Image Compression with DCT and Huffman Coding

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I. Introduction

With the enhancements in technology, size and the amount of images and videos have increased enormously. It is useful to compress images for both storing efficiency and to transmitting time efficiency. On the other hand, by quantizing the image we can be achieve more compression rate with loss.

II. Methodology

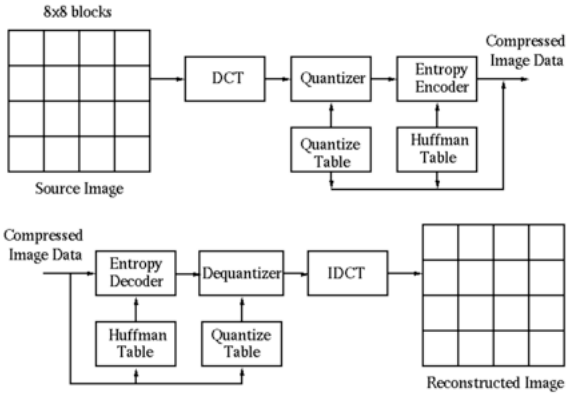

Fig. 2: Flowchart

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

Fig. 1: Quantization Matrix

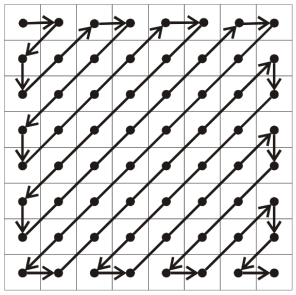

Fig. 3: Reordering Zig-Zag Method

As can be seen from Figure 2, the image is divided into blocks with sizes 8x8. For each block, DCT operation is applied separately. Using DCT gives us better compression rate than using FFT. Resultant DCT matrices are divided by Quantization Matrix in Figure 1. Quantization Matrix is more transparent to terms with low frequencies and suppresses terms with high frequencies. The table is generated empirically and is compatible with human vision system.

Then the symbols in DCT matrix is read by zig-zag method which is represented at the figure 3. After these processes, compression is done by Huffman Coding by using the Huffman table which is standart [1]. Huffman provide us to send data with lower number of bit for lower ac values and higher number of bit for higher ac values. On the other hand, when we send the dc values of the blocks, after the first block, we send the difference of the dc values and this enable us to send lower values so less number of bits.

III. Results

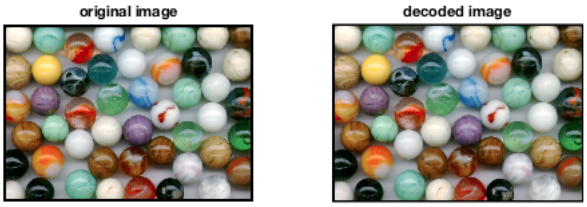

Fig. 4: The Effect of DCT-Reordering-Huffman

	Size(MByte)	Compression Rate
Original	4.06	1
Decoded	0.3	13.53

In figure 4, we achieve 13.53 compression rate by rounding dct matrix values to integers, zig-zag reordering and huffman coding.

Fig. 5: Quantizing Effect

	Size(KByte)	Compression Rate
Original	796	1
80% Quantized	51.1	15.6
50% Quantized	27.5	28.9
10% Quantized	11.9	66.9

The figure 5 and the table above is the results for quantizing dct values to different number of quantizing level.

IV. Conclusion

We implement one of the compression methods which is DCT based Huffman compression. We achieve 13.5 compression rate by only raunding the DCT matrix values to integers and human visual system cannot differantiate the difference between original and decoded image. By using different quantizing level, we compressed image more. 80% or 50% quantizing level does not corrupt the image too much. However, 10% quantizing corrupt the image too much and a human can detect the diference.

References

[1] Gregory K. Wallace *The JPEG Still Picture Compression Standart*. IEEE Transactions on Consumer Electronics, Vol. 38, No. 1, FEBRUARY 1992.