Poster: Color Image Encryption in YCbCr Space

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Abstract—Nowadays, with the development of Internet technology and the improvement of safety awareness, image encryption technique has become very important, especially for color image encryption. The direction of research is focused on the RGB color space. There are few researches in other color spaces, such as HSVL*a*b*, YCbCr. In this paper, we propose a color image encryption method in YCbCr color space. There is much information in Y channel but little information in Cb and Cr channel. Using this feature, we choose different encryption schemes. We first convert the color space from RGB to YCbCr. Then we encrypt the three channels separately. In Y channel, with Arnold cat map, we can do the preliminary image confusion, and then we use three-dimensional Lu chaotic map to do the further image diffusion. In Cb and Cr channels, we use DNA encoding and 1D Logistic chaotic map. Experimental results show that our color image encryption works well, our method in YCbCr space can compare with the RGB and L*a*b* space, and can resist brute-force attacks, differential attacks. The most prominent point is that the speed of encryption and decryption is much faster.

I. Info. of Previously Published Papers

A. Full bibliographical citation

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B. Online Link

IEEE Link

http://ieeexplore.ieee.org/document/7752646/

Non-official version link

http://jinxin.me/downloads/papers/021-WCSP2016c/WCSP2016-YCbCrEnc.pdf

All figures can be found in our WCSP Presentation

http://jinxin.me/downloads/papers/021-WCSP2016c/WCSP2016-YCbCrEnc-presentation.pdf

II. Introduction

With the rapid popularization of cameras, video cameras, smart phones, images, video, 3D and other visual media, big data is rapidly formed, more and more frequent exchange of digital images in the social network is using, the security environment in the cloud of digital images handle network security has become a new challenge to be solved. For example, the digital image obtained through the network will be used for illegal purposes, related to security issues of national security, social security, personal privacy and other aspects. image encryption is the important prerequisite of image retrieval security, video security, video surveillance security, video processing security and other visual media security applications. Therefore, security of image encryption technology became extremely important.

As color images encryption is concerned, many other color spaces except RGB color space, such as HSV, L * a * b *, YCbCr, etc., have not been fully excavated and utilized. This paper designed and implemented a new color image encryption method in the YCbCr color space. And respectively compare the encryption method to that in RGB and L * a * b * space and then give the results of the analysis.

III. Related Work

Chaos encryption technology has been studied for some time, First, because of the features of chaos, such as sensitivity to initial conditions and system parameters, pseudo-randomness and ergodicity, etc. It can be applied to image encryption field due to the high complexity of chaotic systems, and it can improve the image encryption security and reliability. At present, color image encryption method, is almost all in the classic RGB color space. Since the three channels of RGB space has a strong correlation, there are some problems for this color image encryption algorithm, in the image encryption process, when take the operation for each pixel ,it will have the same input and output. It resulted in the redundancy of cryptographic operations, so its time efficiency is not satisfactory, which would to be further improved. There is little research in other color spaces, Jin studied selective encryption on the L * a * b * space [1] before, the encryption and decryption works well, but the speed of encryption and decryption is relatively slow, which promote us to search for more faster encryption method or in other color spaces.

IV. The Proposed Method

In this paper, we encrypt the image in the YCBCr color space, draws on the L * a * b * space selective encryption method [1], we use sophisticated encryption methods in the Y channel contained a large amount of information while simple

encryption methods in the Cb and Cb channels contained little information. Our experimental results show that the effect is equally good encryption, and prominent advantage is much faster encryption and decryption speed than that in L * a * b * space.

V. EXPERIMENTAL RESULTS

We use plenty of plain images to test our method, All the encryption results can be correctly decrypted to the original plain images with the correct keys. The simulation results are quite satisfactory.

A well designed image encryption scheme should be robust against different attacks, such as brute-force attack and statistical attack. We analyze the security of the proposed encryption methods using various images.

VI. CONCLUSION AND DISCUSSION

In this paper, we use a selective encryption method in three channels of YCbCr space. In Y channel, we use 2D Arnolds cat map and 3D Lu Map. In Cb and Cr channels, we use 1D Logistic map and DNA encoding. Thus the encryption and decryption effect is safe, reliable and fast, which can be comparable with RGB and L*a*b*. The most prominent is that the speed is much faster than both RGB and L*a*b*.

In future work, we will utilize the fast speed of the YCbCr method and continue to improve the encryption algorithm to have a better and faster way.

REFERENCES

[1] Xin Jin, Yingya Chen, Shiming Ge, Kejun Zhang, Xiaodong Li, Yuzhen Li, Yan Liu, Kui Guo, Yulu Tian, Geng Zhao, Xiaokun Zhang, and Ziyi Wang, Color Image Encryption in CIE L*a*b* Space, International Conference on Applications and Techniques for Infor-mation Security (ATIS) 2015, Beijing, China, 2015.11.4-11.6