Journal of The Gujarat Research Society
ISSN: 0374-8588
Volume 21 Issue 13, December 2019

IMAGE ENCRYPTION TECHNIQUE BY USING CHAOTIC ECONOMIC MODEL: A COMPREHENSIVE REVIEW

Dr. Raghu N
Assistant Professor, Department of EEE, Faculty of Engineering and Technology, Jain (Deemed-to-be University), Ramnagar District, Karnataka – 562112
Email Id: raghu1987n@gmail.com.

Abstract

Owing to their complex dynamic actions, such as bifurcation and instability, dysfunctional economic systems have gained a lot of coverage in literature. A few academic studies have been performed recently on the use of these systems in cryptographic algorithms. A new image encryption algorithm based on a chaotic economic map is proposed in this paper. An implementation of the suggested algorithm is carried out on a simple image based on a chaotic map. The results obtained show that with the same security keys, the proposed algorithm can successfully encrypt and decrypt the photos. The security analysis is encouraging and shows that the encrypted images have good entropy of information and very low coefficients of correlation and random-like behaviour of the distribution of the grey values of the encrypted picture

Keywords: *Chaotic, Encryption, Economic Model, Image compression, Protection.*

I. INTRODUCTION

One of the problems of the contemporary world is the protection of digital information in wireless and wired communication media, such as Wi-Fi and Ethernet. Today, as opposed to previous decades, progress in science and technology makes our lives simpler, and history shows that this phase of giving comfort and ease pervades all facets of human lives [1]. One of the grounding breaking discoveries by Claude Shannon in 1948 is the concept of converting any analogue information such as text, image, audio and video into digital bit streams. Shannon put forward the notion that it could be transmitted without error once information becomes digital. Digital storage devices such as hard drives, CDs and USBs contributed directly to this groundbreaking idea. Data privacy and copyright protection have become important concerns in the digital world [2], [3].

Journal of The Gujarat Research Society
ISSN: 0374-8588
Volume 21 Issue 13, December 2019

Figure 1: Illustrates the real and encrypted images.

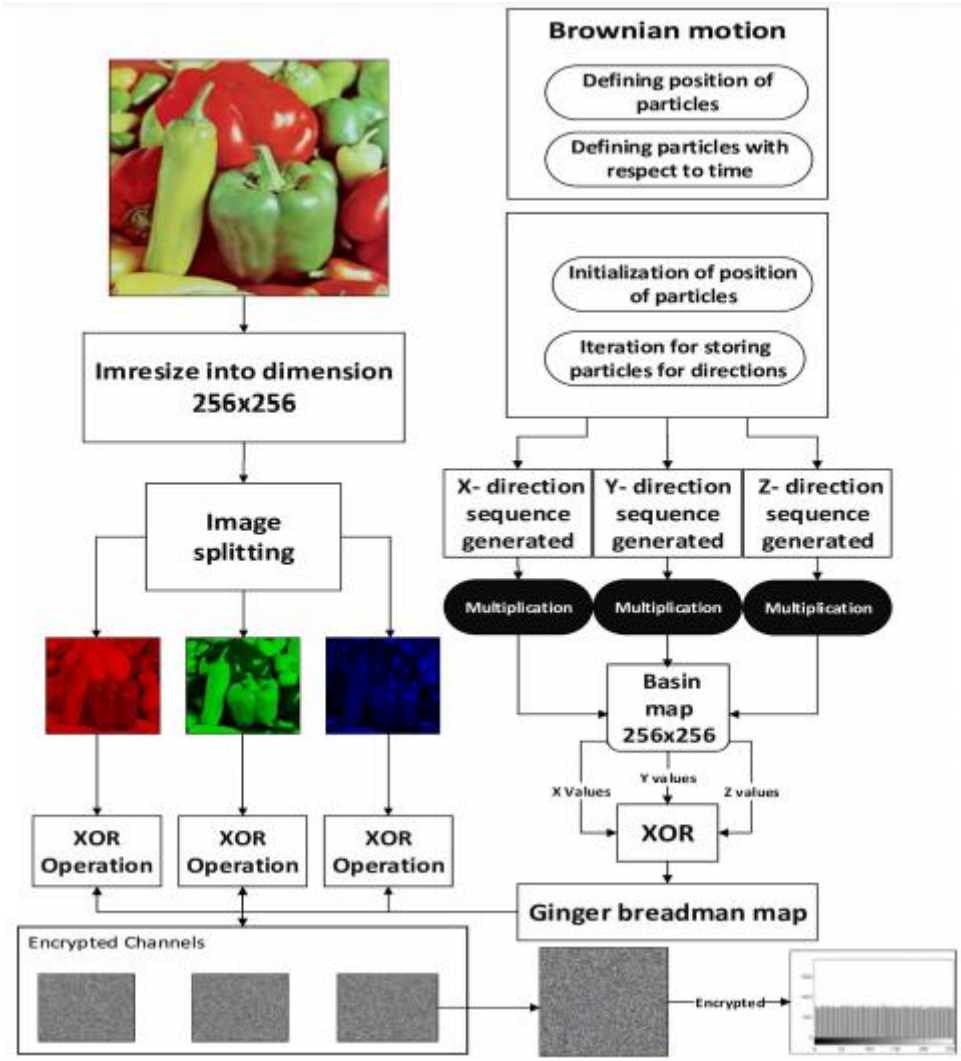

Figure 2: Illustrates the flow diagram of the presented algorithm for safe communication

$$MSE = \frac{\sum_{i=1}^{H}\sum_{j=1}^{W}[P(i,j) - E(i,j)]^2}{W \times H}$$

$$MAE = \frac{1}{W \times H}\sum_{i=1}^{H}\sum_{j=1}^{W}|p(i,j) - E(i,j)|$$

$$E(x) = \frac{1}{N}\sum_{i=1}^{N} x_i$$

$$D(x) = \frac{1}{N}\sum_{i=1}^{N} (x_i - E(x))^2$$

$$cov\,(x,y) = \frac{1}{N}\sum_{i=1}^{N} (x_i - E(x))\,(y_i - E(y))$$

$$r_{xy} = \frac{cov\,(x,y)}{\sqrt{D(x)}\sqrt{D(y)}}$$

$$\sqrt{D(x)} \neq 0, \sqrt{D(y)} \neq 0$$

$$NPCR = \frac{1}{M \times N}\sum_{i=1}^{M}\sum_{j=1}^{N} D(i,j) \times 100\,\%$$

$$UACI = \left[\sum_{i=1}^{M}\sum_{j=1}^{N} \frac{|C1(i,j) - C2(i,j)|}{255}\right] \times \frac{100\%}{M \times N}$$

$$D(y) = \frac{1}{K}\sum_{i=1}^{K} (y_i - E(y))^2$$

The correlation coefficient is another essential constraint to ensure that how much efficient is the encryption algorithm [4].

$$r_{x,y} = \frac{C(x,y)}{\sqrt{D(x)}.\sqrt{D(y)}}$$

Where $C(x,y)$, $D(x)$ and $D(y)$ can be evaluated by using the following equations [5].

$$C(x,y) = \frac{\sum_{i=1}^{K}(x_i - E(x))(y_i - E(y))}{K}$$

$$D(x) = \frac{1}{K}\sum_{i=1}^{K} (x_i - E(x))^2$$

II. LITERATURE REVIEW

An analysis was carried out on the algorithm of digital image encryption based on chaos and enhanced by Zhang et al. Encryption technology has been developed rapidly in recent years and several methods of image encryption have been put forward. A modern encryption method for images is the chaos-based image encryption technique. It uses random sequence chaos to encrypt images, which is an effective way to deal with the intractable issue of easy and highly secure image encryption. However, there are some deficiencies in the Chaos-based image encryption technique, such as the limited accuracy issue. This paper studies

chaotic encryption, DES encryption, and a mixture of image encryption algorithms and simulates these algorithms to define the holes by analyzing the algorithm.

III. DISCUSSION AND CONCLUSION

We have introduced a new encryption and decryption algorithm for images in this paper, based on a chaotic economic map. This work is the first attempt, to the best of our knowledge, to apply a chaotic economic map to the construction of chaotic cryptography. All the simulation and experimental results have shown that the image encryption and decryption algorithm proposed has (1) very wide key space 1084, (2) high sensitivity to all hidden keys, (3) knowledge entropy close to the ideal value 8, and (4) low coefficients of correlation close to the ideal value 0.0. These findings therefore contribute to the efficiency and robustness of the image algorithm proposed. Furthermore, the findings lead us to conclude that other well-known chaotic economic systems such as duopoly and tripoly economic systems are being implemented

IV. REFERENCES

[1] G. Bhatnagar and Q. M. Jonathan Wu, "A novel chaos-based secure transmission of biometric data," Neurocomputing, 2015, doi: 10.1016/j.neucom.2014.06.040.

[2] X. Li et al., "Secret shared multiple-image encryption based on row scanning compressive ghost imaging and phase retrieval in the Fresnel domain," Opt. Lasers Eng., 2017, doi: 10.1016/j.optlaseng.2017.04.005.

[3] M. Khan and T. Shah, "A Literature Review on Image Encryption Techniques," Autoimmunity Highlights. 2014, doi: 10.1007/s13319-014-0029-0.

[4] S. Kumar, A. Gupta, and A. Arya, Triple Frequency S-Shaped Circularly Polarized Microstrip Antenna with Small Frequency-Ratio. International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)/ISSN(Online): 2320-9801, 2016.

[5] E. N. Kumar and E. S. Kumar, "A Simple and Robust EVH Algorithm for Modern Mobile Heterogeneous Networks- A MATLAB Approach," 2013.