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Development of Algorithm for Reservation of Culture Heritage Murals using 2D DWT

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ABSTRACT: Image archiving and preservation finds extensive application in culture heritage murals .The study of cultural heritage is of the extreme importance at national and international levels. Not only global organizations like UNESCO but also museums, libraries, culture, temples and private initiatives are working in these directions. During the last three decades, researchers in the field of imaging discipline have started to contribute an increasing set of algorithms for cultural heritage; in that way providing indispensable support to these efforts The effectiveness of image archiving and preservation are analyzed based on 2-D wavelets filtering. The optimum algorithm is also found based on the results.

KEYWORDS: Image Archiving, Presevation, Culture Heritage and Murals.

I.INTRODUCTION

The signal, image, and video processing, computer vision,3D modelling, and graphics technologies are nowadays broadly employed to capture, analyze, conserve, virtually or physically restore, document, classify, recognize, and render cultural artifacts. These contain historic buildings and monuments, archaeological sites and finds, works of art (paintings, frescoes, sculptures, decorative items, etc.), manuscripts, music score manuscripts, photographs or photographic negatives, films, and other entities of artistic, historical, or archaeological importance. In this research can be grouped into two main strands. On the one hand, tools aim to provide easy access to cultural heritage by both the general public and scholars. On the other hand, a substantial body of work wants to ensure its preservation for future generations.[1],[2].Animportant issue that expedited andboosted theutilization ofimageandvideo process techniques in cultural heritage applications was the initiation of in depth conversion campaigns by public establishments, museums, libraries, and archives throughout the last years. As a result, an enormous quantity ofculturerelated info is currently digitally keep, and therefore amenable to digital process.The field of image and video processing for cultural heritage encompasses a large variety of topics, such as high-resolution 2D and 3D digital capture and rendering of artworks, digital restoration, enhancement, recognition, and classification of features, structures and content in cultural heritage visual data, creation of large-scale multimedia databases of artworks, and user-centered heritage-related visual or multimedia applications. Indeed, image and video processing techniques can significantly improve and make more efficient many aspects of traditional preservation, archival, study, and fruition of our cultural heritage and, very interestingly, can also provide answers to emerging needs. Moreover, they have made feasible the creation of new applications and tools, which would otherwise be impossible to realize. The paper is structured as follows. Chapter II describes the Transform technique and Chapter III discusses the encoding techniques. Results and discussion is explained in chapter IV and this research work is concluded in Chapter V.

I1.WAVELET TRANSFORMS

In wavelet analysis, pictures are archived by a set of basic functions. A single prototype function defined the mother wavelet is used for deriving the basis function, by translating and dilating the mother wavelet. The wavelet transform can be termed as a decomposition of an image in the time scale plane. In this work, Daubechies, symlets and coifles are proposed. The basic and compact wavelet, which is projected by Daubechies is an orthonormal wavelets, which is defined as Daubechies wavelet. It is considered with extremely phase and highest number of vanishing moments for a given support width. Associated scaling filters are minimum-phase filter. Daubechies wavelets are normally used for solving fractal problems, signal discontinuities, etc. The symlets are almost symmetrical wavelet, which are also projected by Daubechies as modifications to the db family.[3] Daubechies

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proposed modifications of her wavelets that raise their symmetry can be increased while retaining great simplicity. The symlets have properties similar to daubechies.[4][5].

III. ENCODING

Embedded Zero trees of Wavelet transforms (EZW) is a lossy image compression method. At low bit rates, i.e. high compression ratios, the majority of the coefficients created by a sub band transform will be zero, or very close to zero. This occurs because "real world" images tend to contain generally low frequency information (highly correlated). However where high frequency information does occur (such as edges in the image) this is mainly important in terms of human perception of the image quality, and thus should be represented precisely in any high quality coding scheme.[6] By making the transformed coefficients as a tree among the lowest frequency coefficients at the root node and with the children of each tree node being the spatially related coefficients in the next higher frequency sub band, there is a high probability that one or more sub trees will consist entirely of coefficients which are zero or nearly zero, such sub trees are called zero trees.[7],[8] Due to this, we use the terms node and coefficient interchangeably, and when we refer to the children of a coefficient, we mean the child coefficients of the node in the tree where that coefficient is located. We use children to refer to directly connected nodes lower in the tree and descendants to refer to all nodes which are below a particular node in the tree, even if not directly connected.[9],[10]

IV.RESULTS AND DISCUSSION

In this work, mural image is used for the proposed algorithms. Discrete wavelet transform based decomposition was performed on the image. Symlet2, coiflet 2 and daubecheis2 are implemented for decomposing the mural image. Levels1, 2, 3 and 4 of decomposition are adopted. After the decomposition, Zero tree Encoding is employed. The capability of the compression algorithms are evaluated in terms of MSE, PSNR, compression ratio and Bits per pixel. This is tabulated in Table1. The Quality of the reconstructed image is measured in terms of mean square error (MSE) and peak signal to noise ratio (PSNR) ratio. The effectiveness of the compression can be analyzed using the compression ratio and bits per pixel. The MSE is often called reconstruction error variance $\square_q^2$. The MSE between the original image f and the reconstructed image g at decoder is defined as:[11][12].

$$MSE = \sigma^2_q = 1/N^* \text{ summation of } (f[j,k] - g[j,k])^2 \quad \ldots\ldots\ldots\ldots (1)$$

Where the sum over j, k denotes the sum over all pixels in the image and N is the number of pixels in each image. From that the peak signal-to-noise ratio is defined as the ratio between signal variance and reconstruction error variance. The PSNR is measured in terms of decibels (dBs) is given

$$PSNR=10\log_{10}(255^2/MSE) \quad \ldots\ldots\ldots (2)$$

Generally when PSNR is 40 dB or greater, then the archived and the compressed murals are virtually indistinguishable by human eyes. The compression ratio of the image is given by No. of bits in original image/ No. of bits in compressed image. The original murals, compressed murals with Symlet2, level 1 decomposition and level 4 decomposition are shown in figure 1,2 and 3 respectively.

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Table 1 Performance Evaluation For decomposition levels

	Decomposition Level 1		
Transforms	**DB 2**	**SYM 2**	**COIF 2**
PSNR (dB)	52.1	59.68	58.47
BPP	20.23	21.99	22.47
CR(%)	84.3	94.79	93.64
MSE	0.51	0.088	0.09
	Decomposition Level 2		
Transforms	**DB 2**	**SYM 2**	**COIF 2**
PSNR (dB)	50.55	50.55	50.41
BPP	16.93	16.93	16.29
CR(%)	70.65	70.65	67.89
MSE	0.573	0.573	0.6
	Decomposition Level 3		
Transforms	**DB 2**	**SYM 2**	**COIF 2**
PSNR (dB)	44.83	44.83	44.84
BPP	10.68	10.68	10.04
CR(%)	44.49	44.49	41.84
MSE	2.14	2.14	2.14
	Decomposition Level 4		
Transforms	**DB 2**	**SYM 2**	**COIF 2**
PSNR (dB)	43.82	44.82	44.8
BPP	10.47	10.49	10.35
CR(%)	43.61	43.64	43.13
MSE	2.2	2.14	2.15

Fig 1.Original Image

Fig 2 Image archived at Decomposition Level1

Fig3. Image archived at Decompostion Level4

The PSNR values are approximately same and very low, compared to levels 1 & 2.The bits per pixel values are also created and the variations in its values are also following the PSNR value, since, it is related to the PSNR. The mean square error is also raised if the level of decomposition is increased. It is wise to obtain a least value of error, which is also given by symlet1 with the first level of decomposition.

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V. CONCLUSION

The main objective of this proposed work is to achieve mural images with high quality, which is obtained by the transformation of symlet wavelet with the encoding of EZW. It is also achieved with the first level of decomposition. The bits per pixel of the different proposed algorithms are also decreased if the level of decomposition is increased. The performances are varied, mainly due to the nature of the mother wavelets, used in this work. The Levels of decomposition also plays an important role in the storage of murals, which is proven by the values of compression and PSNR values.

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