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Implementation of RSA Algorithm for Ciphering Medical Imaging

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Abstract--In this paper we will present software designed for remote visualization of medical images with data security transfer. This interface is implemented under MATLAB environment. The implementation of the image cryptography system uses the RSA algorithm with 64 bits private key length. The transfer of images in a secure way for medical diagnosis is insured by generating a watermarked key to encrypt the original image. More, we introduced a comparison study between the obtained performances and those computed with other algorithms such as DES and IDEA.

Keywords: RSA, DES, Image Processing.

1. INTRODUCTION

Nowadays, the data can undergo grave modifications (access to the credit cards, the transactions in e-commerce, espionage of the secret information in military domain) especially through transmissions on the internet. Where from, it is necessary to look a robust method to secure the data [1]. The encoding (ciphering) can bring solutions of this problem much more than the watermarking due to difficulties to break the encoding key. It is in this context that is situated the objective of this work which is interested in the study of an asymmetric encoding method applied for medical images by using the RSA algorithm. The objective is also to decipher it even in the presence of various types of attacks [7].

Indeed, the university hospital centers uses and exchange several sizes and formats of images relative to patients whose contents can possess confidential information, whether it is for the level diagnosis or at the personal level. Especially since these given and images can be remotely exchanged if the centres are interconnected by a network LAN

2. Cryptography Principle

The current ciphering techniques use algorithms with symmetric or asymmetric keys [6].

Among the most common we can quote the encoding of Vigenère in a single key, the symmetric algorithm DES with secret keys and the algorithm RSA with public and private keys. The algorithm RSA, at present is the most successful use for ciphering keys and passwords or counts. The key long varies from 64 to 1024 bits [1]. It has the advantage to be strong in the break if the key is rather long and on the other hand, it does not need to pass on the key deprived via the network to the receiver. The principle of encoding is based on an acquisition of the image followed by a compression then a segmentation in blocks of L pixels (in normal mode L = 8 pixels or 64 bits).

Then every block of quantified data is coded by the public key (e, n) of the transmitter according to the algorithm of figure1. At the level of the receiver, the deciphering is made by the private key (d, n) [[2, 3].

3. Results and developed interface

We developed under Matlab an interface in which we implemented the algorithm RSA as well as the module of treatment and compression of image. The image is compressed first of all according to the JPEG standard by DCT [4]. The encoding is made in the field of transformed on blocks of 8x8. Only the coefficient BF will be taken into account to relieve the time of encoding-deciphering and decrease the image size.

At present, we replace the compression DCT method by the wavelets by computing the coefficients (L, H) which will be soft threshold than quantified and coded. The results can end in results (profits) better than those obtained with the DCT. The results are illustrated in figures 3 to 6 with L=8x8 and N=64.

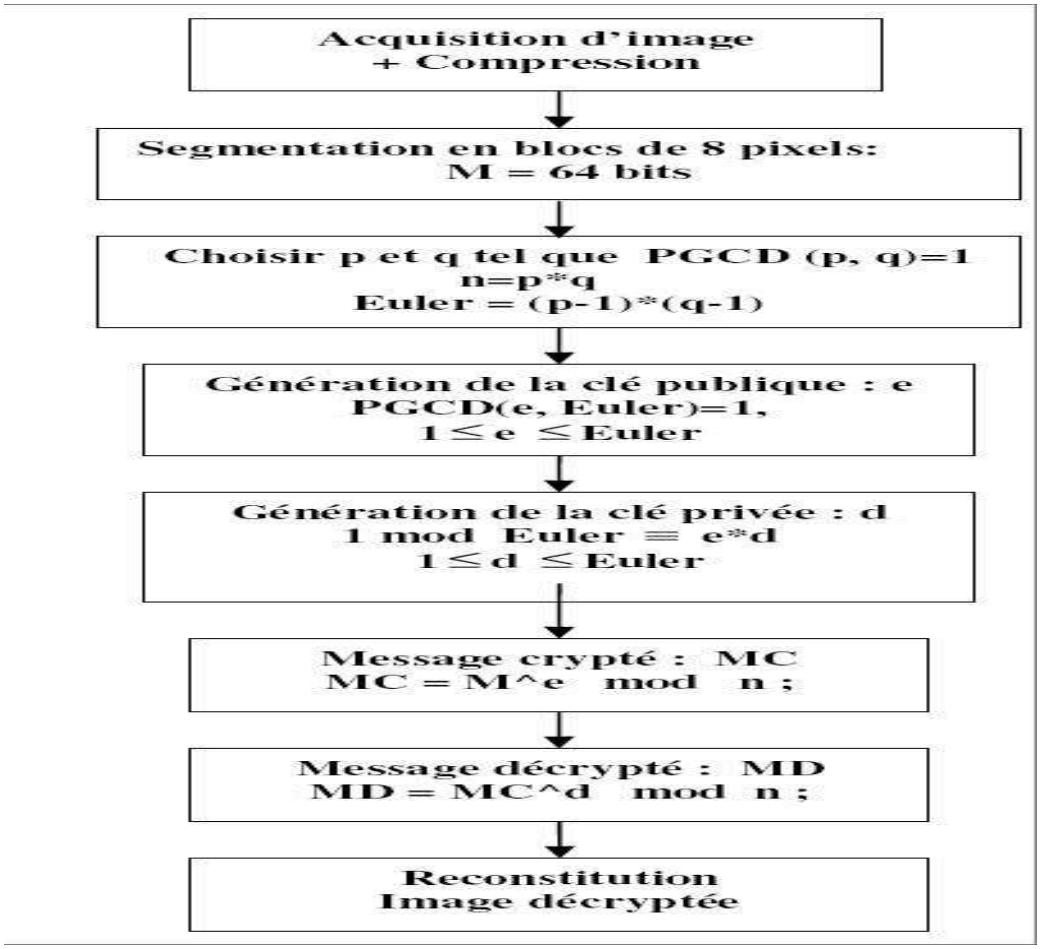


Fig 1 : RSA Algorithm

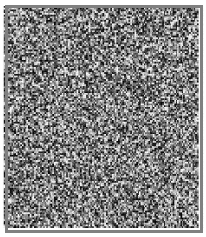
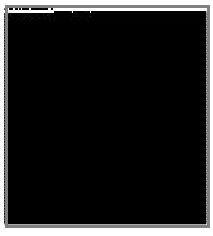
Original Image	Ciphered Image	Deciphered Image	Deciphering error
			

Fig 2: Original and Ciphered images

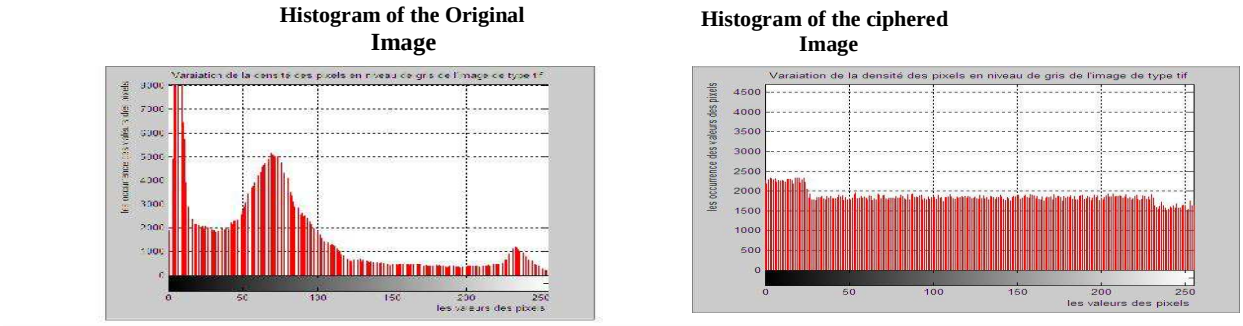


Fig 3: Histogram of the original and ciphered images

Furthermore, we studied the effect of the size of the block L and the key length on the quality of the coded and deciphered image. In the third stage, simulations are made to test the robustness of the algorithm used according to various types of attack in particular during the transmission [8].

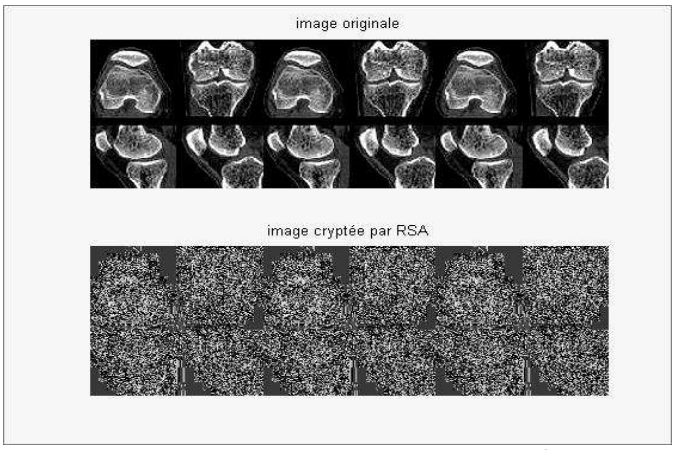


Fig 4:Original and ciphered images for a bloc (L=6 pixels)

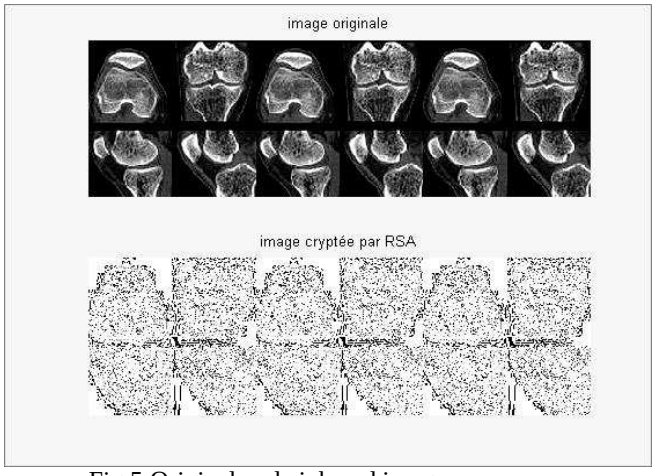


Fig 5:Original and ciphered images for a bloc (L=8 pixels)

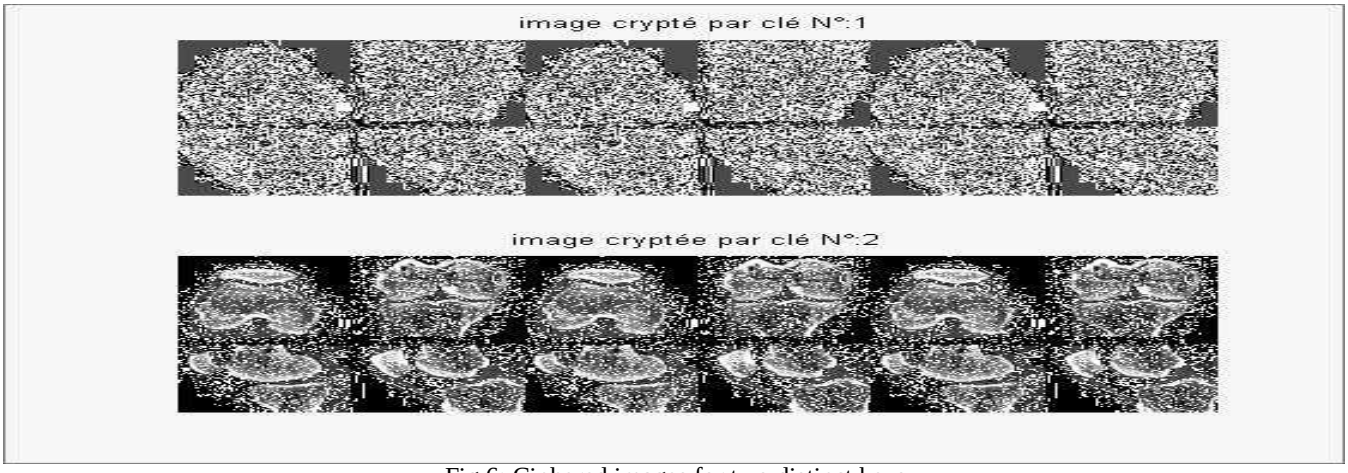


Fig 6: Ciphered images for two distinct keys

Figures 7 and 8 represent the computing times in function of the segmental length L of the image and the ciphering length key.

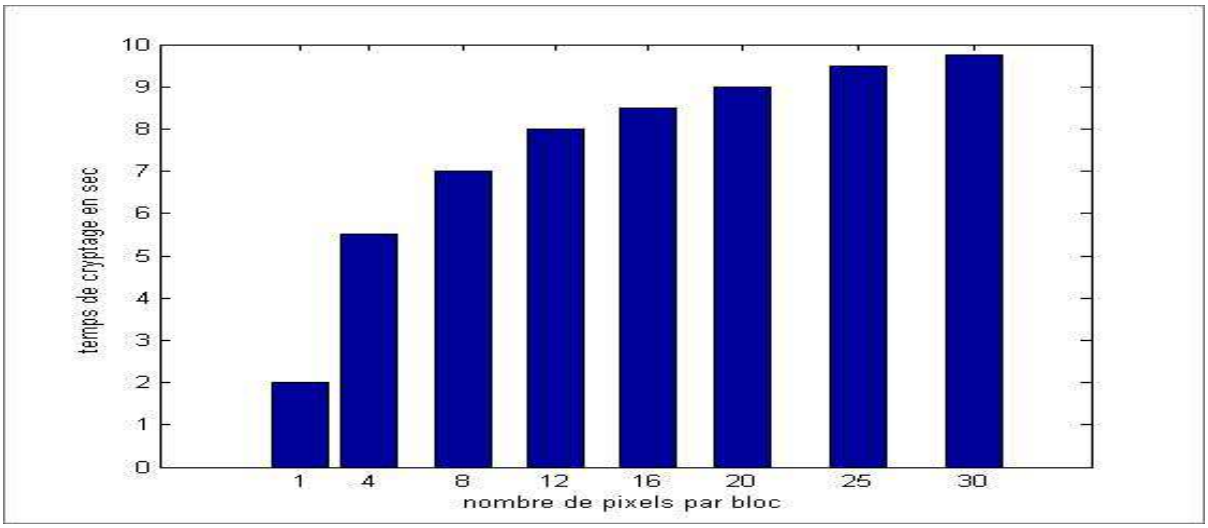


Fig 7: Ciphering time vs. Key length

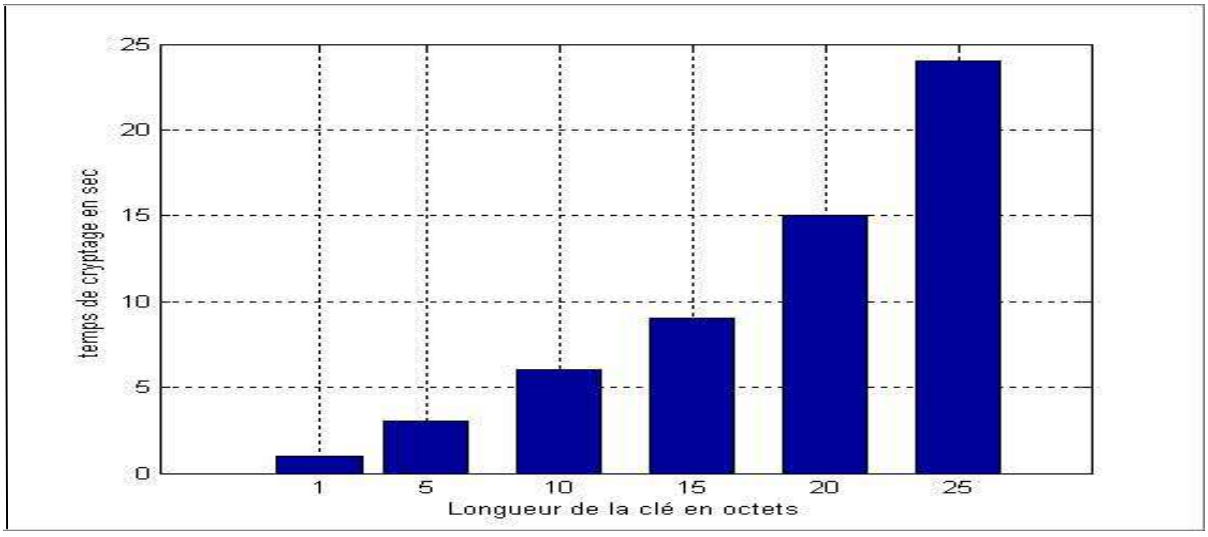


Fig 8: Ciphering time vs. Key length

We notice that the computing time of ciphering/deciphering increase considerably with the two factors (block size and key length). A compromise is necessary to optimize the parameter and the ciphering quality. The simulation results give an optimum for L=8 to 12 pixels as length of blocks and N=1024 bits for the key.

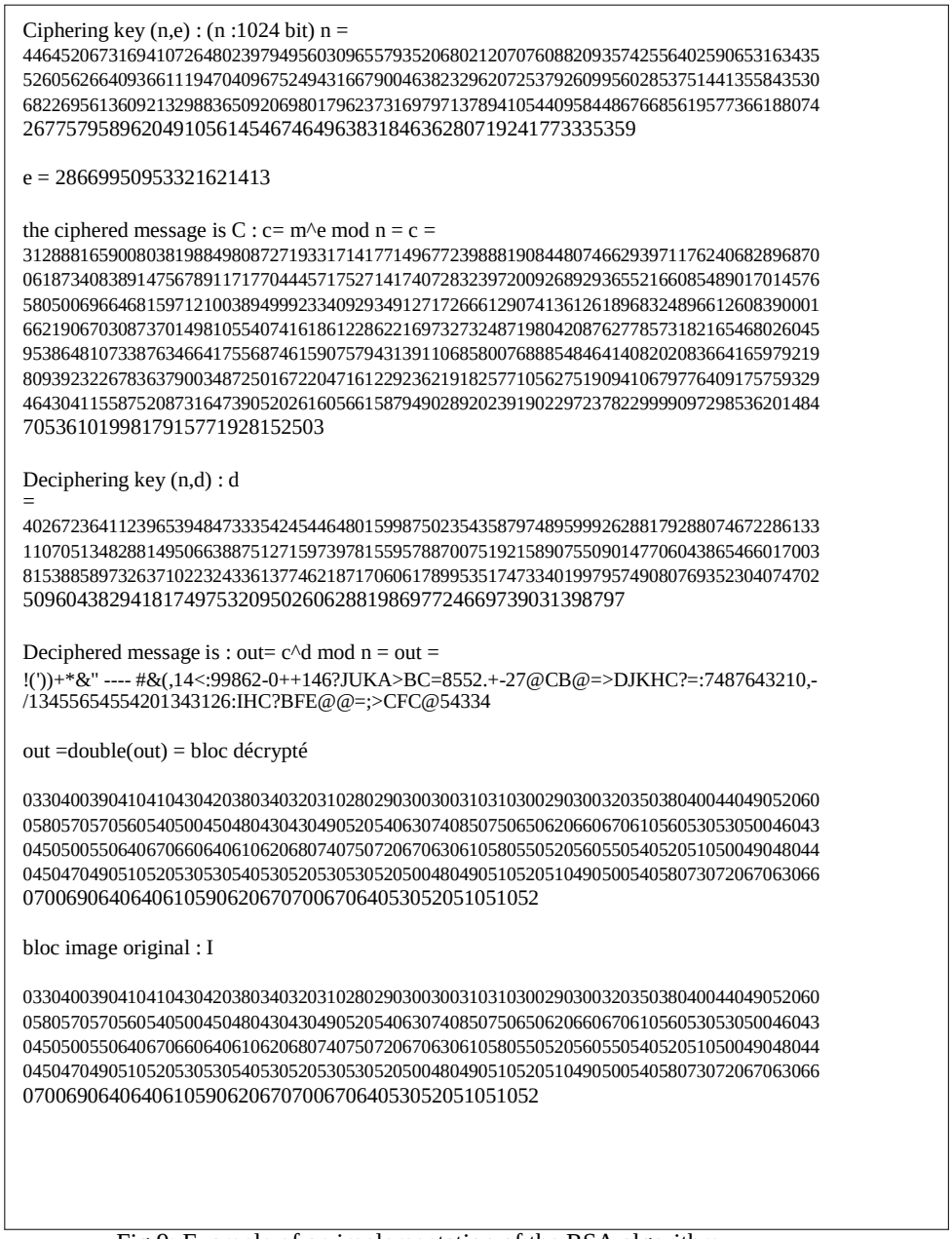


Fig 9: Example of an implementation of the RSA algorithm

4. Conclusion

In this paper, we implemented an algorithm of encoding and ciphering of a digital image based on the R.S.A algorithm and intended for medical applications. This interface was implanted under Matlab. It is based on a pre-processing of the original image based on a JPEG compression followed by a selective encoding and a vectored quantification. The obtained results demonstrate the importance of an optimization of two parameters: The segmented block length and the key length. Thus, we studied the effects of variation of these parameters on the deciphered image quality as well as on the processing time and the flow transmission.

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