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DWT based Image Compression using Image Inpainting

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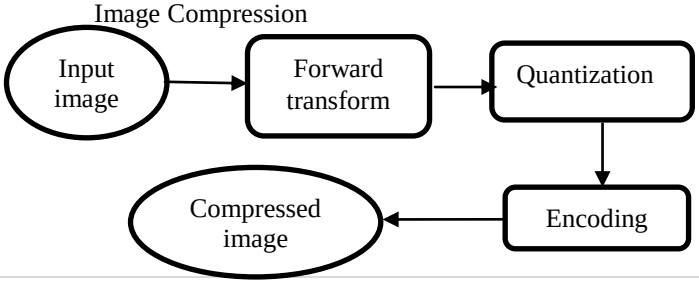
Abstract*:* Image compression is the method of minimizing the size of graphic file in bytes without the degradation of the image quality to unacceptable level. More images can be stored in a given amount of memory or disk by reducing the file size. The time required for an image to transmit over internet or to download from webpages is also reduced considerably. Over the past 20 years, image and video compression has rapid development in both industry and academic. Image compression plays a vital role in medical field. The Discrete Wavelet Transform (DWT) has a huge number of applications in Engineering, Science and Medical fields. Basically, the medical image need more accuracy without any loss of information. DWT is based on time scale representation, which provides efficient results compared to DCT. Inpainting is the process of reconstructing lost or deteriorated parts of images and videos. Using inpainting technique, the image which is similar to the original image. If there is any abnormalities in the reconstructed image, then it is retrieved by inpainting technique. Hence restored image similar to the original image is obtained either by removing the discontinuities and filling in the gaps effectively. The proposed method combines both DWT and image inpainting technique to give better image quality with good psnr value and hence high compression ratio is achieved.
Keywords*:* Image compression, Inpainting.

I. INTRODUCTION

Image compression is the method of converting or encoding an image file in such a way it consumes less space than original file. It is used to reduce redundancy of an image. Lossless compression method is used to avoid any loss of information in compressed image.it is necessary to use lossless compression method in medical image to avoid loss of critical information .image compression has two techniques lossy and lossless technique depends in requirement. The various lossy compression method includes fractal compression, transform coding, fourier_related transform, discrete cosine transform and discrete wavelet transform. Dwt is a wavelet transform in which wavelets are discretely sampled it captures both frequency and time. the great advantage of wavelet is able to separate the fine details in a signal even very small wavelets are used to isolate the fine details in the signal while very large wavelets identified the coarse details. One wavelet generate more sparse representation of a signal. Inpainting is the process of reconstructing the lost parts of images and videos. The various algorithms are used to replace lost or corrupted parts of the image data. Inpainting technique can be classified in to two categories texture oriented and structure oriented. Image inpainting is the one of the fundamental area of research in image processing. using this technique better global structure estimation of a damaged or targeted region can be achieved the following sections in the paper explains about individual blocks involved in this method to obtain compressed image and the reconstructed image quality and also future scope of work. [1] Digital image compression (DICOM) technique is used. In this proposed method DCT offers with minimum distortion, DWT helps in decomposition of images and Huffman coding reduces the average codeword length.

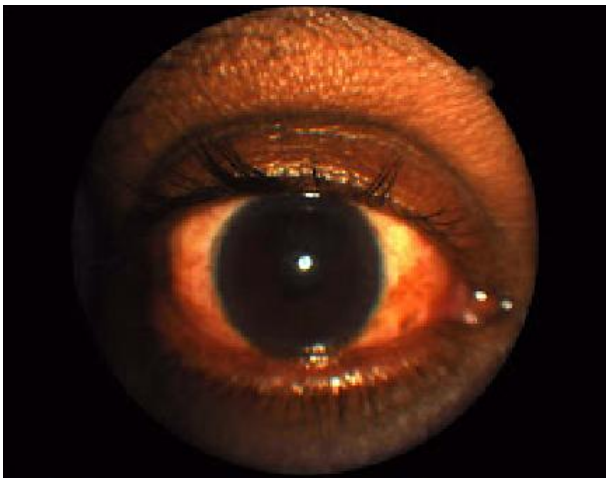
II. IMAGE COMPRESSION

Compression is a process used for compressing large files so that they can be stored in less memory space or disk than original form. This technique widely used in many applications especially in telemedicine it is used to reduce the storage cost and this compression. This increase the transmission speed and data at available bandwidth. Image can be compressed with help of forward transform (dwt), quantizer, and encoder.

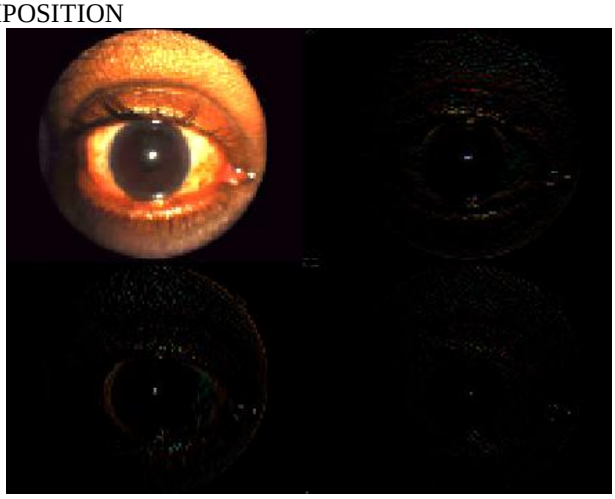


[2] PCM and DWT based compression and in this method DWT yields good results compared to other methods, DWT produces good SNR and PSNR values and DWT has less computational complexity.

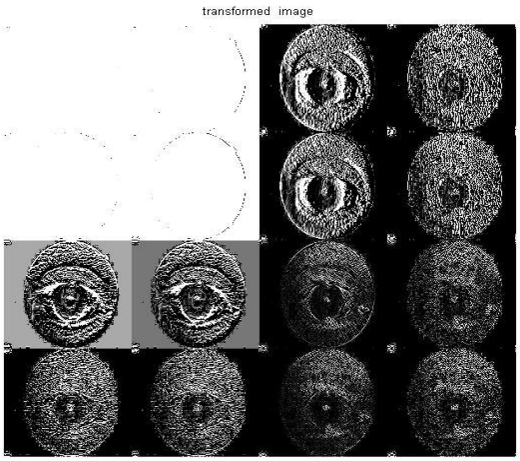
INPUT IMAGE



FIRST LEVEL DECOMPOSITION

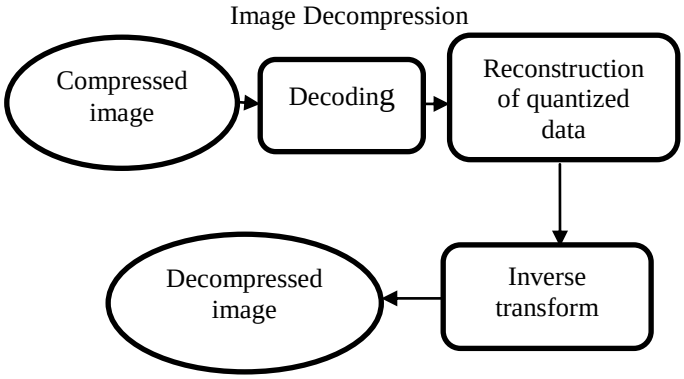


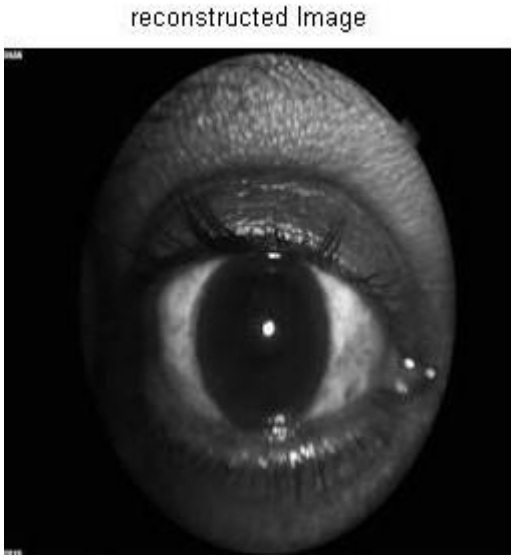
SECOND LEVEL DECOMPOSITION



III. IMAGE DECOMPRESSION

Image decompression is the reverse process of image compression. In this inverse discrete wavelet transform, decoder are used. It is used to retrieve back the original image. It is widely used in data communications, multimedia audio and video file transmissions. This is also referred to as uncompression. In decompression the original data is obtained without any loss. [3] K-NN algorithm and JPEG algorithm is used. The proposed methodology includes good performance and data recreation and it produces more optimized compression ratio.





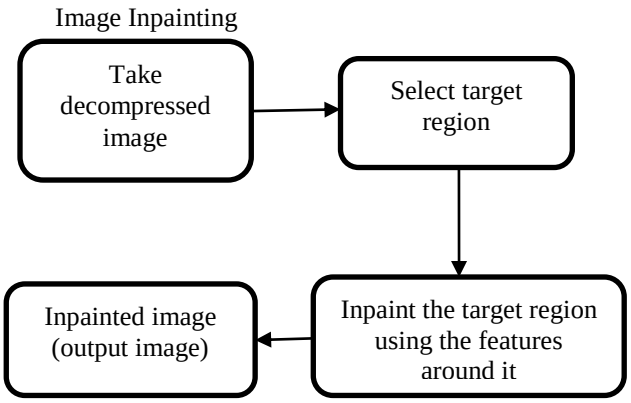
IV. WAVELET TRANSFORM

Discrete haar wavelet transform is simplest possible wavelet in which the wavelet is not continuous and therefore not differentiable mainly used for analysis of signal with sudden transitions. Discrete wavelet transform divide information of an image in to detailed sub signal and the images can be separated as lower resolution approximation image (LL) and horizontal image (HL), vertical (LH) and diagonal image (HH) of detailed components. These wavelets have an average value equal to zero. In discrete wavelet transform the images divided in to blocks and each block contains two filter they are wavelet filter and scaling filter.

V. INPAINTING

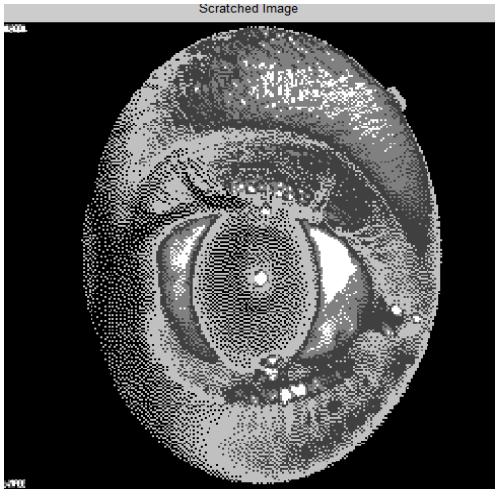
In the digital world, inpainting refers to the application of sophisticated algorithms to replace a lost or corrupted parts of the image data. Inpainting is the process of reconstructing deteriorated parts of images and videos. Inpainting is rooted in the restoration of images. Traditionally inpainting has been done by professional restorers. The global picture determines how to fill in the gap. The purpose of inpainting is to restore the work after processing image compression and decompression, inpainting technique is applied to retrieve back the original image. The image inpainting is the process of the filling in of missing region in image. Image inpainting is widely used in many applications of digital effects such as object removal, image editing, image coding and

recovery of missing blocks. This technique can be classified in to two methods they are texture oriented and structure oriented. The texture synthesis effectively generates new texture by sampling and this fills holes in photographs of real world scenes therefore in structure oriented obtains the missing region by propagating linear structure in to target region. This can be achieved by partial differential equations. The both techniques were used in this paper.

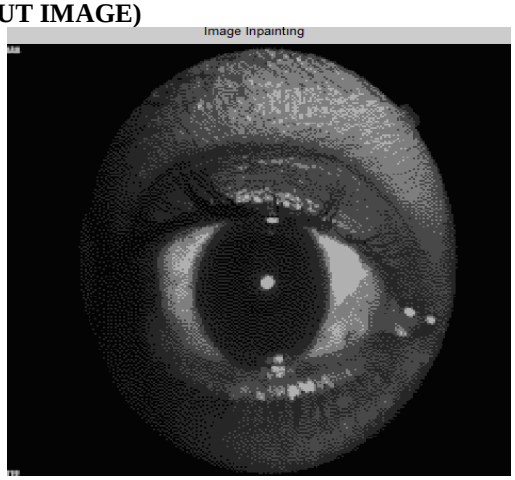


In this process select the target region in a decompressed image and Inpaint the target region and finally Inpaint image is obtained. [4] The proposed codec builds on top of the JPEG image coding standard and uses texture blocks. Inpainting with texture synthesis algorithm usually provides a good reconstruction quality. Texture blocks are recovered with texture synthesis.

SCRATCHED IMAGE



INPAINTED IMAGE (OUTPUT IMAGE)



MEAN-SQUARE ERROR (MSE)

MSE is one of the error metrics used to compare the various images. The MSE is the cumulative squared error between the compressed and the original image. To compute PSNR, MSE should be calculated first by using the following equation,

$$MSE = \sum_{i=1}^{x} \sum_{j=1}^{y} \frac{(|A_{ij}-B_{ij}|)}{x*y}$$

Images	MSE PROPOSED
Eye 1	141.6303
Eye 2	147.3907
Chest X-ray	255
Hand X-ray	224.2663
Brain X-ray	82.5961

PEAK SIGNAL TO NOISE RATIO (PSNR)

Peak signal-to-noise ratio is the ratio between the maximum possible power of a signal and the power of corrupting noise that affects the fidelity of its representation. PSNR is usually represented in terms of the logarithmic decibel scale. PSNR value is high for DWT when compared to DCT.

PSNR (dB) = 10 log (255^2/MSE)

Images	PSNR JPEG	PSNR PROPOSED
Eye 1	23.589	26.6192
Eye 2	25.3145	26.4461
Chest X-ray	22.978	24.0654
Hand X-ray	23.574	24.6232
Brain X-ray	25.475	28.9612

SIGNAL-TO-NOISE RATIO (SNR)

Signal-to-noise ratio is a measure used to compare the level of a desired signal to the level of background noise. S/N ratio is defined as the ratio of signal power to the noise power. It is usually expressed in decibels.

SNR = 6.02N + 1.76 Db

Where N is the number of bits.

$$\text{Compression ratio} = \frac{\text{Size of original image}}{\text{Size of compressed image}}$$

Images	Compression ratio
Eye 1	84.5398
Eye 2	84.5337
Chest X-ray	84.5337
Hand X-ray	84.5337
Brain X-ray	82.5961

VI. PROPOSED SOLUTION

Existing techniques contains the following drawbacks:

[1] The major drawback of this method are lossy compression is used and due to this there occurs a loss of data.
[2] In this method PCM compression method provides poorest result and PCM produces low SNR values.
[3]The existing methodology uses K-NN algorithm and it is very complex to implement.
[4] This method replaces each missing pixels by searching among the known pixels in the neighbourhood.

In this paper we have proposed a discrete wavelet transform technique for image compression and decompression in medical bitmap images. The distorted part in decompressed image can be rectified by inpainting technique. The output image is similar to input image with good quality with high psnr and snr values when compared with discrete cosine transform.

VII. CONCLUSION

In the proposed method, the image is compressed using discrete wavelet transform. Then the image is decompressed using inverse discrete wavelet transform with minimum distortion. By using DWT, the image quality is better when compared to other methods with minimum distortion. The inpainting techniques are applied for scratch removal, object removal, text removal and other modification of images and videos. Nowadays it is widely used in applications like image compression and super resolution. Inpainting techniques commonly used to replace lost or corrupted parts of the image data is used here in the same way, but the descriptive points containing most of the redundant information is considered thus resulting in saving of coding bits in an image. The proposed method will enable to store more number of images in a small memory with good visual quality. This method results in good compression ratio with better perceptual quality. The algorithm used in inpainting results in retrieving back the image which is similar to the original input image which is efficient enough to achieve good compression ratio and better quality.

VIII. FUTURE SCOPE

A new method for medical image compression is using discrete wavelet transform along with inpainting technique. This technique is tested for various medical images with different PSNR values. This method will play a major role in medical application, signal denoising, data compression and image processing. Basically all compression techniques are very useful for real-time medical image transmission. Each technique gives different gives different results based on their method used. This concludes that it is better to use lossless technique to get good quality. Hence in future, this method can be extended to increase the accuracy by increasing the level of transformations and it can be applied to videos to get high-definition videos after transmissions.

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