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# Enhanced SVD Based Image Compression Technique

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***Abstract:-*** With the growth of technology and entrance into the Digital World, it has found itself surrounded by a massive quantity of data. Dealing with such huge data/information will often creates difficulties while transmission of data or storage of data. One feasible solution to overcome such difficulties is to use a data compression technique. Image compression is a method in which the storage space or processing space of image is reduced without degrading the image standard or quality. It conjointly reduces the time needed for images to be uploaded over the Internet or downloaded from Internet. JPEG is a necessary technique used for image compression. So, in order to improve the quality of the image, compression is done using different techniques. In this research work, SVD algorithm is used for compression which is giving better result for image compression without any reduction in quality. The modeling of optimized Singular Value Decomposition (SVD) implemented for JPEG Image compression in MATLAB is implemented. SVD is the core part of the JPEG image compression. In JPEG Image Compression, a quantizer follows the SVD. Such structural channel is beneficial for reducing difficulty in the whole JPEG compression/encoding. To overcome the problem of lossy compression implemented algorithm is designed in order to enhance the performance of compression algorithm with respect to performance evaluation parameters such as, Compression ratio , Bits per pixel , Peak signal to noise ratio, Mean squared error and Signal to noise ratio.

***Keywords:*** **SVD; Image compression; Signal to Noise ratio; JPEG; DCT;**

## I. Introduction

The methodology of high speed enlisting devices and fast change in the field of correspondence has made a gigantic open entryway for various machine based Image applications. The measure of data expected to store an advanced Image is constantly growing and overwhelming the stockpiling devices. Image compression is a type of data compression applied to digital images, to reduce their cost for storage or transmission. Algorithms may take advantage of visual perception and the statistical properties of image data to provide superior results compared to generic compression methods. Image compression

is securing Images using lesser number of bits than its special size. Increase in Image related application has made an issue of image securing and transmission. Securing and transmission of Images oblige great measure of space and transfer speed. Image compression addresses this issue. It reduces the amount of bits expected to address the Image. In this manner, in the time of computerized correspondence, Image compression is key field of examination [1]. There are two sorts of compression strategies: Lossless compression and Lossy compression. In lossless compression, recreated Image is definitely same as packed Image i.e if data have been losslessly compacted, the principal data can be recovered absolutely from the packed data. It is overall used for applications that can't allow any difference between the first and recreated data [2].

Lossy compression techniques attempt to eliminate unnecessary or redundant information, focusing more on saving space over preserving the accuracy of the data. Ideally, the loss is either minimal or undetectable by human observations. Lossy compression techniques are used for pictures and music files that can be trimmed at the edges. Unlike text files and processing files, pictures and music do not require reconstruction to be identical to the original, especially if the data dropped is insignificant or undetectable. On the other hand, we can generally obtain higher compression proportions than is possible with lossless compression. With stripped eyes, viewer can't perceive the complexity between exceptional Image and decompressed Image. Subsequently generally lossy compression is favored over lossless compression. Most by and large used lossy compression technique is change coding, for instance, Discrete Cosine Transform (DCT) used as a piece of JPEG and Wavelet change used as a piece of JPEG. Compression proportion and Image nature of decompressed Image; these are two huge things to be considered in Image compression. As compression proportion grows, nature of reproduced Image starts ruining. Various compression

techniques like Vector Quantization (VQ), Predictive Coding (PC), Transform Coding (TC), Differential Image Coding (DIC) have been introduced [3]. In change coding, at first DCT was pervasive Image compression technique. DCT indicates straightforwardness and adequate execution in compression.

Image computer user framework contains 3 associated components specifically supply encoder, quantizer and entropy encoder. Basically there are two types of compression techniques such as lossless and lossy. Lossless compression is a class of data compression algorithms that allows the original data to be perfectly reconstructed from the compressed data[7]. Lossy compression techniques attempt to eliminate unnecessary or redundant information, focusing more on saving space over preserving the accuracy of the data.

## II. RELATED WORK

Neha Sikka [1], The field of Image processing make a high impact in the era of fast growing technology to increase or to satisfy the human comfort level. A single image may contain thousand times more information than a written text on piece of paper. But due to the advent of technology, number of image formats exists to provide strength to the image data like JPEG, Tiff, BMP, Gif etc. Due to this change in technology and the existence of these different formats, high resolution images are produced and require more memory for the purpose of storage. Even when we wants to communicate on the basis of these images through Internet for some purpose then the issue arises and affect the communication. To deal with this issue some compression mechanism is required. In case of Image procession we can either have lossless image compression or lossy image compression. In this research work a lossless technique of Image processing is proposed by considering Haar wavelet and Vector transform techniques. 97% compression percentage is achieved with the help to proposed method and when the results are compared with other techniques like Integer-to-Integer transform and Band-let image compression, low SNR (Signal to Noise Ratio) values and high RMSE values are achieved for the proposed system which shows its accurate behavior.

Siddharth Sinha et al. [2] performed a survey on the most essential and advance compression methods, including coding techniques based on DCT, DWT, VQ, Fractal approach and other methods. All these studies show that the wavelet approach seems much better than other approaches. Tree based wavelet Image coder is proposed by Jose Oliver, Manuel P. Malumbres [3].

Arian Maleki et al. [4] have proposed Image compression utilizing directional wavelet changes.

Shih-Chung B. Lo, Huai Li, and Matthew T. et al. [5] have proposed neural system based wavelet change for Image compression. They have utilized straight convolution neural system to look for the wavelet that minimizes the blunder and expands the effectiveness. Daubechies wavelet and Haar wavelet have been utilized by them for compression.

Manoj Kumar and Ankita Vaish et al. [6] proposed an efficient color image compression technique using IWT and prediction error is proposed. In our approach the correlation among the RGB planes is reduced using Y Co Cg-R transform, which transforms the R, G, B color space to less correlated Y, Co, Cg color space losslessly. The good performance of proposed work is due to the low computational complexity of both Y Co Cg-R and IWT. The efficiency of proposed work is evaluated by comparing it with several DCT and wavelet based compression methods including standard JPEG2000.

Poonam Dhumal and S. S. Deshmukh et al. [8] approaches such as an adaptive block based mostly compression, these contributions were experimentally checked and gave promising results compared to developed SVD. Singular Value Decomposition (SVD) is a terribly easy, robust and reliable technique.

A.M.Raid, W.M.Khedr, M. A. El-dosuky and Wesam Ahmed et al. [9] Hybrid method gives a good compression ratio and PSNR values and produces a desired high quality compressed image. The Hybrid method gives a compression ratio value better than DCT method. The quality image of Hybrid method is better than quality image of DCT method.

M. S. Abdullah and N. Subba Rao et al. [10] have proposed examination of various wavelets for Image compression. Daubechies wavelet, Haar wavelet, Coiflet, Symlet and bi orthogonal Wavelet changes have been utilized to think about their exhibitions. A half and half Image compression method actualizing a four-dimensional change consolidating the discrete wavelet change and the discrete cosine change has been proposed by E. Elharar et al. [11]. It is utilized for basic imaging and beats JPEG compression plan connected to indispensable Images.

Image compression utilizing double tree complex wavelet change is displayed by Chunxiao Zhang et al. [12].

Compression utilizing cross breed change is displayed as a part of [13]. Kronecker result of Kekre [15] change with other orthogonal changes is utilized and blunder at various compression proportions is watched. It has been watched that when DCT is joined with Kekre change gives least blunder as DCT has high vitality compaction property than other orthogonal changes.

Regarding image quality, the most critical step while converting analog to the digital is maintenance of image quality which is basically dependent on two main factors that is data transfer rate and data storage capacity [10-15]. For processing large amounts of information, data compression technique is

used to process. The principal approach in data compression is the reduction of the amount of image data (bits) while preserving information quality.

## III. PROPOSED METHODOLOGIES

In this work a hybrid JPEG image compression technique is proposed using SVD and Auto-huffman. The proposed technique is fit for both lossless and lossy image compression. During this technique the average values of consecutive pixels and the difference is used for the purpose of compression. The algorithm works on intensity values of the image. These operations produce a matrix of one row of an 8x8 image matrix. Proposed JPEG compression algorithm shown in block diagram figure 1. The proposed compression process consists of following main steps:

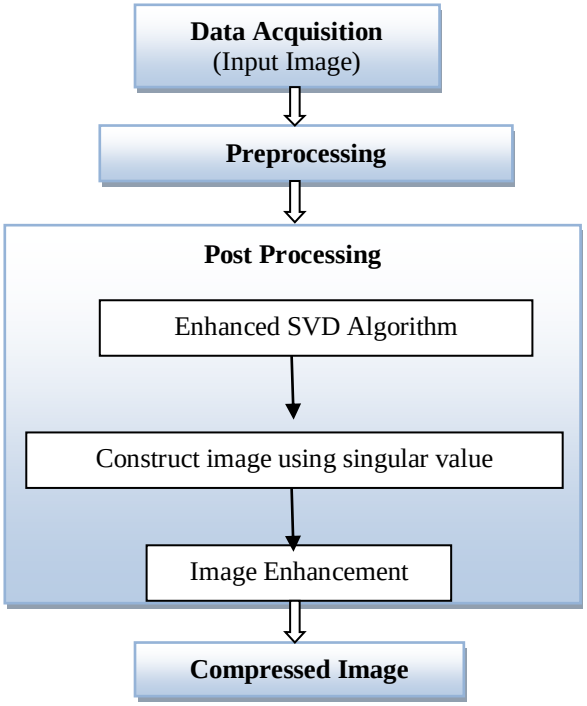



**Figure 1: Block diagram of proposed algorithm**

*A. Data Acquisition*

In this stage first of all we read the image i.e input image. For evaluating the performance of proposed algorithm, a real dataset is prepared for with natural images of high resolutions and outputs are evaluated.

*B. Preprocessing*

This stage is the initial step of proposed algorithm i.e. it is considered as preprocessing. Then the algorithm convert the input image (color image) into a gray scale image which is reducing in intensity value.

*C. Post Processing*

After preprocessing the proposed algorithm will proceed towards next step of the algorithm which is the main part of the algorithm in which enhanced SVD based image compression technique is discussed and shown in figure 2. In this stage each component is decomposed using Singular Value Decomposition i.e. SVD. The algorithm selects k value and discard the diagonal value of S matrix that are not required. And Construct the image using the particular singular values. The k-value in the m-file signifies the number of repetitions engaged on each layer used in the resulting disintegration. This is actually the rank of the SVD matrix. By growing the rank it can enhance precision till an ideal image is not obtained.

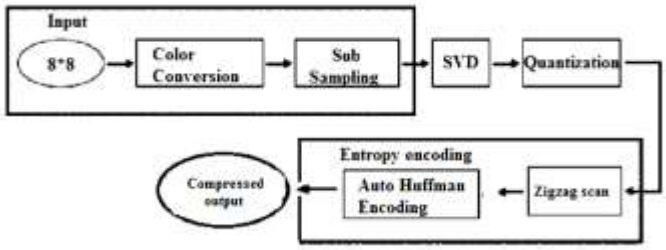



**Figure 2: Process of image JPEG compression system**

## IV. RESULT ANALYSIS

The implemented system shows the process involved in the proposed system. This section comprises with an analytical and numerical description of proposed algorithm which is simulated to obtain the performance of the algorithm. In order to evaluate the performance of proposed algorithm scheme, the proposed algorithm is simulated in Matlab Platform.

In this section the proposed algorithm is compared with five different techniques such as DWT, Haar Wavelet, PCA, SVD. The results are compared by considering the parameters such as CR (Compression Ratio), BPP (Bits per pixel), PSNR (Peak signal to noise ratio), RMSE (Root Mean squared error) and (SNR)Signal to noise ratio.

For evaluating the performance of proposed algorithm, a real dataset is prepared for with natural images of high resolutions and outputs are evaluated and some of these images are shown below.

Figure 3 shows the test image used for the purpose of experiment.

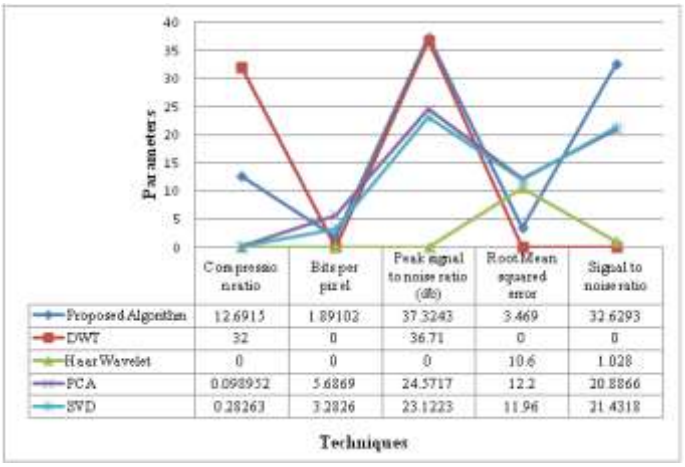
Table I shows the evaluated parameter values of image of the proposed algorithm as well as compared existing techniques such as DWT, Haar, PCA and SVD with respect to CR, BPP, PSNR, RMSE and SNR.

**Figure 3: Image compression through JPEG Compression Techniques**

**Table I: Different filters and algorithm results for image**

| Algorithms/ Output Parameters | Proposed Algorithm | DWT | Haar Wavelet | PCA | SVD |
|---|---|---|---|---|---|
| Compression ratio | 12.6915 | 32 | - | 0.0989 | 0.28 |
| Bits per pixel | 1.89102 | - | - | 5.6869 | 3.28 |
| Peak signal to noise ratio (db) | 37.3243 | 36.71 | - | 24.57 | 23.12 |
| Root Mean squared error | 3.469 | - | 10.60 | 12.20 | 11.96 |
| Signal to noise ratio | 32.6293 | - | 1.028 | 20.88 | 21.43 |

Graph 1 shows the comparative analysis graph of evaluated results in table I.




**Graph 1: Comparison of different techniques for image**

## V. CONCLUSION

Images are generated, emended and transmitted on a very regular basis during immense range of systems these days. The raw image information generated by the sensors on a camera is incredibly voluminous to store and thence not terribly economical. It becomes particularly cumbersome to maneuver it around in bandwidth forced systems or wherever information measure is to be preserved for cost functions such as the World Wide internet. Such situations demand use of economical image pressure techniques like the JPEG formula technique that compresses the image to a high degree with very little loss in perceived quality of the image. The DCT-based compression like JPEG performs good at moderate bit rates; but, at higher compression quantitative relation, the standard of the image degrades thanks to the artifacts ensuing from the block-based DCT theme. Wavelet-based cryptography like JPEG 2000 on the opposite hand provides substantial improvement in image quality at low bit rates thanks to overlapping basis functions and higher energy compaction property of ripple transforms. As a result of the inherent multi-resolution nature, wavelet-based coders facilitate progressive transmission of pictures thereby permitting variable bit rates. The study summarizes the need for compression and classification of compression techniques. A survey is performed on the most important and advance compression techniques, together with coding techniques based on JPEG, DWT, DCT and other techniques. The compression between Wavelet, Haar and JPEG approach is compared. All these studies show that the jpeg approach is much better than the other approaches.

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