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Design and Analysis of Multimedia Compression Techniques

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Abstract: Now a days, multimedia compression becomes required and important. The compression is a technique used to decrease the quantity of the multimedia, because the normal size of the multimedia requires storage space and increases the cost of transmission. Therefore a compression for transmission and storage purposes is applied. So storage devices and bandwidth of a digital network link can be efficiently increased by compression. In this study we propose an adaptive compression model. This model includes loss and lossless compression each type so include different combinations of multimedia compression algorithm. The performance results of this model is evaluated by PSNR and CR where gives lossy compression, high compression ratio with accepted quality.

Key words: Multimedia compression, lossless, loss, JBE, JPEG, run-length, shift coding

INTRODUCTION

Compression is the process in which use tools and techniques in order to decrease the file size of various media formats. By removing redundancies that occur in most files. There are two types of compression, lossy and lossless. Lossy compression (Made and Surabaya, 2012) reduced multimedia size by eliminating some unneeded data that won't be recognized by humans after decoding. Therefor loss compression means that some data is lost when it is decompressed. Loss compression techniques try to reduce unnecessary or redundant data, focusing more on valid space over maintaining the accuracy of the data. Ideally, the loss is either minimal or undetectable by human notes. The main benefit of loss methods above lossless methods. A loss method in selected cases can products a much smaller compressed multimedia than lossless method while lossless compression refers to the compression methods for which the original uncompressed information set can be recovered exactly after decoding. Without losing any data after decoding. The name lossless means "no data is lost". This is essential because if file lost even a single bit after decoding that mean the file is distorted. Therefor, we need for lossless compression to use in the fact that many applications such as the compression of digitized medical data, require that no loss be introduced from the compression method (Made and Surabaya, 2012; Mahalakshmi and Mahendran, 2014; Sharma, 2010). Compression offers an important approach because decrease the number of bits provide reduces the storage space and the capacity of a storage can be efficiently increased required for Multimedia and reduce transmission costs and the bandwidth of a digital communication link can be efficiently increased (Made and Surabaya, 2012; Mahalakshmi and Mahendran, 2014; Begum and Venkataramani, 2013). There are several data compression algorithms. In this study, we will income a appearance on different data compression algorithms that can be used in groups with other in the proposed model. These algorithms can be categorized into transformation and compression algorithms. A transformation algorithm does not compression data but rearrange or change data to optimze input for the next sequence of transformation or compression algorithm (Made and Surabaya, 2012).

Literature review: Sarita *et al*. (2015) they discuss a new rules for information compression, named J-Bit Encoding (JBE). This algorithm will handles each bit of data inside file to reduce the size without losing any information after deciding which is categorized to lossless compression. The performance of this algorithm is measured by matching with a grouping of different information compression algorithms.

Zainab *et al*. (2014) proposed system that contains of audio normalization, followed by DCT convert, scalar quantization, enhanced run length encoding and a novel

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high order shift coding. To decrease the result of quantization noise which is notable at the small, energetic audio parts, a post processing, filtering step is presented as the final step of decoding method. The system presentation is examined using different audio samples; the examine samples have different size and different in audio signal characteristics. The compression performance is calculated, using Peak Signal to Noise Ratio (PSNR) and Compression Ratio (CR). They examine results shown that the compression performance of the system is promising. The compression ratio is more with the increase of block size. Also, the post processing step improved the fidelity level of the rebuilt audio signal.

Mahalakshmi and Mahendran (2014) they have discussed the fundamentals of image compression and correlated responsibility aspects. Compression is a method that produces a compact data representation for storage and communication purposes. Image compression approaches depend on the removal of information inside images to decrease the amount of information necessary to represent them. The info to be removed is commonly categorized as one of two modules: statistically redundant or visually irrelevant. The following segment gives the related information about the compression.

MATERIALS AND METHODS

Multimedia compression: Multimedia computing has looked in the recent few years as a main area of study. Multimedia computer systems have opened the wider-ranging of potential applications by merging a multiplicity of information sources, such as voice, graphics, animation, images, audio and full-motion video. Multimedia compression is Apply methods in order to decrease the file size of various media formats. With the growth of "World Wide Web" the significance of compression algorithm was highlighted because it achieves faster in networks due to it's highly decrease files size. If file audio, graphics and video information not compressed therefore, its need large storage size which is not possible in the case of not compressed video information, even given today's DVD and CD technology. The same is true for multimedia communications. Data transmission of not compressed video information over digital nets needs that very height bandwidth to be provided to a single point-to-point communication. There are three most important reasons the current multimedia system must data to be compressed. These reasons are related to:

- Large storage requirements of multimedia data
- Relatively slow storage devices which do not allow playing multimedia data in real time
- Present network's bandwidth which do not allow real time video data transmission (Mahalakshmi and Mahendran, 2014)

Related algorithms

A- JPEG compression algorithm: In the late 1980's a joint committee identified as the Joint Photographic Experts Group (JEGP) of the International Standards Organization (ISO/CCITT) develop and build the main international compression normal for images. JPEG standard is established for full-color still frame applications. JPEG a lossy image compression method because the last image after decompression and the original image are not fully the identical and in lossy compression the data that may be lost and missed is affordable.

The algorithm researches as follows: convert RGB to Y, CR, CB then makes Transform: Two-dimensional Discrete Cosine Transform (DCT) on 8×8 blocks. Quantization: Compute Quantized DCT Coefficients. Encoding of Quantized Coefficients using Zig Zag Scan (Raid *et al*., 2014).

Burrows-Wheeler transform: Burrows-Wheeler Transform (BWT) is the basic technique for multimedia compression without loss. BWT is a transformation algorithm based on the block-sorting that does not compress multimedia but can help to rearrange (by adding and sorting). Where like-codes are serially. The result can be used as input for another algorithm to perform good compression ratios (Made and Surabaya, 2012).

Move to front transform: Move to Front Transform (MTF) is another technique for multimedia compression without loss. MTF is a transformation algorithm that does not compress multimedia but can help to remove excess information. The main idea is to move to front the symbols which always occurs. Therefore produces a series of small numbers to represent symbols. This technique is required to be used as an optimization for another algorithm likes Burrows-Wheeler transform (Made and Surabaya, 2012).

Run-length encoding: Run-Length Encoding (RLE) is basic and simple technique used to compression information without loss. This technique is useful when there are frequent and consecutive symbols, the notion of this algorithm represents a group frequent and consecutive symbols by two objects such as

(item, number) item is the symbol itself, the number is the count of repeated symbols (Zainab *et al*., 2014; Ahmed, 2011).

Shift coding: Shift-Coding (SC) is another technique used for information compression without loss. Used to decrease the size of number of bits. In this technique the code word is created to encode the series of numbers. The quantity of bits length in code words are less than the bits length requisite to represent the maximum coefficient value when it is coded by using fixed-length coding. The size (in bits) required to encode this series using fixed-length coding (Zainab *et al*., 2014; Ahmed, 2011).

J-bit Encoding: J-Bit Encoding (JBE) is another technique used for data compression without loss. That is implement by manipulating bits of information to decrease the size and optimize input for another algorithm. The main idea of this algorithm is to split the input information into two lists where the first list contains original non-zero byte and the second list contain a bit value explain position of non-zero and zero bytes. Both lists then can be compressed separately with other information compression algorithm to achieve maximum compression ratio (Made and Surabaya, 2012).

Performance criteria in multimedia compression: The Compression Ratio (CR) is the ratio between the original multimedia size and the compressed multimedia size.

$$CR = \frac{\text{Original size}}{\text{Compressed size}} \quad (1)$$

PSNR has been accepted as a widely used quality measurement for the multimedia compression:

$$PSNR_{dB} = 10\log_{10}\frac{(255)^2}{MSE} \quad (2)$$

Mean Square Error (MSE) is a measure of the distortion rate in the reconstructed multimedia:

$$MSE = \frac{1}{N}\sum_{n=1}^{N}(x_n - y_n)^2 \quad (3)$$

The proposed system design: In this study, the proposed system which is called an adaptive compression model. This model includes loss and lossless compression ways each type so include different groupings of multimedia compression algorithm. There are combination techniques for all kind of multimedia and for model loss and lossless in (image and audio) and for model lossless only in text. The adaptive compression system works according to user requests if the user wishes to obtain higher compression but low quality for multimedia used lossy compression. On the other hand, if users want high quality for important multimedia used lossless compression. The system involves the following phases: input multimedia after then compression multimedia to make reverse at the second part decompression multimedia after then reconstructed multimedia. The suggested system is displayed in Fig. 1.

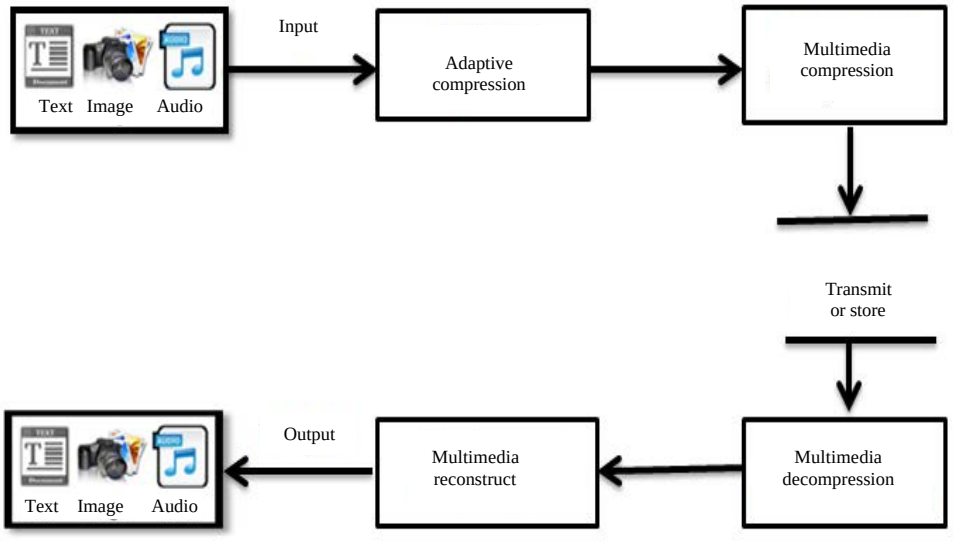

Fig. 1: The structure of the proposed model

RESULTS AND DISCUSSION

The suggested system is tested on five selected images and five audio files for both loss and lossless models and five text files for lossless models. The suggested system was tested on a PC with a 2.30 GHz Core i3 CPU and 4 GB of RAM. Visual C#. NET programming language was used to implement the proposed system.

Loss image compression by combination of different techniques: After test compression on five of the images, the results are shown in a Table 1. We noted that JPEG+RNL+JBE give the compression ratio of an average 1:8.34 and JPEG+RNL+SHIFT_COD the compression ratio as the average 1:9.86. Therefor, through Fig. 2 illustrates that images are compressed with the best compression ratio and low time by combinations of methods JPEG+RNL+SHIFT_COD. Also, we noted that value of Peak Signal to Noise Ratio (PSNR) for the same image in two combinations remains constant because shift coding and j-bit encoding cannot effect on the (PSNR) because its lossless compression. The loss compression for the image would be more appropriate for color image to accomplish better compression ratio but will decrease the quality.

Image compression lossless by combination different techniques: After test compression on five images, the results are shown in Table 2. We noted that BWT+MTF+SHIFT_COD give the compression ratio of an average 1:1.51 and BWT+MTF+RNL the compression ratio as average 1:3.16. Therefore, through Fig. 3 illustrates that images are compressed with the best compression ratio by combinations of methods BWT+MTF+RNL. The lossless compression for the color image give a low compression ratio compaing with lossy compression but will high quality.

Audio compression by combination different techniques: After test compression on five files audio, the results are displayed in a Table 3 for two type compression (lossy and lossless). We noted that in lossless applied method MTF+JBE+SHIFT_COD give the compression ratio of an average 1:1.90 and in loss applied methods DCT_qu+RNL it gave the compression ratio of an average 1:9.03 and DCT_qu+RNL+SHIFT_COD it gave the compression ratio as average 1:11.75. Therefore, through Fig. 4 shows that the compression ratio for lossless method is very low Comparison with loss methods that give high compression ratio with good performance quality.

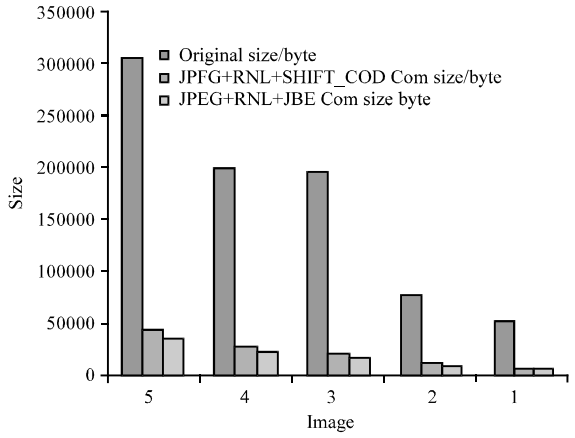

Fig. 2: Comparison of original image size and com size 1

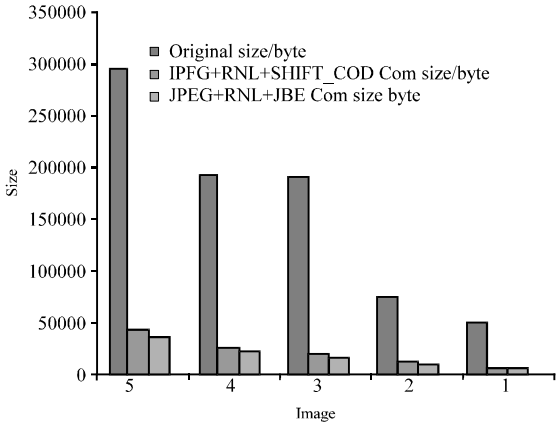

Fig. 3: Comparison of original image size and com size 2

Table 1: Comparison of compression, image size, CR and time

	JPEG+RNL+JBE			JPEG+RNL+SHIFT_COD		
Original Size/byte	Com size	CR	Com time	Com size	CR	Com time
49152	4511	1:10.89	4420	4045	1:12.15	4437
76032	10355	1:7.34	6797	8339	1:9.11	6850
196608	18457	1:10.65	17252	16217	1:12.12	17334
196608	26004	1:7.56	17664	21474	1:9.15	17425
304128	42413	1:7.17	27240	34590	1:8.79	26859

Table 2: Comparison of compression, image size, CR and time

	BWT+MTF+SHIFT_COD			BWT+MTF+RNL		
Original Size/byte	Com size	CR	Com time	Com size	CR	Com time
49152	31543	1:1.55	18233	11886	1:4.13	18012
76032	51749	1:1.47	22913	26534	1:2.86	24711
196608	126913	1:1.55	107421	64048	1:3.06	106622
196608	128376	1:1.53	120412	66082	1:2.98	126221
304128	209332	1:1.45	181511	109090	1:2.78	171415

Text compression lossless by combination different techniques: After test compression on five files text, the results are offered in Table 4. We noted that

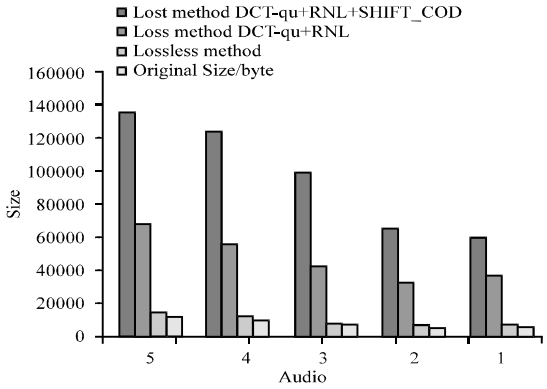

Fig. 4: Comparison of original audio size and com size 3

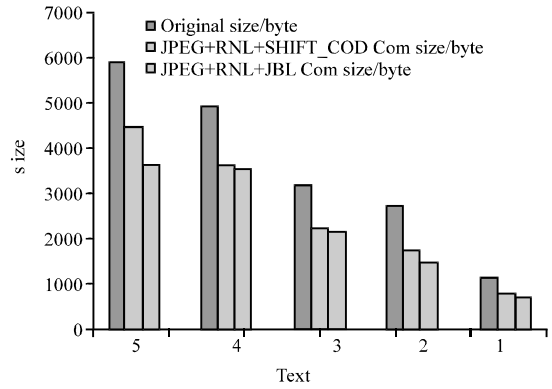

Fig. 5: Comparison of original text size and com size 4

Table 3: Comparison of compression audio size and CR

	Lossless method		Loss method			
	DCT_qu+ SHIFT_COD		DCT_qu+ SHIFT+RNL		DCT-qu+RNL+ SHIFT_COD	
Original Size/byte	Com size	CR	Com size	Com size	CR	Com size
58944	35597	1:1.65	7265	1:8.11	5751	1:10.24
65088	31787	1:2.04	6126	1:10.62	4921	1:13.22
98432	41965	1:2.34	7384	1:13.33	6176	1:15.93
123072	55576	1:2.21	10685	1:11.51	8625	1:14.26
135424	68578	1:1.97	14210	1:9.53	11022	1:12.28

Table 4: Comparison of compression, text size, CR and time

	MTF+SHIFT_COD			BWT+MTF+SHIFT_COD		
Original Size/byte	Com size	CR	Com time	Com size	CR	Com time
977	725	1:1.35	50	661	1:1.48	73
2610	1899	1:1.37	126	1557	1:1.68	394
3233	2395	1:1.35	169	2121	1:1.52	626
4918	3641	1:1.35	261	3986	1:1.67	1468
5839	4295	1:1.36	417	3675	1:1.59	1869

MTF+SHFIT_COD give the compression ratio of an average 1:1.35 and BWT+MTF+SHFIT_COD give the compression ratio as the average 1:1.54. Therefore, through Fig. 5 shows that a low compression ratio for each of the two methods because this compression from type lossless compression also that the text file compression cannot be a loss because any loss in the text file claim not to understand the text correctly and this is impractical.

CONCLUSION

In this study, we propose an adaptive compression model, this model include loss and lossless compression each type so include different combinations of multimedia compression algorithm. The proposed system is tested on five selected files for each media with different sizes. Through a comparative study between different combinations of multimedia compression algorithm. Noted in Lossy image compression the best compression ratio as average equal 1:9.86 by combinations of methods JPEG+RNL+SHIFT_COD. Noted in lossless image compression the best compression ratio as average equal 1:3.16 by combinations of methods BWT+MTF+RNL. Noted in audio compressed the best compression ratio as average equal 1:11.75 by combinations of methods DCT-qu+RNL+SHIFT_COD with good performance quality. Noted in text compressed the best compression ratio as average equal 1:1.54 by combinations of BWT+MTF+SHFIT_COD.

REFERENCES

Ahmed, B.K., 2011. DCT image compression by run-length and shift coding techniques. J. Univ. Anbar Pure Sci., Vol. 5.

Begum, M.B. and Y. Venkataramani, 2013. A new compression scheme for secure transmission. Int. J. Autom. Comput., 10: 578-586.

Made, I. and A.D. Surabaya, 2012. A new algorithm for data compression optimization. Int. J. Adv. Comput. Sci. Appl., 3: 14-17.

Mahalakshmi, R. and S.K. Mahendran, 2014. Multimedia image compression algorithms and techniques to its related terms. Int. J. Innovative Sci., Eng. Technol., 1: 292-299.

Raid, A.M., W.M. Khedr, M.A.E. Dosuky and W. Ahmed, 2014. JPEG image compression using discrete cosine transform a survey. Int. J. Comput. Sci. Eng. Surv., 5: 39-47.

Sarita, A., G. Krushab, J. Nagaria and R. Shah, 2015. Advanced data compression using J-bit algorithm. Int. J. Sci. Res., 4: 1366-1368.

Sharma, M., 2010. Compression using Huffman coding. Int. J. Comput. Sci. Network Secur., 10: 133-141.

Zainab, T., L. Drweesh and E. George, 2014. Audio compression based on discrete cosine transform, run length and high order shift encoding. Int. J. Eng. Innovative Technol., 4: 45-51.