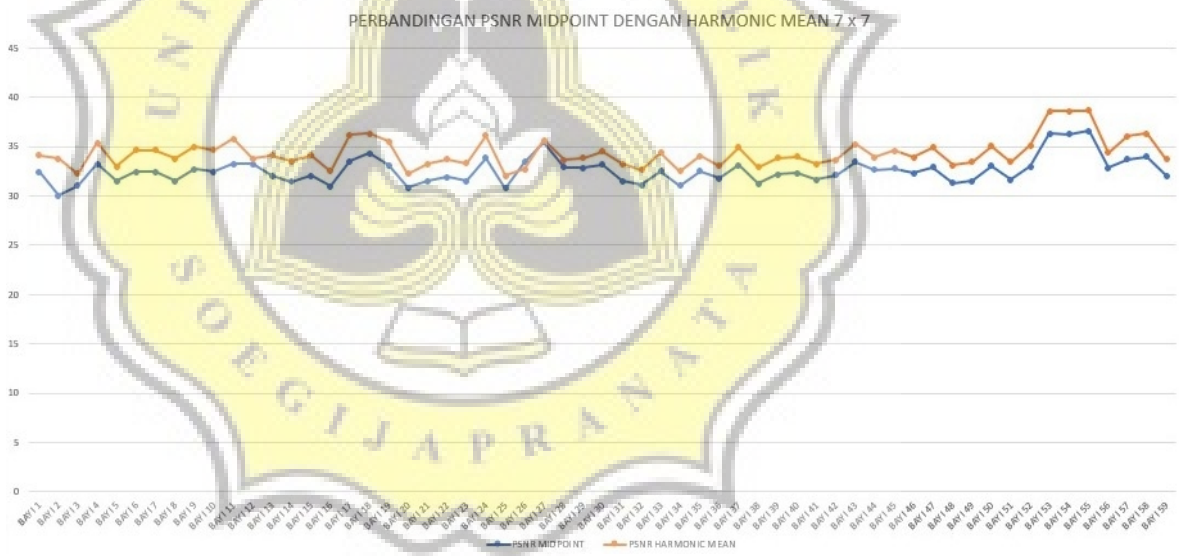


Illustration 4.14: PSNR Kernel 7 X 7

Both of illustration 4.13 and 4.14 use Midpoint Filter and Harmonic Mean Filter in 7 X 7 kernels. The MSE graphic of analysis result from the 7 X 7 kernels shows that the level of filtering error of Midpoint filter algorithm is higher than Harmonic Mean Filter with 59 USG sample images. While the analysis result of PSNR in 7 X 7 kernels shows that Harmonic Mean Filter algorithm is better than Midpoint Filter.

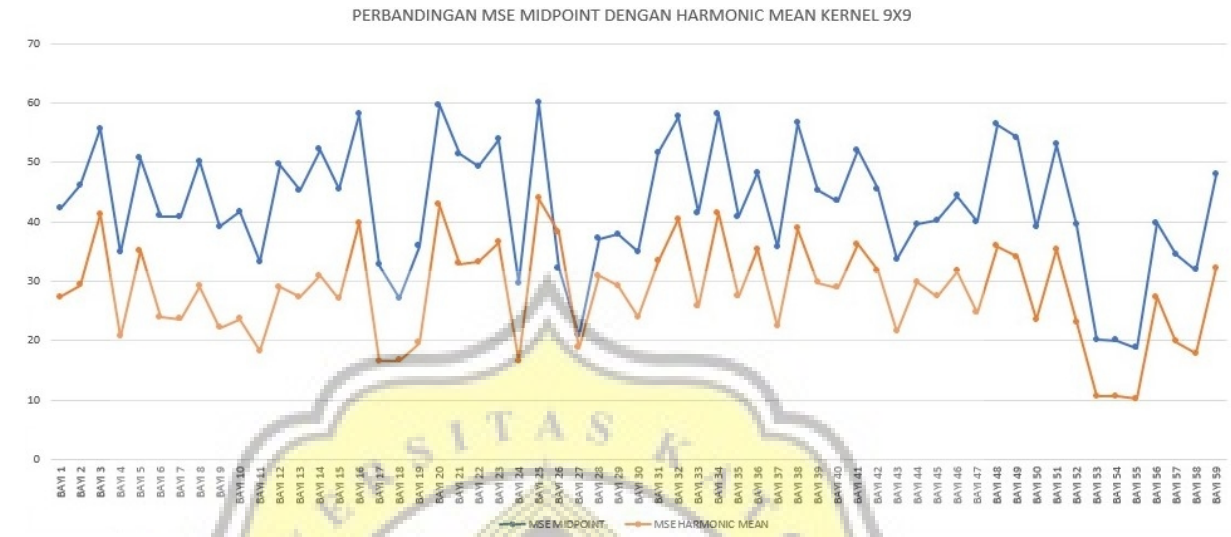


Illustration 4.15: MSE Kernel 9 X 9

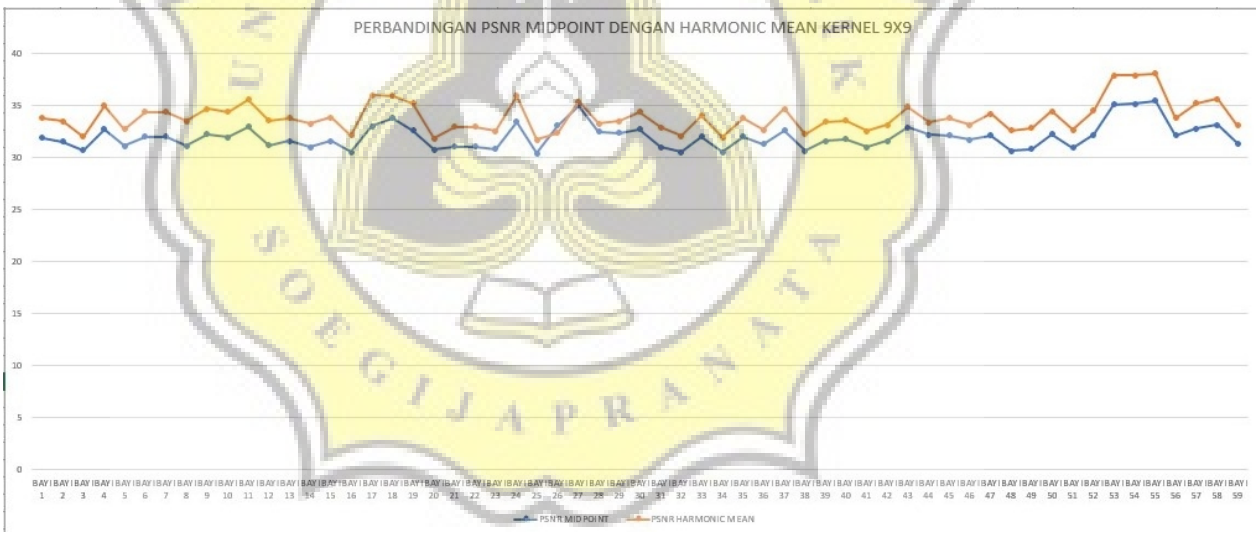


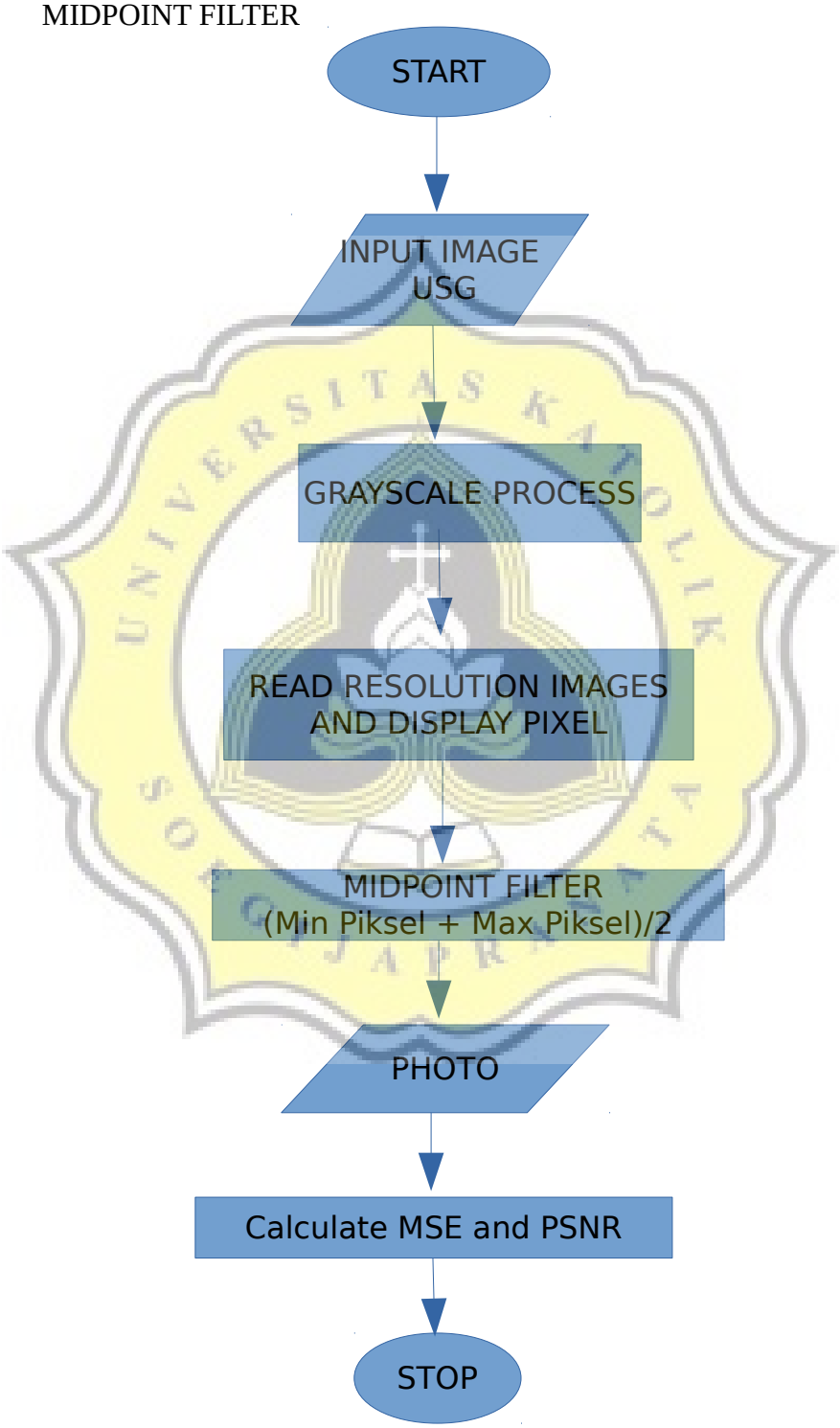
Illustration 4.16: PSNR Kernel 9 X 9

Both of illustration 4.15 and 4.16 use Midpoint Filter and Harmonic Mean Filter in 79 X 9 kernels. The MSE graphic of analysis result from the 9 X 9 kernels shows that the level of filtering error of Midpoint filter algorithm is higher than Harmonic Mean Filter with 59 USG sample images. While the analysis result of PSNR in 9 X 9 kernels shows that Harmonic Mean Filter algorithm is better than Midpoint Filter.

In the testing with 59 USG images, the filtering results are measured by MSE (Mean Square Error). MSE is a tool for calculating the images error after filtered. MSE measurement is the result of the old pixel images minus the result of new images, then squared before they are divided by the number of determined kernels. The graphics of 59 images after filtered by 3x3, 5x5, 7x7, 9x9 kernels show the MSE value that is Midpoint Filter is higher than Harmonic Mean Filter. After that is PSNR (Peak Signal to Ratio) measurement in 59 USG images. PSNR is to measure the comparison of images quality before and after the process. PSNR in the 3x3, 5x5, 7x7, 9x9 kernels graph result shows that Harmonic Mean Filter algorithm is superior in filtering USG images compared to Midpoint Filter.

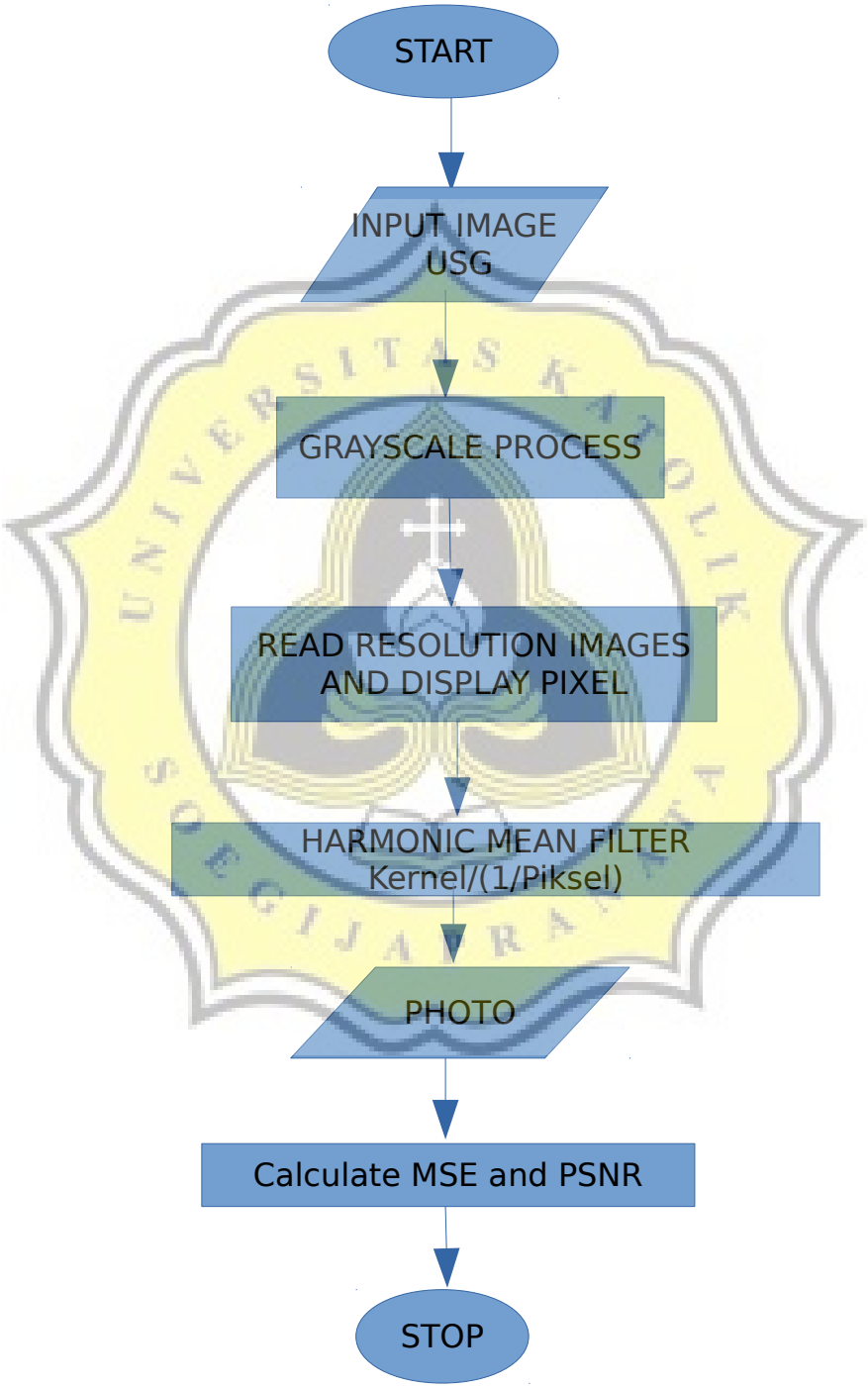
4.2 Design

MIDPOINT FILTER



Flowchart above tells that the first thing to do is input the USG images. After that, the USG images will be changed into grayscale. Next, the resolution of the images will be checked and the pixel will be shown. The next step is filtering, where the images will be filtered by the first algorithm; Midpoint Filter. Midpoint Filter measurement is by calculating the maximum and the minimum pixel, then divide it by 2 from the kernels. After the filtering, the pixel that already changed and stored in the array will be changed into JPG. The images will automatically be stored to the chosen folder. Next, measuring the MSE and PSNR to find the result.

HARMONIC MEAN FILTER



Flowchart above tells that the first thing to do is input the USG images. After that, the USG images will be changed into grayscale. Next, the resolution of the images will be checked and the pixel will be shown. The next step is filtering, where the images will be filtered by Harmonic Mean Filter. The measurement is by divide all the pixels by 1, then total of the kernels will be divided by the average of every divided pixels. After the filtering, the pixel that already changed and stored in the array will be changed into JPG. The images will automatically be stored to the chosen folder. Next, measuring the MSE and PSNR to find the result.