

# Copy-Move Forgery Attack Detection in Digital Images

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**Abstract—** In today's era of digital technology, security becomes a prominent issue while transferring data from one place to another place. A large amount of data is passed in form of digital images in various areas like military, security agencies, secured networks etc. With the advancement in technology & editing tools like Photoshop, Corel Draw and other software tools, it is very easy to tamper the images. Image forensics determines the authenticity of the images. Image tampering (manipulation) is also called as image forgery. Copy move forgery is more critical in which one part of the image is copied and pasted into another location of the same image to hide details. It can be a crucial task where images are used as evidence like court, medical department etc. Detection of forgery can be difficult if forger has applied some post processing operations like resizing, filtering, rotation, JPEG compression etc. It is seen that image forgery can results into various security issues and hence an efficient system is required to detect the forgery into images. In this paper, we have discussed the various copy move forgery detection techniques which includes Block based & Key Point based techniques.

**Keywords—**Copy-move forgery, Image forensics, Block-based methods, , Feature-based methods.

## I. INTRODUCTION

The advent in digital world is changing our way in which we store and manipulate the data. Digital images are fastest means of information transfer because of their ease of acquisition and storage. These images can be used as evidence like the images that are shown in TV news can be accepted as evidence for the truthfulness of that news. Though this technology has many advantages, it can also be used for hiding facts and evidences. Today, digital images are manipulated in such a way that it is not possible to detect forgery with naked eyes. The act of illegal manipulating or reproducing document, signature, images or banknotes is called Forgery. Forgery is the process of creating fake images. Forgery is easily possible with the software's like

Adobe Photoshop, GIMP, and Corel Paint shop. Some forgers performs the forgery for malicious purpose like to hide important features of an image or to convey some wrong information by changing the content. In this case, integrity and authenticity of image is lost.

Image forgery detection techniques are divided into two categories: - Active approach and Passive approach.

In the Active approach, Digital images require some preprocessing like Watermarking, or Digital Signatures etc. Digital Watermarking technique is the process of inserting a digital watermark (a known authentication code) into the image at source side, and then this code is being used for verification of digital information at the time of detection. Watermarks are inseparable from the images. The limitation of Watermarking approach is that it needs to be embedded in image at the time of recording the image before distribution by an authorized person with specialized cameras, but now-a-days most of the cameras are not equipped with the function of embedding watermark. This may also results in degradation of image. Digital Signature approach extracts the unique features of image and encodes them to create digital signatures. These Signatures are used for verification at the detection time.

Passive approach is also called Blind approach which requires no prior information about the image. Image forensics is a passive approach that works on the assumption that these forgeries leave no visual traces; they might alter the statistical properties of the image, referred to as the fingerprints of image that characterizes the life cycle of image from its acquisition to its processing. The manipulation in the image distorts that fingerprints that create inconsistencies in the image. Passive approach applies techniques for the verification of these fingerprints in order to detect tampered region. Passive approach determines the location and amount

of forgery in the image. Passive approach has two methods:-

i. Image source identification:-

This category concerns with the challenges associated with the data source identification. It checks whether the image is computer generated or a natural image and also identifies the device which is used to acquisition of the image.

ii. Tampering detection:-

Image manipulation has become much easier due to availability of digital editing tools that results in complexity of forgery detection. It detects the manipulation of images. Image forgery detection can be manipulated in numerous ways with many Simple operations like affine transforms such as translation, scaling and Compensation operations like colors, contrast adjustments, brightness etc., Suppression operations filtering, compression, noise extraction etc.

Passive approach can be further categorized: -

A. Pixel-based image forgery detection:

Pixel based techniques focuses on the pixels of image and finds the statistical anomalies at the pixel level. These techniques are further categorized: Image Resampling, Image Splicing, Copy-Move forgery.

B. Format-based image forgery detection:

Format based techniques are based on image formats and works mainly in JPEG formats. Format based techniques can detect forgery in the compressed images. These techniques can be divided into three types: JPEG Quantization, JPEG Blocking.

C. Camera-based image forgery detection:

When the image is captured from a digital camera, the image moves from camera sensor to memory. It has to undergo a series of processing steps that includes Quantization, White balancing, Filtering, JPEG compression etc. these techniques can be divided into four categories: Chromatic Aberration, Sensor Noise, Camera Response, Color Filter Array.

D. Physical environment-based image forgery detection:

Consider the creation of an image by splicing together two individual images captured at different places. Here is often difficulty arise to exactly match the lighting effects under each image was originally

photographed. These lightening differences can be used as evidence of forgery. Physical environment based techniques works on the basis of lightening environment. These techniques are categorized as: Light Direction 2-D, Light Environment, Light Direction 3-D.

E. Geometry-based image forgery detection:

Geometry based methods make measurement of objects in the real world and their position relative to the camera. Geometry based methods are: Principal Point, Metric Measurements.

Pixel-based image forgery detection:-

Pixel based techniques are further categorized: Image Resampling, Image Splicing, and Copy-Move forgery

i. Image Resampling: -

It is considered to be less harmful kind of forgery. Image Resampling do no change the image, it only reduce or enhance the features of image. This technique is most popular among Magazines, Newspaper photo editors. This is not proven ethically wrong. It includes rescaling, resizing, rotating the image etc.

ii. Image splicing: -

Image splicing is defined as a paste-up produced by sticking together photographic images. Image Splicing is a technique which involves composite of two or more images to create a new fake image. Image Splicing is more aggressive than the Resampling.

iii. Copy-Move forgery: -

it is the most common kind of forgery technique in which one part of image is copied and pasted into different location of the same image in order to hide information or to change the meaning of image; hence a strong correlation exists between these that can be used as an evidence to detect copy-move forgery.

Copy-Move Forgery challenges:

The duplicated region may not be the exact original region. It may include some preprocessing.

- Image may be saved under Lossy compression.
- Noise may be added to image to make the forgery detection difficult.

- Region may be rotated before performing forgery.
- Copied region may be blurred.
- Copied region's texture may be changed. It may be made lighter or darker.

**Image Retouching**



Fig 1 (a)

Fig 1(b)

In Fig 2 Image Retouching is performed to enhance the features of image. Image on the Right side Fig 2 (b) has better color contrast than image on Left side.

**Image Splicing**

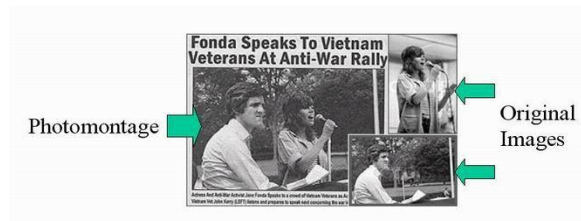


Fig 1: two individual images are used to create a new image by Splicing.

**Copy-Move Forgery**

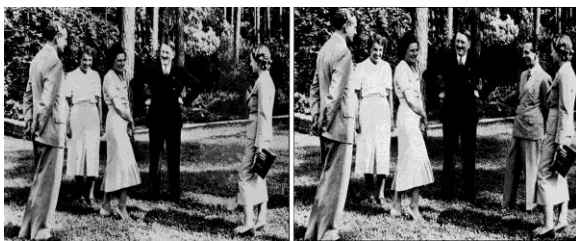


Fig 3(a)

fig 3(b)

In Fig 5, image (a) is the original image that has only 5 persons, and image (b) is tampered image having 6 persons standing in which one person is copied from the same image and pasted into different location of same image.

**Copy-Move forgery with Rotation**



Fig 4(a)

Fig 4(b)

In Fig 3, image (a) is the original image and image (b) is the tampered image in which rotation is performed on street lamp before copied and pasted.

**Copy-Move Forgery with Scaling**



Fig 5(a)

fig 5(b)

Fig 6(a) is original image having 7 guns and Fig 6(b) is Tampered image in which Scaling is performed before copied and pasted.

**II. EXISTING TECHNIQUES**

The Copy-Move forgery detection can be categorized into two methods:-

- Block based Methods
- Key point based Method

1. Block based Methods:

Block based methods aims to divide the image into overlapping or non-overlapping blocks of equal size rather than identifying the entire forged regions. Then transformation for each block is calculated and a comparison is made in order to detect duplicated regions. The regions of image that are covered under matching blocks are copy-moved regions. Algorithm for block based method is:-

Step 1: Input image & convert it into Grey Scale image. Divide the image into equal sized overlapping or non-overlapping blocks.

Step 2: Compute the feature vector for each block.

Step 3: Blocks are sorted lexicographically based on these features.

Step 4: Match each & every feature vector by searching its approximate nearest neighbor.

Step 5: Forgery Decision is made based on the matched blocks.

These techniques can be classified as:

#### 1.1. Moment-based Methods

Under this classification, Copy move forgery is detected by calculating Blur invariant, Hu, Zernike moments among others.

#### 1.2 Dimensionality Reduction-based :

This classification includes PCA, SVD, KPCA, PCA-EVD.

#### 1.3 Frequency-based Methods:

These methods include DCT, DWT, FMT, PHT, DyWT, QCD, LBP, Curvelet.

#### 1.4 Intensity-based Methods:

It includes LUO, BRAVO, LIN, CIRCLE, PCMIFD.

#### 2. Key Point-based Method:

Keypoint-based methods operate on entire image. Features are extracted only for the keypoints. It increases its computational efficiency. SIFT (scale invariant feature transform) and SURF (Speeded Up Robust Features) methods are used to detect copy-move forgery. General algorithm using SIFT:

Step 1: Image is loaded as input and converted into grey scale image.

Step 2: Then search for SIFT keypoints is made. SIFT features are computed for keypoints.

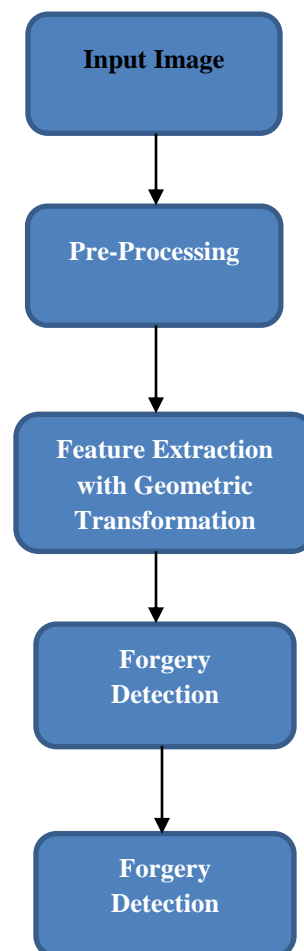
Step 3: Feature matching based clustering approach is used. Best matching keypoints are clustered in a group and cosine distance between features is calculated.

Step 4: Read the keypoints then comparison of keypoints is made, if a match found between keypoints then draws a line that indicates matched keypoints.

Step 5: Next step is Homographic matrix that tells about the relation between keypoints and provides total matched keypoints.

#### General method for Forgery detection:-

Fig 7 Copy-Move Image Forgery Detection



### III. LITERATURE SURVEY

K.Kiruthika et al.[1] used the keypoint based method SURF(Speeded Up Robust Features) for feature extraction. The g2NN strategy is done for identifying the matched points and hierarchal clustering is done on matched points to reduce false detection rate. Takwa Chihoui et al. [2] proposed a method that automatically detect duplicated regions by identifying local characteristics of the image using SIFT (Scale Invariant Feature Transform) and by using SVD (Singular Value Decomposition) for matching between identical features. This hybrid method is robust to Geometrical Transformations and able to detect with high performance duplicated regions. Sudhakar.K et al. [3] presents an efficient method for copy move forgery detection using SIFT features and used Chan-Vese's Level Set approach to reduce the volume of these features. Multiple forged object detection, high speed, invariant to scale and rotation, robustness and simplicity in implementation are strengths of this method. Lu Liu et al. [4] proposed an improved SIFT based method for copy move detection which combines BFSN (Broad First Search Neighbors) clustering and CFA (Color Filter array) features. BFSN clustering algorithm is used to detect multiple copied areas and to distinguish original regions from tampered regions CFA features are used. This method is efficient on different forgeries and also robust and sensitive. Mohammad Farukh Hashmi et al. [5] proposed a method based on DWT (Discrete Wavelet Transform) that is used for dimension reduction and also improves the accuracy of results. It localizes the forgery. Cao et al. [6] proposed a robust copy-move detection algorithm based on DCT for finding DC coefficients. Irene Amerini et al [7] proposed a novel methodology based on SIFT that detects the copy-move forgery and also recover the Geometric Transformation used to perform cloning. It also deals with multiple cloning. Ghorbani et al. [8] presents DWT-DCT (QCD)-based detection. Authors used DWT and divided the image into sub-bands and then performed DCT-QCD (quantization coefficient decomposition). After sorting lexicographically, shift vector is compared with threshold and forged region is detected. Kang et al. [9] proposed a method for copy-move forgery detection. Authors divided the image into sub blocks and used improved SVD. But it is not successful for noisy images. Lin et al. [10] proposed a method based on improved PCA. PCA is used for finding feature vectors and dimension

reduction, after that radix sort is applied on feature vectors to detect forgery. This algorithm is efficient but not works well with compressed and noisy images.

### CONCLUSION

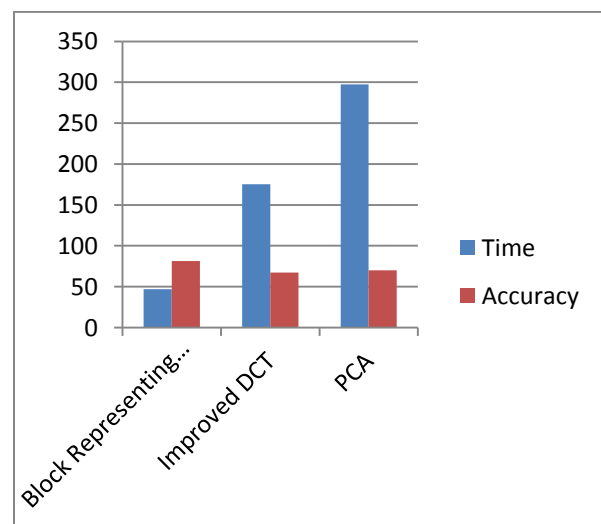
This paper presents the various techniques for copy-move forgery detection in digital images. As concluded copy move forgery detection is an important area of image processing for security reasons. A lot of work has been completed for copy move forgery detection for image cloning. Existing systems cannot detect Forgery in case of Overlapping, Compression, and Enhancement. As Future Work, an efficient system is required to be developed that can detect the copy move forgery in all areas.

#### Comparison of the existing techniques

Table 1

TECHNIQUE	TIME(SEC)	ACCURACY
Block Representing method	47.05	81.27
Improved DCT	175.20	67.17
PCA	297.47	70.17

#### Comparison Graph of existing Technique



Block Representing Method is considered better than other methods as shown in above graph as it takes lesser time and provides better accuracy.

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