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COMBINATION OF JPEG ALGORITHM AND WATERMARKING FOR INCREASING THE QUALITY AND COMPRESSION RATIO

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Abstract

Jpeg formation is compression model of color image which is establish as an ISO and usually public used. Jpeg compression technique started by RGB to YCbCr colour transformation process. And each color component Y, Cb, and Cr compressed by Discrete Cosine Transform (DCT) process,. Quantizing and Coding step by step. Bits of result coding from each component of Y, Cb and Cr combined one group in series. This paper explained compression technique can be optimized JPEG result compression by bit insertion of coding result from one color component to matrix quantization from another color component. The experiment shows that the same compression quality compression technique which develop in this paper have ratio of compression about 10.99% until 154% better then JPEG codec, and for the same compression ratio this technique give better quality compression. Keywords:Image Compression, JPEG,Watermarkning,MIG

1 Introduction

Technology develop of image acquatition more sophisticated, like digital camera, scanner, has produce color image until 8 Mpixel. The higher pixel will increase need of memory and time image transmission. Algorithm develop and optimize image compression technique is prominent solution for increasing transmission efficiency and data memory without decrease of image quality. Compression algorithms developed for lossless and lossy compression.

JPEG 2000 which use in DWT (Digital Wavelet Taransform) is better product compression ratio then quality of JPEG. But its not used in the public. In another hand, JPEG used by DCT is lossless compression ussually used by public and used by all the device of image acquisition. JPEG format acknowledge as ISO (Intenational Standar Organization) for digital color image compression in 1992 (ISO/IEC JTC1 dan CCITT Rec 81)[4].

Base on digital image needs and copyright protection has develop watermarking introduce by G.C Langelar in 1996[16]. This methode is insert the information in to picture by LSB of pixel.

This paper explain about combination of JPEG compression technique and watermarking to optimize compression ratio.

2 JPEG

It has been known, digital color image is pixel collection where each pixel is color vector element three dimension (3-D) there are RGB, YCbCr etc[32]. Image with color representation YCbCr or YUV is used in JPEG compression. Figure 1 shows JPEG compression process, and figure 2 show general figure of bit collection of coding result in three color component there are Y, Cb and Cr.

For each color component , JPEG divide image in to blocks 8 x 8 pixels. Then each pixel block will causes successly DCT process, Quantization, and Coding for color component Y, Cb and Cr. Bits collection of coding result from three color component is compressed image data. And bit header collection,tables and compressed image data formed JPEG bitstream.

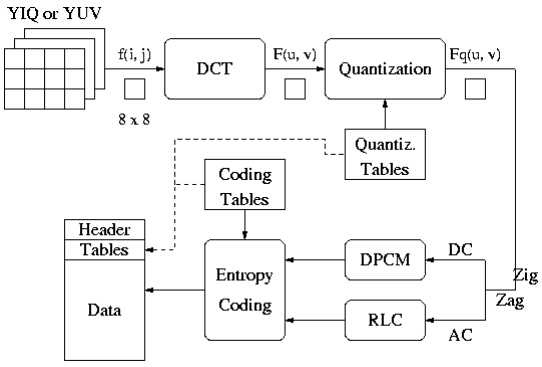

Figure 1: JPEG Compression Process JPEG[18]

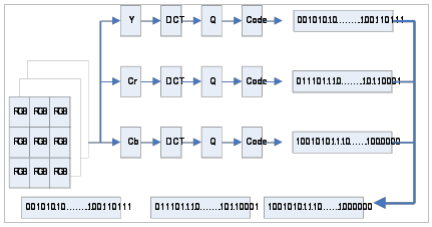

Figure 2: JPEG Compression Model and Coding Componen Y, Cr dan Cb

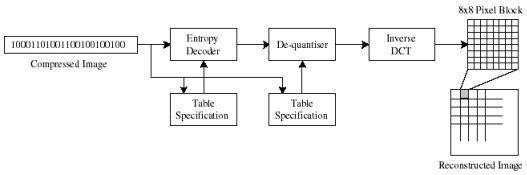

Figure 3: JPEG Decompression Process [35]

To the JPEG image compression, conducted return process wich start by bits divide in each color component and continue successfully by decoding process, de-quantization and DCT invers.This process shows in figure 3. In compression process and decompression process,quatization table and coding (entropy,Huffman coding) was a same.There for this table must participated to JPEG image compressed[35].

3 Digital Watermarking

Digital watermarking is information insert process to audio signal, image or digital video. Information insert has visible and invisible characteristic. In watermarking visible,information can be seen visual. Specially for information like text or owner identification logo from image or video. In watermarking invisible,information inserted to audio ,image or video but cannot be seen by visual.Important application from this type is to copyright protection system. Steganography is one of part of invisible digital watermarking, where two person can communicated secreat by information insertion into audio, image and video.

One of simple methode invisible digital watermarking is bit insertion in to pixel by *Least Significant Bit* (LSB).To hide the information in to image LSB pixel, can be save 3 bits in each pixel.Manipulation of LSB pixel is quick and easy manner to hide the information. Invisible methode of digital watermarking from LSB use from modification technique of JPEG compression.

4 Develop Method

To increase compression ratio,in this part we suggested technique modification of JPEG compression by collection between JPEG compression technique and watermarking. Two collection show in figure 4. Its different with JPEG compression technique in figure 2. This technique, bit insertion of coding result color Cb component into quantized matrix of color Cr component. Then quantizing, inserting and decoding in matrix Cr. Result bits of coding component Cr inserted again into quantized matrix component Y. Finally, quantized and inserted matrix return coding and producing data bits of image compression image. Data bits collected by header bit and quantizing and coding tables become bitstream which saved in file with extensi MIG/.MIG (Multimedia Informamation and data compression Group).

Bit insertion conducted by using watermarking method like explained by G.C Langelar[16], is insertion of LSB in each matrix component.

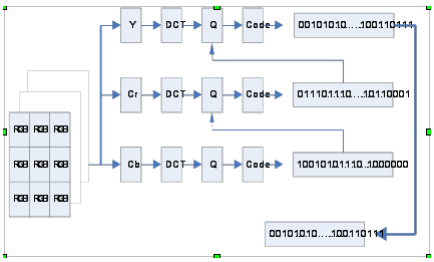

Figure 4: Modification Model of JPEG Compression

5 Result Analysis

To proved performance this methode which developing in this paper,we do experiments with use comparing software are Adobe Photoshop CS2 versi 9.0.1, Morgan JPEG toolbox V2, Morgan JPEG 2000 Toolbox, ACD See 9 toward three standars images in bmp format (Babbon.bmp, Lenna.bmp, dan

peppes.bmp) by resolution 512x512 pixel (file size from each image is 769 kb).

In analyse experiment result conducted in two perspective. First, equal value ratio compression are grouped. So, PSNR value are analyzed which represented as comparation curves between compression ratio (X axis) and PSNR (Y Axis). The results are represented in the following figure 5 , 6 and 7. Second, equal PSNR values are grouped and then compression ratio analyzed, represented , as a comparison curves between PNSR (X axis) and comparison ratio (Y axis). The results are represented in the following figure 8 , 9 and 10.

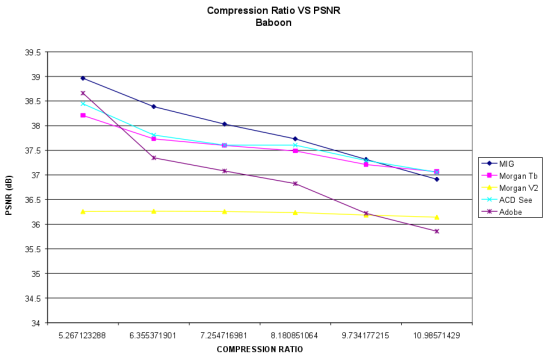

Figure 5: Compression Ratio Versus PSNR (Babbon.bmp)

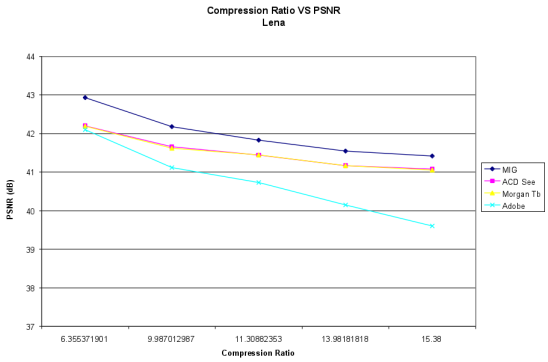

Figure 6: Compression Ratio Versus PSNR (Lena.bmp)

Based on the three figure 5,6 and 7 shows that from equal compression ratio, MIG compression program has a high PSNR value toward adobe, Morgan, and ACD see as comparing software.

For peppers.bmp image with compression ratio about 2.7 until 16.7, MIG have PSNR value better then ACD See (smallest value). And for peppers.bmp image with compression ratio about 16 until 32, MIG have PSNR value 85.415% better then Morgan V2 (higher value). For baboon.bmp image with compression ratio 10.3 until 16, MIG have PSNR the worst value about 2 % from ACD

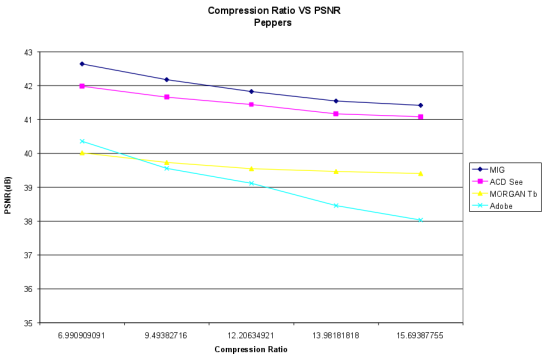

Figure 7: Compression Ratio Versus PSNR (Peppers.bmp)

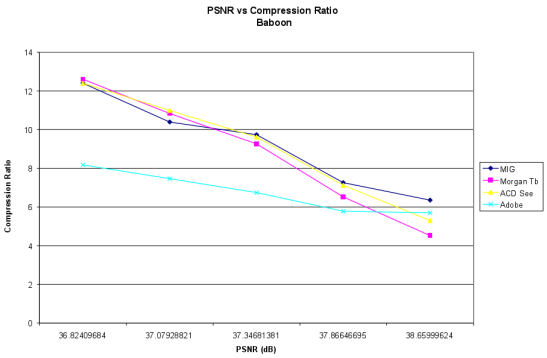

Figure 8: PSNR VS Compression Ratio (Baboon.bmp)

See. For Lena.bmp image with compression ratio about 22 until 35, MIG have PSNR the worst value about 8.23% from ACD See.

Figure 8,9 and 10 show analysis that from equal PSNR value, All MIG compression ratio be better then comparing software. For papers image in PNSR value in above 41 dB. MIG have compression ratio about 10.99 % higher than ACD see (smaller increase in compression ratio). The higher compression ratio about 154% in MIG versus Morgan V2, And for baboon image about 36.2 dB of PSNR value. And for papers image of PNSR value in under 40 dB. MIG compression ratio about 3.8 % is smaller then ACD see.

6 Conclusion

MIG compression methode by collection of JPEG compression technique and Watermarking developed in this paper gives better result then general software, there are Adobe Photoshop CS2 versi 9.0.1, Morgan JPEG toolbox V2, Morgan JPEG 2000 Toolbox, ACD See 9. Generally MIG compression technique optimize the ratio and the JPEG compression quality in software. But MIG is longer

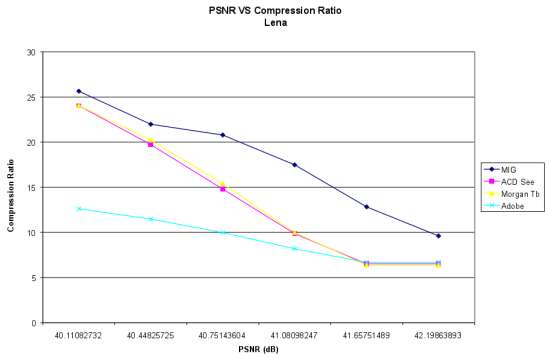

Figure 9: PSNR Versus Compression Ratio (Lena.bmp)

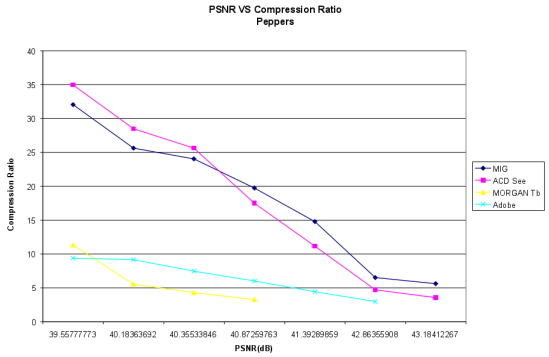

Figure 10: PSNR VS Compression Ratio (Peppers.bmp)

in time excecution process because of increasing insertion bits The future research is applicating develop method in for video compression.

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