

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor & UGC Approved Journal)

Website: www.ijirset.com

Vol. 6, Issue 9, September 2017

Cloning Detection Using SLIC and MIFT

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ABSTRACT: Cloning is a common manipulation technique in image forgery. Cloning is the process of creating a forged image by copying a region of the image and pasting it into another region in the same image. A novel cloning detection scheme using SLIC and MIFT is proposed. The proposed scheme combines block and keypoint-based cloning detection methods. First, the host image segmented into non-overlapping and irregular blocks using Simple Linear iterative Clustering (SLIC). Second, block features are obtained from feature points of each block using Mirror invariant Feature Transform (MIFT), and then matched the block features with one another to locate the labeled feature points; this procedure can approximately indicate the suspected forgery regions. The forgery regions are detected more accurately by Forgery Region Extraction algorithm. It replaces the feature points with small super pixels as feature blocks. Merged regions are obtained by merging the neighboring similar local color feature blocks. Finally, a morphological process is applied on the merged regions to detect forgery regions.

KEYWORDS: Adaptive over-segmentation, Feature point matching, SLIC, Block features, MIFT, Forgery region extraction algorithm, Super pixels, Local color features, Merged regions, Morphological operation.

I. INTRODUCTION

Digital images contain more information they play key role in medical, forensics etc. Available of advance image processing and various computer soft wares increases the manipulation on digital images to hide information and makes the forged images. These modifications hide the pasting operation and make it like original image. Therefore images will lost their integrity and authenticity. Various image forgery detections such as Block based methods, keypoint based methods are available. In Moment-based technique [2] blur property is used for invariants of image area due to non-effected by means of blur additive noise and degradation but it has high computation time. In Hu moment based technique [3], it decreases dimensions through Gaussian pyramid of image. Image separated into many fixed sized blocks that further coinciding and calculate the reign values through Hu moments. This approach is efficient for perceiving copy-move forgery. Scale Invariant Feature Transform (SIFT) algorithm [4] performs normal detection but unable to find out flat copied regions and mirror reflected copy-move forgeries. PCA technique [5] detects even minor variations of noise or lossy compression and it is better for detecting copy-move forgery and gives less number of false positives. SVD method [6] failed to detect copy-move block out of two matched blocks and not vigorous in contradiction of JPEG compression. DWT method [7] fails in detection forgeries like rotation, heavy compression and scaling. DWT & KPCA [8] can detect false findings and it can detect rotation type and flip of forgeries. Intensity based method [9] fails when images are large smooth regions and highly distorted. FMT [10] can detect forgeries rotation up to 10° and scaling of 10% and robust to JPEG compression. MLBP [11] method does not calculate similarity between objects in the image and it does not estimate the weak sensor noise pattern. Existing block based methods increases computational complexity and they unable to identify the forged regions if the copied part is geometrically transformed and pasted. Feature keypoint based methods cannot locate the forgery regions very well. To overcome all these problems if we integrate both the block based and keypoint based methods [1] we will get the better results. In following sections, Section II shows the proposed scheme in detail. In Section III, Experiments are demonstrated. Finally, the conclusions are in Section IV.

II. CLONING DETECTION USING SLIC and MIFT

This Section describes the proposed method in detail. Initially, Image is segmented into image blocks (IBs) using adaptive over segmentation algorithm, it segments the image into non-overlapping irregular blocks. Then features

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extracted from each block using Mirror Invariant Feature Extraction (MIFT) as block features (BFs). These BFs are matched with one another and matched features are labeled for forgery region extraction, these labeled feature points (LFPs) indicates suspected forgery regions. Forgery Region Extraction algorithm detects forgery region from the LFPs by replacing feature points with super pixels and matching neighboring blocks with similar local color features. Finally a morphological operation applied on merged regions to generate the detected forgery regions.

A. Adaptive Over-Segmentation Algorithm

Existing block based forgery detection methods, divides the host image into overlapping regular blocks with fixed block size, but this method doesn't represent the forgery region accurately. The main problem involved in this method is as the size of the image increases the computational complexity increases. To solve it a novel method i.e. Adaptive Over-Segmentation is proposed to segment the image into non-overlapping regions of irregular shapes next the features extracted from these irregular blocks and are matched to detect the suspected forgery region. Therefore Simple Linear Iterative Clustering (SLIC) is used to divide host image into irregular superpixels and are treated as individual blocks.

Steps to calculate initial size of the superpixel of given image:

- i. Perform 4-level Discrete Wavelet Transform (DWT) using "Haar" Transform
- ii. Calculate low level energy (E_{LF}) and high level energy (E_{HF}) as follows

$$E_{LF} = \sum |CA_4| \quad (1)$$

$$E_{HF} = \sum (\sum |CD_i| + \sum |CV_i| + \sum |CH_i|) \quad i=1,2,3,4. \quad (2)$$

i

Where CA_4 is approximation component (4th level) of DWT and CD , CV , CH are diagonal, vertical, horizontal components of DWT

- iii. Calculate Percentage of low power distribution

$$P_{LF} = \frac{E_{LF}}{E_{LF} + E_{HF}} \cdot 100\% \quad (3)$$

$E_{LF} + E_{HF}$

- iv. Calculate the Initial size of super pixel using

$$S = \begin{cases} 0.02 \times M \times N & P_{LF} > 50\% \\ 0.01 \times M \times N & P_{LF} \leq 50\% \end{cases}$$

Using S as initial size super pixel segmentation is applied on host image.

B. Block Feature Extraction Algorithm

Feature points are extracted from image blocks as block features. Each block contains the features of the block. Here adopted MIFT descriptors that are invariant to mirror reflection transformations. MIFT is one of the auspicious local feature detector based on SIFT, that is robust to mirror reflection also. A Mirror reflected version of an image can be acquired by reversing the axis of the image, hence, in a horizontally reflected image the row order of pixels remains the same. So in MIFT mirror invariance is achieved by simple descriptor reorganization. This descriptor reorganization first organizes the arrangement of cell order around the interest points. This is done by checking the values of total left pointing (ml) and right pointing (mr) orientations. Based on the winning orientation, column order may change ($ml > mr$) or not. Second, for each cell, it checks whether the order of orientation bins to follow clockwise or anticlockwise direction. Thus MIFT provides a descriptor which is identical in all cases of mirror reflections.

C. Feature Point Matching Algorithm

By this process we will get labeled feature points from the image blocks. First a threshold is defined according to that any SIFT vector crossing that limit will identify that copy moved region. To define the threshold, calculate the

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correlation coefficients of the image blocks according to this correlation distribution threshold is defined using Euclidian distance concept. By using this threshold matched blocks are located. To indicate the suspected forgery region these matched blocks are labeled.

D. Feature Extraction Algorithm

This stage will detect the forged region exactly. For this replace the LFP with small superpixels to get suspected regions. By measuring local color feature of superpixel and its neighbors suspected region is identified. If the color features matched with each other merge those to form merged regions (MR). To detect the copy-move forged region a morphological operation is applied for merged regions.

III. EXPERIMENTS AND DISCUSSION

In this section, To evaluate the effectiveness of the proposed cloning detection using SLIC and MIFT experiments are conducted. In the following experiments, high-resolution uncompressed PNG true color images are used. Fig. 2 shows the cloning detection results of the proposed scheme. Fig.3. shows the forgery detection on another image. Fig.4. shows the image forgery without reflection and its detection using SIFT. Since SIFT doesn't detect mirror reflections for mirror reflected forged image as shown in Fig.5. is detected by using MIFT as in Fig.5 4(b)

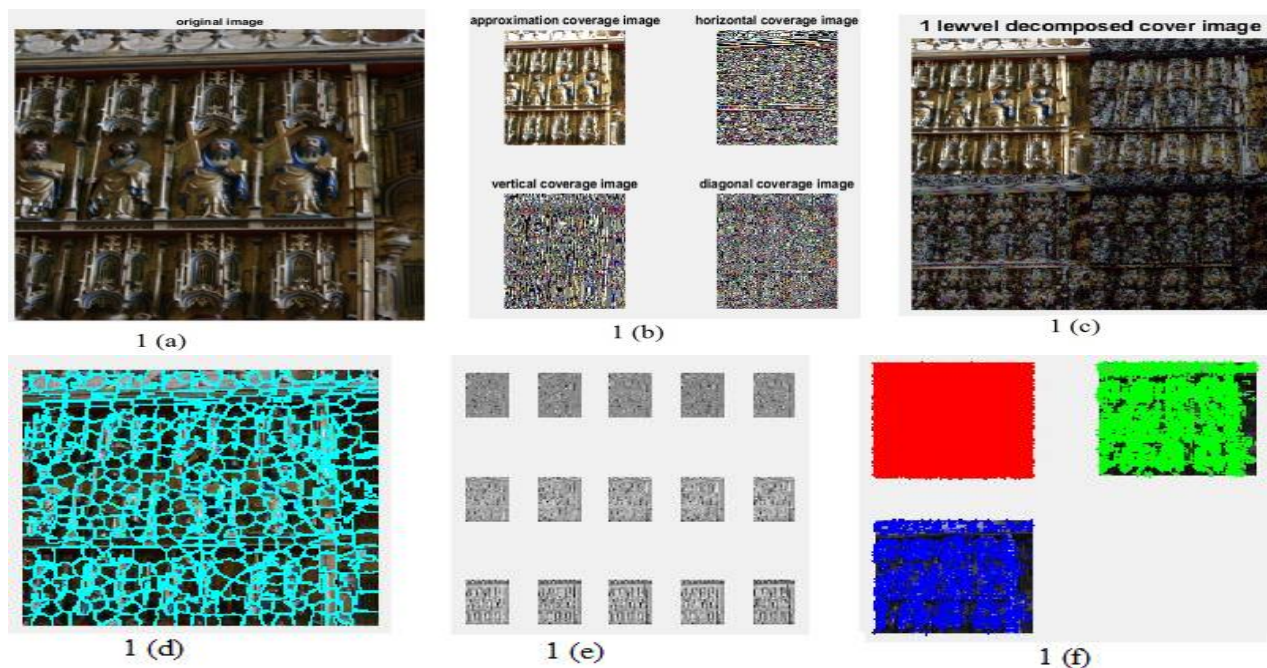


Fig.2: 1(a). Original image, 1(b).Components of DWT, 1(c).DWT 1 level decomposed image, 1(d). SLIC segmented image, 1(e). SIFT descriptors, 1(f). Feature points on image

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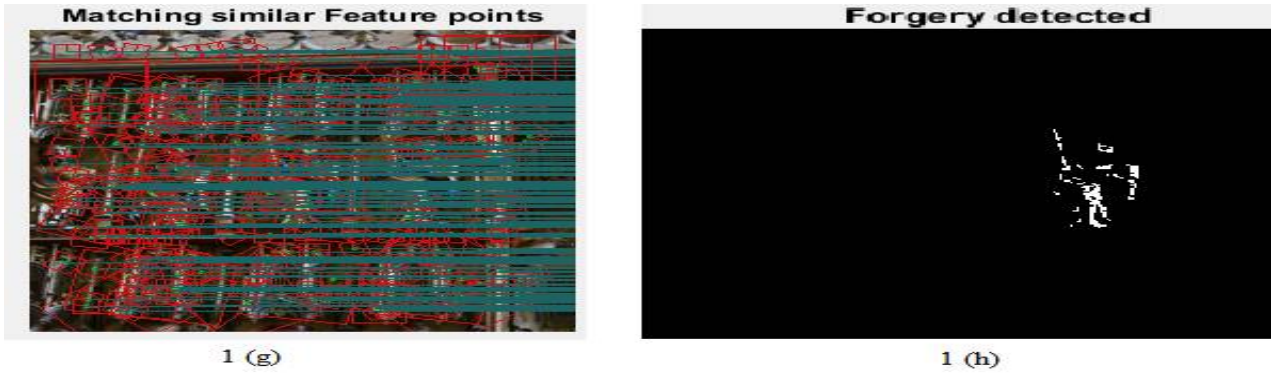


Fig.2. 1(g) Matching similar feature points, 1(h) detected forgery



Fig.3. 2(a) original image 2(b) forgery detected image



Fig.4. 3(a) forged image without reflection 3(b) forgery detection using SIFT



Fig.5. 4(a) forged image with reflection 4(b) forgery detection using MIFT

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IV. CONCLUSIONS

In this paper, we have proposed a novel cloning detection scheme using SLIC and MIFT. Initially the image is segmented using Adaptive Over-Segmentation algorithm. To get better accuracy for each given image a new initial size is calculated according to their energy distribution in lower frequencies. Then, from each block, the feature points are extracted as block features, and the Block Feature Matching algorithm is proposed, with which the block features are matched with one another to locate the labeled feature points; it can approximately indicate the suspected forgery regions. Finally, to detect the more accurate forgery regions, we proposed the Forgery Region Extraction algorithm, in which the labeled feature points are replaced with small superpixels as feature blocks, and the neighboring feature blocks with local color features that are similar to the feature blocks are merged to generate the merged regions. Next, the morphological operation is applied to the merged regions to generate the detected forgery regions. Since in Feature extraction algorithm SIFT unable to detect mirror reflected copy-pasted image a novel method using MIFT is proposed it can detect the mirror reflected forgery accurately. Experimental results show that the proposed scheme can achieve much better detection results for cloning images than the existing copy-move forgery detection methods. Future work could focus on applying the proposed forgery detection scheme based on SLIC and MIFT on other types of forgery, such as splicing or other types of media, for example, video and audio.

REFERENCES

- [1] Chi-Man Pun, *Senior Member, IEEE*, Xiao-Chen Yuan, *Member, IEEE*, and Xiu-Li Bi "Image Forgery Detection Using Adaptive Over-Segmentation and Feature Point Matching " IEEE Transactions on Information Forensics and Security, 2015
- [2] B. Mahdian and S. Saic, "Detection of copy-move forgery using a method based on blur moment invariants," *Forensic science international*, vol. 171, pp. 180-189, 2007.
- [3] J.W. Wang, g.-j. Liu, Z. Zhang, Y. Dai, and Z. Wang, "Fast and Robust Forensics for image region duplication forgery," *ACTA automaticasica*, vol. 35, pp. 14881495, 2009
- [4] D. G. Lowe, "Object recognition from local scale-invariant features," in *Computer vision, 1999. The proceedings of the seventh IEEE international conference*, pp. 1150-1157.
- [5] A. C. Popescu and H. Farid, "Exposing digital forgeries by detecting duplicated image regions," *Dept. Comput. Sci., Dartmouth College, Tech. Rep. TR2004-515*, 2004.
- [6] X. Kang and S. Wei, "Identifying tampered regions using singular value decomposition in digital image forensics," in *Computer Science and Software Engineering, 2008 International Conference on*, 2008, pp. 926-930.
- [7] G. Li, Q. Wu, D. Tu, and S. Sun, "A sorted neighborhood approach for detecting duplicated regions in image forgeries based on DWT and SVD," in *Multimedia and Expo, 2007 IEEE International Conference on*, 2007, pp. 1750-1753.
- [8] Z. Mohamadian and A. A. Pouyan, "Detection of duplication Forgery in digital images in Uniform and Non-uniform regions," in *UKSIM*, 2013, pp. 455-460.
- [9] W. Luo, J. Huang, and G. Qiu, "Robust Detection of Region-duplication Forgery in Digital Image," in *Pattern Recognition, 2006. ICPR 2006.18th international conference*, pp. 746-749.
- [10] S. Bayram, H. T. Sencar, and N. Memon, "An efficient and robust method for detecting copy-move forgery," in *Acoustics, Speech and Signal Processing, 2009. ICASSP 2009. IEEE International Conference on*, 2009, pp. 1053-1056.
- [11] R. Davarzani, K. Yaghmaie, S. Mozaffari, and M. Tapak, "Copy-move Forgery Detection using Multiresolution Local Binary Patterns," *Forensic Science International*, vol. 231, pp. 61-72, 2013.