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Analysis Manipulation *Copy-Move* on Image Digital using SIFT Method and Histogram Color RGB

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Abstract – The application of the SIFT (Scale Invariant feature transform) algorithm and the RGB color histogram in Matlab can detect the suitability of objects in digital images and perform tests accurately. In this study, we discuss the implementation to obtain object compatibility on digital images that have been manipulated using the SIFT Algorithm method on the Matlab source, namely by comparing the original image with the manipulated image. The suitability of objects in digital images is obtained from the large number of keypoints obtained, other additional parameters, namely comparing the number of pixels in the analyzed image, as well as changes in the histogram in RGB color in each analyzed image. The purpose of this research is how to apply the SIFT (Scale Invariant feature transform) Algorithm and RGB color histogram to detect the suitability of objects in digital images and perform tests accurately. This study discusses the implementation to obtain object compatibility in digital images that have been manipulated using the SIFT Algorithm method on Matlab sources, namely by comparing the original image with the manipulated image. The application of the SIFT Algorithm (Scale Invariant Feature Transform) and RGB color histogram in determining the similarity of the keypoint location and the number of pixels in the image, to obtain object compatibility in digital images in matlab was successfully implemented and based on the test results obtained accuracy in identifying images in digital images.

Keywords – *Image Processingl, Copy-Move, SIFT, Histogram RGB*

I. INTRODUCTION

Image processing on digital images can be easily created, edited and manipulated without leaving visual instructions by the user, such as gimp and adobe photoshop applications, for example, which makes it easy for the original image to be changed / manipulated. This ability can of course also be misused to damage the credibility of the authenticity of the image in various aspects, so that it can be carried out as a crime, image changes in digital images can convey information that is different from the image in the original digital image [1]. Criminals try to manipulate the image for their own benefit. The formation of an image in a digital image is obtained from several combinations of pixels [2]. To obtain a modified image, several stages are needed in carrying out a digital image forensics process. In it there are several changes from the original at each pixel value [3].

Digital technology, especially image, has become the main technology for creating, processing, transmitting and storing information in the form of knowledge and intellectual assets. Multidimensional knowledge and intellectual assets are produced and represented in various forms such as audio, video, text, images, if grouped, we can call it a multimedia form [4]. Finally, all forms are stored as digital form and byte form i.e., digital content. Image on Digital images are widely used in our society [5]. From newspapers to magazines, scientific journals, doctors in the medical field, the fashion industry, courtrooms and so on are very dependent on digital images [6]. Information integrity is fundamental in many fields. Digital technology is currently starting to erode trust. Although cases of photo\image tampering are not new, over the last few years, tampered images appear with frequency and sophistication, the development of increasingly sophisticated digital image processing software, it has become easy to create image falsifications from one or more images without leaving clear clues [7]. Digital crime is growing at a very fast rate. This crime has caused many problems, including legal and ethical problems [8].

Image forgery in digital images is mostly done through a passive approach. One of the popular passive approaches is to manipulate by means of the copy-move technique [9]. Image falsification in digital images by means of an image being copied and then pasted into other parts of the image. Image copy-move forgery is done to hide certain details or to duplicate objects in an image. Because the forgery is done in one image, the damaged area is almost the same, the nature of the original image will be difficult to identify by humans [10].

With the field of digital image forensics, it will help law enforcement, intelligence, private investigations, and the media [11]. The increasingly advanced image technology at this time raises new issues and challenges in determining the authenticity of images in digital images. Digital image forensics is one of the scientific methods in the field of research that aims to obtain evidentiary facts in determining the authenticity of images in digital images [12]. This method Algorithm SIFT works by looking for a number of the same keypoint points that are suspected of having similar objects in the digital image, as well as calculating the number of pixels in the digital image.

This method can detect changes in scale, rotation and reflection, as well as changes in color enhancement

on a digital image. [13].

SIFT (Scale Invariant Feature Transform) algorithm is an algorithm in computer vision to detect and describe local features in the image. This algorithm is patented in Canada by the University of British Columbia and published by David Lowe in 1999. This algorithm can perform object

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recognition, robot mapping and navigation, image stitching, 3D modeling, gesture recognition, video tracking, identify wildlife [14]. In another study, the SIFT Algorithm (Scale Invariant Feature Transform) was used to match images based on the main keypoint features (scale invariant and rotation) [15]. The SIFT algorithm is one of the most widely used feature extraction methods. The Shift algorithm is used to find key points in the image, in this method it includes a shift description and a SIFT descriptor [16]. With so many crimes against image manipulation, it is hoped that the method that researchers use can analyze images in digital images so that they can detect images that have been changed from the original digital image [17].

Research on the multiple methods used in digital images has the following objectives:

1. Applying the SIFT (Scale Invariant Feature Transform) Algorithm and RGB color histogram using the Matlab application to be able to detect object matches in digital images.
2. Perform testing for better accuracy in analyzing images on digital images that have been changed from the original.

II. RESEARCH METHODOLOGY

A. Image Digital

Image is a representation (picture), likeness, or imitation of an object. The image is divided into 2, namely, there are images that are analog and there are images that are digital. Analog images are continuous images such as images on television monitors, X-ray photos, CT scan results, etc. Meanwhile, digital images are images that a computer can process.

A digital image can be represented by a matrix consisting of M columns and N rows, where the intersection between the columns and rows is called a pixel (pixel = picture element), which is the smallest element of an image. Pixels have two parameters, namely coordinates and intensity or color. The value contained in the (x,y) coordinate is f(x,y), which is the intensity or color of the pixel at that point. Therefore, a digital image can be written in the following matrix form

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

Based on this description, mathematically a digital image can be written as a function of intensity f (x,y), where x (row) and y (column) are position coordinates and f (x,y) is the function value at each point (x, y) which represents the intensity of the image or the gray level or color of the pixels at that point. In the digitization process (sampling and quantity) the number of rows M and columns N is obtained so that the image forms matrix **M x N** and the number of gray levels of pixels is G.

B. Image Resolution

Image resolution is the level of detail of an image. The higher the resolution, the higher the detail level of the image. Each base color uses 8 bit = 1 byte storage, which means that it has 255 color gradations, meaning that each pixel has as many color combinations. True color image storage in memory is different from grayscale images. Each pixel of a grayscale image has 256 color gradations represented by 1 byte. Meanwhile, 1 true color image pixel is represented by 3 bytes, each byte representing red, green, and blue.

C. Color image (24 bit)

Each pixel of a 24-bit color image is represented by 24 bits for a total of 16,777,216 color variations. This variation is more than enough to visualize all the colors that human vision can perceive. Human vision is believed to only be able to distinguish up to 10 million colors. Each pixel information point (RGB) is stored into 1 byte of data. The first 8 bits store the blue value, followed by the green value in the second 8 bits and the last 8 bits are red.

D. File Format Image

An image file format must be able to combine image quality, file size and compatibility with various applications. There are several types of standard image file formats used today. These formats are used to store images in a file. Each format has its own characteristics. These are examples of common formats, namely:Bitmap (.bmp), tagged image format (.tif, .tiff), PortablNetwork Graphics (.png), JPEG (.jpg), etc.

E. Algorithm SIFT (Scale Invariant feature transform)

Scale-invariant feature transform (SIFT) is an algorithm in computer vision to detect and describe local features in images. Applications of these algorithms include object recognition, robot mapping and navigation, 3D modeling, gesture recognition, video tracking, wildlife identification and similar image transfer.

III. RESULTS AND DISCUSSION

To do this test, the author uses the Matlab application, which has prepared the source code to detect the match of objects in digital images using the SIFT Algorithm. The following is a sample of the original image data and the manipulated image. The files have been processed using Photohop CC 2020, which are saved in JPG/JPEG format, the images include: ds_ori, ds_edit, cover, dika, agus_oci, three, girl1, girl2, cover, dian_ori, dian_edit, background, rs_ori, rs_edit, jm_ori, jm_edit, mnrp, ocy, oci_paris, oshi, sample, sample, rio, dn_edit, ds1, ds2, ar, etc. The SIFT Algorithm method used is a function that can read two images, find their SIFT features, and display a line connecting the matching keypoints. The equation obtained in the first image only if the distance is less than the ratio times the distance to the nearest equation in the second image, then returns the number of matches displayed. The way the algorithm works in this application is, after inputting two images, the initial stage is to find the keypoint on each image, the constant value is created at a ratio distance of 0.6, this is done with the hope, the way the analysis of matlab works becomes lighter, the descriptor in the first image, matched with the descriptor in the second image, the matrices in each image are recalculated, calculate the vector for each corner point, take the inverse cosine value and display the result, in addition to getting

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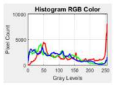
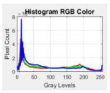
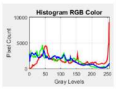
the keypoint, another additional parameter is getting the pixel value to strengthen analysis of the studied image, the results of the process are presented in Table 1 below.

Table 1. Results of Matching Dian Sastro's Pair of Objects with the SIFT Algorithm and RGB Color Histogram

Image Asli 1	Image Asli 2	Image Manipulasi	Hasil Pencocokan Image
			
HISTOGRAM RGB : 	**HISTOGRAM RGB :** 	**HISTOGRAM RGB :** 	**Nilai Keypoint :** `Finding keypoints... 1218 keypoints found. Finding keypoints... 5149 keypoints found. Found 12 matches.`
Pada Perbandingan tiga image diatas menghasilkan nilai histogram dengan jumlah piksel yang berbeda - beda, artinya nilai histogram tersebut bisa dijadikan acuan sebagai parameter tambahan untuk melakukan pencocokan objek.			Ditemukan kecocokan objek sebanyak 12 keypoint pada perbandingan image yang dimanipulasi dengan yang asli
Pada image berikut dilakukan pengujian kembali untuk kecocokan objek			
 `Finding keypoints... 1065 keypoints found. Finding keypoints... 1218 keypoints found. Found 0 matches.`	 `Finding keypoints... 1027 keypoints found. Finding keypoints... 1218 keypoints found. Found 0 matches.`	 `Finding keypoints... 524 keypoints found. Finding keypoints... 1218 keypoints found. Found 354 matches.`	
Ditemukan 0 keypoint, artinya tidak ada kecocokan objek setelah mengambil sampel image pada wajah Dian Sastro yang lain	Ditemukan 0 keypoint, artinya tidak ada kecocokan objek setelah mengambil sampel image pada wajah Dian Sastro yang lain	Terdapat kecocokan objek pada wajah Dian Sastro sebanyak 354 kecocokan keypoint, setelah mengambil bagian dari wajah dian sastro yang asli.	

In comparison, the three images compared produce histogram values with different numbers of pixels, meaning that the histogram values can be used as a reference as an additional parameter to match objects, then when viewed from the number of keypoints, there are matches on objects marked with lines.

He use of the SIFT algorithm was chosen as the feature extraction method because this method is invariant to changes in scale, rotation, translation, and illumination. SIFT is used to obtain the characteristics of the obtained keypoint pattern. The hope is that by applying this method, from the keypoints obtained on each of these images, we get an accurate object match. The first step in determining the keypoint that is invariant to changes in the scale of the image is to find the extreme values in the scale space. To get the keypoint location in a scale space efficiently, the Difference-of-Gaussian (DoG) function is used, the value for the DoG function is obtained from the difference between Gaussian images with different scales.

Given orientation so that it will not be affected by the rotation of the image. In this study, the features in the form of keypoint locations and also the feature vectors of these keypoints have been obtained. Then the classification has been carried out, so it can be concluded that this system is able to detect the match of objects in digital images accurately. To strengthen the results of the analysis in the above test, additional tests using an RGB color histogram graph (Red, Green, Blue) were also added. Where the level of difference in the image can be obtained from changes in the number of pixels and RGB colors displayed based on the histogram graph.

IV. CONCLUSION

The application of the SIFT (Scale Invariant Feature transform) algorithm and RGB color histogram in determining the similarity of keypoint locations and the number of pixels in the image, to obtain object compatibility in digital images in Matlab has been successfully implemented. Based on the test results obtained accuracy in identifying images in digital images using the SIFT Algorithm (Scale Invariant Feature Transform), that the research has been going well and smoothly.

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