International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-2, December 2019

Robust Watermarking Scheme in YC_bC_r Color Space using SVD and DKT-DCT Hybrid Wavelet Transforms

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Abstract: ***Digital image watermarking is a significant one for copyright protection. In this work, a robust watermarking method that can be utilized to ensure copyright is proposed. The proposed technique improves the power of the watermark with the end goal that it very well may be utilized to secure the intellectual property considerably after genuine assaults on the watermark picture. A YCbCr model can be utilized as the ideal color model, the Y part being the ideal color channel here. Frequency domain methods give more robustness. Changes like DCT, Wavelet changes and Singular Values Decomposition (SVD) are some all around investigated transform domain procedures in watermarking. DKT-DCT hybrid wavelet transform is investigated by applying on have and utilized for embedding singular values of watermark. The proposed plan perceptually enhanced one and more strong in opposition to attacks and rotation invariant. The test outcomes show the perceptually enhanced condition as well as the efficiency of the proposed method when compared with traditional methodologies.***

Keywords **: *watermarking, wavelet, color space, singular value decomposition***

I. INTRODUCTION

An advanced watermark is a sort of marker secretively installed in a noise-tolerant signal, for example, sound, video or picture information [1], [2]. Watermarking is the way toward concealing computerized data in a carrier signal, the shrouded data should, however doesn't have to contain a connection to a carrier signal. This is utilized to check the validity of the substance or to perceive the personality of the computerized substance's proprietor. Computerized watermarking can be utilized for various reason, for example, copyright protection and source tracking [3], [4].

Kekre et al. (2015) proposed a watermarking technique. In the proposed approach, the original image is transformed into DKT-DCT wavelet domain [5], [6]. Then compression and watermarking will be done with message or data and SVD, the resulted image will be transformed by a scaling factor and transmitted. At receiver side the original image and message or data will be extracted and recomposed using SVD and inverse DKT-DCT transform [7], [8].

Revised Manuscript Received on December 30, 2019.
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The performance of the proposed approach will be evaluated using mean absolute error. It is used to achieve Authentication and Certification. The Disadvantage is blocking effect.Aniket roy et al. (2015) proposed a watermarking technique. Here, Watermark is done in 'Cb' component image by using SVD algorithm. The resulted image is transmitted. At the receiver side, watermarked image is extracted by using SVD and inverse Arnold transform. It is good in High Perceptual Transparency and Copyright Protection. Its disadvantage is less Robust and it mainly suits only for authentication application.

II. YC_BC_R COLOR SPACE

As indicated by ITU (International Telecommunication Union) a standard ITU-R and YCbCr characterized as a color space for advanced TV frameworks and furthermore characterizes the change of values among two basic color model. The YCbCr color space model portrayals on YUV plane and XYZ plane are appeared in Figures 1 and 2.

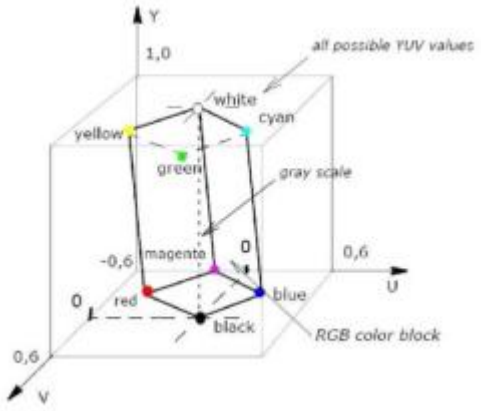


Figure 1 YC_bC_r color model representation on YUV plane

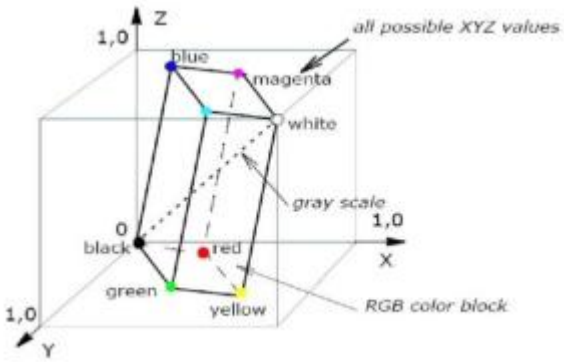


Figure 2 YC_bC_r color model representation on XYZ plane

Figure 3 shows the RGB to YC_bC_r Transformation.

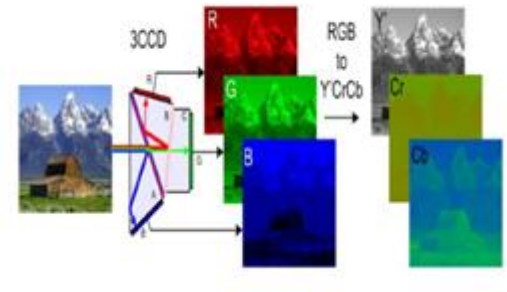


Figure 3 RGB to YC_bC_r color model Transformation

III. PROPOSED METHODOLOGY

The Flow diagram for projected scheme is exposed in Figure 4. The steps of the projected scheme are described as follows.

Step 1: Acquire the RGB digital image (Lena).

Step 2: Modify the Test Input into YCbCr domain and split the Y, C_b, C_r components.

Step 3: Select the 'Y' plane and apply DKT-DCT hybrid wavelet transform.

Step 4: Embed singular values secret data into the transformed image. Singular values are computed by using SVD.

Step 5: Extract the original image from the watermarked image using inverse SVD and inverse DKT-DCT transform.

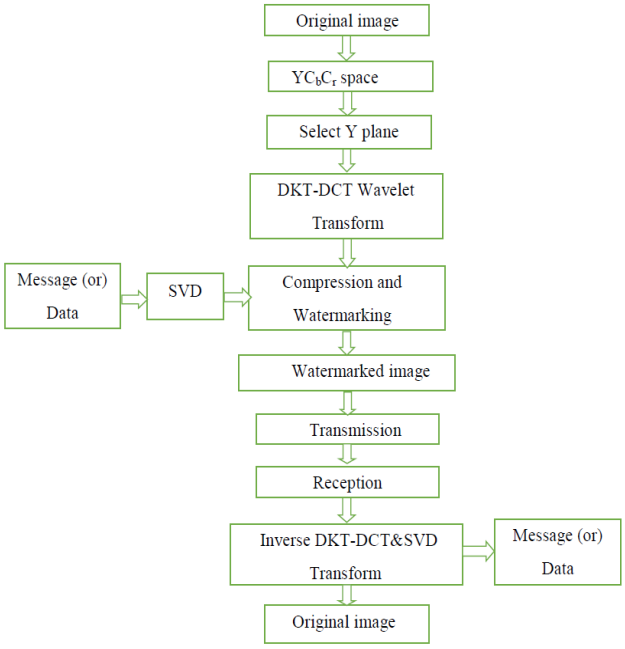


Figure 4 Flow diagram for Proposed Methodology

A. Image Acquisition

There are different approaches to acquire picture, for example, with assistance of camera or scanner. In this work, several test input images (Lena, Parrot, Peppers, Flower, Mandrill……..) are considered for testing with the dimension (250x250).

B. YC_bC_r Color Space

YCbCr is utilized to separate out a luminance signal (Y) that can be put away with high goals or transmitted at high data transmission, and two chrominance segments (Cb and Cr) that can be transfer bandwidth-reduced, subsampled, compressed, or generally treated independently for improved framework efficiency.

C. DKT-DCT Hybrid Wavelet Transform

The upside of Kekre's transform lattice can be of any size PxP. All upper inclining components of kekre transforms are 1, while all lower corner to corner components with the exception of the components just underneath the askew are zero. The equation for Kekre transform is,

$$K_{zv}=\{\ 1\ z\leq v-P+(z-1)\ z=v+1\ 0\ z>v+1$$

Where,

P is a size of image, z is an input pixels & v is a threshold value.

D. SVD Algorithm

In mathematics, the SVD is a factorization of a real or complex lattice. It is the speculation of the Eigen disintegration of a positive semi distinct typical lattice. It is utilized to informational collection containing the huge number of qualities to informational collection containing modest number of significant worth. Assume Z is a p × q grid whose passages originate from the field P, which is either the field of genuine numbers or the field of complex numbers and is defined by,

$$Z=K\Sigma L^*$$

Where,

K is an $p \times p$ unitary matrix over P (if P = R unitary matrices are orthogonal matrices).

Σ is a diagonal $p \times q$ matrix with non-negative values on the diagonal.

L is an $q \times q$ unitary matrix over P, and $\mathbf{L}*$ is the conjugate transpose of **V**.

E. Compression and Watermarking

In this work, after taking DKT-DCT Transform in 'Y' plane, DKT-DCT Transformed image is obtained. As well as, Compression is also done in this transformed image. Compressed image is obtained. SVD is an algorithm to watermark the data into the compressed image. Watermarking is done in this compressed image. Then the Compressed and Watermarked image is transmitted.

F. Extraction of Original Image

After receiving the watermarked image, the inverse DKT-DCT transform and inverse SVD algorithm are used to obtain the hidden information. Consequently the receiver can acquire the exact copy of the original image together with the hidden data. Hence the original image is extracted.

IV. RESULTS AND DISCUSSIONS

For testing, the various digital images are acquired and subjected with the proposed algorithm. The size of the input sample image is 250x250. In order to find the YCbCr color space image, the original image i.e lena is taken. The original image in Red, Green, Blue planes are separated and shown in Figures 5 (a) to 5 (d). These planes are converted into YCbCr color space and Y, Cb, Cr images are shown in Figures 6 (a) to 6 (c).

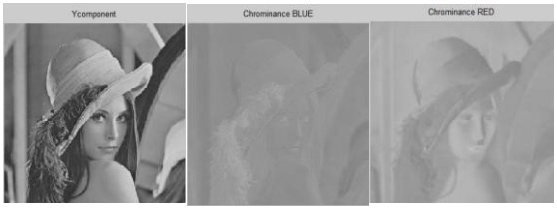
The DKT-DCT Hybrid Wavelet Transform is chosen for the 'Y' component among the YCbCr color components. DKT-DCT Tranformed image is shown in Figure 7 (a). Using DKT-DCT Transform, the image is compressed and Watermarked image is obtained by using SVD algorithm to watermark the data in compressed image.

The watermark is the text information, for example "welcome". The watermarked image is shown in Figure 7 (b). In the extraction process, at the receiver side, after receiving the Watermarked Image, the hidden information and the test input sample image are obtained from the watermarked pixel without any perceptibility. The extracted data of the watermark is given as,

Case: On embedding the data 'welcome'

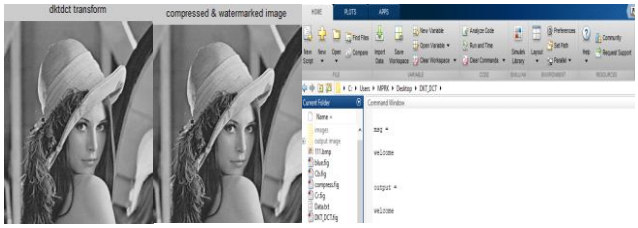
(a) (b) (c) (d)

Figure 5 (a) Test input (b) Red Component (c) Green Component (d) Blue Component



(a) (b) (c)

Figure 6 (a) Y Component (b) C_b Component (c) C_r Component



(a) (b) (c)

Figure 7 (a) DKT-DCT Transformed image (b) Compressed and Watermarked image (c) Data extracted

The data 'welcome' is considered as watermark; the extraction of the data is shown in Figure 7 (c). The image after taking the inverse DKT-DCT Transform, the extracted image is shown in Figure 7 (d).

Figure 7 (d) Extracted output image

A.Experimental Evaluation

The Performance of Proposed strategy is estimated by utilizing execution measures MSE & PSNR. The MSE and PSNR are the two error measurements used to look at the picture quality. The MSE speaks to the total squared error between the recreated and the first picture, though PSNR speaks to the proportion of peak error. Lower the estimation of MSE, bring down the error. In the Proposed work, PSNR in decibels is processed between the input and extracted pictures.

The comparison of PSNR values between the existing and the proposed methods are shown in the Table 1. Investigational outcomes demonstrate that the DKT-DCT Transform achieves better performance with the same image quality than the conventional methods.

Table 1 Comparison of PSNR Values

Sample images	PSNR (dB)	
	Existing Method (RGB)	Proposed Method (YCbCr)
Lena	56.48	74.65
Parrot	58.02	77.33
Peppers	56.10	74.51
Flower	73.20	76.82

V. CONCLUSION

In this work, Secured digital image transmission is proposed using image processing techniques. The robustness of the watermarked image is enhanced by using the novel concept of the hybrid wavelet transform by using two orthogonal transforms DKT & DCT. The Y plane of YCbCr color space is used as the optimal color plane for embedding of watermark. Initially, the message information is used as a watermark. During the extraction, message information is perfectly extracted and the original image is losslessly recovered without any distortion.

The performance measures MSE and PSNR shows that the proposed method using hybrid wavelet transforms gives better performance when compared with traditional methods. In future, this work will be extended to avoid the perceptible that occurs in digital images while embedding the data as watermark.

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