Optical Systems and Digital Image Acquisition

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Abstrak

The image is formed continuously and discrete. The color of the image that the human being sees is determined by the color of the light reflected by the object. Visible (visible spectrum) rays that respond to the eye are about 400 nm (blue) to 700 nm (red). The image formed by eyes is a 2D image, while the object being viewed is 3D. The element (row, column) of the matrix represents the average light intensity in the image area represented in pixels. The results of image identification based on the process of color formation and representation into the matrix aims to facilitate the process of image digitization to produce a better image quality. The image generated by the digitalization process is an early stage of processing digital image formation. The information of the object form can be extracted from the result of preprocessing the image.

Keyword: RGB, Digital Image, Matrix, Preprocessing

I. INTRODUCTION

The color of the object that the people sees is the result of the intensity of light received and then reflected object. The colors received by eyes are the result of a combination of light with different wavelengths. Some experts define colors in the form of RGB (Red Green Blue), CMYK (Cyan Magenta Yellow Black), IHS (Intensity, Hue, Saturation) and Binary (Black and White). The image model is a malar function (continuous) of the intensity of light in a two-dimensional plane. Color images are known as spectral images, arranged by three color components called RGB components, namely red, green, and blue. Each color component uses 8 bits (its value ranges from 0 to 255). color image, amount colors can range from 16, 256, 65536 or 16 million colors each represented by 4.8,16 or 24 bits of data for each pixel.Other colors are obtained by mixing the three basic colors with a certain ratio. Each object contains RGB components, this can be seen when a

digital image is converted in a matrix. A collection of pixels forms columns and rows, the upper-left corner pixel has coordinates (0, 0) and the pixels in the lower-right corner have coordinates (N-1, M-1).
An image must be represented numerically with discrete values. The image representation of the malar function (continuous) into discrete values is called digitalization. The resulting image is called digital image. Image digitization is obtained from an optical system equipped with digitalization function so as to produce discrete images (digital) samples of digital cameras and scanners. The images are saved in .jpg, .bmp, .tif format. Digital image sizes are stored in pixel size, the higher the resolution, the smaller the pixel size (the greater the number of pixels), the smoother the images obtained due to lost information due to grayer grouping on smaller scales. Preprocesing digital images such as resizing, grayscale, thresholding process aims to create better image quality digitally.

II. LITERATURE REVIEW

1. Digital Image

The image (image) is the image on the dwimatra plane (two dimensional).Digital image is an image captured by the camera and quantized in the form of discrete value. Continuous images are generated from optical systems that receive analog signals. Discrete images are generated through the process of digitizing the continuous image. Some optical systems are equipped with digitalization functions so that they are capable of producing discrete images, such as digital cameras and scanners. Digitizer (digital image acquisition system) is a digital image capture system that performs image scanning and converts it into numeric form as input for the computer produces a matrix whose elements express the value of the light intensity at a point.Image acquisition is the process of capturing or scanning an analog image to obtain a digital image. Digital image processing is a discipline that studies techniquesimage processing.

2. Color Basics

The color combinations that provide the widest range of colors are red (R), green (G), and blue (B). These three colors are called staple colors (primaries, true color images), containing a matrix of data sized m x n x 3. Grayscale image is an image that only uses color on the gray color level. The gray color is the only color in the RGB space with red, green, and blue components having the same intensity. Binary images store images in the form of matrices whose elements contain 0 and 1, can only display two colors, namely black (0) and white (1). The indexed image stores images on two matrices, the first matrix having the same size as the number of pixels in the image. Each element in this matrix is a number that is a color code. Meanwhile, the second matrix (also called the color map) stores the color intensity value corresponding to the color code of the first matrix. Based on the

color attribute, each color has 3 attributes, namely intensity (I), hue (H), and saturation (S).

3. Image Digitalization

Digitalization is the image representation of continuous functions into discrete values. The resulting image is called digital image (digital image). Dimension size expressed by height (N) x width (M) or (width x length). Digital image with L gray degree, function:

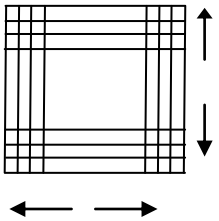
$$f(x,y) = \begin{cases} 0 \le x \le M-1 \\ 0 \le y \le N-1 \\ 0 <= f <= L \end{cases}$$

Digital images of size N (row) x M (column) are expressed by matrix:

$$\boldsymbol{f(x,y)} = \begin{bmatrix} f(0,0) & f(0,1) & \dots & f(0,M-1) \\ f(1,0) & f(1,1) & \dots & f(1,M-1) \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ f(N-1,0) & f(N-1,1) & \dots & f(N-1,M-1) \end{bmatrix}$$

Index row i and column j represent the coordinates of dots on the image. f (i, j): intensity (degree of gray) at point (i, j). Each element of a digital image (a matrix element) is called an image element, picture element or pixel or mop. The gray image is generally quantized at 256 levels, requiring 8 bits for the representation of each pixel (G = 256 = 28) Binary imagery is quantized at levels 0 & 1, only 1 bit for the representation of each pixel. An image is represented in a matrix with height = h width = w;

h



w

Figure 1. Matrix h x w

III. RESEARCH QUESTIONS

Preprocesing image is the initial process of digital image acquisition system, image scan results are stored in .jpg file format. The sampling process is the process of converting the image coordinates into discrete. Performed by dividing the image into unit boxes called pixels (pixels). Meanwhile, the quantizing process is the process of assigning an intensity value to each pixel. The problem that arises is how the process of preprocessing digital image and how to eliminate noise that exist in digital image.

IV. METHOD

1. Research Design

A computer as a processor requires a display device to convert an intensity matrix that represents an image into a view that can be interpreted by people. Stage acquisition image preprocessing:

a. Resize image
   Digital image processing produces digital images, stored in pixels size. Large image size affects the preprocessing process, it is necessary to resize the image.
b. Convert RGB image - Grayscale
   Image digital image consists of RGB components, then change the color of RGB to grayscale (gray)
c. Grayscale image - Thresholding
   Next the grayscale image is converted to black and white by doing thresholding technique or changing the image from gray to black-and-white image.
d. Representation of images into matrix form
   Image is converted into digital form (matrix) to be digitized.
e. Method image processing
   The noise that appears around the digital image needs to be removed.

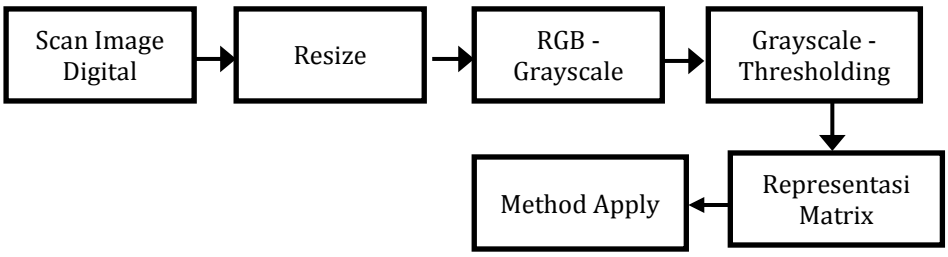


Figure 2. Research Design

2. Literatur

Literatures sourcesfrom Google Scholar the image acquisitionas follows:

a. Penyisipan citra pesan ke dalam citra berwarna menggunakan metode least significant bit dan redundant pattern encoding by Rahmandhita Fikri Sannawira, Agus Sidiq Purnomo, 2016.
b. Klasifikasi Warna Menggunakan Pengolahan Model Warna HSV, by R. D. Kusumanto, Alan Novi Tompunu, dan Wahyu Setyo Pambudi, 2011.
c. Akuisisi citra digital menggunakan pemrograman Matlab by Jana Utama ST.

V. DISCUSSION

The process of image acquisition begins from an object that is taken picture to be a digital image. A light source is needed to illuminate the object, which means there is an intensity of light received by the object. Implementasi image

processing acquisition begins by preparing the input data*name.jpg*size378 x 401 x 3, resultcaptureof image by handphone (Figure 3).

Figure 3. Image Size378x401x3

Resize Image

Image size is RGB : 378x401x 3 so the data source is changed in several sizes(pixels)150x150, 300x300, 500x500 ; RGB : 536x514x3 (Figure 4)

150x150 Pixel	300x300 Pixel	500x500 Pixel
		

Figure 4. Result Image

Konversi RGB –Grayscale

Each image consists of Red, Blue and Green color components. The script in Matlab converts the RGB image into Grayscale:red=image (:,:,1); green=Image(:,:,1);blue=Image(:,:,1);gray2=0.3*red+0.5*green+0.2*blue;

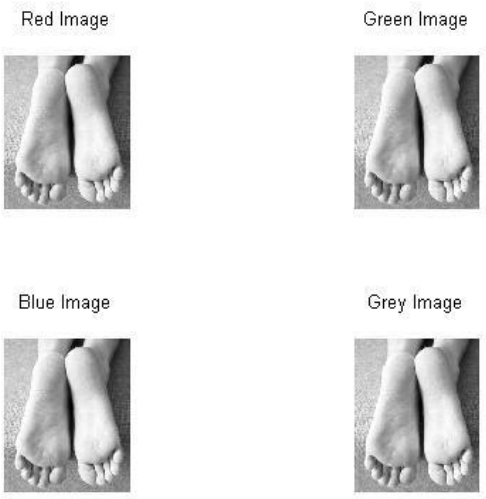


Figure 5.Grayscale Processing

Thresholding Processing

The resulting grayscale image will be thresholded or change the image from gray to black-and-white image BW Image 464x65

Figure 6.Thresholding Processing

Representation of images inmatrix

Each pixel is depicted as a small box. Each pixel has position coordinates. The coordinate system used to express the digital image is shown in the mxn image coordinate system (m row and column n). Digital image is an image that has been through the process of sampling &quantisizing produce a discrete image. the digital image as a matrix of size m x n, with m: the length of the image, n: the width of the image and the elements in the matrix is the intensity of the color in each pixel in the image. The matrix shows the conversion of images represented by RGB to indexed image. The image representation using indexed image can reduce the size of data storage.

255	254	255	254	255	244	254	244	255	255	255
255	253	255	253	255	252	255	253	255	242	255
252	249	251	249	248	251	248	246	241	236	253
251	249	250	249	251	250	248	250	251	250	251
250	248	250	248	237	246	245	244	250	246	223
31	31	35	34	49	50	49	36	44	52	72
30	34	37	39	37	29	36	39	49	44	45
24	28	29	32	28	34	37	41	39	39	40
26	27	27	28	27	32	35	39	39	38	40
29	28	26	26	27	32	34	39	40	39	41

Figure 7. Matrix Data Sample

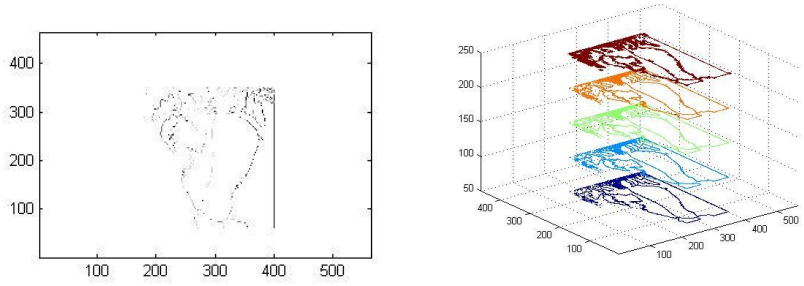


Figure 8. (a) Countur Image (b)Countur 3D.

Method Image Processing

After the pre-process stage of digital image, the next process implements imaging process methods such as thresholding, segmentation and various algorithms that can be applied to improve image quality. The process of segmentation, carried out

the analysis of objects in binary imagery. The process of segmentation aims to group pixel-pixel objects into regions (regions) that represent objects. The histogram shows the brightness and contrast of an image.

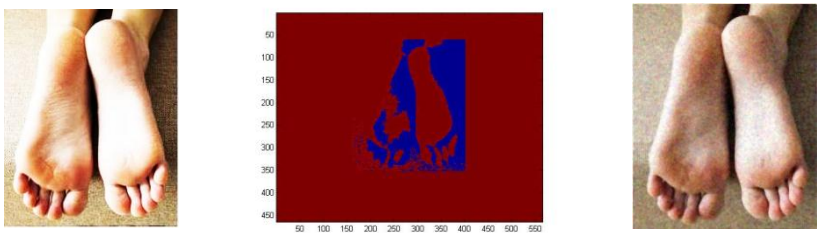


Figure 9 a)Brightness b)Gestur c) Noise

VI. CONCLUSIONS

At the time of taking the image must pay attention to light conditions, position, and image quality. Digitalization of data sources is required to obtain digital images containing light intensity. Processing images in RGB format, first the image color components are separated according to its components including grayscale. Once processed, the components are reassembled into a full RGB image. Preprocess image is the first stage in digital image processing. Furthermore, the implementation of methods and various algorithms to achieve a higher quality image results according to the purpose of image processing.

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