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Performance Evaluation of Compressed Images using Optimization Techniques

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ABSTRACT
As the main form of information exchange, images have always played an important role in communication media, irrespective of whether mobiles or personal computers are considered. An image compression method eradicates redundant and/or unrelated information, and resourcefully encodes leftovers. Practically, it is frequently essential to toss away both non redundant information and relevant information to attain the essential compression. In any case, the ploy is discovering methods that permit important information to be resourcefully extracted and represented. In this paper we present an image compression techniques performance evaluation and shows that our proposed method gives better results than the existing techniques, the simulation works done with the matlab simulink software.

Keywords: Image compressions, Matlab, Compression ratio, Particle swarm optimization, Wavelet transform.

INTRODUCTION

The general-purpose image compression algorithm has widespread applicability to many types of imaging instruments. The algorithm is intended to be suitable for use on-board spacecraft; in particular, the algorithm complexity is designed to be sufficiently low to make high-speed hardware implementation feasible.

In addition, the algorithm permits a memory-efficient implementation which does not require large intermediate frames for buffering. Consequently, the compressor is appropriate for frame-based image formats (two dimensions acquired simultaneously) produced, for example, by CCD arrays (called image frames) as well as strip-based input formats (i.e., images acquired one line at a time) produced by push broom type sensors. The Recommendation can provide both lossy and lossless compression. Under lossless compression, the original image data can be reproduced exactly, while under lossy compression, quantization and/or other approximations used in the compression process result in the inability to reproduce the original data set without some distortion. The perfect fidelity required by lossless compression results in a lower compression ratio (i.e., higher volume of compressed data) for a given source image.

Communication systems now a day’s greatly rely on image compression algorithms to send images and video from one place to another. Every day, a massive amount of information is stored, processed, and transmitted digitally. The arrival of the biometric identity concept demands that governments around the world keep profiles of their citizens, and for businesses to keep profiles of their customers and produce the information over the internet. Image compression addresses the problem of pressing large amounts of digital information into smaller packets (by reducing the size of image and data files) that can be moved quickly along an electronic medium before communication can take place effectively.

Wavelet transforms have been one of the important signal processing developments in the last decade, especially for the applications such as time-frequency analysis, data compression, segmentation and vision. During the past decade, several efficient implementations of wavelet transforms have been derived. The theory of wavelets has roots in quantum mechanics and the theory of functions though a unifying framework is a recent occurrence. Wavelet analysis is performed using a prototype function called a wavelet. Wavelets are functions defined over a finite interval and having an average value of zero. The basic idea of the wavelet transform is to represent any arbitrary function f (t) as a superposition of a set of such wavelets or basis functions [11]. These basis functions or baby wavelets are obtained from a single prototype wavelet called the mother wavelet, by dilations or contractions (scaling) and translations (shifts). Efficient implementation of the wavelet transforms has been derived based on the Fast Fourier transform and short-length fast-running FIR algorithms in order to reduce the computational complexity per computed coefficient. All wavelet packet transforms are calculated in a similar way.

II APPLICATIONS OF IMAGE COMPRESSIONS

Image compression techniques, especially lossy method are considered to be computationally more complex as they get more and more efficient. In this proposed work, an attempt has been made to propose an efficient and less complex image codec algorithm that would be suitable for the internet application and low bit rate image transmission purposes using hand held devices. Proposed algorithm is supposed to produce a good quality image for a given bit rate and will accomplish this task in an embedded fashion i.e. in such a way that all encoding of same image at lower bit rates are embedded in the beginning of the bit stream for the target bit rate. It will be helpful in many applications, particularly for progressive transmission, image compatible Trans coding in a digital hierarchy of multiple bit rates. It is also applicable to transmission over noisy channel in the sense that the ordering of the bits in order of importance leads naturally to prioritization for the purposes of layered protection schemes. As per the literature survey, the existing wavelet based compression methods already have following characteristics.

1. Quality (SNR) which is called as bit rate scalability
2. Spatial scalability
3. Temporal Scalability (Frame rate scalability used in video compression)

The ultimate aim will be propose an efficient image codec algorithm, which would be suitable for the internet application and low bit rate image compression and transmission applications for low capacity, limited battery life hand held multimedia devices.

III RELATED WORK

[1] In this paper, an image compression and encryption algorithm based on chaotic system and compressive sensing is proposed. Firstly, the original image is permuted by the Arnold transform, and then CS is utilized to encrypt and compress the resulting image, simultaneously. Moreover, the bitwise XOR operation and the pixel scrambling method based on chaotic systems are performed on the measurements to change the pixel values and disturb the positions of pixels, respectively. The keys used in the chaotic systems are related to the original image and generated with the SHA-256 algorithm. [2] An image compression and encryption algorithm based on the hyper-chaotic system, discrete cosine transform and AES is investigated. The hyper-chaotic system and AES are utilized to encrypt the DCT coefficients repeatedly. Meanwhile, the nonlinear process of the hyper-chaotic system is adopted to enhance the security of the proposed image compression and encryption algorithm. The proposed image compression and encryption

algorithm weakens the block effect in image compression process with the Arnold map, and reduces the encoding bit rate for image transmission with the DCT. Simulation results indicate that the proposed image compression and encryption scheme is effective and secure against the statistical analysis attack, exhaustive attack and noise attack. [3] A new image encryption-compression algorithm based on an orthogonal wavelet basis and measurement matrix is proposed. The proposed algorithm dramatically reduces the key consumption by controlling the generation of measurement matrix while implementing image compression and encryption simultaneously. Due to the introduction of chaotic system, the sensitivity of the key is extremely high. The key space is large enough to resist the brute-force attack and the correlation between adjacent pixels in the ciphertext image is low. The security analyses verified that the proposed image compression and encryption algorithm can effectively resist statistical attack and noise attack. [4] This paper proposes a new meaningful image encryption algorithm based on compressive sensing and information hiding technology, which hides the existence of the plain image and reduces the possibility of being attacked. Firstly, the discrete wavelet transform (DWT) is employed to sparse the plain image. This is followed by confusion operation on pixel positions, where logistic-tent map is employed to produce a confusion sequence. And then the image is compressed and encrypted by compressive sensing to form an intermediate cipher image. Here, measurement matrix is generated using low-dimension complex tent-sine system. To further enhance recovery quality, we suggest that the inter- mediate cipher image be filled with random numbers according to the compression ratio and confusing them to obtain the secret image. Finally, two-dimensional (2D) DWT of the carrier image is performed, followed by singular value decomposition. The singular values of the secret image are embedded into the singular values of the carrier image with certain embedding strength to obtain the final visually meaningful encrypted image. [5] An optical image compression and encryption scheme based on compressive sensing and RSA algorithm is investigated. The single pixel imaging system is adopted to sample the original image. The original image is measured by the Walsh-Hadamard transform and the measurement matrix based on chaotic map to simulate the optical compressive imaging system to obtain the measurements. Then, the pixels of the resulting image are rearranged by the pixel scrambling algorithm based on the logistic-tent system. Moreover, DNA sequence operations are utilized to change the pixel values. The keys used in the image compression and encryption scheme are associated with the original image and are protected by the RSA algorithm to enhance the security of image transmission. The simulation results and performance evaluations demonstrate that the proposed optical image compression and encryption scheme is secure with high key sensitivity and good compression performance and can resist brute-force attack, chosen-plaintext attack, statistical analysis attack and noise attack to some extent. [7] This paper proposes a new image compression-encryption algorithm based on a meaningful image encryption framework. In block compressed sensing, the plain image is divided into blocks, and subsequently, each block is rendered sparse. The zigzag scrambling method is used to scramble pixel positions in all the blocks, and subsequently, dimension reduction is undertaken via compressive sensing. To ensure the robustness and security of our algorithm and the convenience of subsequent embedding operations, each block is merged, quantized, and disturbed again to obtain the secret image. In particular, landscape paintings have a characteristic hazy beauty, and secret images can be camouflaged in them to some extent. For this reason, in this paper, a landscape painting is selected as the carrier image. After a 2-level discrete wavelet transform (DWT) of the carrier image, the low frequency and high-frequency coefficients obtained are further subjected to a discrete cosine transform (DCT). The DCT is simultaneously applied to the secret image as well to split it. Next, it is embedded into the DCT coefficients of the low-frequency and high-frequency components, respectively. Finally, the encrypted image is obtained. €e experimental results show that, under the same compression ratio, the proposed image compression-encryption algorithm has better reconstruction e.ect, stronger security and imperceptibility, lower computational complexity, shorter time consumption, and lesser storage space requirements than the existing ones. [8] In this paper, we design a color image encryption algorithm based on chaotic system and block compressive sensing. Firstly, the sparse representation of the plain-image is obtained by an adaptive learning dictionary. Secondly, the key streams are produced from two excellent low-dimensional chaotic maps, where updating the initial values and parameters rely on the SHA-384 and the input image. Thirdly, three measurement matrices of R, G, B components are constructed from the chaotic sequences, respectively. Finally, a random rows and columns diffusion method is performed on the encrypted image. Experimental results and safety analysis prove that the proposed scheme has excellent performance. [9] Present paper introduces a polynomial combination of one dimensional chaotic maps that is blended in a dynamic image encryption algorithm. It is special because not only this combination has butterfly folding effect but also it shows generalization property over any polynomial combination. Hence, the butterfly folding effect is caused by governed parameters of polynomial combination. Moreover, multiple simulations and evaluations show the superiority of the proposed chaotic system. An application of this system, which they propose in cryptography, is a novel image encryption algorithm based on dynamic function generation. Compared to the state of the art algorithms, our image encryption algorithm has higher statistical and cryptanalytic properties. Even though this algorithm is not suitable for real-time applications such as streaming video encryption, it makes a good use of the proposed chaotic system. Uppermost cryptanalytic properties that are proven by statistical/numeric tests show good performance and reliability of proposed algorithm for image encryption tasks while unlike any other chaotic image encryption system, our algorithm uses a string input for secret key. [10] In this paper, a fractional-order memristive chaotic circuit system is defined according to memristor circuit. The dynamic characteristics are analyzed through the phase diagram, bifurcation diagram, and Lyapunov exponent spectrum, and the randomness of the chaotic pseudo-random sequence is tested by NIST SP800-22. Based on this fractional-order memristive chaotic circuit, we propose a novel color image compression-encryption algorithm. In this algorithm, compression sensing (CS) algorithm is used for compression image, and then using Zigzag confusion, add modulus and BitCircShift diffuse encrypt the image. The theoretical analysis and simulation results indicate that the proposed compression and encryption scheme has good compression performance, reconstruction effect, and higher safety performance. Moreover, it also shows that the new algorithm facilitates encryption, storage, and transmission of image information in practical applications. [11] In this paper author proposed encryption and decryption scheme, The architecture of compression, confusion and diffusion is adopted. Firstly, the red, green and blue components of color plain image are converted to three sparse coefficient matrices by discrete wavelet transform (DWT), and then a double random position per- mutation (DRPP) is introduced to confuse the coefficient matrices. Subsequently, Logistic-Tent system is utilized to generate the asymptotic deterministic random measurement matrix based on chaotic system and plain image (ADMMCP), which is used to measure the coefficient matrices to obtain measurement value matrices. Moreover, simultaneous double random pixel diffusion between inter-intra components (SDRDIC) is presented to modify the elements of measurement value matrices to obtain the final cipher image. A 4-D hyperchaotic system is applied to produce chaotic sequences for confusion and diffusion, the initial conditions of the used chaotic systems are controlled by the SHA 512 hash value of plain im- age and external keys, such that the proposed image cryptosystem may withstand known-plaintext and chosen-plaintext attacks. Experimental results and security analyses verify the effectiveness of the pro- posed cipher. [12] In this paper, an efficient image compression and encryption scheme combining the parameter-varying chaotic system, elementary cellular automata (ECA) and block compressive sensing (BCS) is presented. The architecture of permutation, compression and re-permutation is adopted. Firstly, the plain image is transformed by DWT, and four block matrices are gotten, and they are a low-frequency block with important information and three high-frequency blocks with less important information. Secondly, ECA is used to scramble the four sparse block matrices, which can effectively change the position of the elements in the matrices and upgrade the confusion effect of the algorithm. Thirdly, according to the importance of each block, BCS is adopted to compress and encrypt four scrambled matrices with different compression ratios. In the BCS, the measurement matrices are constructed by a parameter-varying chaotic system, and thus few parameters may produce the large measurement matrices, which may effectively reduce memory space and transmission bandwidth. Finally, the four compressed matrices are recombined into a large matrix, and the cipher image is obtained by re-scrambling it.

IV PROPOSED WORK

Particle Swarm Optimization (PSO) was proposed by Eberhart and Kennedy. The PSO is a population based search algorithm based on the simulation of the social behavior of birds, bees or a school of fishes. PSO initially intends to graphically simulate the graceful and unpredictable choreography of a bird folk. Each individual within the swarm is represented by a vector in multidimensional search space. This vector has also one assigned vector which determines the next movement of the particle and is called the velocity vector.

The PSO also determines how to update the velocity of a particle. Each particle updates its velocity based on current velocity and the best position it has explored so far; and also based on the global best position explored by swarm. The PSO process then is iterated a fixed number of times or until a minimum error based on desired performance index is achieved. It has been shown that this simple model can deal with difficult optimization problems efficiently. The PSO was originally developed for real valued spaces but many problems are, however, defined for discrete valued spaces where the domain of the variables is finite.

Algorithm procedure.

1. Initialize Population
2. Calculate fitness values of particles modify the best particles in the swarm Choose the best particle
3. Calculate the velocities of particles
4. Update the particle positions
5. until requirements are met

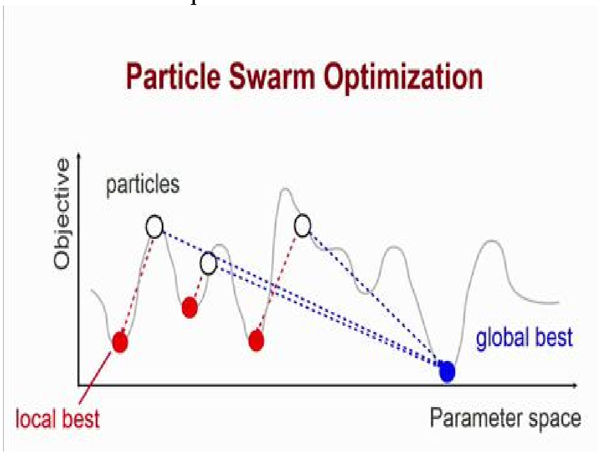

Fig 1: Particle swarm optimization model.

In this paper the experimental process of image compression is performed. This process of image compression is done by using previous method and proposed method. For the performance evaluation of image compression technique with different number of images MATLAB software package is used. MATLAB is a software package for high-performance numerical computation and visualization. It provides an interactive environment with hundreds of built-in function for technical computation, graphics and animation. Best of all, it also provides easy extensibility with its own high- level programming language. The MATLAB stands for matrix laboratory. There are also several optional "toolboxes" available from the developers of MATLAB. Here we are using four different images, they are having different sizes.

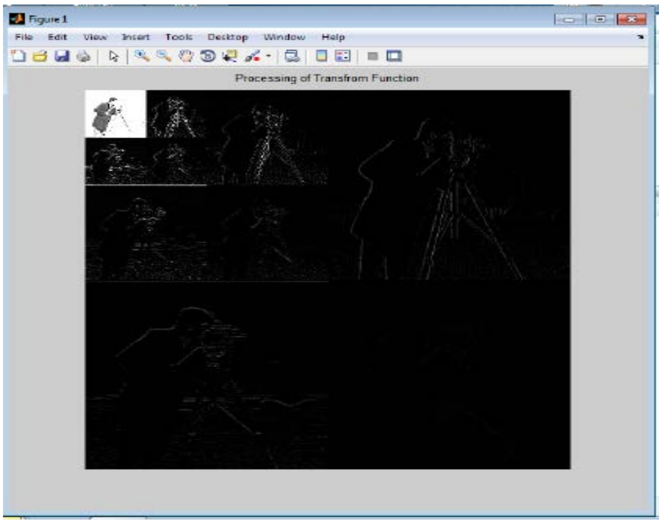

Fig 2: Shows that the Transformation window for cameraman image using previous methods.

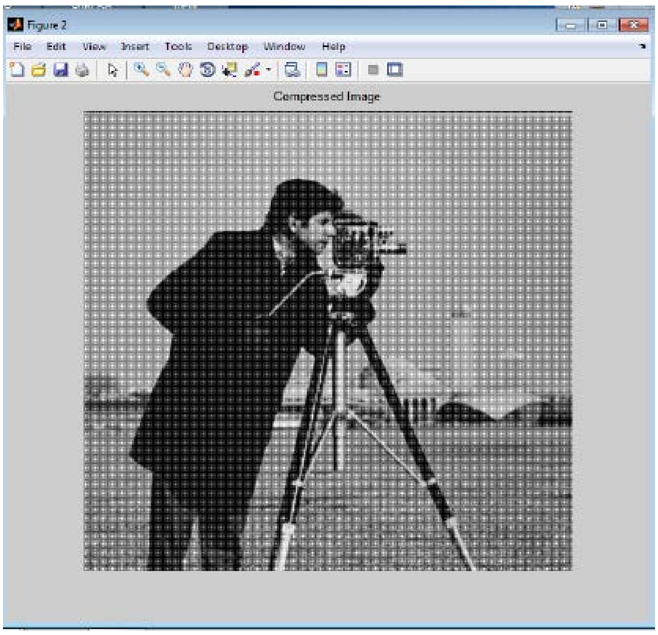

Fig 3: Shows that the Result window for compressed Image with cameraman image using previous methods.

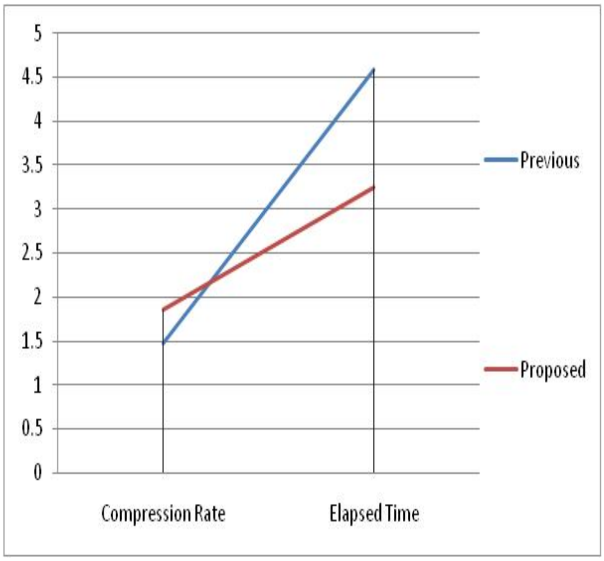

Fig 4: The above figure Show the comparative result analysis using cameraman image for the image compression techniques, with include the performance parameter is Compression Rate and Elapsed Time value with applied the previous and proposed method.

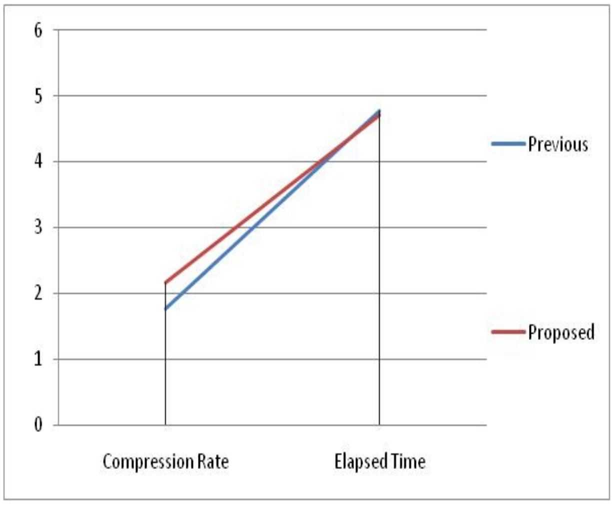

Fig 5: The above figure Show the comparative result analysis using Baballon image for the image compression techniques, with include the performance parameter is Compression Rate and Elapsed Time value with applied the previous and proposed method.

V CONCLUSION AND FUTURE SCOPE

Image compression is an implementation of the data compression which encodes actual image with some bits. The purpose of the image compression is to decrease the redundancy and irrelevance of image data to be capable to record or send data in an effective form. In foregoing years, image compression has become fascinated and vital field. In these past years, many researchers gave many techniques of image compression. In this paper, foremost compression techniques and the quality estimation parameters are reviewed. Here our proposed methods give better parameters evaluation values than the previous techniques.

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