Enhanced LBP Method to Detect Change in Brightness of Copy Pasted Region in an Image

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Abstract. Anyone with average knowledge about image editing software can modify an image and make people believe it is the real image. One type of image modification is to copy a portion of an image, change its brightness, and paste it onto another location. In this paper, we are intending a method to perceive the brightness changes in the copy-pasted region of a colour image by applying LBP (Local Binary Pattern) on all three channels R(red), G(green), and B(blue) of an image. After the application of the LBP, the image is separated into overlapping blocks, and those blocks with equal LBP values in each channel indicate brightness or contrast modified pasted regions. Each of the channels detected regions are combined to identify brightness change in the duplicated region of the image.

Keywords: LBP, Overlapping Blocks, Brightness, Contrast.

1 Introduction

In copy paste image modification a part of the image's brightness or contrast is modified before pasting onto the destination. When such images are shared on social media it changes the perception of the people and, hence there is a need to develop techniques for the detection of tampered images. When the brightness of the colour image is changed and pasted on to the same image by the use of adobe photoshop the pixel values in the red, green, and blue channels are not changed by equal values, hence the detection of a pasted region using Block-based technique [1] is not possible.

Y. Wang, L. Tian and C. Li [2] used LBP- SVD method to detect the pasted region's brightness change, which is computationally intensive. A. A. Alahmadi, M. Hussain, H. Aboalsamh, G. Muhammad and G. Bebis [3] used complex method of detecting forgery region by using chromatic channel information with LBP and DCT operation. S. Kumar, J. Desai and S. Mukherjee [4] used DCT method to compute tampered regions but the method fails to detect the brightness changed regions. Z. Moghaddasi, H. A. Jalab and R. M. Noor [5], Zhao J, Guo JC [6] used DCT and SVD to identify tampered regions but again fails to identify brightness changed regions. X. Kang and S. Wei [8] used SVD method to detect tampered regions but it also fails to identify brightness changed regions. There exists numerous approaches with regard to the assessment of such aspects which are of prime importance in applications pertaining to psychophysics as well as perceptive learning often used in case of different psychophysical tests [9][10]

1.1 Proposed Method

In the proposed method, we apply LBP on R, G, B channels of a colour image of size $(M \times N \times 3)$. The image in each channel is divided into overlapping blocks of size $(b \times b)$. The number of overlapping blocks created in Red, Green, and the Blue channel is respectively $(M-b+1)(N-b+1)$. Blocks with equal LBP values indicate brightness or contrast change in the pasted region. We then combine such detected regions from all channels to obtain the final brightness or contrast change in the pasted region of an image. The flow chart of the implementation is shown below in figure 1.
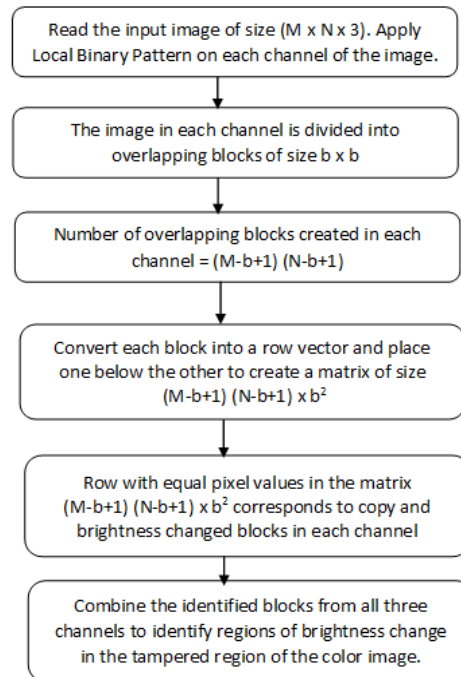

Figure 1: Implementation of detection duplicated brightness modified region using LBP

2. Steps Involved In The Implementtion

2.1 Calculation of LBP on each Channel

LBP is a texture-based descriptor [7], it is used for the classification of objects, scene, and face, LBP computes the local representation of the texture [11]. LBP is computed by comparing the neighbourhood pixel value with the central pixel, depending on the outcome of comparison a binary result is assigned. LBP is computed by using the following algorithm

a) Red, green, and blue channel images of the color image are used as input.

b) For each pixel c in an image find the p neighbourhood pixels that surround it. LBP works in a block size of 3×3.

c) Compare the surrounding pixel intensity with respect to the central pixel, assign a binary 1 if it is more than the central pixel else assign a binary 0.

LBP value of a central pixel is calculated using the formula

$$LBP = \sum_{i=0}^{p-1} g\left(n_i - c\right) \times 2^i.$$

$$g(x) = \begin{cases} 1 & if \ x > 0 \\ 0, & otherwise \end{cases}$$

where c is the central pixel and n_i is the ith neighbouring pixel.

LBP computation operation is shown in the below figure 2

$$1\times 2^7 + 1\times 2^6 + 1\times 2^5 + 1\times 2^4 + 1\times 2^3$$
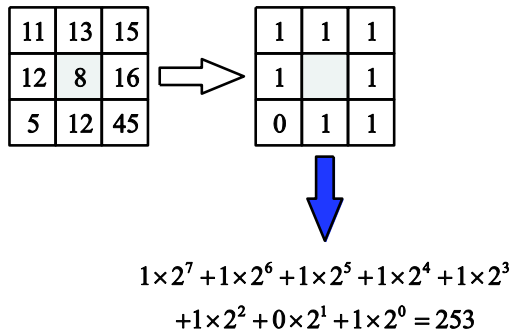$$+ 1\times 2^2 + 0\times 2^1 + 1\times 2^0 = 253$$

Figure 2: LBP computation

d) Repeat the process for the entire image.
e) Repeat the process for all the channels of color image

2.2 Generation of Overlapping Blocks
LBP computed image from previous Step is divide into overlapping blocks of size $b \times b$.
The total number of blocks created will be equal to $(M-b+1)(N-b+1)$.

2.3 Extract Pixels from the Blocks, from a Row Vector, and place one below the other to form a Matrix of Size (M − b + 1) (N − b + 1) x b²
From each of the overlapping blocks extract pixels and form a row vector and place those row vectors one under the other to make a matrix of size (M-b+1) x (N-b+1) x b². The process is shown in figure 3.
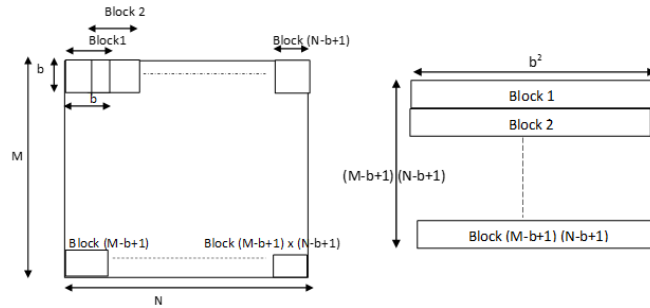
Figure 3: Representing the progression of converting the input image of size $M \times N$ in to $(M-b+1)(N-b+1) \times b^2$ matrix

2.4 Row with Equal Pixel Value represents Brightness Changed Pasted Regions

Rows with equal pixel values in the pixel in the matrix $(M-b+1)(N-b+1) \times b^2$ represents brightness or contrast modified pasted blocks. Highlight these blocks by filling pixel value equal to 255 in this area.

2.5 Combine the Identified Pasted Brightness or Contrast Blocks to find the Total Region

The process of detecting brightness or contrast change in the pasted region is carried out for all three channels and all detected blocks are combined to identify the final brightness of the modified region in the image.
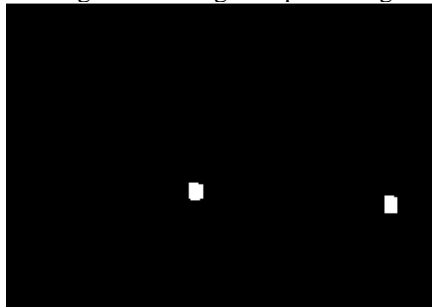
3. Results

The proposed algorithm is run on an image and the brightness or contrast modified region is detected. The results of brightness and contrast change detection are shown in Figures 4,5,6 and 7 respectively.

Figure 4: Indicates brightness changes in pasted region and its detection

Red Channel

Green Channel

Blue Channel

Figure 5: Indicates brightness change detected region in Red, Green and Blue channels

Figure 6: Indicates contrast change in pasted region and its detection

Red Channel

Green Channel

Blue Channel

Figure 7: Indicates contrast change detected in Red, Green and Blue channels

5. CONCLUSION

In the previous methods, if the colour image is converted into greyscale and LBP is applied, it is not possible to detect the brightness modified blocks because the Adobe photoshop tool will not uniformly change pixels in the red, green and blue channels. The proposed technique is an improvement in the detection of the tampered region compared to the previous techniques because it overcomes this drawback.

The proposed method has been applied to more than 100 images that are downloaded from the internet and whose brightness or contrast is modified by using the Adobe Photoshop tool. The proposed algorithm is implemented in MATLAB and the brightness or contrast changes are detected.

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