ISSN 2278-3091
Volume 10, No.1, January - February 2021
International Journal of Advanced Trends in Computer Science and Engineering
Available Online at http://www.warse.org/IJATCSE/static/pdf/file/ijatcse451012021.pdf
https://doi.org/10.30534/ijatcse/2021/451012021

Enhance Detection Method for Identifying Orthogonally Rotated or Flipped Pasted Region in an Image

[1]Venu K N, B K Sujatha[2]
[1& 2]Department of Electronics & Telecommunication Engineering,
Ramaiah Institute of Technology, Bengaluru, India
venu1.kn@msrit.edu, bksujatha@msrit.edu

ABSTRACT
With the widespread availability of image manipulating software and with ease of use, anyone with basic knowledge can modify the image without leaving any traces in the image. People believe in whatever they see in an image, but it is not necessary that the content has to be real. With the wide use of social media people with malicious intent share images that are modified and make you believe that they are real and by doing so they can influence people's opinion which is a grave danger for society. In copy paste attack a part of the image is copied and pasted on to a different region of the same image, this pasted region can be detected by using the block-based method, but when the copied region is rotated orthogonally or if it is flipped before pasting on to the destination, such pasted regions are impossible to detect with the block-based approach. In this paper we are proposing a new technique to detect rotated or flipped pasted regions in an image and the performance of this new technique is compared with the SVD (Singular Value Decomposition) method used for the same purpose. The proposed new technique overcomes the rounding off errors in singular values of SVD method and computationally efficient than SVD and also computes the angle of rotation.

Key words*:* Overlapping blocks, Rotate blocks, SVD.

1. INTRODUCTION

In Copy paste image modification, a part of the image is copied and pasted on to the same image but at a different location. One way of detecting this type of image tampering is to employ a watermark, but this method is more complex because every image that is created from the imaging device needs to have a watermark that is difficult to implement.
People use image editing software like Photoshop to modify images. In Adobe Photoshop there are three different rotate and two flip options are available for rotating and flipping an image. Three rotating options are 180¬0 rotation, 900 CW (clockwise), 900 CCW (counter-clockwise) and the two flip options are Flip Horizontal and Flip Vertical. Block-based technique [1] is one of the passive forensic techniques used for detecting copy-move paste forgery.

In this technique, an image is divided into overlapping blocks. The Overlapping blocks with equal pixel values indicate copy paste portion of the image. If the copied region is either rotated or flipped and pasted, such regions are impossible to be detected using the direct block matching method.
Alin C. Popescu, H. Farid [2] used PCA (Principal Component Analysis) and correlation techniques to determine duplicate blocks but, it fails to detect pasted blocks that have been rotated or flipped. Similarly, X. Kang and S. Wei [3], Ting Zhang, Rang-ding Wang [4], Yang QC, Huange CL [5], Nidhal K. El Abbadi, Alyaa Mohsin [6] used the SVD method to detect copy-pasted image regions but, this too failed to detect the rotated region. Li. G.H., Wu, Q, Tu, D [7] used DWT (Discrete Wavelet Transform) and SVD technique which also failed to detect the rotated region.
In this paper, we are proposing a new method for detecting a portion of the image, which is rotated or flipped before pasting. The performance of this proposed method is compared to that of the SVD.

B. Singular Value Decomposition

Singular value decomposition is a method of decomposing a matrix in to three other matrices

$$A = U S V^T$$

where A is an $m \times n$ matrix, U is an $m \times n$ orthogonal matrix, S is an $n \times n$ diagonal matrix and V is an $n \times n$ orthogonal matrix. The diagonal values of the matrix S are called singular values of the matrix.
Detection of copy paste image forgery using SVD consists of dividing the image of size $M \times N$ into overlapping blocks of size $b \times b$. For each overlapping block, singular values are calculated and placed one below the other to create a matrix of size $(M - b + 1)(N - b + 1) \times b$. Rows with equal singular values indicate copy paste image portion. If singular values are not rounded off to a few digits after the decimal point then singular values of two similar blocks will not match and because of which we are not able to identify the pasted region. To overcome this problem a new approach is used for detecting a portion of the image, which is rotated or flipped before pasting

2. PROPOSED METHOD

In the proposed method, the image of size $M \times N$ is used and is divided into overlapping blocks of size $b \times b$and from each block, pixels are extracted from its outermost boundary, these pixels are sorted and successively placed one below the other to form a matrix of size $(M - b + 1) \times (N - b + 1)$ rows and $(4 \times b - 4)$ columns.

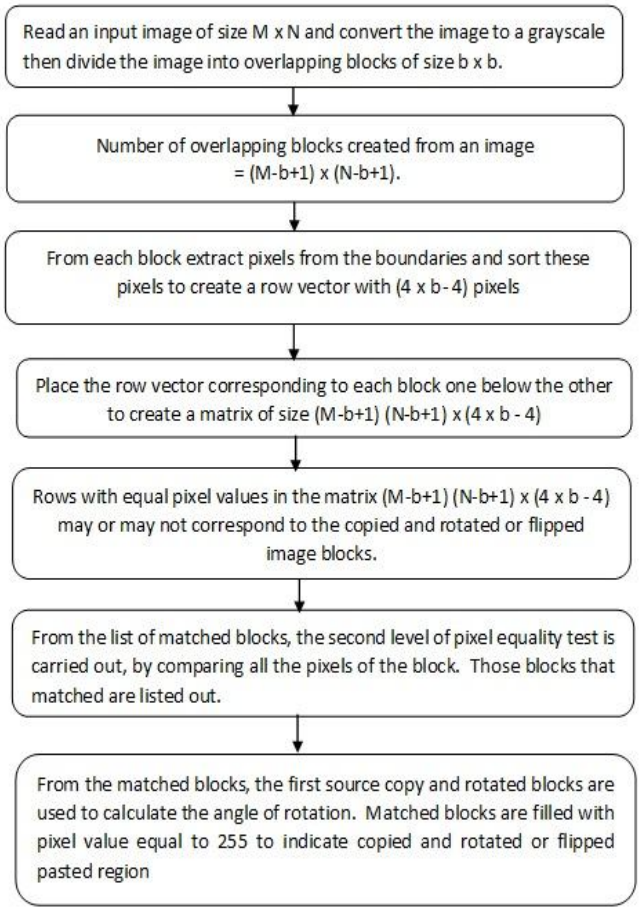

Fig. 1: Flow Chart of the Implementation of the proposed method

Matrix rows with equal pixel values may or may not correspond to the copied and rotated image blocks. We thus carry out another equality check on such blocks by comparing the pixel values of the entire block with the other to confirm whether the blocks are equal or not. If they are equal such block regions are highlighted. The degree of rotation of the pasted region corresponding to the source region is computed. The flow chart of the proposed technique implementation is shown in figure 1.

A. Steps used for Proposed Detection Method

Generation of Overlapping Blocks: Input *an* image of size$M \times N$, then divide it into overlapping blocks of size b x b. Total number blocks created will be equal to $(M - b + 1)(N - b + 1)$.

Extract Pixels from the Boundaries and form a Row Vector: From each of the overlapping blocks extract pixels from their boundaries and form a row vector of size $1 \times (4 \times b - 4)$.

C. Sort the Pixel Values in the Row Vector

Sort the pixels in the row vector and repeat step 2 for all the blocks and stack such row vectors obtained one below the other to create a matrix of size $(M - b + 1)(N - n + 1) \times (4 \times b - 4)$.

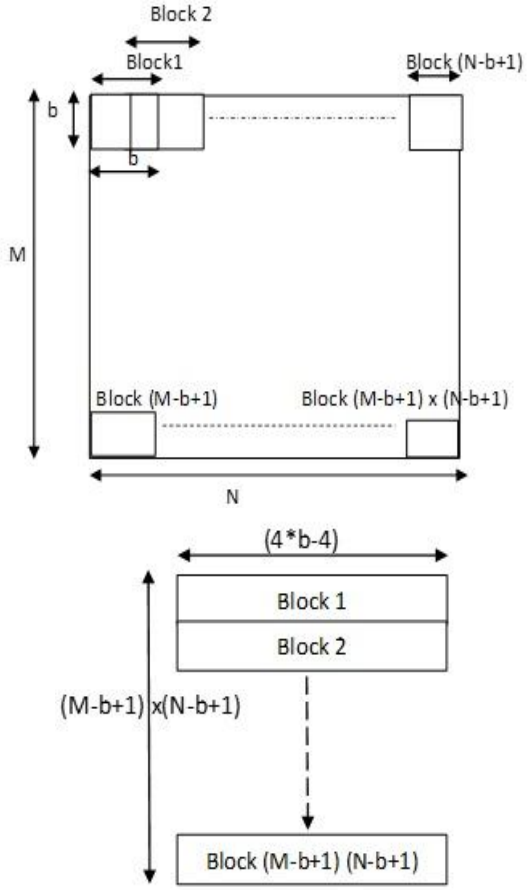

Fig. 2: Depicting the process of converting the input image of size M x N in to (M-b+1) (N-b+1) x (4 x b -4) matrix

Extract the positions of all those blocks which have equal pixel values in the matrix (M-b+1) (N-b+1) x(4 x b – 4): Rows with equal pixel values in the matrix $(M - b + 1)(N - b + 1)$may correspond to similar blocks and their rows and columns position needs to be calculated and extracted.

Let X_1 and X_2 be the rows in the matrix with equal pixel values that correspond to copied region and pasted region which has been rotated or flipped. The rows and columns of the blocks are obtained by using the following calculation.

Copied block row position = $(X_1/(M - b + 1))$, round off the division result to the next integer.

Copied block column position = Remainder of this division $\left(X_1,(N - b + 1)\right)$.

Similarly, pasted block row position = $\left(X_2/(M - b + 1)\right)$, round off the division result to the next in integer.

Pasted block column position = Remainder of this division $\left(X_2,(N - b + 1)\right)$.

Extract Blocks and Check for Equality: In the previous step we had identified the blocks with equal pixel values in the boundary, now these blocks may or may not be the same. To confirm that they are same we perform an equality check on them by considering all the pixels in the block.

Let one of the source blocks be block1 and pasted block be block2. Blocks are compared for equality using the following algorithm.

Check for the equality of block1 and block2, if they match it indicates that the pasted region is not rotated.

Check for the equality of block1 with block2 rotated 90^0 or 270^0 if they match, it indicates the pasted region is rotated clockwise/counter clockwise by 90^0.

Check for the equality of block1 and block2 rotated by 180^0, if they match, it indicates pasted region is rotated by clockwise/anticlockwise 180^0.

Check for the equality of block1 and block2 flipped in a vertical direction, if they match it indicates a pasted flipped region in a vertical direction.

Check for the equality of block1 and block2 flipped in a horizontal direction, if they match it indicates a pasted flipped region in a horizontal direction.

Repeat this algorithm for all blocks in the source and pasted region and find the matched blocks and their respective position in an image in terms of row and column position in the image and highlight those blocks with pixel value equal to 255.

Calculation of Angle of Rotation on Flip of a Pasted Block:

From the matched blocks obtained from the previous step, use the first block of source and pasted region to calculate the angle of rotation using the algorithm specified in previous step.

3. RESULTS

The proposed algorithm is run on an image for different rotation and flips of the pasted part and those regions are identified. Figure 3 and 4 shows the image with pasted region rotated clockwise and anticlockwise direction by an angle of 90^0 respectively and their detected regions have been highlighted. Figure 5 indicates pasted region rotated by an angle of 180^0. Figure 6 and 7 indicates pasted region being flipped vertically and horizontally and their detected regions have been highlighted.

Fig.3 Pasted copied region rotated by 90^0 clockwise is Detected and highlighted.

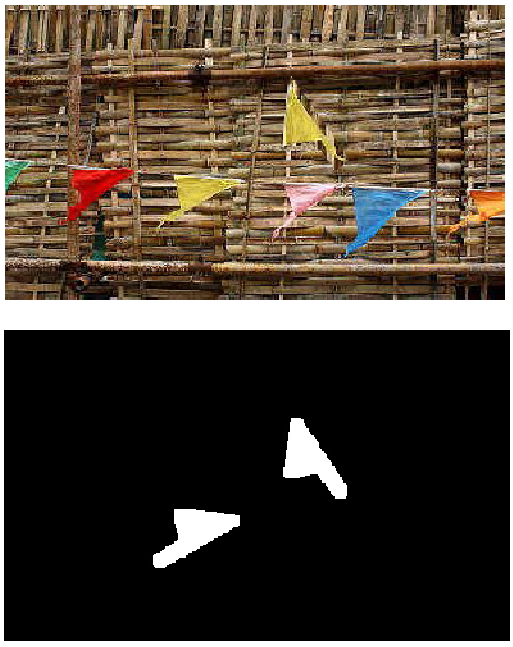

Fig. 4: Pasted copied region rotated by 90^0 anticlockwise is detected and highlighted.

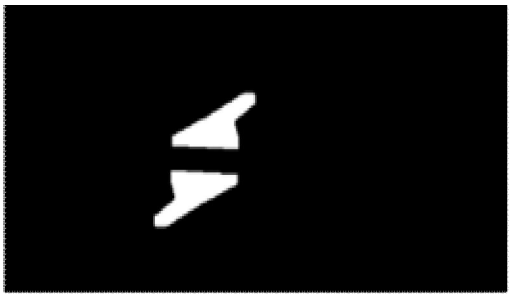

Fig. 5: Pasted region is rotated by 180^0 clockwise/ anticlockwise is detected

Fig. 6: Pasted region is flipped vertically is detected

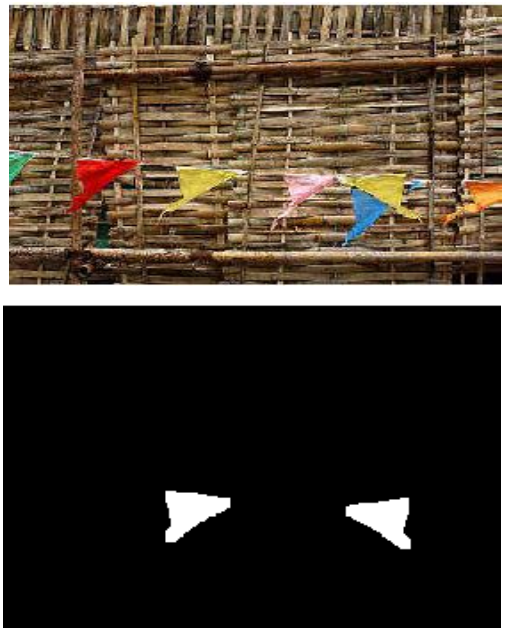

Fig. 7: Pasted region is flipped horizontally is detected

4. COMPARISON OF THE PROPOSED METHOD WITH SINGULAR VALUE DECOMPOSITION

The proposed technique is compared with the singular value decomposition technique by running the code on the intel core i3 processor and it is found that the proposed method takes less computation time and detects the angle of rotation of the pasted rotated or the type of the flip. The execution time for both proposed and SVD algorithms with different pasted rotated part and flips are shown in Table 1.

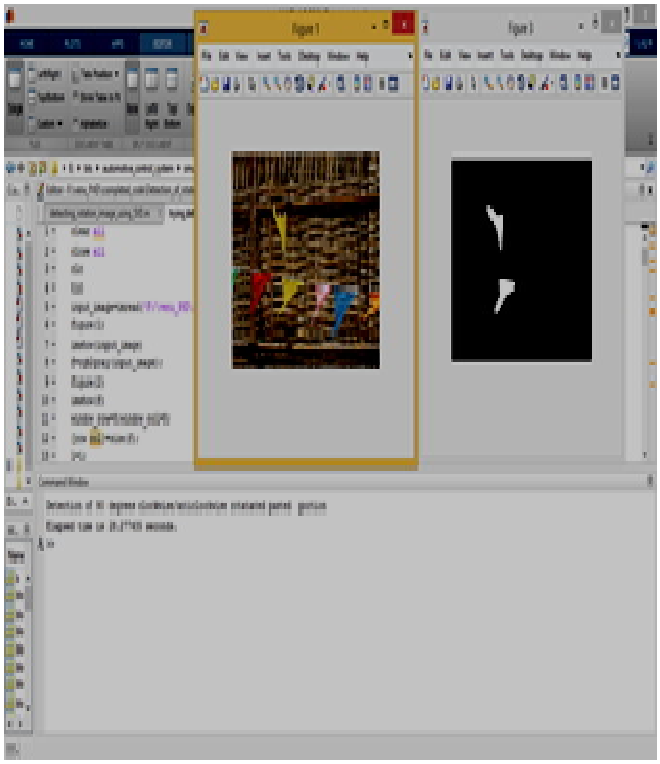

Fig. 8: The proposed algorithm detection of rotated pasted image with 90^0 clock wise rotation and displaying the computation time.

Table 1: Comparison of computation time of proposed method with SVD

Type of pasted region	Proposed method (Computation time) in Secs.	SVD (Computation time) in Secs.
90^0 clockwise rotated	28.507432	43.699185
90^0 anti-clock wise rotated	24.405564	43.024352
180^0 rotated	25.044293	42.851407
Flipped horizontally	25.532100	43.300302
Flip vertically	26.672197	42.525789

5. CONCLUSION

The proposed method has been applied to more than 100 images that are downloaded from the internet and images are modified by using the Adobe Photoshop tool. The proposed method is able to detect pasted regions in all images and at the same time takes less computation than the SVD approach, overcomes the rounding off errors of SVD computation and also computes the angle of rotation.

REFERENCES

[1] J. Fridrich, D. Soukal, J. Lukas, Detection of copy–move forgery in digital images, in: Proceedings of Digital Forensic Research Workshop, IEEE Computer Society, Cleveland, OH, USA, August 2003, pp. 55–61.

[2] Alin C. Popescu, H. Farid, "Exposing Digital Forgeries by Detecting Duplicated Image Regions", Technical Report TR2004-515, Dartmouth College, 2004

[3] X. Kang and S. Wei, "Identifying Tampered Regions Using Singular Value Decomposition in Digital Image Forensics", 2008 International Conference on Computer Science and Software Engineering, Hubei, 2008, pp. 926-930.

[4] T. Zhang and R. -d. Wang, "Copy-Move Forgery Detection Based on SVD in Digital Image", 2009 2nd International Congress on Image and Signal Processing, Tianjin, 2009, pp. 1-5.

[5] Yang Q C., Huang CL. (2009) Copy-Move Forgery Detection in Digital Image. In: Muneesawang P., Wu F., Kumazawa I., Roeksabutr A., Liao M., Tang X.(eds) Advances in Multimedia Information Processing -PCM 2009. PCM 2009. Lecture Notes in Computer Science, vol 5879. Springer, Berlin, Heidelberg.

[6] Nidhal K. El Abbadi, Alyaa Mohsin, "Blind Digital Images Tampering Detection Based on Singular Value Decomposition", International Journal of Intelligent Engineering Systems, Vol.13, No.6, 2020

[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 2007 International Conference on Multimedia & Expo, Beijing, 2007.