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Analysis of Various Gender Detection and Protection Techniques

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***Abstract**: Female feticide is considered by many as a crime against humanity. Most of the countries like India, China facing the problem of female feticide that will affect the sex imbalance ratio and decrease the women population in these societies. Due to the rise in the demand of fetus information security, and patient information security, Information protection plays a very important role in the medical field. I had done the literature review on existing gender detection and protection work from 1999 to 2017 and also given general introduction about gender detection and encryption.*

Keywords— Cryptography; Gender detection; Partial image encryption; Security

1. INTRODUCTION

Over 163 million females have been selectively aborted since 1980 and around 5.3 million female-selective abortions occur in each year. The rate of female sex abortion occurs at high rate in China, India, America, South Korea. In the world population 45% of the people lives in the societies with large male to female ratios. Women's status is lowered in society due to the large sex imbalance ratio [1].

95% of pre-natal sex-detection occurs via the use of ultrasound imaging. The portability, decreasing cost, and increasing accuracy of ultrasound equipment have led to the collapse of private clinics in India capable of determining fetes sex. A study in the Indian state of Haryana, shows that although parents desire to have a male child, this "desire" does not translate into female feticide unless it is aided by technology. Locations with a higher number of ultrasound machines also have shown an increased number of female feticides. In urban areas of India with a high density of

ultrasound machines, there exists greater sex-imbalance in the population [2].

Figure 1 shows the wide classification of various image encryption techniques. Depending on application any one of the image encryption approach can be used to protect the Gender information in the ultrasound machine.

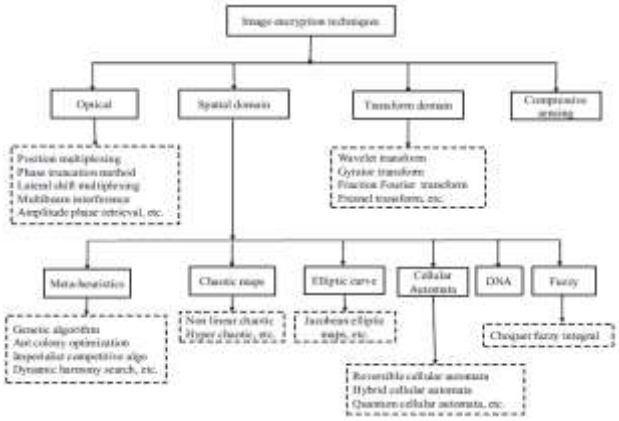

Figure 1: Classification of image encryption techniques

2. RELATED WORK

Due to advancement in the communication and internet applications there are many ways to forward the information from one place to another place. So in order to protect that information from third party, need of security apparently required. Encryption provides the one way of security. For some particular applications like medical and military, no need of complete image encryption. We can go with some low level encryption methods like selective image encryption and partial image encryption. Selective image encryption (SIE) encrypts only specific portion of interest in the original image where partial image encryption (PIE) randomly encrypts the percentage of pixels throughput the input image.

Z Efrat, and Akinfenwa .et al introduced the fetal gender determination during first trimester. During 11-14 weeks of pregnancy, this method capable of identify the sex occurring using ultrasound [3].

G Clif Lamb and Paul M Fricke developed an ultrasonography, which is the best method to analysis the fetal sexing which gives more information about the uterus, fetus, ovary, corpus and follicles with more accuracy [4].

X Yang, MChen, HFWang described learning curve method measuring the fetal fronto maxillary facial angle after achieving number of cases during 11-13 weeks of gestation, Which is similar to sonographer to determine a true midsagittal plane[5].

Hirut Bisrat and Sifrash Meseret Gelaw describes the duty of ultrasound machine while recognizing the fetal sex. This method is relatively easy and noninvasive [6].

Haris Godil, Raj Shekhar, and Sonya Davey developed a novel method for fetal sex feature identification and protection. Ultrasound image input to the method and that image undergo several processes to detect and localize the genitalia and at last blurred that particular region to protect sex detection. Window concept used for detecting the feature using classifier [7].

Nidhi Taneja, Balasubramanian Raman, and Indra Gupta proposed cipher technique operate in frequency state with the help of wavelet transform. Image divided into several frequency bands. Encryption applied to sub band which got significant information that will save computational time and resources [8].

H T Panduranga and SK Kumar introduced a concept of SCAN patterns and mapping image. Different mapping image are obtained from different SCAN patterns. Mapping pixels are replaced into original image, whose pixel value act like a row and column value of mapping image [9].

Gaurav Bhatnagar and QM Jonathan Wu explain the concept of SVD and pixel of interest to encrypt selectively the group of pixels in the input image [10].

Ahmed B Mahmood and Robert D Dony explained algorithm which divides the medical image into two parts based on amount of significant and non-significant information namely the ROI-Region of Interest and the ROB-Region of Background. To lower an encryption time AES applied to ROI and Gold code (GC) to ROB [11].

Parameshachari B D, Rajashekarappa .et al introduced the partial encryption of color RGB image. In this method input colour image segmented into number of macro blocks. Based on the interest few significant blocks are selected and encrypted using chaotic map [12].

Zhongyun Hua, Yicong Zhou .et al recommended an cipher technique that uses 2D sine logistic map for pseudo random number generation. Sine logistic map has a several characteristics like periodicity, ergodicity and sensitive to initial conditions. An input image's pixels are rearranged using a chaotic map [13].

Salwa K Abd-El-Hafz, .et al explained the various pixel position manipulation algorithms to encrypt input image. Based on application, six different permutation techniques can be used to get encrypted images [14].

Tao Xiang, Jianglin Sun, and Jia Hu described the medical image full and selective image encryption. In this technique consists of several stages where every stage consists of permutation phase and diffusion phase. With the use of a chaotic map, a block-based concept can be used to permute and encrypt [15].

Kiran, Dr.Parameshachari B D et al discussed how you can get partial encrypted images by generating random images from chaotic images and then adding DNA to them. [16].

3. PERFORMANCE ANALYSIS OF IMAGE ENCRYPTION ALGORITHM

It is necessary to analyze parameter relationships between source and cipher images to determine the most efficient encryption technique. The following parameters are commonly used to analysis efficiency of general image protection techniques.

3.1 Entropy Analysis

A measure of unpredictability in an encryption system is entropy. Entropy can be calculated using the following formula:

$$H(S) = \sum_{i=0}^{2^M-1} P(si) \log_2 \frac{1}{P(si)} \quad (1)$$

Where P(si) denotes the probability of the ith gray level appearing in the image. For a random image, the ideal value of entropy is 8. Predictability is higher if it's lower.

3.2 Mean Square Error (MSE)

By considering the mean of squared difference between the input and encrypted picture, MSE may be determined. The higher the MSE number, the more nose is introduced, and the lower the signal strength. If I1 is the source picture and E1 is the cypher image, then MSE is given by Eq. 2.

$$MSE = \frac{1}{MXN} \sum_{i=1}^{M} \sum_{j=1}^{N} [X(i,j) - Y(i,j)]^2 \quad (2)$$

Where, row and column are shown as h, w, and image X(i,j) is the source image and image Y(i,j) is the cipher image.

3.3 Peak Signal to Noise Ratio (PSNR)

PSNR is a ciphering quality metric. MSE is greater than PSNR, and vice versa. The PSNR number reflects how strong the signal is. In a mathematical sense, as in.

$$PSNR = 10 \log_{10} \frac{255}{MSE} \quad (3)$$

3.4 UACI and NPCR

UACI-Unified Average Changing Intensity and NPCR-Number of Pixels Change Rate are used to measure the sensitivity of the proposed ciphering technique to the source image and key. Eq. 4 is the formula for calculating UACI.

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$$UACI = \frac{1}{N}\left[\sum_{i,j}\frac{|C1(i,j) - C2(i,j)|}{255}\right] \quad (4)$$

Where, m and n denotes the number of rows and columns, respectively, with C1(i,j) and C2(i,j) corresponds to the original image and the cypher image, respectively.

$$NPCR = \frac{\sum_{i,j} D(i,j)}{MXN} X100\% \quad (5)$$

Where, M represents rows and N represents columns and D(i,j) is given by

$$D(i,j) = \begin{cases} 1, C1(i,j) \neq C2(i,j) \\ 0, \quad otherwise \end{cases} \quad (6)$$

where C1(i,j) represents the cipher image and C2(i,j) represents the original.

4. PERFORMANCE COMPARISON OF IMAGE ENCRYPTION SCHEME

The following figure 2 and table 1 give the performance comparison of various image encryption techniques. From the table it can be concluded that some of the existing methods uses the concept of full image encryption and take more computation time to encrypt the image.

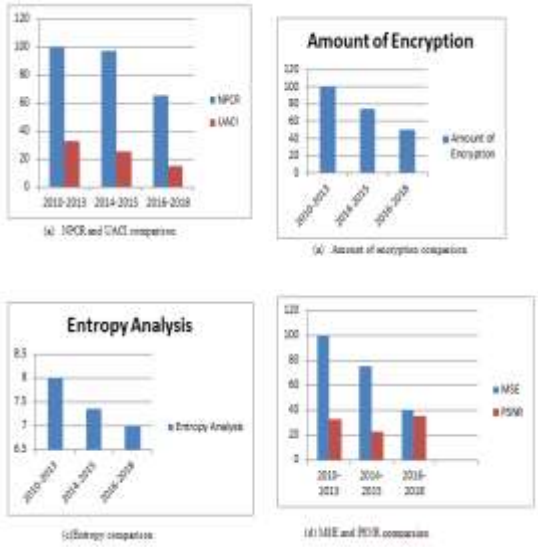

Figure 2: Comparison of various parameters for existing partial encryption scheme

Figure 2 gives the information about how the performance parameters affected to various image encryption algorithms. Early encryption algorithms mainly concentrating on encrypting entire plain image so that performance parameters are approached to their ideal values. As the computational complexity and time considered as important aspects in the present encryption techniques, a selective/partial encryption techniques are used to encrypt only selected part of images. That why from table 1 recent encryption techniques provides smaller performance parameters values. Table 2 explained about comparison for various existing image encryption techniques. From the table 2 we can observed most of the encryption algorithms are used to encrypt entire image that will increases computational complexity and time. Therefore to provide efficient algorithms for better security, selective/partial encryption approach should be employed.

METHODS	ENTROPY	MSE	PSNR	NPCR AND UACI	SPEED	AMOUNT OF ENRCYPTION (%)
[9],[13],[14]	MAX	HIGH	LOW	HIGH	SLOW	FULL
[8]	MEDIUM	HIGH	LOW	HIGH	MEDIUM	PARTIAL
[10],[11]	MEDIUM	MEDIUM	HIGH	MEDIUM	MEDIUM	PARTIAL
[12]	MEDIUM	LOW	HIGH	MEDIUM	LOW	PARTIAL
[15]	MEDIUM	MEDIUM	HIGH	HIGH	MEDIUM	PARTIAL
[16]	MEDIUM	LOW	HIGH	LOW	LOW	PARTIAL

Table 1: Comparison of various existing image encryption technique

5. CONCLUSION

In today's world encryption speed and high security plays important role for medical image encryption techniques. By using a partial image encryption algorithm we can achieve fast encryption time and high security. In this proposed paper we have surveyed different gender detection and image encryption techniques in the span of 18 years (1999-2017). We conclude that each technique has its own set of benefits and drawbacks, and that security is provided such that no one may access the image in the open network. From the literature survey we can conclude that any one of the technique does not having control over the amount of encryption. Hence it is necessary to develop an efficient algorithm which is capable of controlling the amount of encryption as per the requirement and specific application.

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