

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).

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