Image Forgery Detection using SIFT and MIFT

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Abstract: **Due to the technology development and advancement, the digital images are losing its authenticity and genuinity. Various detection techniques are used to find the authenticity of the digital images. In this paper we mainly concentrate on detection of copy-move forgery in images. SIFT (Scale Invariant Feature Transform) is used for matching the images. Here we find the boundary of the forged images. They fail for flipped images. So, MIFT (Mirror-Reflection Invariant Feature Transform) is used to overcome these disadvantages. It is also called as Reflective SIFT.**

Keywords: SIFT-Scale Invariant Feature Transform, MIFT-Mirror-Reflective Invariant Feature Transform, Image forgery, key points, flipped.

1. INTRODUCTION:

Digital images can be manipulated due to the availability of Hardware and Software. So it is very important to verify the genuinity of images. There are three major types for altering the digital images. They are copy-move, splicing, cloning. Cloning is closer to splicing.

In copy move technique a part of the image is copied and then moved to another place. This copied or duplicated part of the forged image can be rotated, flipped, scaled and blurred before moving to a new location. The first forged image was done in early 1840s.This first forged image was done by H.Bayrad.

Fig 1: This was a fake image picked up by the British Newspaper website, which apparently shows a dead Osama bin Laden, broadcasted on Pakistani television.

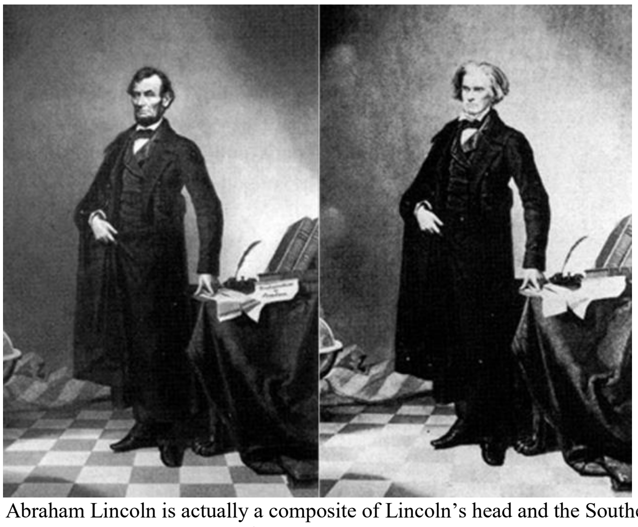

Fig 2: This iconic portrait of U.S. President Abraham Lincoln is actually a composite of Lincoln's head and the Southern Politician John Calhoun's body. This is the second forged image in circa 1860.

2. METHODOLOGY

SIFT IMAGE FEATURES:

SIFT- Scale Invariant Feature Transforms

Many features are available for any object, interesting points on the object, which can be extracted to provide a "feature" description. There are many considerations when extracting these features. SIFT image features provide a set of features of an object that are not affected by the complications experienced in other methods, such as object scaling, rotation.

SIFT features are also very resilient to the effect of "noise" in the image. SIFT approach, for image feature generation, takes an image and transferred into a "large collection of local feature vectors". Each of those feature vectors is invariant to any scaling, rotation or translation of the image. To aid the extraction of the features the SIFT algorithm applies a 4 stage filtering approach:

1. SCALE –SPACE EXTREME DETECTION:

This is the first stage that represents the filtering to identify those locations and scales. Which is identifiable from different views of the same object. This can be efficiently achieved using a "scale space" function. The scale space is defined by the function:

Where * denotes the convolution operator, G(x, y,) denotes the variable-scale Gaussian and I(x, y) denotes the input image.

Various techniques can be used to detect stable key point locations in the scale-space. Scale-space extreme D(x, y, σ) is located using Difference of Gaussian(DOG) technique for computing the difference between two images, one with scale k times the other. D(x, y, and σ) is given by:

$$D(x, y, \sigma) = L(x, y, k\sigma) - L(x, y, \sigma)$$

To detect the local maxima and minima of D(x, y, σ) each point is compared with its 8 neighbours at the same scale and its 9 neighbours up and down one scale. If this value is the minimum or maximum of all these points then this point is an extreme.

2. KEY POINT LOCALISATION:

This stage attempts to eliminate more points from the list of key-points by finding those that have low contrast or are poorly localized on an edge. This is achieved by calculating the Laplacian equation. Extreme based on poor localization is eliminated by noting that there is a large principle curvature across the edge but a small curvature in the perpendicular direction in the DOG function. Each point of an image can be identified using its location and quality. With these specifications the key points are determined.

3. ORIENTATION ASSIGNMNT:

In this step, based on the local image properties, the consistent orientation to key points are assigned. The key point descriptor described below can then be represented relative to this orientation achieving invariance to rotation.

4. KEY POINT DESCRIPTOR:

The local gradient data used above, is also used to create key point descriptors. This data is then used to create a set of histograms over a window centred on the key point. Key point descriptors typically using a set of 16 histograms, aligned in a 4x4 grid, each with 8 orientation bins, one for each of the main compass directions and one for each of the mid-points of these directions.

MIFT:

In image transformation, flipping of images is a common operation. There are three different ways appeared in the mirror reflection. They are Horizontal reflection, Vertical reflection and combined reflection. The key points are extracted by the process of MIFT. These key points are defined by the quality vector.

ORDER OF 16 CELLS:

After specifying the dominant orientation out of 36 candidates the 16 cells are organized in a fixed order by using SIFT. There will be multiple descriptors for same combinations of scale and location. It is because multiple peaks of 36 orientations are closer to the highest peak.

$$m_r = \sum_{k=1}^{(Nbin-2)/2} L(nd - k + Nbin)\%Nbin$$

$$m_l = \sum_{k=1}^{(Nbin-2)/2} L(nd + k + Nbin)\%Nbin$$

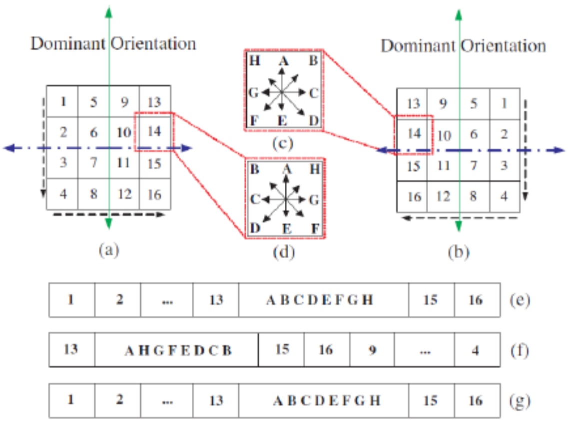

Fig 3: (a) Key points in original image. (b) Corresponding key points. (c) Scattering in the 14th cell of (b). (d) Scattering in the 14th cell of (a). (e) Descriptor of (a). (f) SIFT descriptor of (b). (g) MIFT descriptor of (b).

Order of 8 Orientations:
Reorganization of cells is a first essential step. Then restructuring the order of orientation bins in each cell is the next step. This is done based on the values of m_l and m_r.

3. EXPERIMENTAL RESULTS

Fig 4 is tested using SIFT algorithm and it also detects the boundary of the forged part, but it fails for flipped images. Fig 5 is tested using MIFT algorithm and it successfully detects the flipped images.

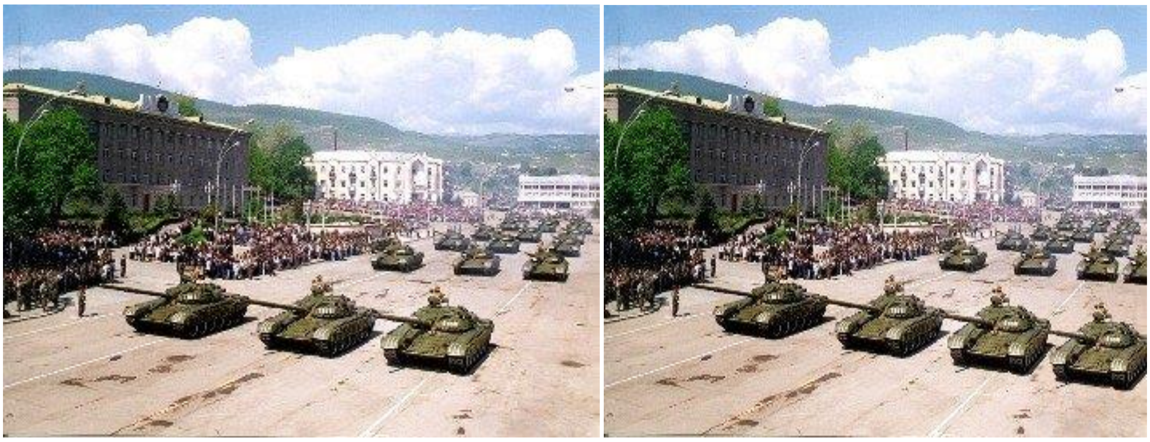

Fig 4: Example image. (a) Original image. (b) copy-moved image.

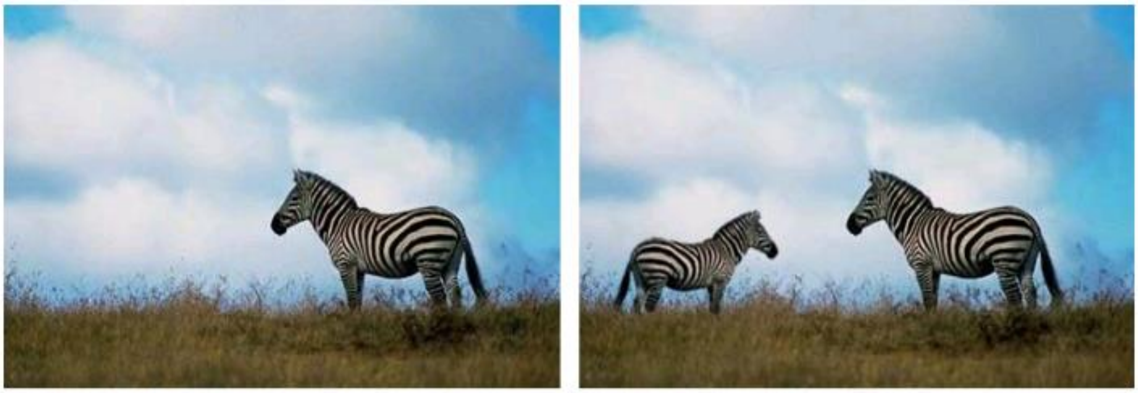

Fig 5: Example image. (a) Original image. (b) With reflection and scaling.

4. CONCLUSION

In this paper SIFT and MIFT algorithms produce good results against the forgery images. It works for almost all the types of transformations including reflection. Though SIFT and MIFT gives such good results, but still it fails for images with flat region. No key points are found in flat region, further work can be done to achieve this forgery image.

5. REFERENCE

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