iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** VIII **Month of publication:** August 2017

DOI: http://doi.org/10.22214/ijraset.2017.8140

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue VIII, August 2017- Available at www.ijraset.com

Analysis of Different Techniques of Copy Move Forgery Detection: A Review

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Abstract: ***With the advancement of image processing editing tools and software, the tempering of the image has become easy. There are various ways for manipulating the image but one of the most common manipulating practices is copy move forgery in which the part of the image is copied and pasted in the same image at another place. There are various techniques for detecting image forgeries; they are commonly referred as Copy Move Forgery Detection (CMFD). In this paper we have reviewed various techniques for forgery detection and algorithm used for detecting the features and matching the detected features. We have also studied the advantages and drawbacks as well of the various algorithms used in different steps of forgery detection.***
Keywords: Copy move forgery detection(CMFD), scale invariant feature transform(SIFT), discrete cosine transform(DCT), discrete wavelet transform(DWT), stationary wavelet transform(SWT).

I. INTRODUCTION

Nowadays, with easy availability of the image editing tools and software, the tempering of image has become so effective that it cannot be detected by the human vision system. The integrity of the images cannot be presumed without further investigating them. In recent times so many techniques have developed for detection of forgery of images. The techniques can be broadly classified into categories: active methods and passive or blind methods. Digital watermarking comes in first category in which the certain information is embedded into image either during its creation or before it is broadcasted, in this for detection we require prior information of the image and these techniques also require specially equipped devices[11]. On the other hand in passive or blind methods we do not need any prior information that is embedded into the image but investigate from the image itself. We are working on the passive methods.

Among the various forgery attacks copy move forgery is the most common forgery attack. In this forgery attack the region is copied from one region onto another thereby hiding the information. or contents in the image. It can also be used for increasing the contents of the image. To make the forgery attack more effective, many other post processing operations are also applied on the image such as adding noise to the image, blurring or rotating the image, these are applied to the duplicated regions [1]. In CMF the regions selected for hiding or replicating some contents of the image are usually similar textured regions. The reason for such selection is they have similar color and noise properties. Till now many techniques have suggested for detecting CMF. In this paper we have reviewed various techniques for detecting forged region in the image. The techniques we have studied, they decompose the image either into blocks or key points then the features are extracted using various algorithms and the matching of these features is followed. In the end duplicated regions are extracted and the result is taken out.

(A) Original images (B) Forged Images

Figure 1: Images showing copy move forgery (CMF)[1]

II. DIFFERENT TECHNIQUES FOR DETECTING COPY MOVE FORGERY DETECTION

A. *Exhaustive Search*

This method involves comparing the image with every cyclic shifted version of itself to detect the copy-move forgery. But, this approach is computationally very expensive and may require (MN) 2 steps for an image of size MxN.

B. *Autocorrelation Approach*

The approach used by this method is that detection is done here based on autocorrelation. Peaks are introduced in the original and copied segments due to the autocorrelation for the shifts that resemble the copied-moved sections. Thus these peaks are used for copy-move forgery detection. Because, natural images consist most of their power in low frequencies, thus if the autocorrelation is computed directly for the image itself, it would result in large peaks at the image corners and their neighborhoods. Therefore, autocorrelation should not be computed from the image directly but can be done from its high-pass filtered version. There are several high-pass filters like Marr edge detector, Sobel edge detector, Laplacian edge detector, and noise extracted. The downside of this approach is that it is effective only when the duplicated regions are a large portion of the image.

C. *Block-Matching Procedure*

There are two block matching procedures those are an exact match and robust match. In the exact match, those segments of the image are identified that match exactly where as in robust match, the idea is very similar to the exact match except that order and matching of the pixel representation of the blocks is not done here, but their robust representation is done for the blocks that consist of quantized DCT coefficients.

D. *Key Point-based methods*

In this method, there is a Scale Invariant Feature Transform(SIFT) algorithm that can be used for detailed detection. This algorithm is robust in contradiction of post processing. This method calculates SIFT key points and matches this with another to find forgeries. If the result is in the shape of identical SIFT points, then the image is declared as copy-move forgeries. This matching procedure is done for every key point by classifying its nearest neighbor. There exist some problems in this method when this method needs to detect forgeries in the high scale images. Therefore BBF (Best-Bin-First) search method is used for matching. In this technique, classification is done by greatest related vectors with a maximum prospect and minimum calculation. After that one tempered image is taken and repeated the detection for the dissimilar threshold. There is another algorithm for detection that is speeded up Robust Features (SURF) algorithm. This algorithm uses Hessian matrix for detecting and describing the key points and then assigns the orientation. Then the SURF descriptors used for matching. The threshold is used to enhance the robustness and evades false detections.

III. GENERAL WORKFLOW OF FORGERY DETECTION CONSISTS OF 4 FACES

A. *Decomposition Of Image Into Blocks*
B. *Feature Extraction*
C. *Feature Matching*
D. *Forgery Detection*

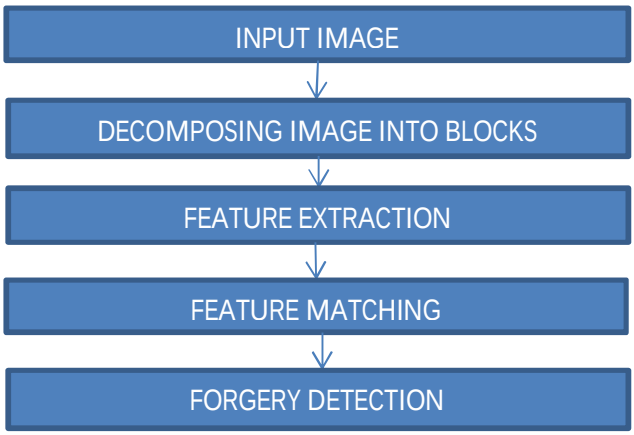

Figure 2: General Workflow Of Forgery Detection [21]

The utilization of this technique is to detect new forgery in the original image. This technique also fights the new challenges in the image forgery detection. The general technique mentioned above apply different feature extraction techniques like PCA, DCT ,DWT et cetera. It also applies different feature matching techniques like radix sort and K-D tree.

IV. RELATED WORK

A. In 2016 T. Mahmood, T. Nawaz, Z. Mehmood, Z. Khan, M. Shah, R. Ashraf[1]

Developed an efficient and automatic algorithm which is used in digital images for detecting the move-copy forgeries based on stationary wavelet transform. This technique works in the absence of any information which is used in forgery attack. For detecting the duplicate region in the image processing, stationary wavelet transform (SWT) is used. In research, experiment describes the capable algorithm which is used to detect the duplicate blocks and also identifies the multiple CMF. For detecting the duplicate blocks, the images which are contaminated by noise and blurring, and to identify CMF, stationary wavelet transform algorithm is used. The performance of this algorithm is better than the other because it increases the detection ratio which increases the efficiency of the system.

B. In 2017 G. Mohammad, M. Hussain, K. Khawaji[2]

Discovered the blind copy moving image detection using dyadic un decimated wavelet transform. The paper tells that the DYWT is the better than the discrete wavelet transforms for data analysis. It helps to compose the input image into approximation and then converts into the sub-bands. Then convert Sub-bands into blocks and measure the similarity between that blocks. The similarity between the blocks shows that blocks from the LL1 Subband should be high, while the HH1 subband should be low due to noise consistency in the moved blocks. In this research, the author utilized both the subbands and then discovered similarities and dissimilarities between the blocks of the image for the detection of copy move. The main purpose of the author is that to propose the method which using color information instead of converting color images into the Gray images.

C. In 2014 R. Sekhar, Chithra AS [3]

Developed a copy-move forgery that needs for developing the efficient algorithm. Different methods are used to handle the forgeries. In research, a single system is used to handle the copy-move forgery. A technique is used for one type of post processing which not efficient for post-processing of another type to handle it. Copy-move forgery technique is used in juncture in which a region is copied off an image and paste the same image of another region after post-processing such as scaling, blurring, rotation, noise addition, JPEG compression, etc. The block-based and key based method is used in copy-move forgery techniques of detection. Both have some disadvantages and advantages which are explained thoroughly in this paper.

D. In 2013 A. B. Singh, S. D. Barma and K. M. Singh[4]

Presented discrete cosine transformation DCT algorithm of CMFD which is used to detect the moved and copied area. This algorithm is used to perform robust block matching. If the area is flat, uniform, and small then sometimes it is very difficult to detect them which are used for concealing an object. Post-processing activity like scaling, rotation, and other transformation make the copy- paste detection difficult and fails the algorithm to detect the image. In this research, an algorithm is used which performs block matching of robust and it gives the better results.

E. In 2016 Mahmood, T. Nawaz, A. Irtaza, R. Ashraf, M. Shah, and M.T. Mahmood [5]

Analyzed Copy-Move Forgery Detection Technique for Forensic Analysis in Digital Images in which they talked about the forgery image which cannot be detected by human eye. To identify the false pictures and to detect forge of the picture, maps are divided into square blocks, rather overlapping blocks and components of DTC (discrete cosine transform) are used as block representations. Due to vast dimensions of the image, the kernel is used to reduce the dimensional vector. It improves the quality of the image and compares state of the art. The copied images start blurring, compressive and hence we detect that given image is a copy-move picture. Therefore, this technique is highly efficient to identify the fake picture. Hence, the given method provides a computationally efficient. To identify the forgery picture, they proposed a plan the DCT and Gaussian RBF kernel PCA using squared blocks. They also proposed the algorithm about this.

F. In 2016 Manjeshbn, Madhu BN [6]

Developed CMFD-PSO approach which is used in the digital image to detect CMFD-PSO by determining and detect the parameters values of the image, then applying them on particle swarm optimization PSO algorithm for the detection of CMF and at last to

detect CMF by integrates the CMF detection into SIFT framework. To generate the digital images, copy-move forgery (CMF) is used which is detected by using Scale Invariant Feature Technique (SIFT). Scale Invariant Feature Technique detect copy-move forgery because of the robust performance of SIFT. To detect the CMF images, SIFT framework is used because of robust performance, but it is not applicable for some CMF images that not give satisfactory results.

G. In 2016 SHI Wenchang, ZHAO Fei, QIN bo, LIANG Bin[7]

Eveloped an improved image forgery detection using particle swarm optimization technique. This technique integrates Particle Swarm Optimization algorithm into SIFT- based framework. In this technique CPV that is customized parameter values for images are generated which overcome the drawbacks of EPV that is experience parameter values. EPV are applicable to few images and sometimes true. duplicated regions are left using EPV. Although CMFD-PSO is applicable to all the images still this technique has less efficiency where the copied regions are very small.

V. COMPARSION OF METHODS OF DECOMPOSING THE IMAGE , FEATURE EXTRACTION AND FEATURE MATCHING

Sr. no.	Author	Algorithm for decomposing image and feature extraction	Algorithm for feature matching
1	T. Mohmood, T. Nawaz, Z. Khan, M. Shah[1]	Stationary wavelet transform(SWT) Algorithm with lexicographical sorting	Euclidean distance
2.	G. Muhammad, M. Hussain, K. Khawaji[2]	Dyadic wavelet transform(DyWT) with (LL1) and (HH1) approximation	Euclidian distance
3.	R. Sekhar, Chithra A S[3]	Same Affine Transformation Selection(SATS)	Kd- Tree
4.	A.B. Singh, S. DebBarma, Kh. M. Singh[4]	Discrete Cosine Transform(DCT)	Block Quantization and Shift Vector Calculation
5.	MANJESHBN , MADHU BN[5]	Copy Move Forgery Detection-Particle Swarm Optimization (CMFD-PSO)	Best-Bin-First Algorithm (BBF)
6	SHI Wenchang, Z. Fei, Q. Bo, L. Bin[6]	Integration of (CMFD-PSO) With Scale Invariant Feature Transform(SIFT) based framework	Best-Bin-First Algorithm (BBF)

VI. CONCLUSION

From the literature survey it can be concluded that many techniques have been suggest for the detection of copy move forgery. The techniques are facing challenges where the forged image has undergone post processing operations like addition of noise or blurring attack to make forgery more effective. During research we also discovered a new challenge in this field. it is when the copied region is very small, it is hard to detect those copied regions. The techniques which have been suggested till now have yet to find its accuracy on large scale databases such as MICC, CoMoFoD, and Coverage.

VII. ACKNOWLEDGEMENT

I am highly indebted to Dr. Reecha Sharma for their guidance, constant supervision and motivation for this work. I am also thankful to my esteemed university for providing the facilities and opportunities that were needed for this work.

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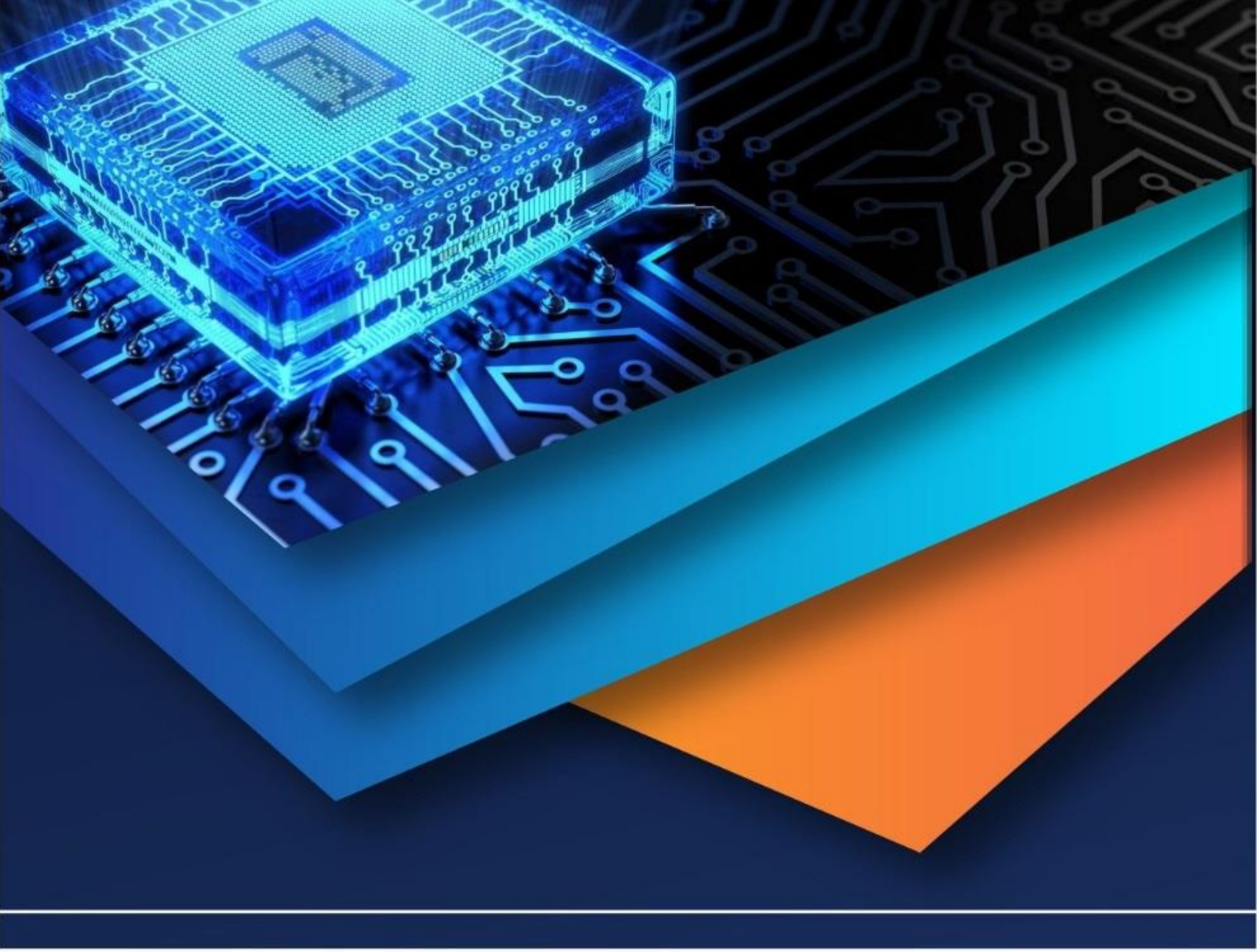

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