CHAPTER 4
ANALYSIS AND DESIGN

4.1 Analysis

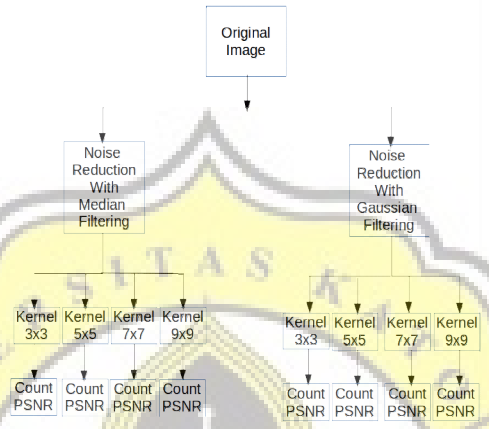

Illustration 4.1: Diagram Analysis

This project use Gaussian Filtering method and Median Filtering method with different size of kernels , 3x3 , 5x5 , 7x7 , 9x9 to reducing noise in images , also this project use PSNR (dB) value as the parameters to find out the quality of an images that processed with Gaussian Filtering method and Median Filtering method

1. Gaussian Filtering

Gaussian Filtering use convolution method to processing the original images , the convolution method means changing original pixel value which multiplied by kernel value

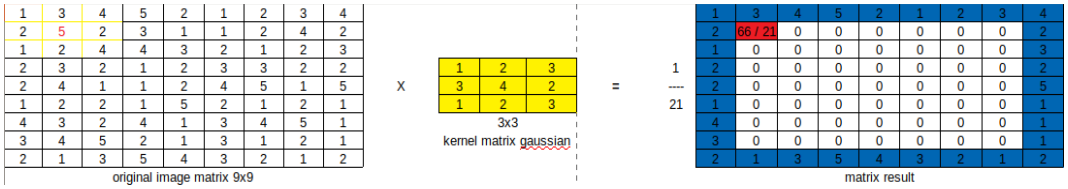

Illustration 4.2: 3x3 Kernel Gaussian Matrix

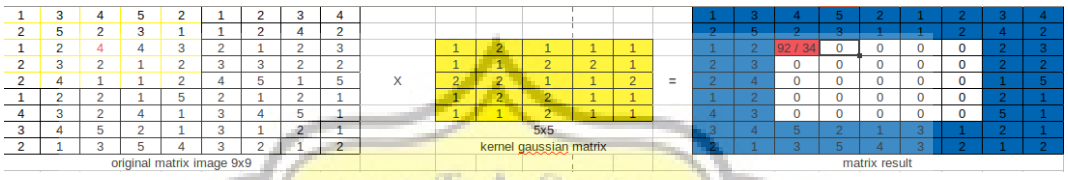

Illustration 4.3: 5x5 Kernel Gaussian Matrix

Illustration 4.4: 7x7 Kernel Gaussian Matrix

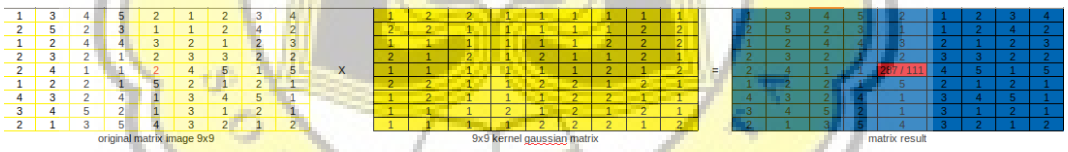

Illustration 4.5: 9x9 Kernel Gaussian Matrix

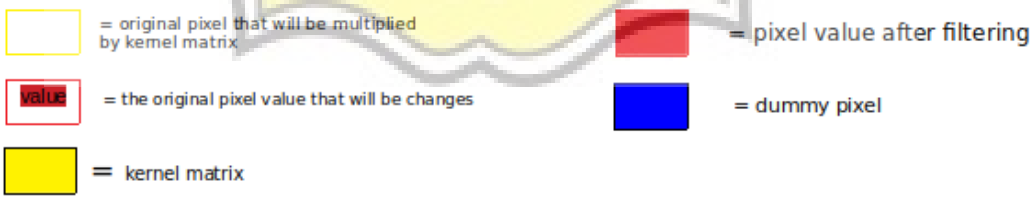

Illustration 4.6: Note

To determine the kernel value of gaussian using the formula :

$$G(x,y) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}}$$

Note :

g (x,y) = position of kernel matrix

o = standart deviation

2. Median Filtering

Median Filtering changing the value of pixel by finding the median value of surrounding pixels

1	2	2	1	3	4	4	2	1
7	4	2	1	6	7	4	2	2
2	3	4	5	9	7	5	1	5
3	2	5	2	3	5	4	3	4
5	1	5	7	4	5	2	1	4
5	2	5	6	2	3	5	7	3
3	3	2	3	4	7	4	5	2
2	2	3	4	5	2	3	5	3
1	5	3	2	1	3	2	4	5

=

1	2	2	1	3	4	4	2	1
7	2	0	0	0	0	0	0	2
2	0	0	0	0	0	0	0	5
3	0	0	0	0	0	0	0	4
5	0	0	0	0	0	0	0	4
5	0	0	0	0	0	0	0	3
3	0	0	0	0	0	0	0	2
2	0	0	0	0	0	0	0	3
1	5	3	2	1	3	2	4	5

Illustration 4.7: 3x3 Kernel Matrix Median

1	2	2	1	3	4	4	2	1
7	4	2	1	6	7	4	2	2
2	3	4	5	9	7	5	1	5
3	2	5	2	3	5	4	3	4
5	1	5	7	4	5	2	1	4
5	2	5	6	2	3	5	7	3
3	3	2	3	4	7	4	5	2
2	2	3	4	5	2	3	5	3
1	5	3	2	1	3	2	4	5

=

1	2	2	1	3	4	4	2	1
7	4	2	1	6	7	4	2	2
2	3	3	0	0	0	0	1	5
3	2	0	0	0	0	0	3	4
5	1	0	0	0	0	0	1	4
5	2	0	0	0	0	0	7	3
3	3	0	0	0	0	0	5	2
2	2	3	4	5	2	3	5	3
1	5	3	2	1	3	2	4	5

Illustration 4.8: 5x5 Kernel Matrix Median

1	2	2	1	3	4	4	2	1
7	4	2	1	6	7	4	2	2
2	3	4	5	9	7	5	1	5
3	2	5	2	3	5	4	3	4
5	1	5	7	4	5	2	1	4
5	2	5	6	2	3	5	7	3
3	3	2	3	4	7	4	5	2
2	2	3	4	5	2	3	5	3
1	5	3	2	1	3	2	4	5

=

1	2	2	1	3	4	4	2	1
7	4	2	1	6	7	4	2	2
2	3	4	5	9	7	5	1	5
3	2	5	4	0	0	4	3	4
5	1	5	0	0	0	2	1	4
5	2	5	0	0	0	5	7	3
3	3	2	3	4	7	4	5	2
2	2	3	4	5	2	3	5	3
1	5	3	2	1	3	2	4	5

Illustration 4.9: 7x7 Kernel Matrix Median

1	2	2	1	3	4	4	2	1
7	4	2	1	6	7	4	2	2
2	3	4	5	9	7	5	1	5
3	2	5	2	3	5	4	3	4
5	1	5	7	4	5	2	1	4
5	2	5	6	2	3	5	7	3
3	3	2	3	4	7	4	5	2
2	2	3	4	5	2	3	5	3
1	5	3	2	1	3	2	4	5

=

1	2	2	1	3	4	4	2	1
7	4	2	1	6	7	4	2	2
2	3	4	5	9	7	5	1	5
3	2	5	0	0	0	4	3	4
5	1	5	0	7	0	2	1	4
5	2	5	0	0	0	5	7	3
3	3	2	3	4	7	4	5	2
2	2	3	4	5	2	3	5	3
1	5	3	2	1	3	2	4	5

Illustration 4.10: 9x9 Kernel Matrix Median

= original pixel value

= pixel dummy

= original pixel that will be processed

= pixel value after processed

5 = original pixel that will be changed

Illustration 4.11: Note

3. PSNR (Peak Signal to Noise Ratio)

The higher PSNR value , the better quality of images , PSNR using formula :

$$PSNR = 10 \cdot \log_{10} \left(\frac{MAX_I^2}{MSE} \right)$$

Note :

MAX = maximal value of pixel (255)

MSE = Mean Square Error

Before calculating PSNR value , calculate the MSE value first using formula :

$$MSE = \frac{1}{mn} \sum_{i=0}^{m-1} \sum_{j=0}^{n-1} [I(i,j) - K(i,j)]^2$$

Note :

m x n = dimensions of the image (width * height)

I = original image

K = processed image

(i , j) = the coordinate of pixel

4.2 Design

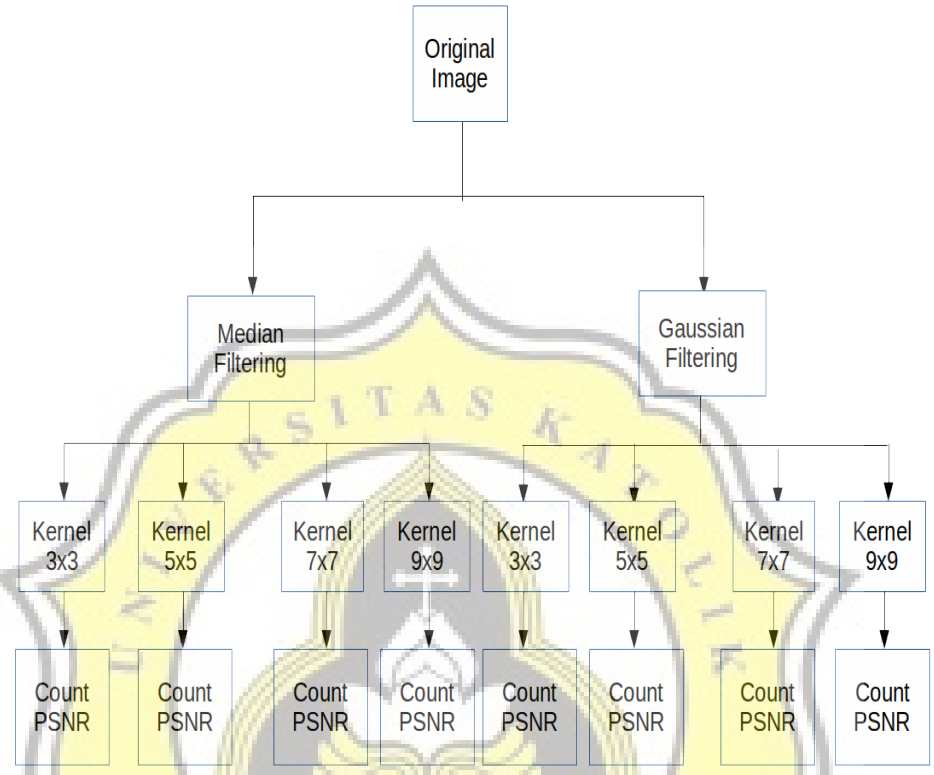

Illustration 4.12: Data Flow Diagram

The object in this project is 20 images with noise (10 salt & pepper noise , 5 speckle noise , 5 gaussian noise) which obtained from the web so it has various color (RGB / grayscale) and various resolution.

Then all the images are processed by Median Filtering method and Gaussian filtering method with different size of kernels , 3x3 , 5x5 ,7x7 , 9x9 for reducing a noise in images

After the images has been processed by 2 methods with different size of kernels , then count the PSNR (dB) value of each processed images

Comparing the PSNR value of processed image between Median Filtering and Gaussian Filtering methods , the higher PSNR value , the better method it has