CHAPTER 4
ANALYSIS AND DESIGN

4.1 Analysis

The quality of images is not all of good quality in the meaning have a high pixel quality. All depends on the lighting factor when taking a picture or camera sensor less of extensive capture power so the image is bad and the quality is poor. One of the method for improving image quality that can be doing is by Contrast Stretching (CS) and Histogram Equalization (HE) that is stretching the degree of gray and leveling the quality of pixels. We need an original image for processing then using contrast stretching or histogram equalization to improve image quality. After that we had an output image and we execute it with original image to get PSNR value.

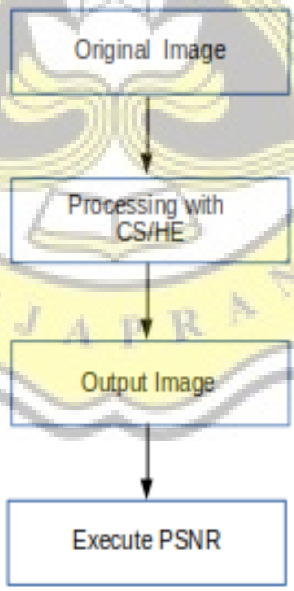

Illustration 4.1: Processing the Image

Contrast Stretching

Contrast Stretching is talk about distribution pixel intensity to expand the range of intensity through point operation. The Original Pixel range is 84-153 to expand it from range 0-255, we subtracting 84 from each pixel intensity making the range 0-69. After that, we multiplied each pixel by 255/69 so the result will be 0-255 and contrast stretching done.

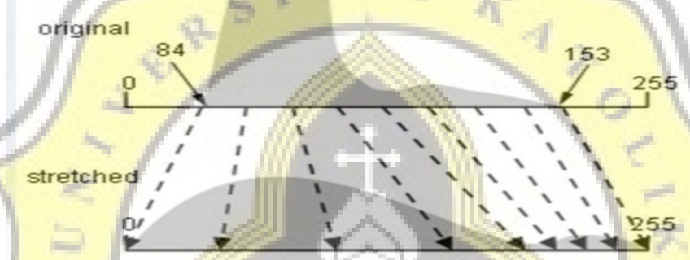

Illustration 4.2: Contrast Stretching Techniques.

Histogram Equalization

The purpose of Histogram Equalization method is to produce distributed histogram so that also called leveling histogram. Histogram Equalization formula is below :

$$h(v) = \text{round}\left(\frac{cdf(v) - cdf_{min}}{(M \times N) - cdf_{min}} \times (L-1)\right)$$

Illustration 4.3: Histogram Equalization Formula

v: the pixel value you want to replace.

cdf (v): the cumulative distribution function for the value of v.

cdf min: minimum value from the cumulative distribution.

MxN: image building pixel, with M number column and N number of rows.

L: gray chopped which can be used, image gray 8 bits then L = 256. We get cdf from the sum of probability, the probaility getting from pixel divided by total frecuency pixel. We can also get the cdf min and cdf max. MxN is the size of image column x rows. L is the range of Equalized example 0-256.

Table 4.1: Pixel and Count Frequency.

Value	Count	Value	Count	Value	Count	Value	Count	Value	Count
52	1	64	2	72	1	85	2	113	1
55	3	65	3	73	2	87	1	122	1
58	2	66	2	75	1	88	1	126	1
59	3	67	1	76	1	90	1	144	1
60	1	68	5	77	1	94	1	154	1
61	4	69	3	78	1	104	2		
62	1	70	4	79	2	106	1		
63	2	71	2	83	1	109	1		

Table 4.2: Example to Get CDF Value.

v, Pixel Intensity	cdf(v)	h(v), Equalized v
52	1	0
55	4	12
58	6	20
59	9	32
60	10	36
61	14	53
62	15	57
63	17	65
64	19	73
65	22	85
66	24	93

4.2 Design

1. Contrast Stretching

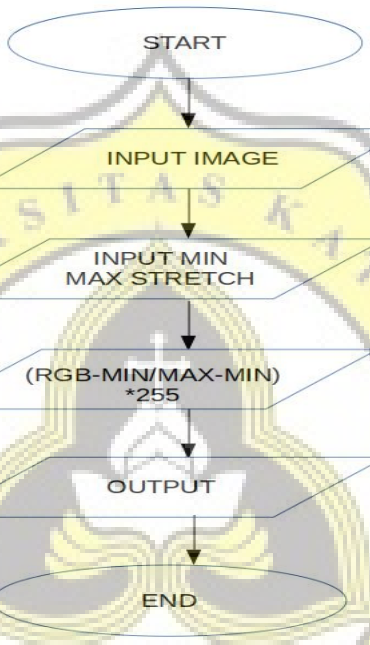

Illustration 4.4: Contrast Stretching FlowChart

That is Contrast Stretching flowchart by inputting the original image, then we input the min max stretch value. After that, we enter the formula (rgb-min) / (max-min) * 255 to get the value of contrast stretching then the next process printing the output image from the contrast stretching process.

2. Histogram Equalization

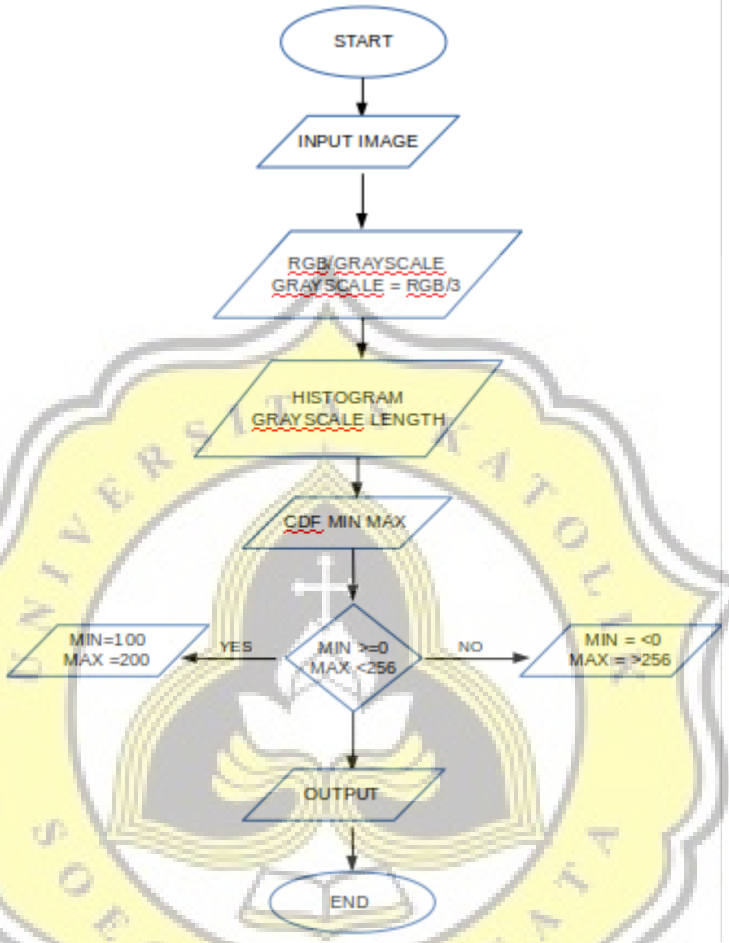

Illustration 4.5: Histogram Equalization Flowchart.

To do Histogram Equalization method we need an original image rgb/grayscale if the input rgb image we must divide the value of rgb by 3 to make grayscale. After that, we make histogram length to get the range intensity of pixel then we make a cdf of the image the parameter to get min max cdf in 0-255 range is min>=0 and max <256 then we get the output image after processing it.

3. PSNR

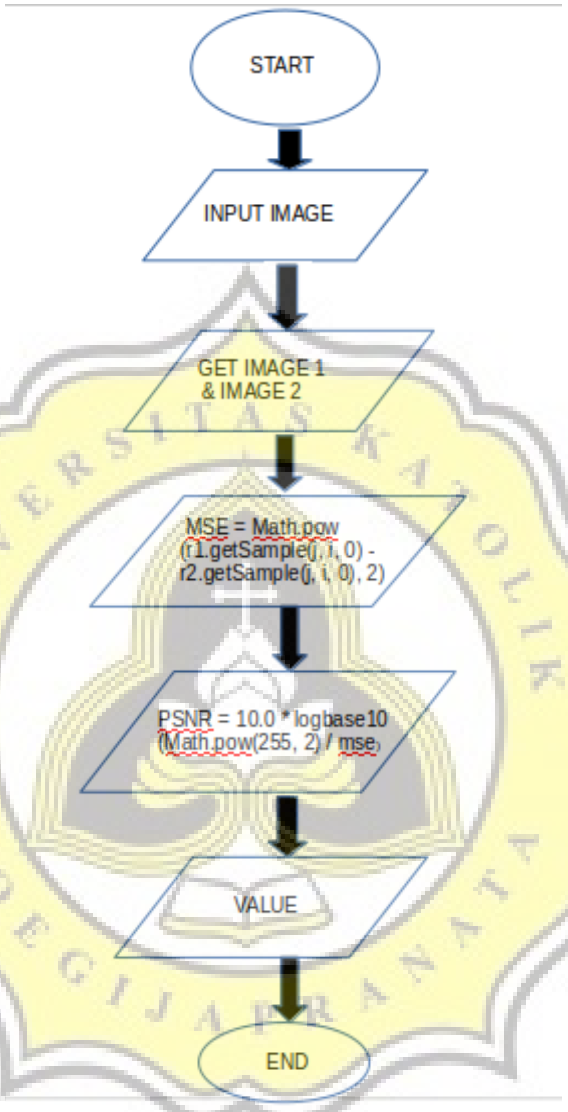

Illustration 4.6: PSNR Flowchart.

Finding a PSNR requires 2 image input, that is original image and processed image. Then we find MSE value first, the pixel value of the comparison - the pixel value of the original image using the math pow command. After getting the MSE value, then enter it into the PSNR formula.