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# HIGH IMAGE RESOLUTION USING CURVELET AND CONTOURLET TRANSFORM FOR BIO-MEDICAL APPLICATIONS.

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**ABSTRACT**

*The goal of image fusion is to integrate complementary information from multi focus information such the new pictures area unit additional appropriate for the aim of computer-processing tasks like segmentation and feature extraction. In This work presents a picture fusion theme that is predicated on the Curvelet model (DCT). The curvelet transforms of the input pictures area unit fittingly combined, and therefore the new image is obtained by taking the inverse Curvelet remodel of the united rippling coefficients. Associate in nursing area unite-based most choice rule and a consistency verification step are used for feature choice. The projected theme performs higher than the Transform strategies as a result of the compactness, directional property, and orthogonality of the curvelet remodel. A performance live mistreatment specially generated check pictures is usually recommended and is employed within the analysis of various fusion strategies, and in examination the deserves of various rippling remodel kernels. Intensive experimental results together with the fusion of multi focus pictures, Landsat and Spot pictures, Landsat and Sea sat SAR pictures, IR and visual pictures, and magnetic resonance imaging and PET pictures area unit bestowed within the paper.*

***Keywords ---- DWT, NSCT, DCT***

## I. INTRODUCTION

IMAGE fusion is an extremely significant technique for different image processing along with pc vision applications like feature extraction and objective detection. Through image fusion, unlike pictures of a related prospect may be collective into a single consolidate image. The consolidate image will offer extra comprehensive information as regards the scene that is further helpful for human and machine perception. As an instance, the act of feature extraction algorithms may be enhanced with fusing multi-spectral remote sensing pictures. The fusion of multi-exposure pictures is able to use for photography. Within these applications, straight image fusion methodologies have the consequent properties. First, it will maintain most of the useful information of a grouping of pictures.

Segmentation of head tissues within gray matter, white matter and tumor on medicinal image is not only of high interest in serial treatment monitoring of “disease burden” in oncologic imaging, but also ahead recognition with the advance of image guide surgical approaches. Outlining the brain cancer contour is the main step in arrangement spatially localized radiotherapy e.g. (MRI) which is usually done physically on contrast improved T1-weighted magnetic resonance images (MRI) in current experimental practice. On T1 MR Images acquired

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after management of a contrast agent, blood vessels and parts of the cancer, where the contrast can exceed the blood–brain obstacle are observed as concentrated intense areas.

## II. LITERATURE SURVEY

Literature survey is the mainly significant step in the software development process. Before developing the tool it is essential to determine the time factor, economy and company strength. Once these things are satisfied, then after that step is to conclude which operating system and language is able to be used for developing the tool. Once the programmers initiate building the tool the programmers require lot of external support. This support can be obtain from senior programmers, from websites. Before build the system the above considerations are taken into explanation for improvingthe proposed system.

### SURVEY-1.MULTIRESOLUTION DCT (DISCRETE CURVELET TRANSFORM) DECOMPOSITION FOR MULTIFOCUS IMAGE FUSION

Image fusion is gaining energy in the research community with the aim of combine all the important information from multiple images such that the fused image contain more accurate and complete information than that contained in the individual images. In this work, it is proposed to fuse multi focus images in the multi resolution DCT domain.

### SURVEY-2.DCT BASED FUSION OF MULTI-FOCUS IMAGES FOR VISUAL SENSOR NETWORKS

EG5D7In This work present a simple and resourceful multi-focus image fusion scheme clearly considered for wirelessvisual sensor systems prepared with resource constrained image sensors employed in surveillance, harmful environment like battlefields etc.

## III. PROPOSED METHOD

## WAVELET TRANSFORM

Wavelets are an expansion Fourier analysis. Wavelet analysis uses a related approach but as a replacement of sinusoids, waves of partial duration, termed basis function or mother wavelets, are used.

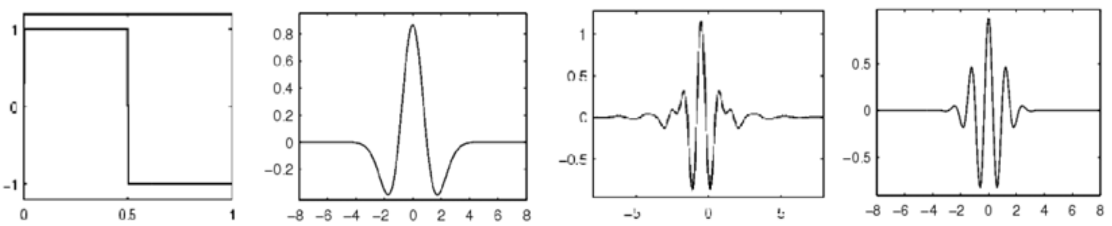

**Figure1:- Wavelet family examples, from left to right: Haar, Mexican Hat and Morlet.**

Different Fourier transformation, an amount of dissimilar mother wavelet families exist. While Fourier transformation breaks a signal up into sin and cosine functions of different frequencies, wavelet transformation break a signal up into shifted and scaled version of the mother wavelet [figure].

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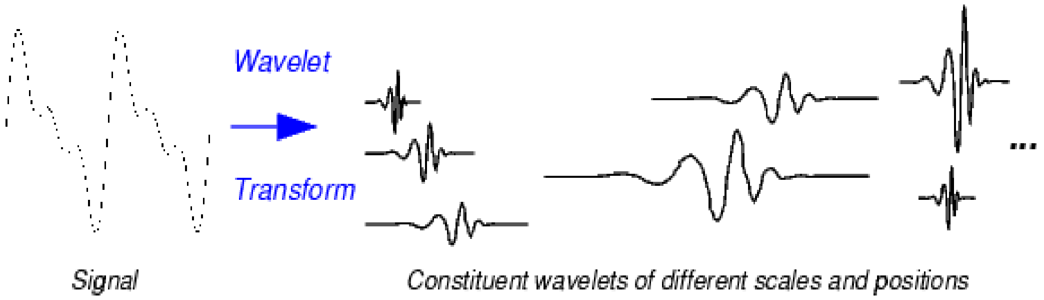


**Figure2:- Wavelet analyses represent the signal as combination of scaled and shifted mother wavelets.**

## IV. PROJECT IMPLEMENTATION

### IMAGE PREPARATION:

Digital images of melanoma and benign nevi were collected in JPEG arrangement from dissimilar source totaling 72, half melanoma and half benign. MATLAB's Wavelet Toolbox only supports indexed images with linear monotonic color maps so the RGB images were changed to grayscale images. The after that step in the procedure was to segment the lesion from the surrounding skin. While a obvious color difference existed between lesion and skin, thresholding be very appropriate for t his assignment. A black and white image be produced and its dimension augmented by six pixels approximately in order to contain the complete border area

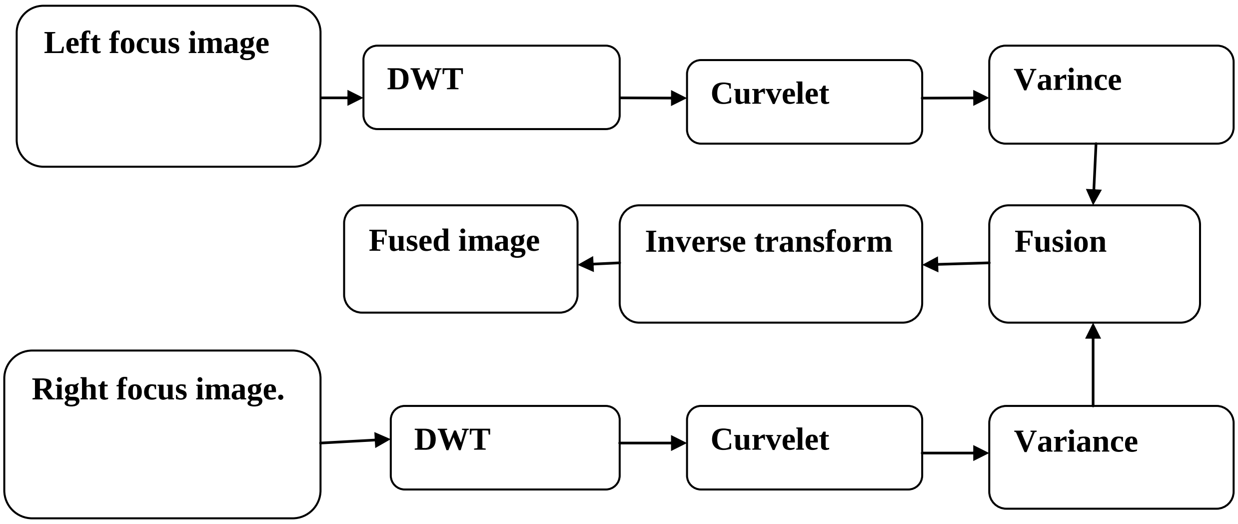


**Figure3**:- Proposed Block diagram using DWT and DCT Methods

### Multi-Level Discrete Wavelet Transform and Feature Extraction:

Discrete Wavelet transform (DWT) is a algebraic tool for hierarchically decomposing an image. The DWT decomposes an input image into four components label as LL, HL, LH and HH .The first letter correspond to apply moreover a low frequency operation or high pass frequency operation to the rows, and the second letter refer to the filter apply to the columns. The lowly resolution level LL consists of the estimate component of the original image. The remain three resolution levels consist of the element parts and present the vertical high (LH), horizontal high (HL) and high (HH) frequencies. Figure 2 show three-level wavelet decomposition of an image.

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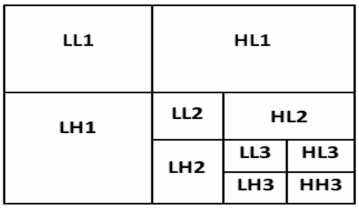


**Figure4:- Three-level Discrete Wavelet Transform.**

The black and white mask from the segmentation step is used to decide which coefficient toward select from the transformed image. Typically, discrete multi dimensional wavelet transforms create a wavelet matrix half the dimension of the original image use a method called down-sampling where only half the coefficients are conserved. Within order to sustain the original image dimension, a discrete wavelet transformation is used which suppress down-sampling, generate a wavelet matrix the same size as the input matrix. For mutual levels, the mean and variance of wavelet coefficients for approximation and information were calculated, resultant in a entire of 8 features. Features be normalized to range linking 0 and 1.

While the wavelet is partial duration, it be able to be shift down the signal at recognized intervals. At every step a coefficient is considered representing how closely the wavelet resembles this segment of signal. By scaling the wavelet, compressing it, information about the overall signal trend to little information can be attained.

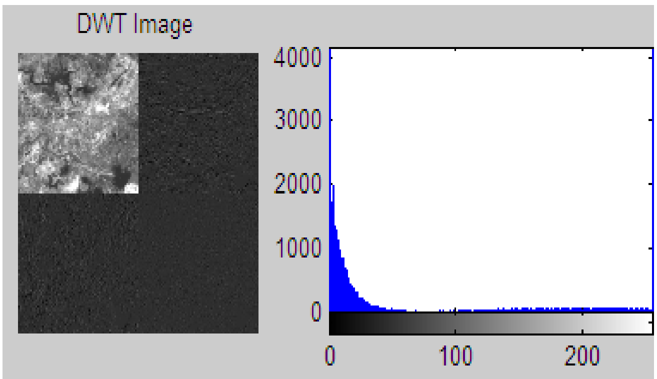


**Figure5:-**Example of DWT Image and Histogram Image

## V. NSCT-BASED FUSION ALGORITHM

### Principle of NSCT:

In the primary contourlet transform down samples and up samples are existing together the laplacian pyramid and the DFB. Therefore, it is not shift-invariant, which cause pseudo-Gibbs phenomena about singularities. NSCT is an enhanced structure of contourlet transform. It is forced to be working in some applications, in which redundancy is not a main issue, i.e. image fusion. In contrast with contourlet transform, non sub-sampled pyramid structure and non sub-sampled directional filter banks are use in NSCT. The non sub-sampled pyramid construction is achieved by using two-channel non sub-sampled 2-D filter banks. The DFB is achieving by switching off the down-samples up-samples in each two-channel filter bank in the DFB tree structure and up-sampling the filters accordingly. As a result, NSCT is shift-invariant and lead to improved frequency selectivity and regularity than contourlet transform.Fig.7shows the decomposition construction of contourlet transform and NSCT.

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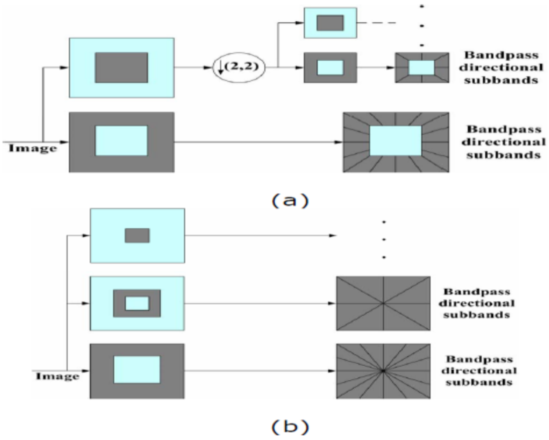


**Figure6:-Decomposition framework of contourlet transform and NSCT.**

In this work, image decomposition is performing with the NSCT. We expect that large number of NSCT, which are shift-invariant, multi resolution, localization, directionality, and anisotropy, will exist more appropriate for image fusion and additional image processing, i.e. target recognition, objectdetection, etc. within the fusion procedure, both neighborhood coefficients and cousin coefficients information are utilize in the salience measure.

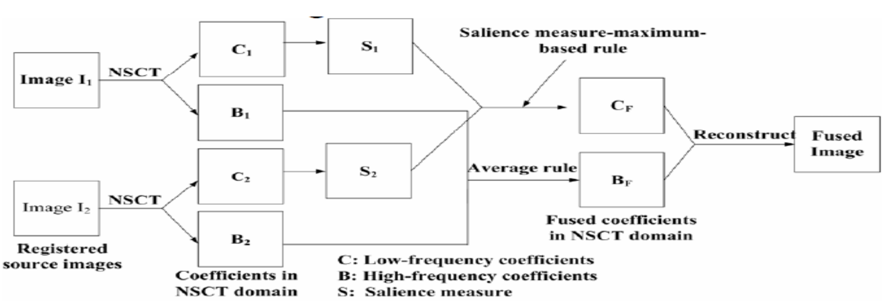


**Figure 7**:-Framework of the NSCT based fusion algoritham

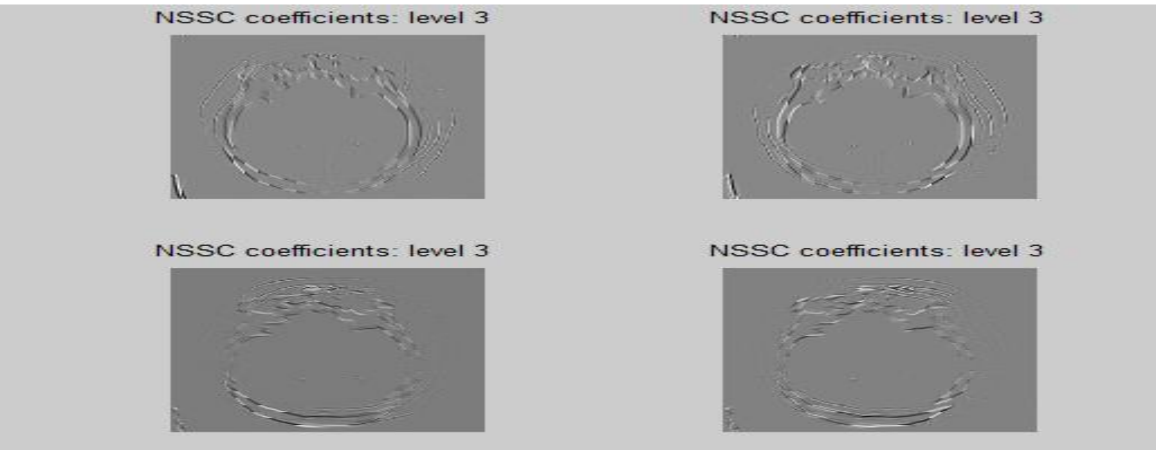


**Figure8:- NSCT coefficients for different levels**

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## VI. DCT (DISCRETE CURVELET TRANSFORM):-

We use the second generation of curvelet transform, discrete curvelet transform (DCT), and adapted the DCT coefficients with a suitable nonlinear function. One way to augment the image contrast is toward enhancing the image ridges, which play an significant role in enhancing image contrast. In the process of concurrently enhance the feeble edges and remove the noise, the modify function parameters are defined based on several statistic features of DCT coefficients.

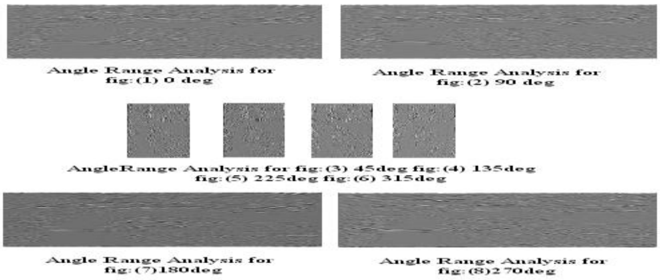


**Figure9:-** Discrete Curvelet Transform Process

## IMAGE FUSION:-

Image Fusion be the method of combine related information from two or more images into a single image. The fused image supposed to have further complete information which is additional helpful for human or machine perception.

## FUSION OF LOW-FREQUENCY COEFFICIENTS

In view of the images' estimated information is constructing by the low-frequency coefficients, regular rule is adopt for low-frequency coefficients. Suppose $B_F(x, y)$ is the fused low-frequency coefficients, then

$$\frac{B_1(x,y)+B_2(x,y)}{2} = B_F(x, y)$$

Where, $B_1(x, y)$ and 2 $B_2(x, y)$ *denote* the low-frequency coefficients of source images.

## VII. FUSION OF HIGH-FREQUENCY COEFFICIENTS

High-frequency coefficients always contain edge and texture features. Within order to create full use of information in the region and cousin coefficients in the DWT domain, a salience evaluate, as a grouping of area energy of DWT coefficients with correlation of the cousin coefficients, is proposed intended for the first time. We define region energy by compute the totaling of the coefficients' square in the local window. Suppose $C_l^k$ (x y) is the high-frequency DWT coefficients, whose location is (x,y) within the sub-band of k-th direction at l-th decomposition scale. The region energy is defined as follows:

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$$E_1^K = \sum_{m,n\epsilon sM+N} (C_1^K(x+m, y+n))2$$

where $S_{M\times N}$ denotes the regional window and its dimension is M × N (typically 3×3 ).Region energy, moderately than single pixel value, will be additional reasonable to extract features of source images by utilize neighbors' information.

## VIII. CONTRAST ENHANCEMENT

In spitefulness of increasing require for enhancing remote sensing images, existing histogram-based contrast enhancement method cannot protect edge details and demonstrate saturation artifacts in low- and high-intensity region. Within this section, we present a novel contrast enhancement algorithm for remote sensing images using dominant brightness level-based adaptive intensity transformation.

If we do not judge spatially changeable intensity distributions, the equally contrast-enhanced images may have intensity distortion and drop image details in some regions. For overcome these troubles, we decompose the input image into various layer of single dominant intensity levels. To utilize the low-frequency luminance components, we execute the DWT + NSCT on the input remote sensing image and after that approximation the dominant brightness level by the log-average luminance in the LL sub band. Since high-intensity standards are dominant in the bright area, and vice versa.

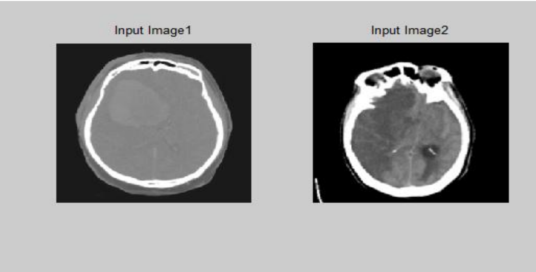


**Figure10**: Input Images

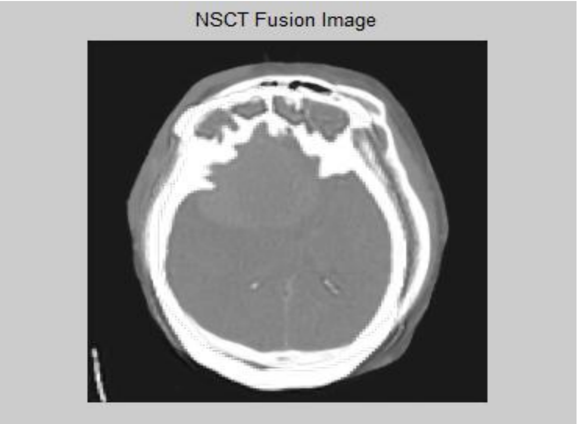


**Figure11**:- Fusion Image

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## IX. RESULT ANALYSYS

Here we report several experimental results that illustrate the presentation of the proposed approach. The experiments were performing under windows and matlab running on a desktop machine.

## X. QUALITY MEASUREMENT:-

The Quality of the reconstruct image is considered in-terms of mean square error (MSE) and peak signal to noise ratio (PSNR) ratio. The MSE is frequently called re-enactment error variance $\sigma_q^2$. The MSE linking the original image f and the reconstruct image g at decoder is definite as:

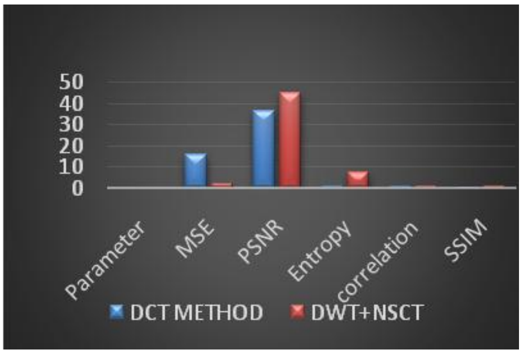
$$MSE = \frac{1}{MXN}\sum_{j,k}(f[j,k]-g[j,k])$$

Where the sum over j, k denote the sum above all pixels in the image and N is the number of pixels in every image.

**Table1:-**Performance of DCT and DWT+NSCT Methods

| Method | DCT METHOD | DWT+NSCT |
|---|---|---|
| Parameter | | |
| MSE | 15.7486 | 2.0719 |
| PSNR | 36.1584 | 44.9672 |
| Entropy | 0.885451 | 7.5912 |
| Correlation | 0.6999693 | 0.9837 |
| SSIM | 0.00429584 | 0.963 |

Bar graph of various parameters for existing and proposed methods.




From to the PSNR is define as the ratio linking signal variance and re-enactment error variance. The PSNR among two images having 8 bits per pixel in provisions of decibels (dB) is given by:

$$PSNR = 10 \log_{10}\left(\frac{255^2}{MSE}\right)$$

Commonly when PSNR is 20 dB or larger, then the original and the reconstruct images are practically identical by human eyes.

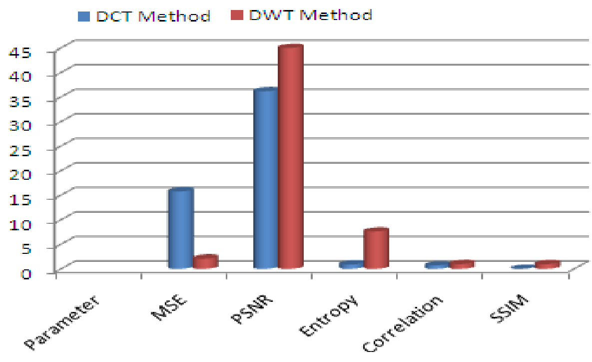



**Figure12:-**Comparison graph for DCT and DWT Methods

## XI. CONCLUSION

In this letter, a new approach based on spatial frequency for fusion of multi-focus images has been proposed in the DWT area instead of the spatial domain. We evaluate the presentation of the proposed method with various evaluation metrics and it is found that the presentation of fusion in the DCT domain is better to that of conventional approaches based on DWT with the state-of-the-art methods including Curve let, and NSCT, in provisions of visual quality and quantitative parameters. Moreover, the proposed method is simple to implement and computationally efficient while the source images are coded in JPEG format, especially in wireless visual sensor networks.

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