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Watermark Compression in Digital Medical Image Watermarking

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Abstract

Large size data not only require more storage space but also require more transmission time in communication environment. Mostly this obstacle exists in every type image communication process such as in satellite and distributed health facilities provision applications. Data compression causes reduction in storage space and communication time. Data compression is divided into two main categories, lossy and lossless. Although in lossy compression the compression ratio is higher than lossless but mostly important part of data is lost. During data lossless compression important data is not lost and only size reduction taking place. Teleradiology is a health promoting technology used to share medical images among different experts located apart from each other to analyze the image data for patient better treatment and surgical planning. Medical image data is very sensitive data and need its compression without any loss otherwise it will result in erroneous input into health recovery process. This paper focuses on Ultrasound medical image lossless compression using different techniques. PNG, GIF, JPG, JPEG2000 version j2c, JPEG2000 version jp2 in lossless mode techniques were used for this purpose as shown in table 1. The techniques were compared based on compression ratio, time taken during compression and PNG was found the best one. The selected technique is suggested to be used for digital watermarking of Ultrasound medical images. Our consideration is US images because US images are small in sizes as compared to images produced by other modalities and most of information is located in the central part of the image known as Region of Interest (ROI). The rest of the image other than ROI is known as Region of Non Interest (RONI). The main purpose of image compression is the removal of redundant data in such a way that it can be reversed to their original version for the desired operations [Vilas H. Gaidhane *et al*, 2011]. Mostly the original data is needful after its compression for some type of decision making process. Such an example is the case of medical images decompression after communication in teleradiology domain to an expert for problem diagnoses and suggesting treatment. While some time only the compressed data is sufficient for the onward operations and do not require its reversion to its original state, such as video, satellite images or any other digital images [Kosmas Karadimitriou and John M. Talor, 1997]. Image compression can be categorized into two main groups, lossy and lossless. Analyzing the figure 1; is helpful in making the concept clearer. This shows that decompression of lossless compressed image results into exactly the original image. Lossy compression which is also known as irreversible compression can be used to compress the image data up to a range of ten to fifty times of the original data but mostly loosing important part of data or even damaging the image [S. Wong *et al*, 1995]. The lossy compression is applicable to video data and digital images other than medical images because it does not make problem if some part of data is lost [V. H Gaidhane et al, 2011]. Transform coding techniques such as wavelet transform, and cosine transforms are efficient for such types of compressions [S. –G. Miaou and C. –L. Lin, 2002]. The lossless compression also known as reversible compression is that one which does not cause loss of data and the compressed data can be reversed into its original version as it was before its compression. This group of compression techniques can transform the image data into less space in a ratio up to 10:1 but without disturbing the diagnostic properties of medical images [E. Watanabe and K. Mori, 2001]. This is the main reason to use lossless compression as compared to lossy one for sensitive data such as medical image to enhance PACS performance by reduction of bit rate and storage space. In this research US images are selected due to

small in sizes and having a certain part of interest as compared to other modalities produced images to be selected as watermark [Hashwmi Berenjabad S., *et al,* 2011].

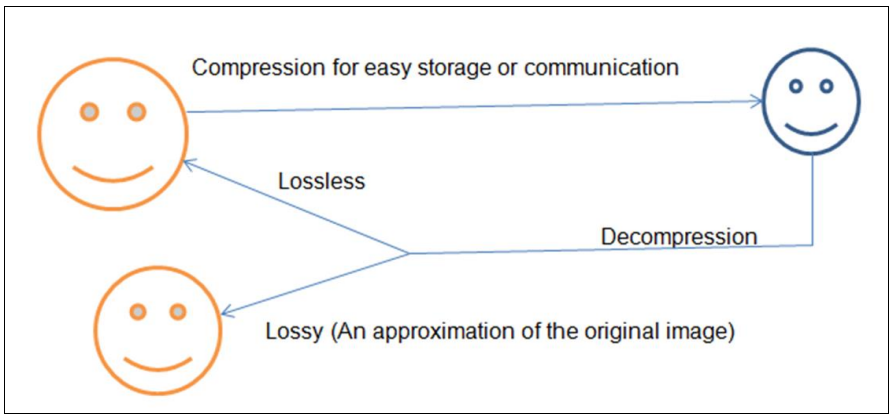

Figure 1: Description of an Image Lossy and Lossless compression.

No	Compression technique	Mode	Bytes before compression	Bytes after compression	Time taken	Compression ratio
1	PNG	Lossless	307200	88056	0.7578	0.5018
2	GIF	Lossless	307200	134748	0.020	0.8477
3	JPG	Lossless	307200	121382	0.206	0.5201
4	JPEG2000-j2c	Lossless	307200	80981	0.048	0.444
5	JPEG2000-jp2	Lossless	307200	81066	0.009	0.4505

Table 1: A bmp US image (total 307200 bytes) compression

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