Image Processing Application for 2 Dimensional Image Improvement Based on Graphical User Interface (GUI) USING Matlab

Surya Guntur[1], Ahmad Riady Hasibuan[2], Putri Rizki Syafrayani[3]
[1]Department of Informatics Management, Politeknik Ganesha, Indonesia
[2] Department of Primary Teacher Education, Universitas Muhammadiyah Sumatera Utara,Indonesia
[3] Department of English Applied Linguistics, Universitas Negeri Medan, Indonesia

ABSTRACT

Image is a 2-dimensional image that can produce some information. A lot of information can be obtained from an image if the image displays the condition of the object that has been converted into a 2-dimensional image, so that the color, shape, size and other parameters can be known. If the image is not good or not clear and is not as expected, it is necessary to improve the image. In some images, images are sometimes found that are not in accordance with expectations because they are damaged or there is a change in color and pixel defects. This can be caused by noise in the image or damage to the color caused by the length of the image. Therefore, to overcome various problems of damage to the image, it is necessary to improve the image. To improve the image, there are two things, namely the color or gray of the image and the pattern (pattern) of the image. For image repair with damage to color with a widened pixel area, it does not form a pattern but tends to occupy the area of the pixel, while pattern damage generally takes the form of breaking the similarity of the pixel values. To perform image processing or image repair at the pixel level, you can use Matlab because Matlab provides functions or commands/coding related to image processing. In addition to commands/coding, Matlab also provides a more representative form for displaying images. The GUI is a graphical user interface that can be used to display images from before and after repairs.

Keyword : Image; GUI; Matlab; Pixel; Pattern;

Corresponding Author:
Surya Guntur
Department of Informatics Management
Politeknik Ganesha
Jl. Veteran No. 194
Email : guntur@polgan.ac.id

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1. INTRODUCTION

In today's modern industry, technology plays a very important role in facilitating human work processes. Especially in industry, many units that used to be worked on by humans have been replaced by technology so that the role of technology greatly influences the process in industry. Technology that is no less important is vision technology by applying vision technology, the process can be more accurate because visually the object can be seen more clearly. The vision part includes image processing produced by the visual sensor of the camera. So that things related to image processing become important, namely: repair, analysis, image compression, restoration, image transmission, image reconstruction, and image representation (Jain, 1989). One of these image repair systems is an image recognition and processing system with pixel size and file format specifications. This system imitates the human thinking algorithm to recognize images, namely the process of observing and comparing images before and after they have been repaired. Image processing is one of the techniques used to process images and manipulate them to obtain the desired image. This is necessary because each image element or pixel carries at least two pieces of information, namely location and color. If an image has a size of 320 x 200 pixels, then it is at least 320 x 200 x 2 information or 128,000 information (Muharom Syahri, 2021).

So that the image which is a 2-dimensional image is susceptible to changes in image color or image damage due to noise. So to make improvements or image reconstruction is needed to be able to approach the original image.

One of the devices/software that can be used to perform image processing is matlab because in matlab there are already functions/coding related to images. In addition to the functions that are already

available in matlab, there is also a GUI (graphic user interface) that allows you to create a display for images, not only value information can be displayed in the form of images (Gonzalez Rafael C, 2002).

2. RESEARCH METHOD/MATERIAL AND METHOD/LETERATURE REVIEW

A. Digital Vision

A digital image is a matrix where the row and column indices represent a point in the image and the matrix elements (called image elements or pixels) represent the gray level at that point (Johan Supriyanto, 2013).

In general, a digital image is a visual representation of an object stored in digital format, consisting of a collection of pixels or dots that form an image (Agung Adhitya, 2023). Digital images can be produced in a variety of ways, including using a digital camera, scanning a physical object, or creating computer graphics. Digital images are often manipulated, edited, or retouched using image processing software such as Adobe Photoshop or GIMP.

B. Image Histogram

An image histogram is a graph that describes the distribution of pixel intensity values of an image or a particular part of an image. From a histogram, the relative frequency of occurrence of the intensity in the image can be known. Histograms can also show a lot about the brightness and contrast of an image. Therefore, histograms are valuable tools in image processing work both qualitatively and quantitatively (Munir, 2019).

In the Histogram there are several calculations, for example, a digital image has L degrees of gray, namely from a value of 0 to L – 1 (for example, in an image with 8-bit gray quantization, the gray value is from 0 to 255 (Anggraeni, 2007).

C. Matlab

Matlab is a high-level, closed, and case-sensitive programming language in a numerical computing environment developed by MathWorks. One of its most popular advantages is the ability to create graphs with the best visualization (Advernesia, 2020). In this context, MATLAB provides a series of functions and tools for manipulating, analyzing, and processing digital images.

Some basic operations in digital image processing along with examples of their use in MATLAB are as follows:

1) Reading Images: img = imread('image_filename.jpg');
2) Displaying Images: imshow(img);
3) Converting Images to Grayscale: gray_img = rgb2gray(img);
4) Resizing Images: resized_img = imresize(img, [new_row, new_column]);
5) Thresholding: thresholded_img = img > threshold_value;
6) Histogram Equalization: equalized_img = histeq(img);

3. RESULTS AND DISCUSSION

In this study, because what is studied is only coding, the planning is only related to the flow of coding used for image repair in 2-dimensional images. For that, the system can be described in the form of a block diagram as below:

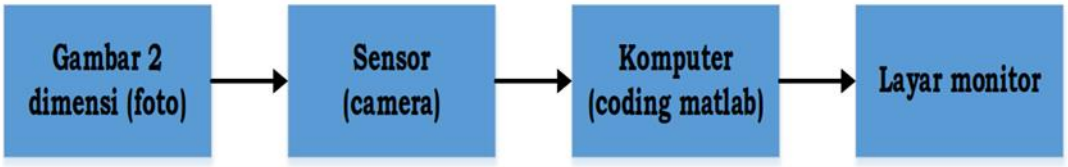

Fig 1. Image Enhancement System With Matlab

Thus from figure 1. for each block can be explained as follows:

a. 2-dimensional image, is an image in printed form (printed) or photos, for that 2-dimensional images have a resolution that is the result of printing or printing. So that the sharpness of the print on the 2-dimensional image from a soft file to a printed 2-dimensional image affects the quality of the image resolution (Jähne, 2005).

b. Sensor (camera/scanner), Scanner is a tool for reading 2-dimensional images or photos which results in image files which can then be stored in the computer directory. In reading 2-dimensional images into soft files (image files) is also determined by the selected resolution, the higher the resolution, the larger the size of the soft file, and also directly proportional to the number of pixels owned by the 2-dimensional image in the form of a soft file (muharom syahri, 2021).
c. Computer, the computer is a place to store image files from scanners/cameras in certain directories and also a place to carry out image processing. In this image processing process is done using software, GUI in matlab (Pratt, 2001). d. Monitor, is a device that functions to display 2-dimensional images. For that the results of processing by the processor that follows the matlab coding for image processing (Woods, 2001).

Thus, for the 2-dimensional image repair system, a flow like the block diagram above is used, which is the sequence for processing images on 2-dimensional images. Each block has an important role, so that from the blocks only the image processing block with matlab on the computer requires software design, while the others do not require any settings. For this reason, software planning is needed to produce a program logic algorithm that approaches what is needed for image repair on 2-dimensional images (Sundararajan, 2017). Flowchart coding for image repair below:

Fig 2. Image Processing Flowchart

After taking the photo object with a camera or scanner, the image file is obtained, then determine the current directory which is where the file will be processed by Matlab. This can be done in two ways, namely by placing the file in the current directory that is active in Matlab or directing the file call to the directory where the file is located (Jensen John R, 2015). The initial step in using Matlab for image improvement is to design a GUI (graphic user interface) in Matlab, by determining the necessary components as below:

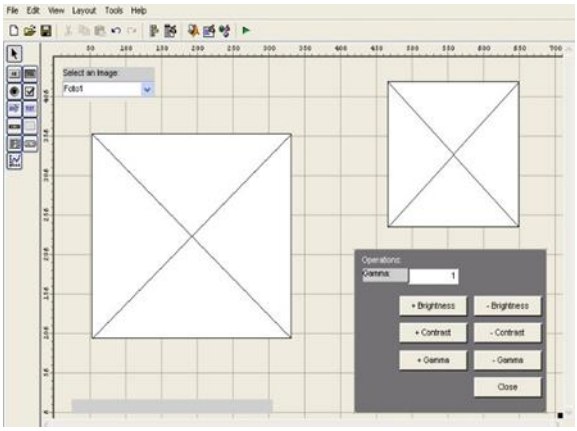

Fig 3. GUI Design

In this image repair process, it begins with reading the image or information about the image which is usually called the reading process. This image reading is very necessary to know the image before repair so that it can make it easier to do image repair. Below is the function structure in reading images, where the image used as an object is a damaged photo and is stored in the computer directory (D:\MATLAB6p5\demos) with the file name photo.jpg.

This test is conducted to determine the level of success. In addition, with the test, it can be known if there are weaknesses or deficiencies in the image, so that some necessary improvements can be made. The focus of the test lies in software testing only.

As for the hardware which is a supporting device, it will not be discussed, because the hardware is already in finished form. There are several steps in conducting image testing. Below will be explained the steps for testing image processing software from the beginning of reading the image to the results of image improvement.

A. Image Reading

Image reading is taking an image stored in a certain directory, then translating it into a matrix and from this matrix image processing can be carried out.

Fig 4. Image Reading on GUI

From the image reading method with Matlab, a matrix can be produced from the image above as shown below:

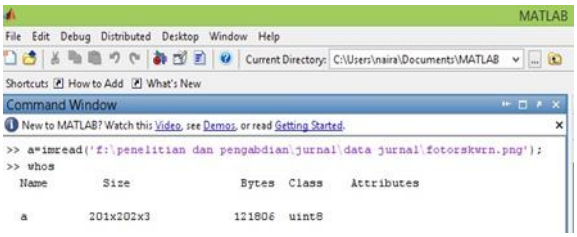

Fig 5. Image Reading With Matlab.

B. Image Improvement

After reading the image, it is necessary to improve the image as needed. This image improvement is done in 4 ways, namely brightness, contrast, gamma, and color. Below we will explain each step taken in image improvement (Ridho'i et al., 2022). Brightness, This process will provide a level of brightness to an image. This change can be seen in the image below.

Fig 6. Image Change With Brightness

By increasing the brightness value to a high grayscale towards 255 so that the image becomes brighter. Contrast, This process adjusts the gray scale color in the image. Contrast will work well when the image color is combined with the brightness intensity. This image change can be seen as shown in the image below.

Fig 7. Image Change Through Contrast

Gamma, This process has the same function as brightness, which is to adjust the brightness level of an image. But there is a difference between gamma and brightness, namely the increasing gamma (gamma > 1) will produce darker colors and vice versa the decreasing gamma (gamma < 1) will produce brighter colors. In addition, gamma has a more detailed value compared to brightness with a normal value of :

1. This image change can be seen in the image below.

Fig 8. Image Change With Gamma

Color, This process is used to adjust the color elements of the image as desired. This process is needed to repair the color elements in the image that are damaged. This image change can be seen as shown in the image below.

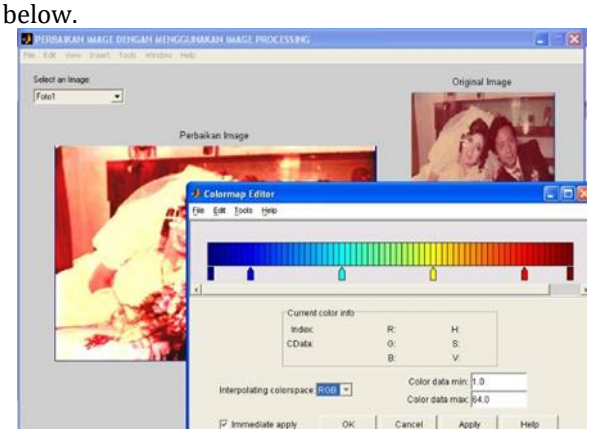

Fig 9. Image Change With Color

2. Image Comparison

After performing image repair, an image comparison is made between the image before repair and the image after repair. Below you can see the results of the comparison of the original image with the repaired image along with its values (Muharom Syahri, 2021). Images that experience color damage, images that experience color damage before repair have pixel values as below.

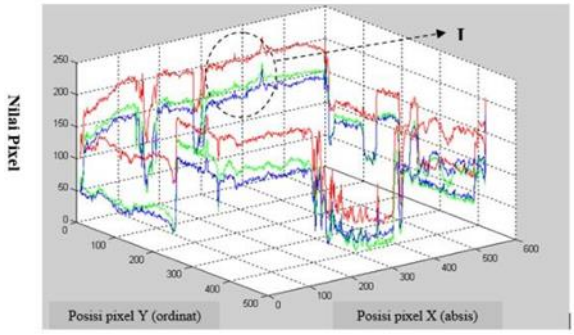

Fig 10. Pixel Value Graph Before Repair

While after image improvement, the pixel value changes as shown below.

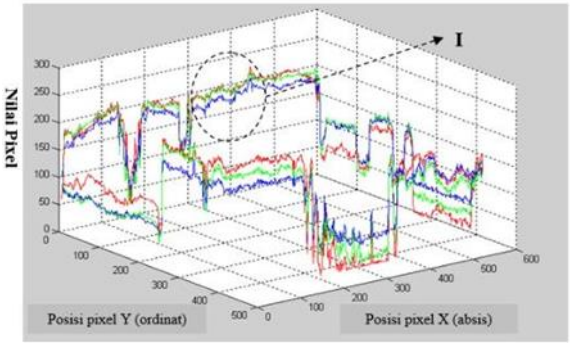

Fig 11. Pixel Value Graph After Repair

From the graphic image above, we can see the change in pixel value before and after the repair. The color of the graph above shows the RGB color, where the color is composed of red, green, and blue. Noise-affected image, the image affected by noise before repair has a pixel value as below.

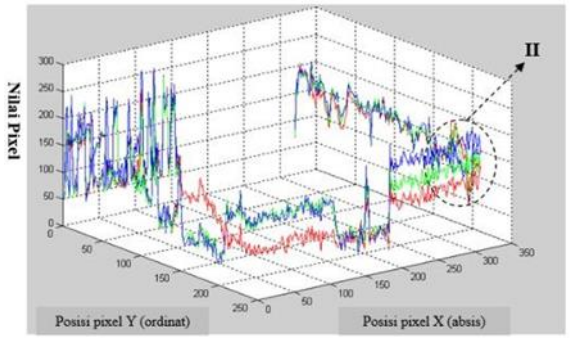

Fig 12. Pixel Value Graph Before Repair

Meanwhile, after image repair is carried out, the pixel values change as shown below.

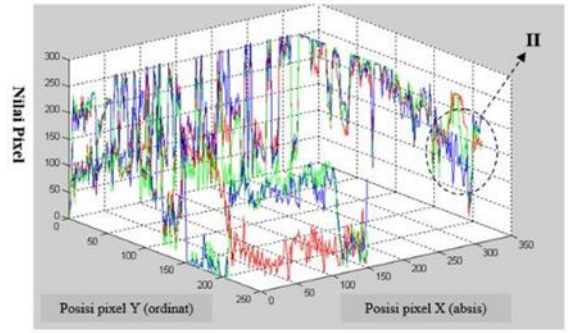

Fig 13. Pixel Value Graph After Repair

As with the graphic images that have been explained previously, the graphic image above can also be seen the change in pixel values before and after the repair. The color of the graph above shows the RGB color, where the color is composed of red (Red), green (Green), and blue (Blue).

4. CONCLUSION

Based on the results achieved during the planning, creation, and testing of software in image processing, it can be concluded as follows: this software can be used to support image file reading activities using a working algorithm that is similar to the human mind when performing the reading process, namely the process of reading 2-dimensional images or information about 2-dimensional images. The weakness of this software lies in its need for processing speed memory by the processor.

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