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LINEAR OPERATION TO QUALITY IMPROVEMENT COAL IMAGE USING *CONTRAST STRETCHING* AND *SOBEL*

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ABSTRACT

This linear operation is one way to improve image quality using contrast stretching and sobel methods. The processed image has a higher contrast value so that it can produce new information. This study aims to apply the contrast stretching method to improve the quality of coal images in JPEG format. Based on the test results, the average value of coal variance has increased. This result proves that contrast stretching causes the spread of RGB values to be even. The even distribution of RGB values causes the coal image to have better contrast than the original image before the repair. Where the results of the study found that the quality of coal was obtained based on the level of calorie content contained in coal, the smaller the calorie content, the quality of the stone was very good

Keywords: *Image, Coal, Contrast Stretching, Sobel, Calorie*

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INTRODUCTION

Digital image is a picture of an object that is analog in the form of *video* signals on a television monitor, or digital that can be directly stored on a storage media such as *hard disk, flash, memory card* and various other storage media (Zhang et al., 2021).

In the process of capturing images using a camera, most images are not in accordance with the expected results, this can occur because of fog or light that blocks the object being taken (Santos et al., 2019). In sending image data from a distance, it causes poor image quality as well as images have low and high contrast due to the intensity of sunlight (Sun et al., 2006). This condition affects the quality of lighting in the image captured. Images that are too bright or too dark can disguise the information contained in the image (Chen et al., 2018), To improve image quality, a method is needed so that the image can be conveyed properly. The Contrast Stretching method has a good ability to improve image quality and is able to improve image quality (Hai-long et al., 2021).

Energy has an important role in various economic activities and people's lives (Mofijur et al., 2021). Therefore, in national development, energy becomes one of the most important economic input factors in the production process, in addition to capital, labor, raw materials, and technology (Hassan & Bhuiyan, 2017).

Towards the end of the century, it faced a very serious energy problem. Especially energy derived from petroleum. So far, petroleum has become the main focus in national development, both as a source of energy and as a source of income. However, this situation cannot be relied upon in the future because the presence of petroleum in will run out. Therefore, it is necessary to find alternative energy sources that can be used (Asana et al., 2017).

Indonesia Blessed with the potential of good quality coal which is very abundant. In line with the energy diversification policy, coal has a very large opportunity to replace the role of petroleum (Supriyatin, 2020).

The contrast stretching method is a method done by increasing or decreasing contrast (lighting) so that the image is sharper than the image. The image formats used are JPG, BMP, and GIF. So this study will be developed image quality improvement with the same method but with input in the form of RGB images (Wakhidah, 2011).

Although an image is rich in information, but often the image we have has a decrease in quality (degradation), for example, contains defects or noise (noise), the color is too contrasting, less sharp, blurring (blurring), and so on. Of course, this kind of image becomes more difficult to interpret because the information conveyed by the image becomes less. In order for a disturbed image to be easily interpreted (both by humans and machines), it needs to be manipulated into another image of better quality using image processing techniques (Cao & Li, 2020).

METHOD

In changing the pixel contrast value of the original pixel using the conditions as in figure 2.1, namely:

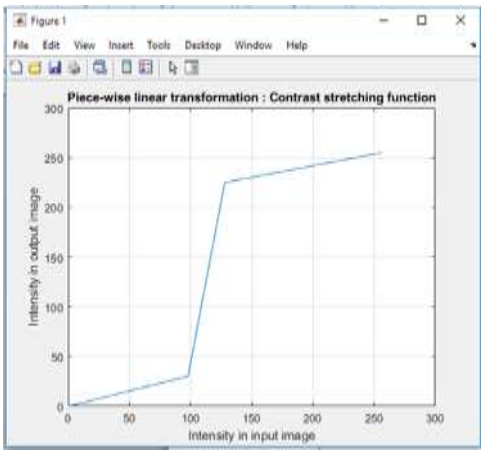


Figure 2.1 Digital Image Detection

1. There will be a change in the pixel contrast value if the grayness values R1 ≤ R2 and S1 ≤ S2.
2. There will be no change in the pixel contrast value if the grayness values are R1 = R2 and S1 = S2.
3. will transform the image into a binary image (*thresholding*) if r1 = r2 and s1 = 0 and s2 = 255.

The sobel method is a method that uses two kernels measuring 3x3 pixels for gradient calculations so that the approximate gradient is right in the middle of the window. The amount of gradient calculated using the sobel operator is as follows:

$$G = \sqrt{S\frac{2}{x} + S\frac{2}{y}}$$

G = large gradient operator sobel

Sx = horizontal sable gradient

Sy= vertical sobel gradient

Where G is the magnitude of the gradient at the midpoint of the *ernel* and the partial derivative is calculated using the following equation:

$Sx = (a_2 + c\ a3 + a_4) – (a_0 + c_{a7} + a_6)$

$Sy = (a_0 + c\ a1 + a_2) – (a_6 + c_{a5} + a_4)$

Where C is Constanta which is worth 2. Sx and Sy are implemented into the following kernels:

Sx=

-1	0	1
-2	0	2
-1	0	1

Sy=

1	2	1
0	0	0
-1	-2	-1

Figure 2.2 Sobel Operator

The input image in the form of grayscale images The Sobel method in detecting the edges of a digital image is as follows:

1. Convolution grayscale images with horizontal sobble kernels.

(Sx) = and vertical sobel kernel = $\begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 2 & 1 \\ -2 & 0 & 2 \\ -1 & -2 & -1 \end{bmatrix}$

2. Calculate gradient size with formula

$$G = \sqrt{S\frac{2}{x} + S\frac{2}{y}}$$

The output image is the result of a large gradient(G)

RESULTS AND DISCUSSION

The initial process of inputting data from a function is obtained in the following way:

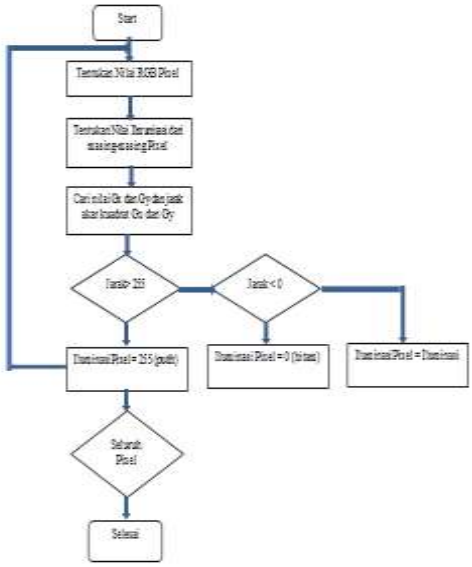
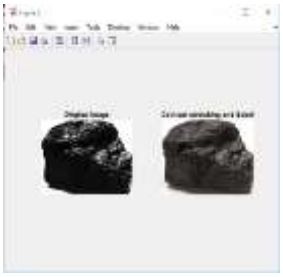
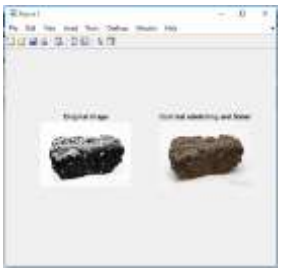


Figure 4.1 Data initial process flow

```
Function result = Contrasstectching (image, r1, r2, s1, s2)
Image = im2double(image);
Result = image;
[m,n] = size(image);
R1 = r1/255;
R2 = r2/255;
S1 = s1/255;
S2 = s2/255;
For k = 1 : m
For l = 1 : n
If (image(k,l)<= r1)
```

Table 1. Data Test Results

Types of Coal	Contrast Streching and Sobel	Information
		Volatile content < 2% in dry state

Anthracitic Rank		
Rank Bituminous		Volatile content >14% - <22% in dry state
Rank Sub-Bituminous		>10500 BTU/lb - <11500 BTU/lb
Lignitic Rank		>6300 BTU/lb - <8300 BTU/lb

The results of the data test found that what affects the improvement of coal quality can be seen from the caloric content where the smaller the calorie content, the quality of the new brick is very good, after testing the data, it can be seen that a very good improvement in coal quality can be seen in the table above.

CONCLUSION

Thus linear operations can improve coal quality improvement using contrast streching and sobel methods, where the improvement in coal quality depends on the level of calorie content, the smaller the calorie content, the quality of coal is very good and vice versa, the author hopes that this research can be used as a reference to conduct other research in the field of coal and the author also hopes to use other methods In research can improve the results of research for the perfection of research later.

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