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VISUALLY LOSSLESS JPEG 2000 COMPRESSION ON STEREO IMAGES

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ABSTRACT

Most of the television and games software's contain stereoscopic content and now a days people are viewing these types of content more, there is higher chances of availability for the exposure of user level three-dimensional. The right and left eye images of a stereo pair are given to the observer's right and left eye. These two images are combined in human brain to obtain perception of three-dimension. In order to view the stereo image properly crosstalk hasto be reduced and the uncompressed image must be a lossless by recovering the entire original image. An image is divided into codeblocks and sub-codeblocks. The visibilitythresholds are calculated for each codeblocks. These thresholds values represent gray level of both the right eye and left eye images. Then compression ratio is calculated for compressed image. The resulting image is displayed in three-dimensional space and after uncompressing image, compression ratio is calculated to it and compared with obtained compression ratio. The modelled method reduces lossy component in an image. This experimental result is investigated on left eye image. Same procedure is repeated for right image of the eye in a stereo pair. This model is concerned to reduce the lossy component and crosstalk effect in both left eye and right eye image in a stereo pair individually. The resulting image is with reduced lossy component and crosstalk effect when displayed in both two-dimensional and three-dimensional modes.

Keywords: Codeblocks, Compression, Stereoscopic Device, Stereogram.

I. INTRODUCTION

The imagination of depth in an image is intensified by means of binocular vision. This approach is known as stereoscopy. Both left eye and right eye of a picture is known as stereo pair. These stereo pair is referred as stereogram. The stereo images can be viewed using a device known as stereoscope. The lens provided by the stereoscopic device makes the image seen through it to appear larger. In many stereoscopic devices, two separate images are given independently for both right eye and left eye. Perception of 3D in human brain is created by combining the stereo pair. The devices used for viewing stereoscopic three dimensional elements uses passive or active glasses. In case of passive systems, the right eye and left eye images are polarized and are shown serially in the display device. The correct images of both right eye and left eye are passed in polarized glasses. To view the image, active shutter glasses are used in case of active systems. The Left eye and right eye Lenses in active shutter glasses changes into two different states such as DARK state and ON state to permit correct signals passed through to each eye. The proposed work consider to reduce Lossy compression problem in stereoscopic content while viewing. This approach compress each images of a stereo pair separately which results in reduction of lossy component in the image while displaying and viewing in three dimensional space.

The two major problems that are occurred during displaying the stereo image in 3D space in visual to the human eye and while performing compression on the stereo image are crosstalk effect and lossy compression. These two major problems are investigated in the proposed design. The crosstalk effect is also known as ghost effect. While human viewing three dimensional images this effect may reduce the quality of his perception. The Crosstalk effect is doubling exposure of both right eye and left eye images of a picture. One of the major approach used in image processing is compression. There are two kinds of compression methods. They are lossless compression and lossy compression. In Lossy compression, a file is reduced permanently by discarding

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few amount of data after uncompression. In case of Lossless compression, each and every bit of information is restored after uncompression, which was originally in file. In proposed system these two problems are investigated by achieving visually lossless compression for both right eye and left eye images of a scene individually .Then these images are compressed and displayed in 3D space, resulting image when viewed is visually lossless as compared to the image (compressed both right eye and left eye of a scene) showed in 3D space before resolving crosstalk and lossy compression problems occurred in stereo pair individually. To handle this, for stereoscopic three-dimensional images with crosstalk effect, the contrast sensitivity function (CSF) is investigated. The contrast sensitivity function is a popular approach which describes different procedure for compressing the two dimensional images according to perception of human views with different frequencies measured in cycles or degrees. Currently, the contrast sensitivity function is modelled using the discrete wavelet transform. According to this model, to generate a stimulus image, noise is added for each wavelet subband uniformly. At each level, the noise in each subband is adjusted to the perception of human viewer by measuring visibility thresholds (VTs) in each of these subband.

In this work a methodology for measuring visibility threshold in the presence of crosstalk is proposed. The left eye and right eye images of a stereo pair are compressed jointly by using JPEG2000 coding method by using the measured visibility thresholds. After decompressing the image when viewed independently as two dimensional and as a three-dimensional stereo pair, in both the cases the image is viewed with reduced Lossy component and crosstalk effect.

II. METHODOLOGY

In the stereo image, the two major problems are occurred during displaying the stereo image in 3D space in visual to the human eye and while performing compression on the stereo image.

Crosstalk

Crosstalk is the doubling of an image while viewing. This leads to incomplete combination of left eye and right eye image of a scene which results in improper imagination of depth in an image by human viewer.

Compression

One of the major image processing techniques used is Compression. Compressing an image is the process of reducing the file size compared to original file. It is a technique which is used to reduce the file size by retaining acceptable level of Image quality. Two different methods among image compression methods are lossless compression and lossy compression.

In lossless compression, when the image is uncompressed entire original information is restored as stored in original file. In Lossy Compression, when the file is uncompressed, only a part of the original information is restored with reduced file size by permanently discarding few amount of information from the original file.

The methods used in design approach for Visually Lossless Compression on stereo images are

Stereoscopic Image Crosstalk Effect

Crosstalk effect is a doubling exposer of an image which creates improper imagination of depth in an image. The left eye and right eye image flows into one another creating doubling of two images. Crosstalk is also known as ghosting effect. A Ghost effect is a copy of transmitted image over the display, left eye image is super imposed on right image in the display.

In compression of 3D images crosstalk effect has to be carefully investigated to obtain visually lossless image. The crosstalk effect is also called as the ghost effect. While human viewing three-dimensional images this effect may reduce the quality of his perception. The Crosstalk effect is doubling exposure of both left eye and right eye images of a picture Crosstalk is caused by flowing between the left eye and right eye passage. There are ongoing efforts to quantify the volume of crosstalk between the two channels in systems using active shutter glasses. The gray levels of these two images are set to various combinations.

By placing a photometer behind a lens of the active shutter glasses Luminance values are measured. By comparing the measured luminance values crosstalk is defined. Crosstalk is determined for each view in cathode ray tube displays using liquid shutter glasses. For stereoscopic three-dimensional images with crosstalk effect, the contrast sensitivity function (CSF) is investigated. The contrast sensitivity function is a popular approach which describes different procedure for compressing the two-dimensional images according

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to perception of human views with different frequencies measured in cycles or degrees. At each level, the noise in each subband is adjusted to the perception of human viewer by measuring visibility thresholds (VTs) in each of these subband.

Bit plane Coding

Bit plane coding is a set of bits corresponding to a given bit position in each of the binary numbers represented the signals. Three stereoscopic images are shown on the display simultaneously. One image is placed at the top center of the screen, and the other two images are arranged at the bottom left and bottom right, in consequence. The other two stereoscopic images do not any noise.

Stereoscopic images are adapted from the coding method. In JPEG2000, a subband is partitioned into rectangular codeblocks. The coefficients of each codeblock are then quantized and encoded through bit-plane coding. Evidently, larger bitrates are required to achieve visually lossless approach for 3D stereoscopic images than the 2D images for displaying and viewing but also the various sequences of luminance values in both the leftand right channels of stereoscopic images. The Visibility threshold obtained through the proposed model were then employed in the development of a visually lossless coding scheme for monochrome stereoscopic images.

Visually Lossless

In this module visibility threshold values are calculated for compressed left eye image and right eye image of a stereo pair. In this proposed method left eye image of a picture is considered and visibility threshold calculation is performed on left eye image and same procedure is repeated for right eye image. An image is compressed by dividing entire image into codeblocks. Each codeblock is subdivided into sub codeblocks.at each code block visibility threshold is calculated. The compressed code stream coefficients calculated differs from one code block to other code blocks. This module optimizes mean squared error in each codeblocks of an image.

Discrete Wavelet Transform

One of the popular conversion approach adopted in image compression technique is discrete wavelet transform. Discrete wavelet transform is the new image coding standard released by the JPEG committee. The discrete wavelet transform is easier method for division of subbands in an image.an important process in image processing is two-dimensional discrete wavelet transform. It analysis and decomposes image into wavelet coefficients. One of the characteristic of discrete wavelet transform is to calculate wavelet coefficients for each subband for compressing images.at each pixel blocks wavelets convert the image into a series of wavelets which is stored. In two-dimensional wavelet transform, one row is viewed as one-dimensional wavelet scheme and other wavelet scheme is viewed along one column. Each one- dimensional wavelet of rows and column values are transposed. Each rows of matrix is decomposed at one level.

The resulting matrix is divided into two vertical halves. First vertical half stores average coefficient and second vertical half stores specification. The same procedure is repeated for other columns by dividing the matrix into for sub-bands. Each pixel in an Image is arranged in two-dimensional matrix and the intensity of image is diagonally equal. The redundancy in each pixel must be eliminated for performing compression process on an image. The spatial domain pixels are transformed into frequency domain information using discrete wavelet transform processor which is displayed in multiple sub-bands.

JPEG 2000

The lossy component and the lossless component is identified from the sub divided code blocks the compression ratio is calculated for both the lossy and lossless component, where in the code blocks with lower bitrate is the lossless component. The lossy components compression ratio is calculated by displaying the code block of an image in disparity map with the RGB coding value, in which the lossy component in the image is displayed with the gray or black color component. The lossless component is displayed in the map with the RGB color code as specified.

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III. MODELING AND ANALYSIS

The following two algorithms are used in the proposed work

Median Filters

To remove the noise in an image, one of the nonlinear digital method called median filter is applied. To improve the results of further processing steps such as edge detection in an image, reducing noise in image is a pre-processing step is to be performed. In this filtering technique, the process starts by moving through entire image from one pixel to another and replaces value with the median value of neighboring pixels. The arrangement of pixels with their neighboring pixels in image is called window.

Haar wavelet transform

The simplest discrete image transform method is haar wavelet transform. The processing steps starts by rescaling the image into four-subbands. The two-dimensional haar wavelet transform divides four-subbands into further subbands. The division always starts from left corner of an image. Hence energy transform is at the left corner of the image.

IV. RESULTS AND DISCUSSION

The following table specifies the compression ratio obtained for an image. Compression ratio is calculated based on two values 'N' and 'depth', varying these two values corresponding compression ratio is recorded.

Table 1. Result analysis for the image Insect-Right image

Image Name Right Image	Depth value	N value	Compression Ratio obtainedafter compression	Compression ratio obtained (after reducing lossy component
Insect	4	8	1.2192	0.2192
Insect	5	9	1.2674	0.2674
Insect	6	10	1.7373	0.7373

Table 2. Result analysis for the image Insect-Left image

Image Name Left Image	Depth value	N value	Compression Ratio obtainedafter compression	Compression ratio obtained (after reducing lossy component
Insect	4	8	1.0381	0.0381
Insect	5	9	1.6299	0.6299
Insect	6	10	1.1768	0.1768

Table 3. Result analysis for the image Building-Left image

Image Name Left Image	Depth value	N value	Compression Ratio obtainedafter compression	Compression ratio obtained (after reducing lossy component
Building	4	8	1.2169	0.2169
Building	5	9	1.7266	0.7266
Building	6	10	1.4671	0.4671

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Table 4. Result analysis for the image Building-Right image

Image Name Right Image	Depth value	N value	Compression Ratio obtainedafter compression	Compression ratio obtained (after reducing lossy component
Building	4	8	1.1623	0.1623
Building	4	9	1.4468	0.4468
Building	4	10	1.5109	0.5109

V. CONCLUSION

Steroscoping is a technique used to create the imagination of depth in an image presenting two slightly different overview of the same object to the eyes of the viewer. Stereoscopic image provides spatial information that trick a user's brain to believing and see the depth in an image. During watching three dimensional content, to identify the difference among the right eye and left eye of human viewer, right and left images of a picture are captured from two separate positions. Both right eye and left eye images of viewed picture forms a stereo pair. The right and left eye images of a picture in stereo pair are given to the right eye and left eye of the observer in consequence. If there is crosstalk effect in image both left eye and right eye perceive quantization error while viewing. To reduce this effect the proposed method measures the visibility threshold values for both right and left eye images and compression ratios are calculated respectively. These two images individually displayed in 3D space. The proposed method mainly worked to reduce the crosstalk effect and the lossy component while displaying the left and right eye image respectively on 3D display technologies. This is achieved by removing Lossy component in the left and right eye image individually then displayed in 3D space individually and with both compressed. The resulting Image is visually lossless when displayed both two-dimensional and three-dimensional modes.

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