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A Survey on Image Tampering Detection Using Probability Of Block Matching

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Abstract - *As image editing tools are easily available, the authenticity of the images has become questionable. Therefore the image tampering detection has become very important nowadays, as it can be used for misleading the general public as well as false evidence in court. In this paper we focus our research on copy-move forgery detection where a region of image is copied and pasted into the same image. Firstly divide the image into overlapping blocks. We propose fusion methodology for feature extraction, and Support Vector Machine for feature matching. Then calculate the probability of each matched block and compare it with a threshold value.*

Key Words: **Tampering detection**, **Copy-move forgery, fusion, Support Vector Machine, probability, threshold.**

1. INTRODUCTION

The fauxtography and digital image manipulation has increased considerably. Therefore the scientific community is aimed at fighting and detecting these activities. The manipulation of image consist of copying from an image and pasting into same image so as to multiply or hide a part of the image, this method is known as copy-move forgery. Another type of forgery include copying from an image and pasting into different image, this method is known as splicing and third type of forgery is retouching which enhances the image by adjusting colors, contrast, noise, sharpness etc.

1.1 COPY-MOVE FORGERY

In this paper, we focus our attention on copy-move forgery, that is a specific type of image forgery where a part of the image is copied and pasted on another part of the same image. It is also known as cloning. An example for this type of forgery can be seen in Fig. 1. The left side image is the original image of sun rise whereas the right side image is the tampered image showing two sun

There are mainly two methods to solve the copy-move forgery according to Christlein et al [1]. The first method is to use the block of image having transformed pixel then apply sorting and thresholding to these blocks, the image having similar blocks are marked a copy-move part. The second method is to use the points of similar interest known as the key-points which can be obtained by Scale-Invariant Transform SIFT [2],Speeded-Up Robust Feature SURF [3] etc.

Fig -1: Example of copy-move forgery;(left) original Image; (right) tampered image with two sun.

2. LITERATURE REVIEW

This section contains the existing method for copy-move detection

Christlein et el [1] proposed a flowchart for image tampering detection. This included pre-processing, feature extraction using block based or key-point based method. Then feature matching, filtering and post-processing.

B.L. Shiva Kumar, Lt. Dr. S. Santhosh Baboo [4] compared region cloning, with and without scaling and rotation. They proposed a methodology in which SURF key-points are extracted and stored in KD-tree.

P. M. Panchal, S. R. Panchal, S. K. Shah [5] showed the comparison between two key-point based algorithm SIFT (Scale Invariant Feature Transform) and SURF (Speed Up Robust Feature).Based on their comparison it was shown that SIFT detects more key-points as compared to SURF. But SIFT takes more time to detect the key-points than SURF.

Prerna.C, Percy Granaph.J, Angaline.S, Thanga Belsi.I [6] proposed a method by using K-d tree (K-dimensional tree) for feature matching because K-d tree is faster than other algorithms. They identified the forged region by estimating the transform between matched SIFT key-point. They used SIFT with k-d tree and RANSAC (Random Sample Consensus) algorithm.

Silva et al. [7] used key-points as well as blocks of pixel to detect the tampering with voting in multiscale.

3. PROPOSED METHOD

In this paper we propose to use fusion methodology for feature extraction, and feature matching will be done by Support Vector Machine (SVM) Fig 2. shows the block diagram of the proposed method.

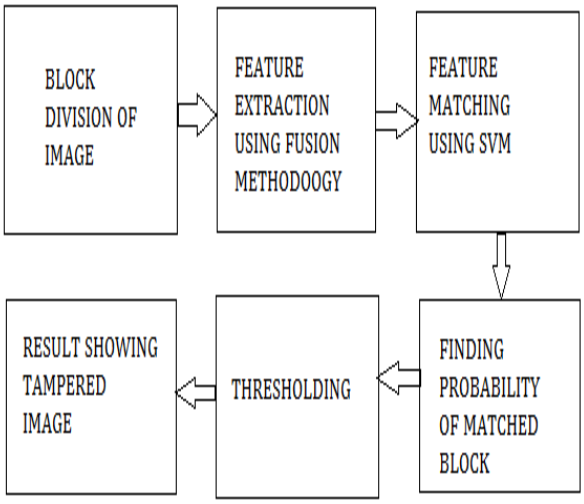

FIG-2: Block Diagram Of Proposed Method

As shown in the block diagram the image is first divided into number of overlapping blocks. Next feature extraction is done. For feature extraction the fusion methodology is used, that is block based as well as key-point based algorithm is used. For block based, three classifier are applied they are a) edge mapping b) colour mapping c) morphological features. For key-point based SURF classifier will be used. The next block shows feature matching which uses Support Vector Machine method (SVM). Then the probability of the matched blocks is found using correlation formula. Finally a threshold value is fixed and blocks having matching probability greater than the threshold is termed as forged. Each method is described in the following paragraphs.

EDGE MAPPING: Edge detection is the name for a set of mathematical methods which target at classifying points in a image at which the image intensity varies sharply or, has discontinuities. It is mainly grouped into two categories, gradient and Laplacian. The gradient method detects the edges by looking for the maximum and minimum in the first derivative of the image. The Laplacian method searches for zero crossings in the second derivative of the image to find edges. In this paper we are finding the edge detection using the Extended Epanechnicov function .

COLOR MAPPING: A colour mapping may be referred to as the algorithm that results in the mapping function or the algorithm that transforms the image colour. It gives the colour value of each pixel. The histogram is plotted between the number of pixel of that colour (Y axis) to the gray levels(X axis). While comparing the blocks having similar histogram pattern would be considered as forged.

MORPHOLOGICAL FEATURES: Morphological image processing is a collection of non-linear operations related to the shape or morphology of features in an image. Morphological techniques probe an image with a small shape or template called a structuring element.

Mean value:

$$\bar{x} = \frac{x_1 + x_2 \ldots\ldots + x_n}{n}$$

Standard deviation :

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$$

SPEEDED UP ROBUST FEATURE (SURF): SURF is a local feature detector that is used to extract features. SURF is able to detect multiple cloning and it detects this faster. This method is invariant to geometric transformation such as scaling and rotation. But it does not give desired result in case of highly compressed JPEG image. The detector finds key-point in image and descriptor defines the feature vector of the key-point. To detect the key-points SURF uses integer approximation of the determinant of Hessian detector. Feature descriptor is based on the sum of Haar wavelet response around the point of interest. The Hessian matrix H(p, σ) at point p and scale σ, is

$$H(p,\sigma) = \begin{bmatrix} L_{xx}(p,\sigma) & L_{xy}(p,\sigma) \\ L_{yx}(p,\sigma) & L_{yy}(p,\sigma) \end{bmatrix}$$

Where Lxy (p ,σ) was the convolution of the Gaussian second order derivative with the image I in point p, and similarly Lxy (p ,σ) and Lyy (p ,σ).

SUPPORT VECTOR MACHINE (SVM): Support Vector Machine (SVM) is a machine learning algorithm which can be used for both classification or regression challenges. Given a set of training examples, each marked as belonging to one or the other of two categories, an SVM training algorithm builds a model that assigns new examples to one category or the other. It performs the classification task by constructing hyperplanes in multidimensional space separating cases of different class label.

PROBABILITY: Probability is quantified as a number between 0 and 1, where 0 indicates impossibility and 1 indicates certainty. In this paper probability of the matched blocks is found using the correlation formula.

Let *X* and *Y* be any two random variables (discrete or continuous). The correlation coefficient of *X* and *Y*, denoted Corr(*X*,*Y*) is defined as:

r(X,Y) = E[(X- E(X))(Y -E(Y))] / D(X) * D(Y)

4. CONCLUSIONS

Image tampering detection is very difficult to solve. By using just single algorithm it is not possible to detect the image forgery perfectly. Also a certain algorithm may not be able to detect due to anti-forensic operation created by the forger.

To solve this problem we have combined various detectors that is we have combined the block based and key-point based detection methods. The advantages are 1) As different forgery detection methods have different benefits and drawbacks, their fusion can exploit the pros and alleviate the cons of them separately. 2) The efficiency of tampering detection will increase.

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