ISSN 2229-5518

"New Approach for Automatic Separation of ROI and BG in Crime Scene Images and Compression using DWT (ASRBDWT)"

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Abstract-Crime scene images are very sensitive to do any kind of preprocessing and compression, but the use of images is increasing in exponential manner in crime detection and crime solving, so we require to compress the crime scene images as well. For more compression ratio we can use Region of Interest (ROI) compression. For crime scene images our ROI may be evidences of crime. We might have multiple ROIs in crime scene images. Sometimes it may not possible to select ROI manually; because ROI may be too small and even sometimes we can miss some evidences in manual ROI selection. The solution to this problem is automatic separation of ROI and background (BG). In this paper, we had implemented one algorithm for automatic separation of ROI and BG for crime scene images. We had use color crime scene image for automatic separation of ROI and BG and then compression is done using DWT.

Keywords: ROI, BG.

I. INTRODUCTION

In conventional compression model, an entire image is compressed with single compression ratio, i.e. equal or same level of compression is applied to the useful area as well as to the redundant area of an image. But in crime image compression it is desired to preserve the quality of a particular portion of an image more as compared to the rest of the image. The disadvantage of a conventional compression system is that it will compress the entire image with same compression ratio. Hence we cannot get a good overall compression performance in case of a conventional compression algorithm. And that is where a newer concept of compression, called the Contextual compression arises where the important and unimportant areas of an image are compressed with different compression ratios [1][3][4].

Now, crime scene images comprise of: Region of Interest (ROI), that used for the diagnosis and unimportant area-Background region, which comprises the less important information and is redundant. The background area in a crime image is quite large and we can compress it with quite a large compression ratio as it contains the redundant information. Again we cannot compress the diagnostically important area (ROI) beyond certain CR, in order to retain quality of the reconstructed image. Hence, the Contextual compression aims at compressing the ROI with the best quality (and least CR) and compressing the background with poor quality (and highest CR) to attain an overall better compression performance.

In crime scene images there are multiple ROIs and some of the ROIs are too small like bullets of gun, so we may miss to select that kind of ROIs in manual selection procedure. We had proposed one solution for this problem which is automatic separation of ROI and BG. By this method we can separate the ROI and BG and then compress them separately.

The other use of this method is that if some evidences are too small and not found by detectives but they are present in an image then if we apply this method to that crime scene image then those evidences can be highlighted.

II. PROBLEMS IN AUTOMATIC SEPARATION OF ROI AND BG

The ROI is not fixed for all crime scene images. Even if the ROI is same then also the color and size of the ROI may vary. Automatic separation method is available for only two kinds of ultrasound kidney images (Ultrasound Transverse and longitudinal kidney images) [2]. There is no any general method exist for automatic separation of ROI and BG. In particular crime scene images, we have multiple, and some very small ROIs are there because of evidences. The most important reason is that the ROI is totally subjective matter.

III. PROPOSED SOLUTION FOR AUTOMATIC SEPARATION OF ROI AND BG

We can separate the ROI and BG automatically by performing edge detection operation and morphological closing operation. First we will convert the RGB image to gray scale image then we will apply canny edge detection technique to find edges and then we will apply the morphological closing operation to fill white color in the objects. Then we will separate the R, G and B component of an original color image, and subtract R, G and B component from the resulting gray scale image.

ISSN 2229-5518

The advantage of automatic ROI selection is that it will help you in finding some evidences which are not visible in images normally but they exist. Because when automatic selection is done than only BG area will be selected and the color of BG will change so we can recognize the hidden evidences.

Following are the steps for ASRBDWT algorithm,

Step 1) Read the image.

Step 2) Convert the RGB image to gray scale image.

Step 3) Apply canny edge detection technique to detect the edges on resulting gray scale image of step(2).

Step 4) Apply morphological closing operation on resulting image of step(3) for filling the objects with white color.

Step 5) Invert the white and black color of resulting image of step(4).

Step 6) Separate the R, G and B component of an original colored (RGB) image.

Step 7) Subtract the R, G and B component from the resulting image of step(5) image using.

Step 8) Combine the R, G and B component of step(7).

Step 9) Subtract resulting image of step(8) from the original image. By this step we will get separated background image.

Step 10) Apply forward DWT for encoding of background portion of an original image.

Step 11) Calculate the wavelet coefficients of BG.

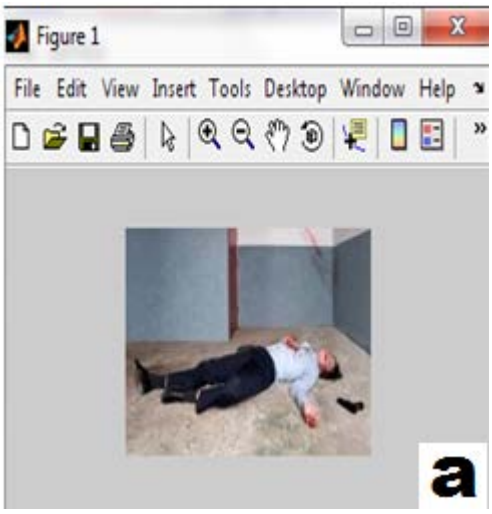
Step 12) Quantize the wavelet coefficients for each subband of BG.

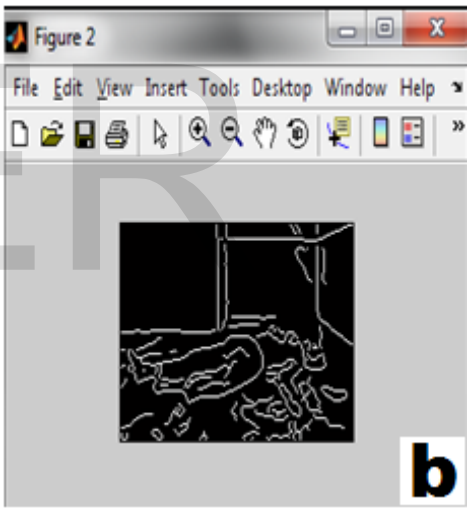
Step 13) Get the compressed bit stream for BG.

Step 14) Combine the image of step(13) (Compressed BG image) and image of step(8) (ROI portion of an original image).

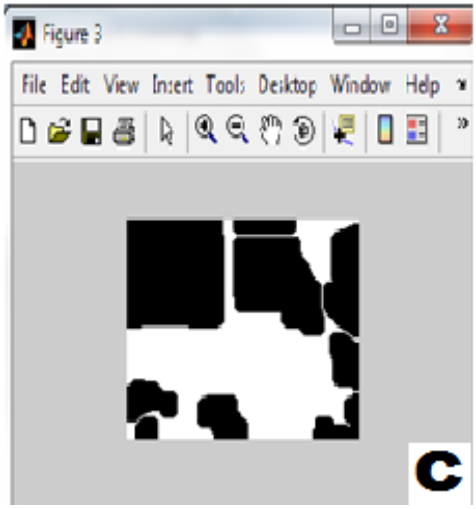
IV. RESULTS AND DISCUSSION

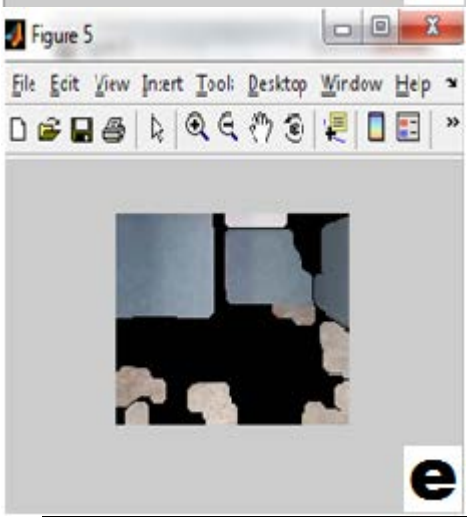
Figure 4.1 shows the results of proposed ASRBDWT algorithm; In the following image our region of interest is dead body, gun and the blood on the wall, and rest of the portion is consider as BG. Figure 4.1(a) represent the original image, Figure 4.1(b), shows the result of canny edge detection technique which we had applied to original image. Figure 4.1(c) shows the result of morphological processing applied on result of canny edge detection. Figure 4.1(d) and (e) shows the separated ROI and BG portion respectively. Figure 4.1 (f) shows the resulting compressed image.





ISSN 2229-5518





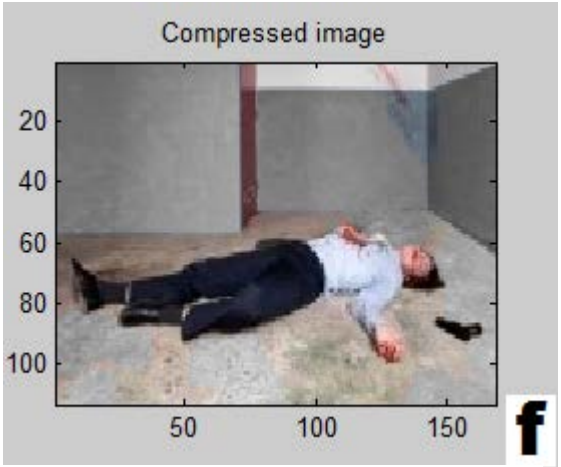


Fig. 4.1 (a)Original crime scene image (b)Canny edge detection (c)Morphological processing (d)Separated ROI portion (e)Separated BG portion (f)Compressed image

In this algorithm we are not applying compression of any kind to the ROI portion, because ROI portion in the crime scene images contains very sensitive information. The compression is applied only to the BG portion of the crime scene image. This way we will get good compression ratio as well as good image quality in ROI portion.

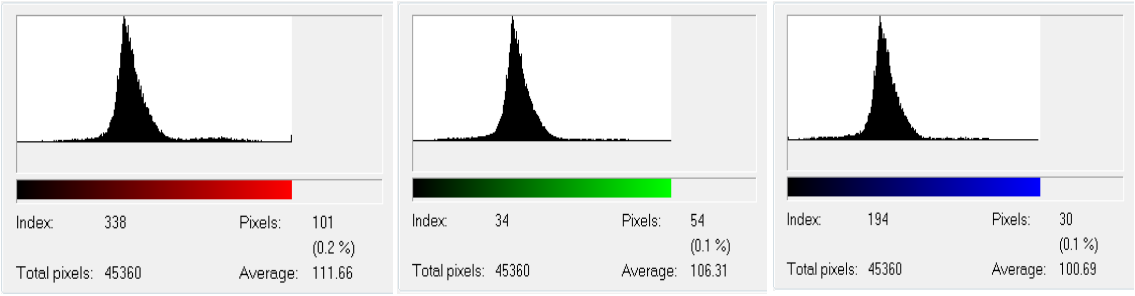
Table 4.1 shows the statistical analysis of ASRBDWT algorithm with parameter Bits per pixel, Compression ratio, Mean square error and Peak signal to noise ratio. We can see from the Table 4.1 that as the decomposition level increases the CR will increases and as CR increases, PSNR decreases.

Sr. No.	Decomposition level	BPP	CR	MSE	PSNR
1	1	1.24	51.52	0.7132	49.60
2	2	1.24	84.44	6.2510	40.17

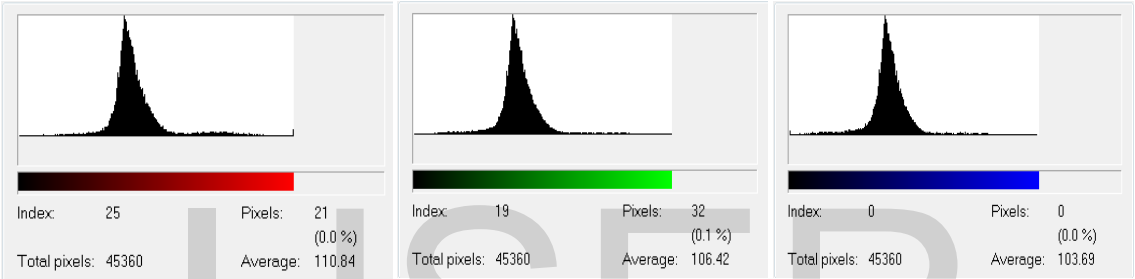
ISSN 2229-5518

3	3	1.24	95.58	14.5032	36.52
4	4	1.24	98.80	27.5000	33.74

Table 4.1 Results of ASRBDWT algorithm



(a) Histogram of original image with R, G and B components



(b) Histogram of compressed image with R, G, and B components

Figure 4.2 Histograms of original and compressed image

Figure 4.2(a) shows the histogram of original image and Figure 4.2(b) shows the histogram of compressed image with R, G and B components.

V. CONCLUSION AND FUTURE WORK

The proposed ASRBDWT provides automatic separation of ROI and BG, and separate compression for BG using DWT compression technique. This algorithm provides good results for crime scene images with multiple ROIs.

Some other compression algorithm like JPEG2000, SPIHT etc. can be used with automatic separation of ROI and BG so that we can see more adequate results in the future.

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