A Novel Image Encryption Approach using Matrix Reordering

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Abstract: - Transmission and storage of multimedia data like audio, video, and images over the Internet has increased in today's digital communication. Among the different multimedia data, images are transmitted and used very often. It is essential to protect the multimedia data from unauthorized disclosure during transmit. A novel approach for encrypting digital images using Matrix Reordering (MR), a kind of scanning, and simple XOR operation is proposed in this paper. The MR is applied to permute the pixel positions and the XOR operation is done to diffuse the pixel values. The bitwise XOR operation is performed using pseudorandom numbers generated by the linear congruential method. The image encryption algorithm evaluation parameters such as histogram, correlation, cut test, dispersion test, visual testing, and speed test have been conducted using the suggested method, and the results are analyzed. The analysis shows that the proposed system is resistant to statistical and differential attacks, and could be used in real-time applications to provide confidentiality service for images with less computational overhead.

Key-Words: - Information Security, Image Encryption, Matrix Reordering, Scan Pattern, Image Histogram, Image Correlation, Differential Attack.

1 Introduction

Information security has become a very critical aspect of modern computing systems to protect data from unauthorized access. Securing sensitive information has gained significant importance in the recent years, and security is an important issue in communication and storage. Approximately 20 million photos are viewed and 3,000 images are uploaded on Flickr per minute and 350 million photos are uploaded per day on Facebook. The security of digital images has become essential due to the rapid evolution of the Internet in the digital world and numerous image encryption methods have been proposed to secure digital images.

The conventional algorithms like Data Encryption Standard, International Data Encryption Algorithm, and Advanced Encryption Standard have certain limitations in multimedia data encryption and there is a need to develop specific encryption methods for multimedia data. Position change, value transformation and visual transformation are the different types of image encryption methods introduced by numerous researchers [2, 5, 8, 9, 13]. Chaos based image encryption using wavelet transforms, vector quantization, and random phase encoding for color image encryption are some of the existing image encryption algorithms available in the literature [1, 3, 6, 14]. The advantage of an image encryption over traditional text encryption is that the decrypted image is tolerant with small distortion due to human perception.

1.1 Scan Methodology

The image scanning is a formal language-based two-dimensional spatial-accessing methodology which could efficiently specify and generate a wide range of scanning paths or space filling curves. The scan based pixel permutation and block transformation is a widely used technique for image encryption [2, 8]. Algorithms used to encrypt text messages are not sufficient to encrypt images due to the reasons like (a) image size is always greater than text messages and (b) conventional algorithms take a long time to encrypt digital images.

The objective of this paper is to propose a novel image encryption method based on scan methodology and simple XOR operation. The scan path is derived from the concept of matrix reordering and the random bit stream to perform XOR operation is obtained using Linear Congruential Generator (LCG).

A Novel Image Encryption Approach Using Matrix Reordering

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Novel Image Encryption Technique Louis Tanach,2011 *A Novel Color Image Encryption Algorithm Based on Genetic Recombination and the Four-dimensional Memristive Hyperchaotic System* ,2016 Abstract Recently many image encryption algorithms based on chaos have been proposed Most of the previous algorithms encrypt components R G and B of color images independently and neglect the high correlation between them In the paper a novel color image encryption algorithm is introduced The 24 bit planes of components R G and B of the color plain image are obtained and recombined into 4 compound bit planes and this can make the three components affect each other A four dimensional 4D memristive hyperchaotic system generates the pseudorandom key streams and its initial values come from the SHA 256 hash value of the color plain image The compound bit planes and key streams are confused according to the principles of genetic recombination then confusion and diffusion as a union are applied to the bit planes and the color cipher image is obtained Experimental results and security analyses demonstrate that the proposed algorithm is secure and effective so that it may be adopted for secure communication **A New Encryption Algorithm for Image Cryptosystems** Min-Shian Hwang,Chin-Chen Chang,Chen Tung-Shou,1996 Image Encryption Using Random Sequence Generated from Generalized Information Domain ,2016 Abstract A novel image encryption method based on the random sequence generated from the generalized information domain and permutation diffusion architecture is proposed The random sequence is generated by reconstruction from the generalized information file and discrete trajectory extraction from the data stream The trajectory address sequence is used to generate a P box to shuffle the plain image while random sequences are treated as keystreams A new factor called drift factor is employed to accelerate and enhance the performance of the random sequence generator An initial value is introduced to make the encryption method an approximately one time pad Experimental results show that the random sequences pass the NIST statistical test with a high ratio and extensive analysis demonstrates that the new encryption scheme has superior security **A Novel Image Encryption Scheme Based on Kepler's Third Law and Random Hadamard Transform**

,2017 Abstract In this paper a novel image encryption scheme based on Kepler s third law and random Hadamard transform is proposed to ensure the security of a digital image First a set of Kepler periodic sequences is generated to permutate image data which is characteristic of the plain image and the Kepler s third law Then a random Hadamard matrix is constructed by combining the standard Hadamard matrix with the hyper Chen chaotic system which is used to further scramble the image coefficients when the image is transformed through random Hadamard transform In the end the permuted image presents interweaving diffusion based on two special matrices which are constructed by Kepler periodic sequence and chaos system The experimental results and performance analysis show that the proposed encrypted scheme is highly sensitive to the plain image and external keys and has a high security and speed which are very suitable for secure real time communication of image data   **New Methods of Matrix Encryption** Walker White (M.),1993

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