

An Evaluation of Digital Image Forgery Detection Approaches

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Abstract: With the headway of the advanced image handling software and altering tools, a computerized picture can be effectively controlled. The identification of image manipulation is vital in light of the fact that an image can be utilized as legitimate confirmation in crime scene investigation and in numerous different fields. The image forgery detection techniques intend to confirm the credibility of computerized pictures with no prior information about the original image. There are numerous routes for altering a picture, for example resampling, splicing, and copy-move. In this paper, we have examined different type of image forgery and their detection techniques, mainly we focused on pixel based image forgery detection techniques.

Keywords: Image forgery, Image forgery detection, Copy-move, Splicing.

INTRODUCTION

Imitations are not new to humanity but rather are an exceptionally old issue. In the past it was restricted to craftsmanship and writing yet did not influence the overall population. These days, because of the headway of computerized picture handling software and altering devices, a picture can be effortlessly controlled and changed [1]. It is extremely troublesome for people to recognize outwardly whether the picture is unique or manipulated. There is fast increment in digitally controlled falsifications in standard media and on the Internet [2]. This pattern shows genuine vulnerabilities and abatements the credibility of digital images. In this manner, creating procedures to check the honesty and realness

of the advanced pictures is essential, particularly considering that the pictures are introduced as evidence in a court of law, as news things, as a part of restorative records, or as money related reports. In this sense, image forgery detection is one of the essential objective of image forensics [3].

The main objective of this paper is:

- To present various aspect of image forgery detection;
- To review some late and existing procedures in pixel-based image forgery detection;
- To give a comparative study of existing procedures with their advantages and disadvantages.

The rest of the paper is organized as follows. A review of image forgery detection have presented in first section. In second section we discuss different type of digital image forgery. In third section we present digital image forgery detection method. In fourth Section we introduce and discuss about different existing techniques of pixel-based image forgery detection, mainly copy-move. Comparison of various detection algorithms are given in fifth section and the last section gives the conclusion of this paper.

TYPES OF DIGITAL IMAGE FORGERY

Picture altering is characterized as adding, changing, or deleting some important features from an image without leaving any obvious trace [2]. There have been different techniques utilized for forging an image. Digital image forgery can be isolated into three primary classifications by taking into account the methods used to make forged images: Copy-Move forgery, Image splicing and Image resampling.



Figure 1. (a) Real image (b) Forged version [24]

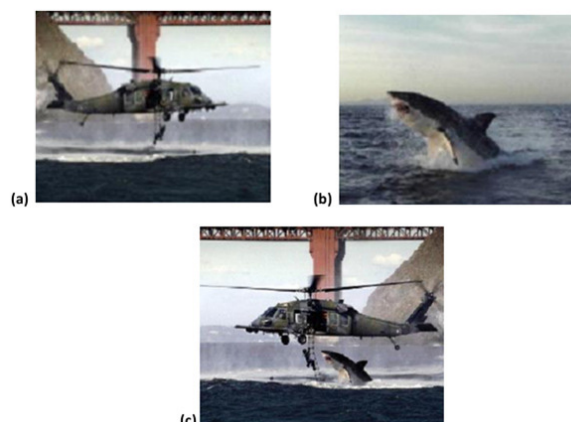


Figure 2. (a) Image (i); (b) Image (ii); (c) Combined image [25]

Copy-Move Forgery

In copy-move forgery (or cloning), some part of the picture of any size and shape is copied and pasted to another area in the same picture to shroud some important data as demonstrated in Figure 1. As the copied part originated from the same image, its essential properties such as noise, color and texture don't change and make the recognition process troublesome.

Image Forgery using Splicing

Image splicing uses cut-and-paste system from one or more images to create another fake image. When splicing is performed precisely, the borders between the spliced regions can visually be imperceptible. However, splicing disturbs the high order Fourier statistics. Therefore, these insights can be utilized as a part of distinguishing phony. Figure 2, demonstrates a decent sample of image splicing in which the pictures of the shark and the helicopter are merged into one picture.

Image Resampling

To make an astounding forged image, some selected regions have to undergo geometric transformations like rotation, scaling, stretching, skewing, flipping and so forth. The interpolation step plays a important role in the resampling process and introduces non-negligible statistical changes. Resampling introduces specific periodic correlations into the image. These correlations can be utilized to recognize phony brought about by resampling. In Figure 3, the picture on the left is the

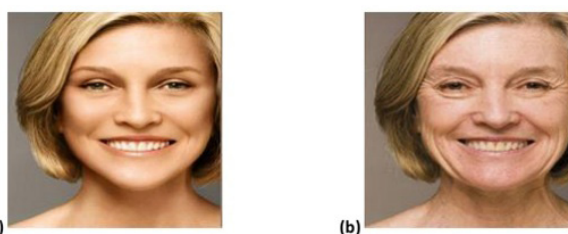


Figure 3. (a) The real image (b)Result of image retouching [26]

original image while the one on the right is the forged image obtained by rotation and scaling.

DIGITAL IMAGE FORGERY DETECTION METHODS

Digital image forgery detection techniques are grouped into two categories such as active approach and passive approach. In the active approach, certain information is embedded inside an image during the creation in form of digital watermark. Drawback of this approach is that a watermark must be inserted at the time of recording, which would limit to specially equipped digital cameras. In the passive approach, there is no pre-embedded information inside an image during the creation. This method works purely by analyzing the binary information of an image. Passive image forgery detection techniques roughly grouped into five categories [4].

Pixel-based image forgery detection

Pixel-based techniques accentuate on the pixels of the digital image. These techniques are generally classified into four sorts such as copy-move, splicing, resampling and statistical. We are concentrating just two sorts of techniques copy-move and splicing in this paper. This is most common image manipulation technique amongst the well-known phony identification techniques.

Format-based image forgery detection

Format based techniques are another kind of image forgery detection techniques. These are mainly based on image formats, in which JPEG format is preferable. Statistical correlation introduced by specific lossy compression schemes, which is helpful for image forgery detection. These techniques can be partitioned into three sorts such as JPEG quantization, Double JPEG and JPEG blocking. If the image is compressed then it is exceptionally hard to identify fraud however these techniques can detect forgery in the compressed image.

Camera-based image forgery detection

Whenever we take a picture from a digital camera, the picture moves from the camera sensor to the memory and it experiences a progression of processing steps, including quantization, color correlation, gamma correction, white adjusting, filtering and JPEG compression. These processing steps from capturing to saving the image in the memory may shift on the premise of camera model and camera antiques.

These techniques work on this standard. These methods can be separated into four classes such as chromatic aberration, color filter array, camera response and sensor noise.

Physical environment-based image forgery detection

These techniques basically based on three dimensional interactions between physical object, light and the camera. Consider the creation of a forgery showing two movie stars, rumored to be romantically involved, strolling down a night-fall shoreline. Such a picture may be made by grafting together individual pictures of each movie star. In this manner, it is frequently hard to exactly match the lighting effects under which each individual was initially captured.

Contrasts in lighting across an image can be utilized as proof of altering. These techniques work on the basis of the lighting environment under which an article or picture is caught. Lighting is very important factor for capturing an image. These techniques are isolated into three classifications such as light direction (2-D), light direction (3-D) and light environment.

Geometry-based image forgery detection

These techniques basically based on principal point i.e. projection of the camera center onto the image plane, that make measurement of the object in the world and their position relative to camera.

Grooves made in firearm barrels confer a twist onto the shot for increased accuracy and range. These grooves acquaint to some degree particular markings to the bullet fired and consequently can be utilized with a particular handgun. In the same soul, several image forensic techniques have been produced that particularly display relics presented by different phases of the imaging procedure.

Geometry-based image forgery detection methods are separated into two classes such as principle point and metric measurement [4].

PIXEL BASED EXISTING IMAGE FORGERY DETECTION TECHNIQUES

There are numerous methodologies that have been proposed by different authors for identifying pixel-based image forgery. Figure 4 demonstrates the general procedure of detecting copy-move image forgery [2].

PCA: principal component analysis; DCT: discrete cosine transform; DWT: discrete wavelet transform; SVD: singular value decomposition; SIFT: scale invariant feature transform; SURF: speeded up robust features.

Fridrich et al. [13] proposed a method for identifying copy-move image forgery in 2003. In this method, the image is divided into overlapping blocks (16×16) and DCT coefficients are used for feature extraction of these blocks. At that point, the DCT coefficients of blocks are lexicographically sorted. After lexicographical sorting, comparable squares are distinguished and forged region are found. In this paper authors perform robust retouching operations in the image. But authors have not performed some other vigor test.

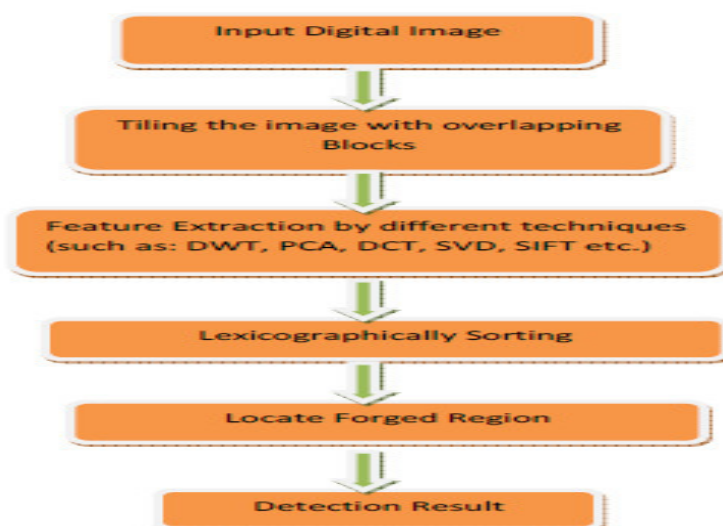


Figure 4. General block diagram of copy-move image forgery detection system.

Popescu et al. [14] proposed a method for identifying duplicate image regions in 2004. In this method, authors applied PCA on fixed-size image of block size (16×16 , 32×32), then computed the Eigen values and eigenvectors of each block. The duplicate regions are automatically detected by using lexicographical sorting. This algorithm is an efficient and robust technique for image forgery detection even if the image is compressed or noisy.

Kang and Wei [8] proposed the utilization of SVD to distinguish the altered areas in a digital image in 2008. In this paper Authors utilized SVD for extracting feature vector and dimension reduction. Similar blocks are identified by using lexicographical sorting on row and column vectors and to detect forged regions. This method is robust and efficient.

Lin et al. [15] proposed quick copy-move forgery detection technique in 2009. In this paper Authors utilized PCA for finding features vectors and dimension reduction after that Radix sort is applied on feature vectors to recognize phony. This algorithm is proficient and functions admirably in noisy and compressed images.

Huang et al. [9] proposed copy-move forgery detection in digital images using SIFT algorithm in 2009. In this paper, authors presented SIFT calculation algorithm using feature matching. This algorithm gives great results even when picture is compressed or noisy.

Li et al. [10] proposed a copy-move forgery detection based on sorted neighborhood approach by using DWT and SVD in 2007. In this paper, authors utilized DWT and disintegrated into four sub-groups. SVD was utilized in low-frequency sub-bands for dimension reduction. At that point,

they connected lexicographical sorting on particular quality vector and the forged region is recognized. They tried this algorithm for gray-scale and colour images. This algorithm is robust.

Luo et al. [16] proposed a strong identification of duplicated region in digital images in 2006. In this paper, authors divide an image into overlapping blocks and then apply similarity matching algorithm on these blocks. The similarity matching algorithm recognizes the copy-move forgery in the given image. This method additionally meets expectations in the JPEG compression, additive noise and Gaussian blurring.

Zhang et al. [17] proposed a new method for copy-move forgery detection in digital image in 2008. Authors utilized DWT and divide given image into four non-overlapping sub-images and phase correlation is adopted to compute the spatial offset between the copy-move forgery regions. At that point, they applied similarity matching algorithm between the pixels for detecting forged regions. This method functions admirably in the highly compressed image and extremely effective with lower computational time as compared with other methods.

Kang et al. [18] proposed a method to detect copy-move forgery in digital image in 2010. In which firstly image is divided in sub-blocks then applied improved SVD on each blocks. At that point, similarity matching is performed on each blocks based on the lexicographically sorted SVD vectors. Finally image forgery region is detected.

Ghorbani et al. [11] proposed a method to detect copy-move forgery based on DWT-DCT (QCD) in 2011. Authors utilized DWT to divide image into sub-bands, then performed

DCT-QCD (Quantization coefficient decomposition) in row vectors to reduce vector length. Shift vector is computed after lexicographically sorting of the row vectors, then it is compared with threshold and finally duplicated region of an image is highlighted.

Lin et al. [7] proposed an integrated method for copy-move and splicing forgery detection in 2011. To begin with, the authors changed over a picture into the YCbCr colour space. For copy-move detection, SURF is used. For splicing detection, image is firstly divided into sub-blocks, then DCT is applied for feature extraction in each blocks. This method works well in both copy-move and splicing forgery detection.

Qu et al. [6] proposed a algorithm to detect splicing image forgery with visual cues in 2009. Authors used a detection window and divided it into nine sub-squares. VAM (visual consideration model) is used to distinguish an obsession point and afterward feature extraction is used to extract the spliced region in the digital image.

Lin et al. [19] proposed an automatic and quick altered JPEG image detection technique using analysis of DCT coefficient in 2009. Authors have utilized DCT coefficient and Bayesian approach for feature extraction, then similarity matching algorithm is used to detect duplicated region map.

Huang et al. [22] proposed a method to detect copy-move forgery based on Improved DCT of an image in 2011. In this paper, DCT coefficients are used for finding feature vector. After that similarity matching algorithm is used to identify imitation areas of an image.

Cao et al. [23] proposed a robust algorithm to detect copy-move forgery in digital image in 2012. In this paper, authors have used DCT for finding DCT coefficients of each block that are represented by circle block and extract feature from each circle block, then searching operation is performed to find similar block pairs for duplicated region map.

G. Muhammad [24] proposed a blind copy move image forgery detection method using dyadic wavelet transform (DyWT). DyWT is shift invariant and hence more relevant than discrete wavelet transform (DWT) for data analysis. In this method, first decompose the input image into approximation (LL1) and detail (HH1) subbands. Then we divide LL1 and HH1 subbands into overlapping blocks and measure the similarity between blocks. The main idea is that the similarity between the copied and moved blocks from the LL1 subband should be high, while the one from the HH1 subband should be low due to noise inconsistency in the moved block. This method is not relevant for color information instead of

converting the color images to gray images. This method is highly efficient method

N. Muhammad [25] proposed a method to detect copy-move forgery, which is one type of tempering that is commonly used for manipulating the digital images. In this method a part of an image is copied and pasted on another region of the same image. In this paper efficient non-intrusive method for copy-move forgery detection is explained. This method is based on image segmentation and similarity detection using dyadic wavelet transform (DyWT). Copied and pasted regions are structurally similar and this structural similarity is detected using DyWT and statistical measures. The results show that this method outperforms the state-of-the-art methods. In this paper algorithm effectively detect tempering on the image and no need of the knowledge about any camera and large number of image for decision making, the algorithm can be used for complicated background and texture.

Copy-move is a common manipulation in digital images. H. Yao [26] proposed an efficient copy-move detecting scheme with the capacity of some post-processing resistances. The image is divided into fixed-size overlapped blocks, and then non-negative matrix factorization (NMF) coefficients are extracted from list of all blocks. We use lexicographical sorting method to reduce the probability of invalid matching. By measuring the hamming distance of each block pair in the matching procedure, if the distance is shorter than a threshold, we declare them as the tampered region.

Copy paste forgery is the most common type of image forgery where in a region from an image is replaced with another region from the same image. P. Kakar [27] proposed a good technique based on transform invariant features. These are basically depend on the Trace transform and achieved by modifying the MPEG-7 image signature tools descriptors in many aspects. As a result this is highly efficient scheme for image forgery detection.

L. Li [32] proposed a best approach for detecting copy-move forgery with rotation. To extract the features of the circular blocks, which are then used to perform block matching, Polar Harmonic Transform can be used. This method is valid for noisy and rotated figures.

M. Hussain [34] proposed a method to detect copy-move forgery based on Multi-resolution Weber law descriptors (WLD). The proposed multi-resolution WLD extracts the features from chrominance components, which can give more information that the human eyes can not notice. Accuracy rate of the proposed method can reach up to 91% with multi

Table 1. Comparative study of existing copy-move forgery detection methods

| S.No. | Paper title | Method used | Tampering detection type | Pros/cons | Publication year |
|-------|--|---|--|---|------------------|
| 1 | Detection of copy-move forgery in digital image [13] | DCT | Copy-move region is detected | Will not work in noisy image | 2003 |
| 2 | Exposing digital forgeries by detecting duplicated image regions [14] | PCA | Exact copy-move region is detected automatically | Time complexity is high | 2004 |
| 3 | Robust detection of region duplication in digital image [16] | Similarity matching | Copy-move region detected in noisy conditions | Time complexity is reduced w.r.t. [14] | 2006 |
| 4 | A sorted neighbourhood approach for detecting duplicate region based on DWT and SVD [10] | DWT-SVD | Efficiently detects forged region | Time complexity is less compared to other algorithms [14] | 2007 |
| 5 | A new approach for detecting copy-move forgery detection in digital image [17] | DWT | Exact copy-move region is detected | Works well in noisy and compressed image | 2008 |
| 6 | Detection of copy-move forgery in digital images using SIFT algorithm [9] | SIFT | Copy-move region is detected | Detects false result also | 2008 |
| 7 | Identifying tampered regions using singular value decomposition in digital image forensics [8] | SVD | Copy-move region is detected accurately | Will not work in highly noised and compressed image | 2008 |
| 8 | Fast copy-move forgery detection [15] | Improved PCA | Exact copy-move region is detected | Works well in noisy, compressed image | 2009 |
| 9 | Detect digital image splicing with visual cues [6] | DW-VAM | In spliced image, forged region is detected | Work only in the splicing | 2009 |
| 10 | Fast, automatic and fine-grained tempered JPEG image detection via DCT coefficient analysis [19] | Double quantization DCT | Tampered region is detected accurately | Works only in JPEG format | 2009 |
| 11 | Copy-move forgery detection in digital image [18] | SVD | Forged region is detected | Will not work well in noisy image | 2010 |
| 12 | Blind copy move image forgery detection using dyadic undecimated wavelet transform [24] | Dyadic undecimated wavelet transform | Copy-move region is detected | Will not work in noisy image | 2011 |
| 13 | Copy-move forgery detection using dyadic wavelet transform [25] | Dyadic wavelet transform | Image segmentation and similarity detection | Not efficient for complicated background and texture | 2011 |
| 14 | Detecting copy-move forgery using non-negative matrix factorization [26] | Non-negative matrix factorization (NMF) | Copy-move region is detected | Some geometric distortions (e.g. rotation, reflection etc.) can render the method invalid | 2011 |
| 15 | Detecting copy-paste forgeries using transform-invariant features [27] | Transform-invariant features | Copy-paste forgery detection | Difficult detection in case of blurred image | 2011 |
| 16 | Detection of copy-create image forgery using luminance level techniques [28] | Luminance level techniques | Copy-create image forgery | Time consuming and less accurate | 2011 |
| 17 | Image copy-move forgery detection based on 'crossing shadow' division [29] | DWT and crossing shadow | Copy-move region detected | Algorithm has advantages of low computational complexity | 2011 |

Table 1. Continued

| S.No. | Paper title | Method used | Tampering detection type | Pros/cons | Publication year |
|-------|--|---|---|--|------------------|
| 18 | A fast image copy-move forgery detection method using phase correlation [30] | Phase correlation | Copy-move region detected | Method is valid in detecting the image region duplication and quite robust to additive noise and blurring | 2012 |
| 19 | An evaluation of popular copy-move forgery detection approaches [31] | DCT, DWT, KPCA, PCA | Copy move region detected | low computational load and good performance | 2012 |
| 20 | Copy-move forgery detection based on PHT [32] | Polar harmonic transform (PHT) | Detect the tampered regions, when they are rotated before being pasted and can detect the copy-move forgery, when the copied region is rotated before being pasted. | Scheme is not efficient for scaling, local bending in images | 2012 |
| 21 | Copy-move forgery detection in digital images based on local dimension estimation [33] | Local dimension estimation | Copy-move region detected | Less computational efficiency | 2012 |
| 22 | Copy-move image forgery detection using multi-resolution weber descriptors [34] | Multi-resolution weber descriptors | Copy move region detected | Multi-resolution Weber law descriptors (WLD) extracts the features from chrominance components, which can give more information that the human eyes cannot notice. WLD is a robust image texture descriptor and with its extension to different scales and highly accurate | 2012 |
| 23 | Detection of copy-move forgery image using gabor descriptor [35] | Gabor descriptor | Copy-move region detected | Highly accurate and reliable | 2012 |
| 24 | Detection of copy-move forgery in digital images using radon transformation and phase correlation [36] | Radon transformation and phase correlation | Exact copy move region is detected | Detect exact forgery even if the forged images were underwent some image processing operations such as rotation and gaussian noise addition | 2012 |
| 25 | A robust image copy-move forgery detection based on mixed moments [37] | Mixed moment, gaussian pyramid transform | Tampered region is precisely detected | Accuracy is improved, time complexity and robust features are also solved and algorithm has some limitations on the smaller tamper regions | 2013 |
| 26 | A fast DCT based method for copy-move forgery detection [38] | DCT | Copy-move region is detected | Will not work in noisy image | 2013 |
| 27 | Copy-move forgery detection using DWT and SIFT features [39] | DWT and SIFT | Copy-move region is detected | Defects false results also | 2013 |
| 28 | Copy move image forgery detection method using steerable pyramid transform and texture descriptor [40] | Steerable pyramid transform local binary pattern (LBP) and texture descriptor | Copy-move region is detected | Accuracy is high | 2013 |

Table 1. Continued

| S.No. | Paper title | Method used | Tampering detection type | Pros/cons | Publication year |
|-------|--|---|--------------------------------------|---|------------------|
| 29 | Copy move image forgery detection using mutual information [41] | Mutual information | Copy-move region detected | Less accurate | 2013 |
| 30 | Copy-move forgery detection in images via 2D-fourier transform [42] | 2D- fourier transform | Copy-move region detected accurately | This work detects multiple copy move forgery and it also robust to jpeg compression attacks even if the quality factor is lower than 50 hence highly accurate | 2013 |
| 31 | Copy-move image forgery detection using local binary pattern and neighborhood clustering [43] | Local binary pattern and neighborhood clustering | Copy-move region detected | Highly accurate | 2013 |
| 32 | Detection of copy-move forgery using wavelet decomposition [44] | Wavelet | Copy-move region detected | Accuracy is high | 2013 |
| 33 | Detection of copy-move forgery using krawtchouk moment [45] | Krawtchouk moment | Copy-move region detected | Works well if the image is noisy or blurred | 2013 |
| 34 | Video copy-move forgery detection and localization based on tamura texture features [46] | Tamura texture features | Copy-move region detected | Precision of this method is 99.96%. Hence highly accurate method | 2013 |
| 35 | A copy-move image forgery detection based on speeded up robust feature transform and wavelet transforms [47] | Speeded up robust feature transform and wavelet transforms | Forged region is detected accurately | Works well for copy-move | 2014 |
| 36 | A scheme for copy-move forgery detection in digital images based on 2D-DWT [48] | 2D-DWT | Copy-move region is detected | Works well in noisy and compressed image | 2014 |
| 37 | Adaptive matching for copy-move forgery detection [49] | Block-based methods, It is proposed to employ an adaptive threshold in the matching phase in order to overcome this forgery problem | Copy-move region is detected | Accuracy is less | 2014 |
| 38 | Copy-move forgery detection based on patch match [50] | Patch match, an iterative randomized algorithm for nearest-neighbor search | Copy-move region detected | Accuracy is high | 2014 |
| 39 | Copy-move image forgery detection based on sift descriptors and SVD-matching [51] | SIFT descriptors and SVD-matching | Forged region is detected | Less efficient in noisy image | 2014 |
| 40 | Copy-rotate-move forgery detection based on spatial domain [52] | Spatial domain | Forged region is detected | Highly efficient | 2014 |

Table 1. Continued

| S.No. | Paper title | Method used | Tampering detection type | Pros/cons | Publication year |
|-------|---|---|-----------------------------------|----------------------------|------------------|
| 41 | Copy-rotation-move forgery detection using the mrogh descriptor [53] | Mrogh descriptor | Copy-move region detected | Highly efficient | 2014 |
| 42 | JPEG copy paste forgery detection using bag optimized for complex images [54] | Bag optimized for complex images | Forged region is detected | Highly efficient | 2014 |
| 43 | Shape based copy move forgery detection using level set approach [56] | Level set approach | Copy-move region detected | Time complexity is minimum | 2014 |
| 44 | Speeding-up sift based copy move forgery detection using level set approach [57] | SIFT | Copy-move region is detected | Less efficient | 2014 |
| 45 | Video frame copy-move forgery detection based on cellular automata and local binary patterns [58] | Cellular automata and local binary patterns | Copy-move region detected | Highly efficient | 2014 |
| 46 | Detection of splicing forgery using wavelet decomposition [55] | wavelet decomposition | Splicing type of forgery detected | Highly efficient | 2015 |

resolution WLD descriptor on the chrominance space of the image.

H. C. Nguyen [36] proposed a method based on non block-matching to detect copy-move forgery. In this paper exploiting phase correlation are used. Results of experiments indicate that the method is valid for detecting image region duplication and quite robust to additive noise and blurring.

S. Kumar [38] proposed a method to detect copy-move forgery. In this method discrete cosine transform (DCT) is used to represent the features of the overlapping blocks. It has detected image forgery with good success against added Gaussian noise, JPEG compression and small amount of scaling and rotation for the given data set, it has shown robustness. However, robustness against more post processing operations like flipping, shearing and local intensity variations may be extended in this algorithm.

M. F. Hashmi [39] proposed a method to detect copy-move forgery using DWT and SIFT. This paper proposed a algorithm for image-tamper detection based on the Discrete Wavelet Transform i.e. DWT. DWT is used for dimension reduction, which in turn improves the accuracy of results. First DWT is applied on a given image to decompose it into four parts LL, LH, HL, and HH. Since LL part contains most of the information, SIFT is applied on LL part only to extract the key features and find descriptor vector of these key features and then find similarities between various descriptor vectors to conclude that the given image is forged.

This method allows us to detect whether image forgery has occurred or not.

L. Yu [53] proposed a method to detect copy-rotation-move forgery detection using the MROGH descriptor. This paper discuss a new algorithm, in which screened Harris Corner Detector and the MROGH descriptor are used to gain better feature coverage and robustness against rotation. it is highly efficient method.

COMPARATIVE RESULTS & DISCUSSION

We have discussed various methods that are proposed by various authors to detect image forgery. The thought process of the considerable number of strategies is to recognize the imitation in the picture yet the procedures are diverse. Table 1 shows the comparison of various copy-move and copy-create forgery detection methods, which have discussed in this paper.

Performance analysis of proposed methods [24], [34], [35], [36], [38], [39], [40], [42], [43], [44], [45], [46], [47], [48], [50], [52], [53], [57] and [58] is shown in Figure 5, which have detection accuracy 99.5%, 91%, 91%, 99%, 99%, 94%, 95.2%, 96.23%, 95%, 86.7%, 95%, 99.6%, 77%, 93%, 99.3%, 99.9%, 92.6%, 99.62%, and 100% respectively. Figure 6 shows performance analysis of proposed methods [25],

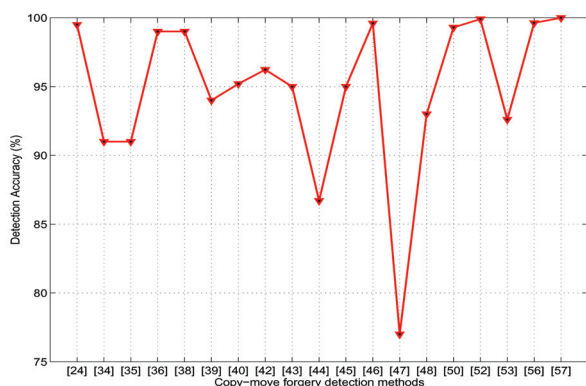


Figure 5. Performance analysis of copy-move forgery detection methods in terms of accuracy

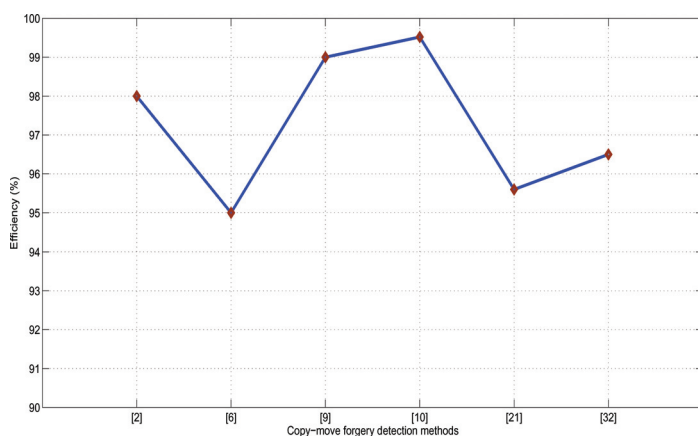


Figure 6. Performance analysis of copy-move forgery detection methods in terms of efficiency

[29], [32], [33], [44] and [56], which have efficiency 98%, 95%, 99%, 99.52%, 95.60% and 96.50% respectively.

CONCLUSION

In this paper different methodologies of image forgery detection have been surveyed and discussed. All the approaches and methodologies talked about in this paper have the capacity to recognize fraud. In any case, a few algorithms are not viable regarding identifying actual forged region. On the other hand some algorithms have a time complexity problem. So, there is a need to develop an effective (efficient) and accurate image forgery detection algorithm.

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