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A 2D-DWT Based Enhanced Technique of Copy Move Forgery Detection

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Abstract *—Communication in visual form is very important in itself. It is also a very convincing medium of transfer of information. Numerous fields of technology depend vastly on better quality and correctness of source image. But digital image forgery creates problems for these technologies. Manipulation of images is now a very easy job due to availability of numerous images editing software. It is now possible to add, modify, or remove important features from an image without leaving any perceptual traces of tampering. Image forensics is a domain dedicated to stop such attempts and preserve the data in an image. Through this project, we would like to detect a faulty image from image move forgery attack*

Keywords- *Image processing, copy move forgery, Discrete Wavlet Transform, hit rate, miss rate*

I. INTRODUCTION

Images are the natural and most common source of information. Currently these are the convenient way to express and transmit the information .With the help of digital image, information emphasized in thousands of words can be easily expressed [1]. The fiducial of photographs has an significant role in many areas, including: forensic investigation, surveillance systems, criminal investigation, intelligence services, journalism, medical imaging, and intelligence services. The art of making image forgery has a long history. But, now a days digital age, it is possible to very easily change the information delineated by an image without leaving any obvious traces of tampering. Even people who are not experts in image processing can manipulate with an image easily without leaving visible clues with the widespread use of powerful digital image editing tools,. Thus it poses a very critical social problem as to how much of its content can be believed in, whether it is tampered or authentic, especially as a witness in a courtroom, scientific fraud and insurance claims. Image, as a digital signal is affected by this revolution and its applications are increased in various fields. Specifically, it has found new applications such as being used as evidence in court or news broadcasting. The images content must be highly reliable for that kind of usages. [2].An example is shown in the figure below

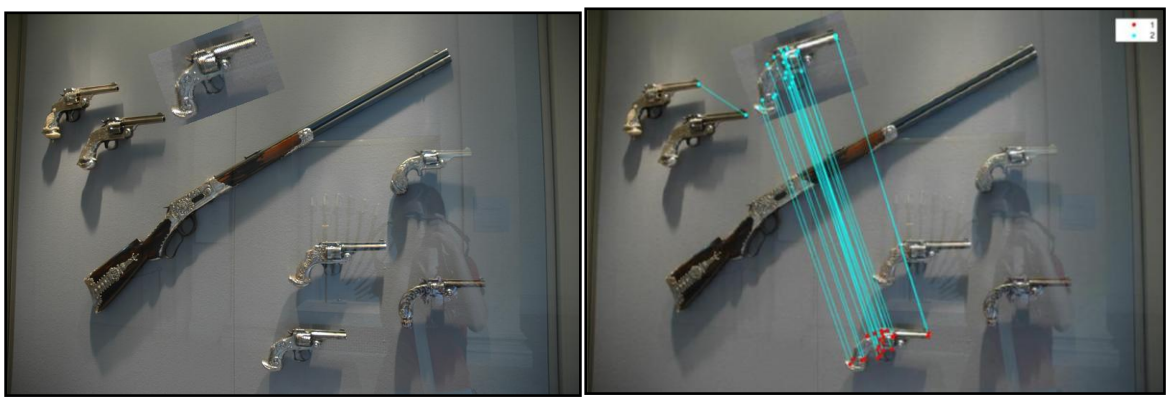

Figure 1. Example of copy move forgery

For authenticity checking of the digital images, many techniques have been developed. These techniques can be divided into two types:

A. Intrusive approach

Intrusive detection approach requires post-processing manipulations of the image after captured by the image capturing device. Intrusive approach includes inserting a digital copy of the image into the image itself, known as self inserting and other one is digital signature, where a cloggy form of the image is embedded into the host image. However, millions of images which are already on the internet cannot benefit from this approach. This approach is also known as active approach.

B. Non-intrusive approach

Non-intrusive approach does not require prior presence of digital signature or watermark to attest the image. This approach takes into account, the correlation of the image for forgery detection. Hence, it comes out to be the most useful approach for those images that are already on the web. This approach is also known as passive approach. [3]

II. PROPOSED WORK

The copy-move forgery detection is very difficult because of the fact it is visually difficult to trace out the duplicated region if it is done very carefully. The 2D-DWT based method is used for copy-move forgery detection.

2.1. Discrete Wavelet Transform

DWT i.e Discrete wavelet Transform is a wavelet transform for which the wavelets are sampled at discrete intervals. DWT accommodates simultaneous frequency and spatial domain information of the image. An image can be analyzed by the sequence of analysis filter bank and decimation operation in DWT. The analysis filter bank consists of a pair of high and low pass filters related to each decomposition level. The low pass filter removes the approximate information of the image but the high pass filter removes the details such as edges. The 2D transform take out from two separate 1D transforms. In 1D DWT, the approximation coefficients contain low frequency information but the detail coefficients contain high frequency information. The 2D DWT decomposes the input image into four sub bands: low frequency component in the horizontal and high frequency component in the vertical direction (cV), low frequency components in horizontal and vertical directions (cA), high frequency components in horizontal and vertical directions (cD) [9] and high frequency component in the horizontal and low frequency component in the vertical direction (cH) Given forged color image, firstly, three layers of data (R, G, and B) are collected and after that the 2D-DWT operation is performed on each layer. The DWT accommodate a time-frequency representation of the signal. It uses the multi-resolution technique through which different frequencies are analyzed with different resolutions. Because of its multi-resolution uniqueness, the DWT is used in the proposed method. The continuous wavelet transform of a signal s(t) and a mother wavelet ψ(t) is mathematically expressed as

$$c(a,b) = \frac{1}{\sqrt{a}} \int s(t)\psi\left(\frac{t-b}{a}\right) dt \quad [1]$$

where a represent scale and b represents shift parameters. The DWT coefficients are calculated by restricting the scale a to powers of 2 and the position b to integer multiples of the scales and are mathematically given by

$$\psi \quad = 2^{j/2} \int_{-\infty}^{\infty} s(t)\psi(2^j t - k)dt \quad [2]$$

where j and k are integers and ψj,k are orthogonal baby wavelets defined as

$$\psi_{j,k} = 2^{\frac{j}{2}}\psi(2^j t - k) \quad [3]$$

2.2 Execution Details

Read the image

1. Match SIFT features in a single image using our multiple match strategy.
    a. Import SIFT key points
    b. returns image's SIFT key points
    c. work around key points executable
2. Fits 2D homography.
3. Evaluate the symmetric transfer error of a homography with respect to a set of matched points.
4. Normalizes 2D homogeneous points.
5. Find the indices of the points that are not at infinity.
6. For the finite points ensure homogeneous co-ords have scale of 1.
7. Robustly fits a model to data.
8. Computes 2D homography.
9. Normalizes array of homogeneous coordinates to a scale of 1.
10. Convert a set of homogeneous points to non-homogeneous form.
11. Condition a set of 2D homogeneous or non-homogeneous points using conditioner.
12. Hierarchical Agglomerative Clustering.
13. Show an image depicting clusters and matches.
14. Given clusters of matched points compute the number of transformations.
15. Detection.

III. RESULTS AND PERFORMANCE ANALYSIS

Following are the results for this project. We show you the original image and then the image as obtained after forgery processing. We were able to detect images which were tampered due to image forgery attacks. Please have a look at the below results and calculate the parameters which are hit rate miss rate and FDR (false detection rate).We calculate these parameters by following formullas

$$\text{Hit Rate} = \frac{\text{image detected as forged being forged}}{\text{Forged image}} \times 100\% \quad (4)$$

$$\text{Miss Rate} = \frac{\text{image detected as not forged being forged}}{\text{Forged image}} \times 100\% \quad (5)$$

$$\text{FDR} = \frac{\text{image detected as forged being original}}{\text{Original image}} \times 100\% \quad (6)$$

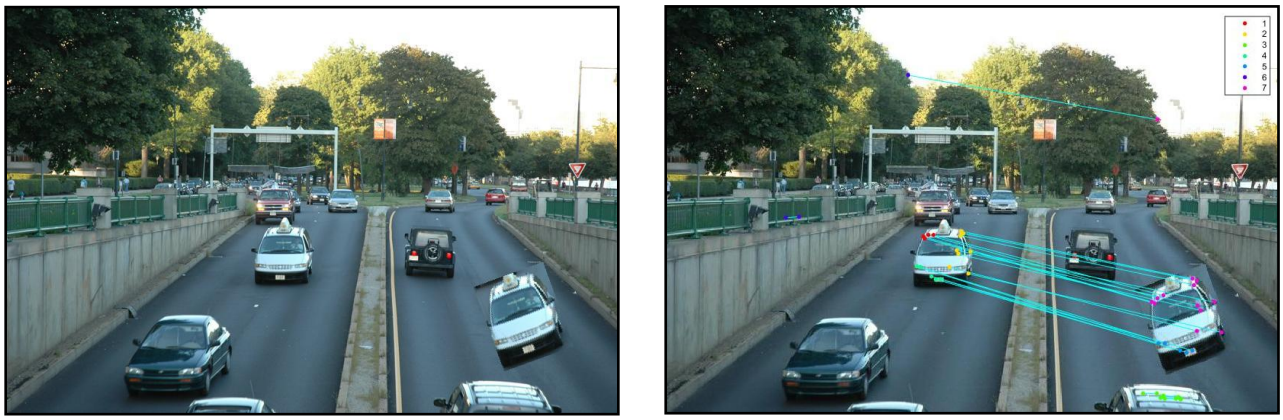

Figure 2. Forgery detection in case of very small forged area in comparison to the overall size of the image: (a) forged or Tampered image, (b) forgery detected image by using the proposed method

Figure 3. (a) No tampering to the original image (b) no tampering detected

In figure 2 the forgery is detected in right side and in figure 3 no tampering is done to the original image so in the result no tampering is detected.

Figure 4. Forgery detection in case of very small forged area in comparison to the overall size of the image: (a) forged or tampered image (c) forgery detected image

Table 1. Comparison of old and proposed for forgery detection

S. no	***Parameters***	***Old Approach***	***Proposed Approach***
1	*Hit rate*	*93%*	*97%*
2	*Miss rate*	*7%*	*3%*
3	*FDR*	*5%*	*0%*

We can conclude easily that the above mentioned processing stands fit to detect copy move forgery attacks in images which is better than the previous method.

IV. FUTURE SCOPE

The future work includes detecting digital image forgery when the copied region is processed before pasting into the same image. We can also work on localizing the forgery in the tampered image

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