An Analysis of Various Image Compression Techniques: A Review

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Abstract - In this earlier multimedia scenario, the various disputes are the optimized use of storage space and also bandwidth. In order to shrink the storage space of pictures and transmission of information with customize limited bandwidth availability, Image compression plays a crucial role by retreating the size of image and to exploit the bandwidth in economical and valuable manner without demeaning the superiority of image. In this paper we explore the review of different compression of images with their pros and cons. The overall compression process helps to reach a satisfactory level for image transmission in limited bandwidth over a telecommunication medicine application. We analyzed the performance of image compression technique using quality metrics such as Peak Signal to Noise Ratio (PSNR), Mean Square Error (MSE) and Compression Ratio (CR). The obtained results show that local threshold provides better reconstruction of image than Global threshold.

Index words- Mean Square Error (MSE), Compression Ratio (CR), Peak Signal to Noise Ratio (PSNR), Threshold.

I. INTRODUCTION

Image compression is a process of reduction of the number of bits used to define an image. Many techniques are available. For example, run-length encoding scheme permits a set of pixels consists the same color to be mentioned by the color and number of pixels resolution with that color in a sequence. Other approaches consists fractal image compression and wavelet image compression. Compression can produce an ballpark figure of the image, in which case it is not possible to decompress the image and retrieve the original form. Image compression is typically performed through an image/data compression algorithm or codec. Basically such codecs / procedures pertains multiple approaches to decrease the image size, like as by:

- Justifying all likewise colored pixels by the color name, code and number of pixels. This approach one pixel can suitable to hundreds or thousands of pixels.

- The image is formed and represented using mathematical wavelets.

- Splitting the image into different parts, each identifiable using a fractal.

Some of the general image compression methods are:

- Fractal mode compression

- Wavelets compression

- Chroma sub sampling transform

- Transform coding

- Run-length encoding

II. RELATED WORK

Following are the image compression procedures which are implemented in computer vision technologies. The core reason of all these conventional and meta-heuristics image compression procedures are proper exploitation of possessions. Some of the procedures are considered below with due to the author and their task.

SAR Image Compression Using Multi scale Dictionary Learning and Sparse Representation [1]: In this they focus on a new compression scheme for synthetic aperture radar (SAR) amplitude images. SAR images have some different characteristics when compared with outdoor images that can affect the layout of a compression technique. First, we explain SAR properties, sparse representation, and dictionary learning theories. Second, we propose a novel SAR image compression scheme by using multi scale dictionaries. The experimental result says that the proposed method is suitable for saving the desired characteristics of SAR images with a competitive compression performance.

Cloud-Based Image Coding for Mobile Device- towards Thousand to One Compression [2]: They propose a method of cloud-based image coding that is distinguish from current image coding even on the position. Initially, they explain an input image depend on its down-sampled version and local keypoint descriptors. Second, the down-sampled image is compressed using current image coding. The experimental results show that the visual quality of reconstructed images is significantly better than intra-frame coding in HEVC and JPEG at thousands level to one desired compression.

Compression Efficiency for Combining Multiple Embedded Image Compression Methods with Huffman Encoding [3]: In this paper compression was done with the help of different embedded wavelet based image coding in combination with Huffman- encoder. There were different kinds of procedures available for lossy image compression out of which EZW, SPIHT and Modified SPIHT algorithms are the some of the important compression techniques. At last results show that these hybrid algorithms give quite promising PSNR values at low bitrates.

Region Based Lossless Compression for Digital Images in Telemedicine Application [4]: In these areas, lossless compression can support to achieve high efficiency performance in telemedicine applications. Main benefits of Region based coding method is elaborated in this paper. Here the ROI section of the image is represent by manually and combined with the effect of Integer Wavelet Transform (IWT). IWT compression approach is suitable for reconstruct of source image, reversibly with desired quality. The result of compression process gives a satisfactory for image transmission in limited bandwidth over a telemedicine application.

Image Compression by Learning to Minimize the Total Error [5]: In this paper, we will work on lossy image compression technique. In which we store only the grayscale image and some carefully choose color pixel seeds. For decompression method, regression prototypes are learned with stored data to assume the missing colors. This reduces image compression to standard active learning and semi supervised learning problems. In this paper, we propose a novel algorithm that makes use of all the available during the encoding stage. By reducing the total color prediction error, our method may achieve a better compression ratio and better colorization quality than previous methods.

Image Compression with Mean shift Based Inverse Colorization [6]: This paper tells us about a mean shift segmentation based on inverse colorization approach for image compression. The compression makes use of the mean shift segmentation procedure in automatically choosing the representative pixels from the source image from which the colored image is reconstructed by the decompression. Through the modes of the clustered regions as the representative pixels, the compression rate becomes high and reconstructed image has good visual quality.

Lossless medical image compression by IWT and predictive coding [7]: E-health was born with the integration of networks and telecommunications. In recent years medical care systems rely on images obtained in two dimensional tasks in the case of still images, or multi dimensional tasks for volumetric video strips and images. Medical information's either in multidimensional or multi-

resolution form, this creates enormous amount of data. This technique combines integer transforms and predictive coding to enhance the concert of lossless compression approach. The proposed methods can be calculated for performance using compression quality measures.

Image Compression via Colorization Using Semi-Regular Color Samples [8]: This paper improves colorization-based image compression by lightly sampling color nodes on a irregular grid and compressing them using JPEG compression standard. We explain variations of sampling situation depend on extreme gray-scale values for further increase PSNR.

Complex SAR Image Compression Based on DLWT with High Clustering Capability [9]: This paper had two synthetic aperture radar (SAR) complex image compression schemes based on DLWT_IQ and DLWT_FFT. DLWT_IQ compresses the real sections and imaginary sections of the images using directional lifting wavelet transform and bit plane encoder, while DLWT_FFT compresses the real images converted by fast Fourier transform. We focus on a novel phenomenon, that is, DLWT with direction calculation acquire a higher clustering potential for complex SAR images than DWT. Then, coding procedure based on DLWT accepts fewer coding level than DWT for the same number of coding coefficients and DLWT outperforms DWT in sequences of rate-distortion quality metrics even if the K-term nonlinear approximation of DWT is better than that of DLWT.

III. IMAGE COMPRESSION TECHNIQUES

Image compression is an application of data compression that encodes the source image with few bits level. The main objective of image compression is to reduce the redundancy of the image and to store or transmit data in an efficient form. Fig 1 shows the block diagram of the general image storage system. The key objective of such system is to decrease the storage quantity as much as probable and decoded image displayed in the observed can be parallel to the source image as much as can be.
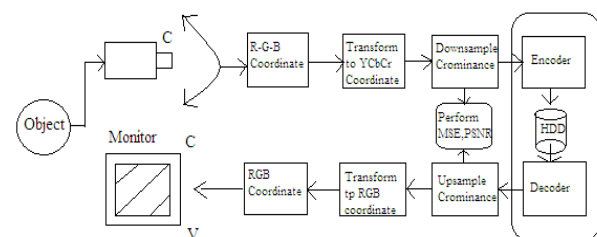

Figure 1: A General Image Storage System

Image compression technique may be lossy or lossless. Lossless compression approach is favorites for archival purposes and often for healthcare imaging, engineering

drawings, clip art or comics. Lossy compression approaches especially when used at low bit levels, introduce compression scenarios. Lossy techniques are especially perfect for natural images such as photographs in applications where slight loss of faithfulness is acceptable to observe a considerable reduction in bit rate level. The lossy compression approach that produces hardly noticeable differences may be called visually lossless.

Techniques for lossless image compression are:

- Run-length encoding is considered as default method in PCX and as one of possible in BMP, TGA, TIFF

- Area image compression

- DPCM and Predictive Coding

- Entropy encoding technique

- Adaptive dictionary algorithms such as LZW used in GIF and TIFF

- Deflation is used in PNG, MNG, and TIFF

- Chain codes

Techniques for lossy compression:

(1) Decreasing color space to the most general colors in the image. The selected colors are mentioned in the color palette in the description of the compressed image. Each pixel just references the index of a color in color palette; this method can be combined with dithering to avoid pasteurization.

(2) Chroma Subsampling - This takes benefits of the truth that the person eye perceives spatial changes of intensity more stridently than those of color by averaging or dropping some of the chrominance content in the image.
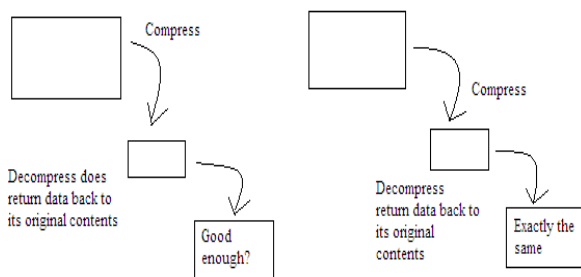

Figure 2: Comparison between Lossy and Lossless Methods

(3) Transform coding - This is the most generally used technique. A Fourier-related transform like as the Discrete Cosine Transforms is widely used. The DCTs is generally explained to as "DCT-II" in the situation of a family of discrete cosine transforms. The recently developed discrete wavelet transform is also used extensively and followed by quantization and entropy level coding.

(4) Fractal image compression.

IV. TOOLS RELATED TO IMAGE COMPRESSION

Image Compression technique can be implements with MATLAB R2010a and R2012a description is mentioned below.

MATLAB is a high-presentation, efficient and interactive tool for mathematical computing environment. It integrates Computation, visualization, graphical, processing and programming in an easy-to-use environment where questions and solutions are implements in familiar mathematical syntactic expression and graphical form. Typical uses include mathematical matrix form and other computation algorithm development Data acquisition Modeling, image processing, Data processing, simulation, and prototyping Data analysis, exploration, and visualization Scientific and engineering graphs and graphics platform development including graphical user interface building. MATLAB is an interactive programming tool whose basic data element is an array (Matrix form) in different dimensional scheme, that does not require to specify dimensioning. This allows you to solve many technical computing problems in different format, especially those with matrix and vector formulations, in a small fraction of the time it would take to write a program in a specific scalar non interactive language like as C or FORTRAN. The name MATLAB is stands for matrix laboratory. MATLAB is used in every facet of computational mathematics. Following are some commonly used mathematical calculations where it is used most commonly: Dealing with Matrices and Arrays, 2-D and 3-D Plotting and graphics, Linear Algebra, Algebraic Equations, Non-linear Functions, Statistics, Data Analysis, Calculus and Differential Equations, Numerical Calculations, Integration, Transforms, Curve Fitting, Various other special functions.

MATLAB has evolved over many periods of years with different input from many more users. In university research environments, it is the standard and efficient instructional tool for introductory and advanced courses in mathematics, engineering, and medical science. In engineering industry, MATLAB is the tool of choice for better high-productivity research, development, proactive and analysis. MATLAB provide basic features a family of add-on application-specific solutions called toolboxes. Very most important to most and licensed users of MATLAB, toolboxes allow you to learn and apply specialized computing technology. The Help window is as follows
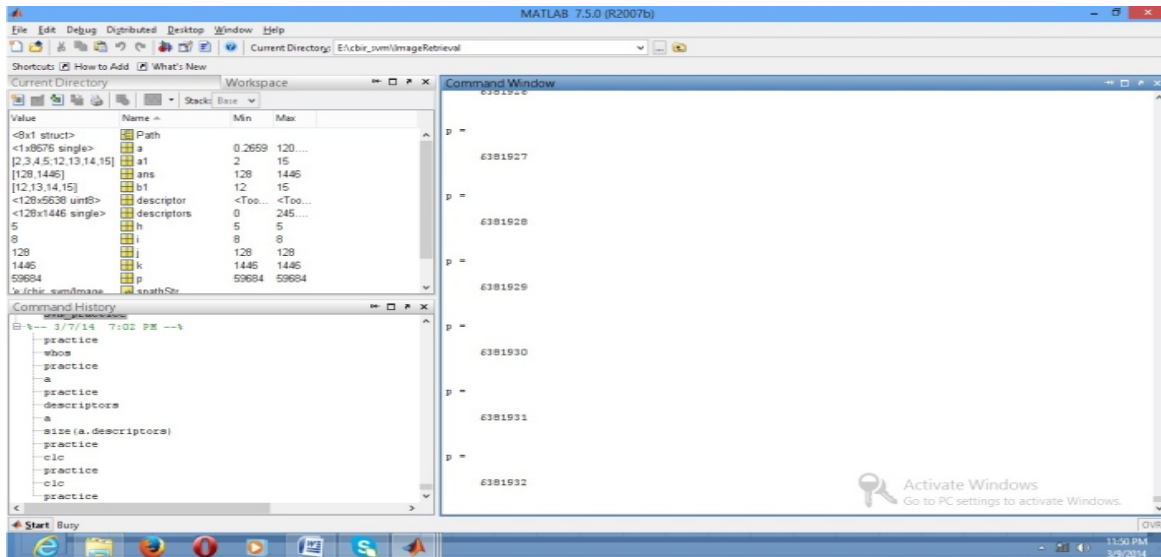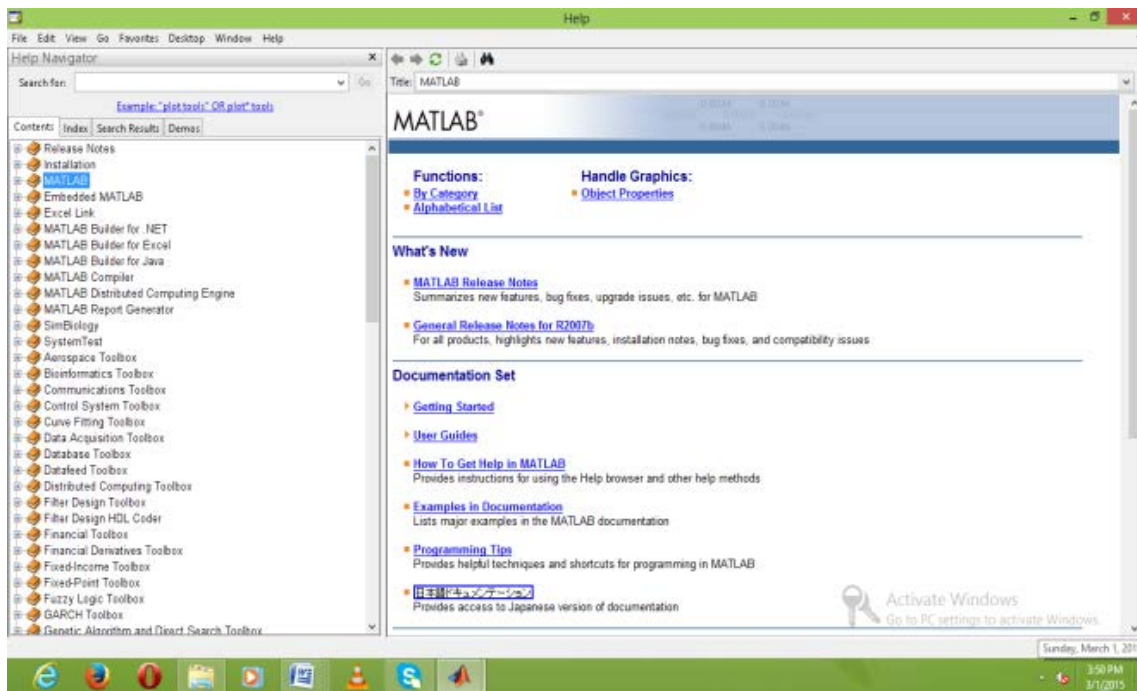
Figure 3: MATLAB Command Window

Figure 4: MATLAB Help Window

Following are the basic characteristics of MATLAB:

(1) It is an upper-level language for arithmetical computation, revelation and application development.

(2) It also enables an interactive environment for iterative investigation design and problem solving.

(3) It enables vast library of numerical functions for sequential algebra, statistics, Fourier analysis, filtering, optimization, numerical integration and illustrate general differential equations.

(4) It enables built-in graphical tool for visualizing information and methods for creating generalize custom plots.

(5) MATLAB programming platform gives tools for creating code quality and maintainability and improving quality.

(6) It enables tools for making applications with customized graphical platforms.

(7) It enables mappings for integrating MATLAB based algorithms with other applications and languages like as C, C++, Java and .NET.

MATLAB is widely used as a numerical method in science and engineering, the areas of physics, chemistry and all engineering   streams.

V. COMPARISON OF REVIEW TECHNIQUES

Image Compression Algorithm	Image Quality Parameters	Objective	Tool	Pros	Cons
SAR Image Compression Using Multiscale Dictionary Learning and Sparse Representation [1]	Multiscale Dictionary Learning, Sparse Decomposition, Quantization and Coding	Make effective study of dictionary learning and sparse representation	MATLAB	Powerful in capturing the important structural features and targets	Quantize and code the coefficients, make the trained dictionary shape adaptive
SIFT for Image encoding And RANSAC For Image Decoding [2]	Score, PSNR, Compression Ratio, Visual Quality, Highly Correlated Images, Complexity Analysis, Compression with SIFT Feature vector Coding	highly informative fused image through merging multiple images	MATLAB	computationally efficient, strong correlations between neighborhood pixels	Complex Calculation
DifferentEmbedded Image Compression Techniques with Huffman Encoding [3]	PSNR comparison,	Make effective image compression technique with Huffman encoding	MATLAB	Less Calculation, Less time execution	SSIM is high
Lossless Compression for Digital Images [4]	ROI, Non ROI, Background	Lossless Compression for DigitalImages in Telemedicine Application	MATLAB	An effective, efficient and feasible algorithm	For the noised image, the fusion result is affected by the noise
Image Compression for Minimize the Total Error [5]	PSNR, Computation Efficiency Analysis, Comparison With Standard Techniques, Benchmark Evaluation, Evaluation on Colorization Quality, Implementation Details	It helping to reducing the total error	MATLAB	More efficient image fusion	More time taken in execution
Image Compression with Mean shift Based Inverse Colorization [6]	SSIM value and compression ratio	Makes use ofmeanshift segmentation algorithm and the representative pixels from the original image from colored image is reconstructed.	MATLAB	high mutual information, instability or inconsistency	Complex implementation code
Image compression by IWT and predictive	Comparative analysis, Predictive coding	Make an Lossless medical image	MATLAB	Minimum artifacts and	More mathematical

coding [7]	techniques, Predictive Coding Based Image Compression, Reverse Lifting scheme, Forward lifting scheme, Implementation of Integer Wavelet Transform, Implementation Using Filter Bank,	compression byIWT and predictive coding		maximum edge preservation	calculation
Image Compression Using Semi-Regular Color Samples [8]	R-D Curve	Improves colorization-based image compression	MATLAB	Excellent fusion of multi-resolution images	Low mutual information
SAR Image Compression Based on Directional Lifting Wavelet Transform With High Clustering Capability [9]	Coding Performance of Amplitude SAR Images, Contribution of DLWT and FFT Program, Coding Performance of the Proposed Coding Algorithm	Encodes the real parts and imaginary parts of the images using directional lifting wavelet transform and bit plane encoder	MATLAB	High PSNR	High MSE

VI. CONCLUSION

In this paper, we elaborate the distinguish kinds of image compression procedures. Most generalize technique for image compression is the wavelet approach. Image compression is one of the most in all, the foremost effective work in image processing atmosphere. During this research paper, we have got discuss varied programming algorithmic strategies and tabulated varied argument. We have notified that high image compression rate is most important concern in image processing environment. This paper presents a survey of image compression procedures in image processing environment. Main objective of image compression procedure is to gain more performance in image processing atmosphere by optimal usage of storage capacity and other resources. This research would next focus on finding optimal approach for better performance of applications running in image compression for RGB image.

VII. REFERENCES

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