Comparison of Bit Plane Complexity Segmentation and Discrete Cosine Transform Technique for Stenography

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Abstract— Steganography provides secret and secure communication whose goal is to make communication unintelligible to those whose do not possess the right keys. Steganography techniques like Discrete Cosine Transform (DCT) and Bitplane Complexity Segmentation are given and its PSNA and MSQE are calculated using Matlab program and tabulated. In this project the program was tested on mat lab tool, the parameters to be obtained such as the PSNR and MSQE were obtained for various transformation techniques. It was found that minimum mean square quantization error is said to be very minimum for BPCS than compared with DCT. PSNR calculated for BPCS is greater than DCT.

Key words: Discrete Cosine Transform (DCT) and Bitplane Complexity Segmentation (BPCS), Power signal to noise ratio (PSNR) and Minimum Mean Square Error (MSQE)

I. INTRODUCTION

We have considered DCT and BPCS stegnographic technique. Discrete Cosine Transform Works in frequency domain. DCT allows an image to be broken up into different frequency bands, making easier to embed watermarking information in the middle frequency bands of an image. The middle frequency bands are chosen such that they minimize and avoid the most visual important parts of image (low frequency) without over exposing themselves to removal through compression and noise attacks. BPCS (BITPLANE COMPLEXITY SEGMENTATION) ALGORITHM was proposed by "EIJI KAWAGUCHI". Advantages of BPCS over other methods are it makes use of characteristics of human visual system in its embedding operation. A large amount of data can be embedded. Data occupies 50% of the vessel data in a 24-bit BMP image file. About 70% of the data can be occupied in a vessel image. It works in a compressed domain. It uses lossless compression techniques. Detection of BPCS becomes quite difficult. PSNR is greater than 30dB.Even with less bandwidth, more amount of information can be sent. It is allowed to send GIF files too. We have calculated the parameters to be obtained such as the PSNR and MSQE were obtained for various transformation techniques. It was found that minimum mean square quantization error is said to be very minimum for BPCS than compared with DCT. The PSNR calculated for BPCS is greater than DCT stegnographic technique.

II. DCT COMPRESSION INTERFACE

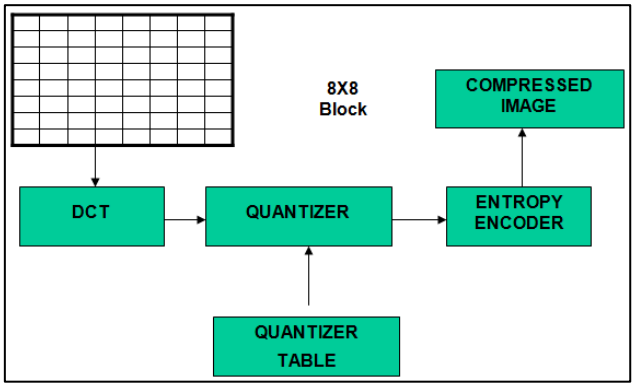

Fig. 1: DCT compression technique [1] [2]

The above diagram shows DCT compression technique. We can define DCT coefficients in a quantization table which as shown in table1.

	f_L						
		f_M					
				f_H			

Table 1: Quantization table with frequency components of coefficients

f_L is used to denote lower frequency components of the block. f_H is used to denote higher frequency components. f_M is used to denote embedding region. Next two locations $B(u_1,v_1)$ and $B(u_2,v_2)$ are chosen from the f_M region for comparison. Rather than arbitrarily choosing these locations, extra robustness can be achieved by choosing the coefficients on the JPEG quantization table.

16	11	10	16	24	40	51	61
12	12	14	19	26	58	60	55
14	13	16	24	40	57	69	56
14	17	22	29	51	87	80	62
18	22	37	56	68	109	103	77
24	35	55	64	81	104	113	92
49	64	78	87	103	121	120	101
72	92	95	98	112	100	103	99

Table 2: Quantization table with the coefficients

The sender and receiver agree ahead of time on location for two DCT coefficients in the 8 x 8 block. Middle frequencies with same quantization value: Location 1 is (4,1) & Location 2 is (3,2). Based on the table, we can

observe the coefficients (4,1) (3,2) or (1,2) & (3,0) are good for comparison as their quantization values are equal. The DCT block will encode 1 if B_1 (u_1, v_1) > B_2 (u_2, v_2) , otherwise 0. The coefficients are then swapped if the relative size of each coefficient does not agree with the bit that is to be encoded. The swapping should not alter the watermarked image.DCT coefficients of middle frequency have similar magnitudes. Robustness can be increased by introducing a strength constant 'K' such that B_1 (u_1,v_1) - B_2 (u_2, v_2) > K.

A. Procedure Followed In Dct Transformation Technique:

Convert image into YIQ color space. Each color plane is partitioned into 8x8 blocks. Apply DCT to each block. Values are quantized by dividing with present quantisation values. Values are then rounded to nearest integer. Each block will encode a single bit 0 or 1 if the message bit is 1, the larger of two values is put in location, and otherwise smaller of the two values is put in location. JPE G compression is performed. Information hiding is embedding in difference between DCT coefficients. Embed in quantization rounding decision. JPEG uses DCT to compress an image. Message is thus embedded in signal, not noise and can be implemented in compressed domain, thus saving time. The only disadvantage is PSNR obtained is less than 27dB. Since the acceptable value is > 30dB.[3] Therefore DCT steganography is not suitable for smooth images.

III. BPCS (BITPLANE COMPLEXITY SEGMENTATION) ALGORITHM

A. Procedure followed in BPCS.

A multi-valued image (P) consisting of n-bit pixels is decomposed into a set of n binary pictures. P = (P_1 P_2 ....P_n) . Each bit plane can be segmented into 'shape informative' and 'noise looking regions'. Shape informative region contains simple patterns.

Noise looking region contains complex patterns. Two regions can be segmented by using a 'black &white boarder length based' complexity measure. Each noise looking region can be replaced with any other noise looking regions without deteriorating the overall image quality. It Uses CGC (CANONICAL GREY CODE) system. The secret data is segmented into a series of 8 byte blocks. Each block is divided into 8x8 binary segments. The series of the image is embedded in each complex region of the dummy image. Noisy regions are replaced by the series of secret file pieces in a scattered way. Secret file is better to have a random file structure to ensure security. The advantages of methods are BPCS. It makes use of characteristics of human visual system in its embedding operation. A large amount of data can be embedded. Data occupies 50% of the vessel data in a 24-bit BMP image file. About 70% of the data can be occupied in a vessel image. It works in a compressed domain. It uses lossless compression techniques. Detection of BPCS becomes quite difficult. PSNR is greater than 30dB. Even with less bandwidth, more amount of information can be sent. It is allowed to send GIF files too. [5] Sections 2 and 3 tells about DCT and BPCS technique and the procedure.

IV. COMPARISON BETWEEN DCT AND BPCS TECHNIQUE

We have calculated POWER SIGNAL TO NOISE RATIO and MEAN SQUARE QUANTIZATION ERROR for DCT and BPCS Stegnographic technique. By using Matlab program we calculated the two parameters [4] and the results are given in Table 3. It was found that minimum mean square quantization error is said to be very minimum for BPCS than compared with DCT. PSNR calculated for BPCS is greater than DCT

	BPCS	DCT
MSQE	2.37	25.67
PSNR	44.39 db	34.02 db

Table 3: MSQE and PSNR for DCT & BPCS

V. CONCLUSION

It was found that the performance of the embedded image is good when compared with the original image in BPCS than DCT and it is proved that communication between source and destination is secret as well as secure without affecting the quality of the vessel image in which the information is embedded. So for MSQE is minimum for BPCS and PSNR are maximum for BPCS and gives better performance than DCT technique.

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