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A comprehensive Survey for Hiding Medical Data Based DNA Lossless Technique

Anfal Emad Lafta[1*], Sahar Adil Kadhum[2]

1College of Sciences for Women, University of Babylon, scw869.anfal.emad@student.uobabylon.edu.iq, Hilla, Babel, Iraq

2 College of Sciences for Women, University of Babylon dr.sahar.Adill@gmail.com, Hilla, Babel, Iraq.

***Corresponding author email:** scw869.anfal.emad@student.uobabylon.edu.iq; mobile: 07805348655

مسح شامل لإخفاء تقنية فقدان الحمض النووي المعتمدة على البيانات الطبية

انفال عماد لفتة [1*]، سحر عادل كاظم[2]

1 كلية العلوم للبنات ، جامعة بابل ، scw869.anfal.emad@student.uobabylon.edu.iq الحلة، بابل ،العراق

2 كلية العلوم للبنات، جامعة بابل، dr.sahar.Adill@gmail.com، الحلة ،بابل ، العراق

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ABSTRACT

The health information data includes reports on the patient's condition, including addresses, names, tests, treatments, diagnoses, and medical history. It is sensitive information for patients, and all means of protection must be provided to prevent third parties from manipulation or fraudulent use. The goal of this paper presents studies of safeguard the transfer of sensitive data over an unsecured network using DNA techniques to enhance security. A comparison analysis is used to show the security issues of the various DNA-based data (ciphering, concealing, and compression) techniques that are studied and investigated. Also, in our study is to provide future researchers with the necessary knowledge to conduct data security research to develop or improve DNA-based data- ciphering, compression-hiding strategies that are more reliable, secure, and efficient. Thus, future researchers need to propose a trustworthy DNA-based data (ciphering, hiding, and compression) techniques. The result of our study appears the perceived vulnerability of medical data and health insurance to concerns of security as well as common security issues, also the nature of these common security concerns, for reducing medical data security risks.

Keywords: DNA steganography, Cryptography, Clinical data privacy, DNA compression, Medical Data

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INTRODUCTION

Electronic health record is a type of records digital health that is regular be created or updated as well as disseminated through internet for accurate data collection and facilitate efficient thanks to the proliferation of an intelligent and smart technologies [1] . A patient's EHR is a combination of information around patient maintained by the providers of relevant healthcare, containing of all patients demographics [2], Medical and HER history with other relevant information its sent in online record is vulnerable to unauthorized duplication, tampering or eavesdropping, and other forms of theft because its send in real text [3]. Through todays heavy reliance on internet and digital communication networks, protecting private data are more important than ever [4].

Through, the increasing focus on protecting information has continued, especially in recent years, in more effective ways. It has focused on the main concept of securing data using methods that prevent all adversary attempts from decrypting or seizing any clear data. Here the concept of encryption explains the practice of encrypting data or studying how to encrypt [5]. This data is transferred before it is transferred online to public networks by converting clear data into encrypted data that is incomprehensible and difficult to break, so that authorized and authorized persons can view its contents. This will provide protection for the data and prevent unknown persons from viewing or understanding that data [6]. In light of this, different encryption methods are frequently used because of the many benefits they provide to protect data [7].

Here we must point out that one of the main challenges of encryption operations is the clarity of the encryption on the message [8]. In other words, anyone can notice the presence of encryption on the message because the text will appear in an incomprehensible and suspicious way, which will attract attention and greatly increase the suspicions of attackers who are trying to access real data in different ways. illegal. Therefore, there has emerged a great need for data hiding techniques and methods to address the main challenge in encryption processes, so it is called information hiding. It represents a secret communication method that ensures the presence of confidential data contained in hidden messages transmitted within the environment. This method also provides various techniques and methods [9] for hiding information that depend mainly on including information. within a cover without causing any distortion to its quality. In the methods of steganography, public medium is containing a secret data is called as the cover medium. Data created after performing a steganography is known as steg-data. Authorized person can send the communication uses the set of secret data, known as steg-key, for hide a secret HER inside the cover medium with produce steg-data. Later, the authorized person sends the stego data to the receiver. The approach of steganography is lossy or irreversible if the cover in the medium can't be reconstructed to its real form. A reversible and lossless of approach of steganography successfully reconstructs the cover in medium by errorless. Steganography is a widely applied for providing authenticity and privacy for sensitive data in covert connection.

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Steganography can use for ownership protection, annotation, privacy, copyrighting and authentication at healthcare.

Preprocessing strategies, along with compression methods, can be hired to the enter information to facilitate embedding of bigger numbers of records without compromising the fine of the duvet image. so, once the concealed facts to detected, it is able to be decrypted simply. By development the latest methods, cyberattack strategies also are evolving, making it critical to create a robust encryption scheme that is tough to break.

In light of this days, some other technique for ensuring give up-to-cease protection in healthcare a DNA is used. the use of the organic structure of DNA to keep and transmit the statistics which conceals the hidden statistics and turns into left out because it pertains to the healthcare terminologies. The concept is to use the four-nitrogen base of DNA as code and the records is encoded into DNA series earlier than transmission.

This paper's number one contribution is a primer at the records and assessment metrics of Lossless DNA information (encryption, steganography, and compression). further, the predicted layout targets, goals, methodologies, evaluation measures, and weaknesses are mentioned with the contributions of the surveyed scheme. finally, cutting-edge demanding situations are underscored, and several avenues of ability research that may make contributions to bridging the present gaps in those domain names are highlighted, thereby facilitating.

The following are how the paper is organized: In a section two, we covered why it is necessary to secure medical data. We have outlined what is required for data encryption or compression methods in section three. We introduced the measurements and criteria used to compare the effectiveness of different algorithms in In a Section four, the conclusion is discussed as a final section.

LITERATURE REVIEW

The literature on lossless compression has a wide range of data compression methods and algorithms; different approaches may be available for a given type of data. Before implementing DNA compression using a few technical techniques, First, we will go over a few different approaches to data compression.

Data compression is one of the interesting fields. Data compression reduces storage capacity and data transmission volume, which has an impact on bandwidth use. Furthermore, when transforming plain text into encrypted text. As a result, a massive amount of data is saved. Both the storage capacity and security challenges must be resolved in view of the growing amount of information. This problem can be resolved by compressing the Cipher text using a variety of compression techniques.

The study [9] proposed in his work by the new encryption scheme as a lossless color image to means of DNA sequence operations, two simple improved chaotic systems, and the ciphertext diffusion technology in crisscross mode. Compared with the current DNA-based image encryption schemes, our proposed scheme involves not only DNA-level confusion and

different fusion but pixel-level diffusion, which will enhance the security, complexity, and sensitivity of the cryptosystem. some biological and algebraic operations are constructed for the DNA sequences to promote the application in cryptography. Also, they use exclusive (XOR) operation for DNA sequences is adopted to encrypt and decrypt the digital images. The XOR operation for DNA sequences is performed according to the traditional binary XOR.

The research [10]proposed a proposed that utilizes cryptography and steganography as a hybrid method, for hiding sensitive data for patient by pixels of a medical image. Medical image is selected to be a cover image for lossless compression method as a PNG format. Sensitive patient data, that is examination data and patient's data, encrypted by first step using block cipher and then embedded a ciphertext in the image. This will make it harder to interpret and recognize image when message under attack.

The paper [11]proposed a lossless method for sensitive data hiding and other method for image cryptography by Choas Block for encrypted image. Lossless means when the marked image is considered reliable, in this case the embedding distortion can be all of removed from the marked image afterward embedded method has been extracting. This steps uses features of the pixel difference to embed more data than other random partitions using Block based a sharpness index filtering with refined of a one level wavelet decomposition shifting method to prevent image distortion problems.

In the Ref. [12] proposed Block-chain used FASTA and FASTQ used a lossless compression (BAQALC) method, the lossless compression method that allows for the perfect storage with transmission of an immense amounts of sequence data of DNA that was being generate through NGS. Even, reliability issues and security exist in public DNA sequence data. The proposed solution is envisioned to contribute to providing an efficient and secure transmission and storage platform for next-generation medical informatics based on smart devices for both researchers and healthcare users.

In the Ref. [13] proposed a new method as a robust with lossless color image by encryption method based by DNA sequence operation with single coupled map lattices. First step decompose image in 3 gray-scale level components and they random convert them into 3 DNA matrices through the DNA encoding rules. XOR operation also applied for DNA matrices double times. Then shuffled DNA matrices is moved through 3 gray-scale images depending on the DNA decoding rules. Last step of this work is a diffusion process for further used to change the pixel's values in image by applied key stream as well as cipher image is attained. The generation of key stream by OCML is related to the plaintext. Final experimental results and analysis of security are demonstrate as proposed method has a useful encryption effect also can withstand different typical of attacks.

In the Ref. [14] proposed a lossless Deoxyribonucleic Acid (DNA) series hiding approach that can be used to make sure the authenticity of DNA sequences in the context of cell Cloud-based healthcare systems. Hiding statistics inside DNA sequences results in everlasting information loss in DNA series. consequently, providing DNA sequence authenticity using facts

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hiding is challenging. moreover, present works on DNA records hiding require a reference DNA sequence information to retrieve hidden data. The proposed method hides authentication information inside a DNA sequence, extracts authentication statistics, and reconstructs the DNA collection without any lack of information.

In the Ref. [15] proposed method for image encryption scheme by applied the combination of chaos, hyper-chaos with DNA sequence. For this work the performs 3 steps based on encryption methods. Those are selection level of a hyperchaotic sequence dependents on DNA-shuffling operation with keys image in DNA diffusion methods as well as, hyper chaotic sequence of dependents on DNA shuffling.

In the Ref. [16] proposed Jarvis algorithm as a new method that applied the competitive prediction depend on 2 various classes. Weighted stochastic repeat models (WSR models) with Weighted context models (WC models). WC models can be using a soft blending method, with a decaying forgetting factor of models for substitutional tolerant context. The WSR models use also the soft blending method, with a decaying forgetting factor, between multiple repeat models of specific word length. Both of them applied half-programs to handle inverted repeats. The competitive prediction is dependent on maximum probability on each one of class at a precise moment. The method is trained over a prediction by using a WC. A last probability, for every base is coded by an arithmetic encoder method.

the single pass frame work by able to perform a lossless compression with lossless data hiding of the marked stream, also, applied exploiting a capability of a predictive paradigm. Substantially, in a one pass, the marked with compressed steg-image as obtained, which also can be exactly restored in receiver side based on decompressing with reversibly reconstructing an original unaltered image[17].

proposed a description of a novel reference free sequence of DNA compressor call is DNACSBE. So, the hybrid lossless compressor within 3 stages is called DNAC-SBE. The other bases positions are having a frequency that are lower than Bi in the first replaced with zero's, from starting within the bigger base Bi and also positions of each one of a Bi be replaced with ones. Second, utilizing two separate methodologies, we suggest a novel single-block encoding strategy (SEB) to encode the generated streams. This SEB takes advantage of the nearby bits' positions within the block[18].

proposed the R-pattern algorithm using the dictionary-based compression of DNA sequence and attains a better compression ratio and is tested with the benchmarking datasets from NCBI(National Center for Biotechnology Information)[19].

provide a security framework based on the encoding of deoxyribonucleic acid (DNA), the hyperchaotic equation, and the logistic equation. After encryption, the encrypted secret picture is transformed into shares for distributed storage on cloud-based servers using a Lossless Computational Secret Image Sharing (CSIS) technique. The system is encrypted using DNA and hyperchaotic methods to increase its overall security[20].

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proposed the efficient crypto system for security of medical images dependent on exploiting the advantages of DNA chaos maps with rules. In the present work, logistic chaos map, PWLCM with DNA encoding is employed[21].

present work for lossless IoT data hiding method, proposed work dependent of error correcting codes. they conducted various experiments to demonstrate a performance of him method work. Establish of the experimental results of lossless property dependent on present method while maintaining another data hiding properties[22].

presents a work being carried out by minimize an executing-time with lossless compression rate as a DNA sequence length an increase of the large amount. Protection of DNA sequence of databases for hacker are the challenge question. This work method called lossless DNA sequence compression that was develop dependent of searching for an exact Palindrome with Repeat. Single hidden characteristics of a DNA sequence is approximate repeats, the feature of Palindrome with Repeat was considered by his work. The proposed method applied for minimize capacity of storage with reduce a transmission cost. DNA sequence compression is optimize based on encoding exact palindromes with repeats in match positions. They should be not overlapping of a palindrome with repeat method for DNA sequence compression. By the proposed method, also compression 2 files are produced library and compressed files. Library file acts is the providers and signature security. Characters set of palindrome with repeat method also act as the provide strong data security with private key[23].

presents the new method for reference dependent of lossless compression, so they proposed DNA sequences stored in FASTA format that can be act in the layer above of gzip compression. several experiments are performed for evaluate his method and experimental results present that is be able for obtain promising ratios of compression to saving up of 99.9 % reaching and space of gain at 80% for some plant genomes. The proposed method in this work was succeeds a performing of compression at the acceptable time[24].

propose a lossless quality score compression dependent of adaptive of coding order. The main idea of proposed work is traverse a quality score adaptively at a most correlative trajectory based on sequencing process. Based on cooperating and adaptive arithmetic coding with the improved of context strategy, adaptive of coding order was achieves state of the art quality score compression performances and moderate complexity for next generation sequencing data[25].

proposes an image compression-encryption system using Chevrolet transformation for improve quality of compression within reducing of storage space, and the 3-D chaotic logistic map with Tuna Swarm Optimization and DNA encoding for image encryption process. The system is implemented on the field programmable gate array within achieves secure and efficient transmission of data. Experimental analysis shows the reliability and scalability of the technique, with security metrics such as PSNR is 32.3db, SSIM is 0.98, and last 7.9972 information entropy[26].

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Proposed technique uses a hybrid image encryption method for hiding data inside images to be difficult to sense a presence of the data inside image during transmission process. It is combines the LSB method by applied ADO along within method of Canny edge detection to embedding the data of each patient inside medical image. Then subsequently encrypted of each image by applied keys of six various chaotic maps sequentially based on the Xor bits for improve reliability dependent to preventing intrusion. Therefore, encrypted images are further converted to DNA sequence [27].

Present in this work a scheme for divide different of report image based on create the regular cube on layer planes of the fixed length. Any image was rotated at anticlockwise direction, then followed at dimensional column with row and also face swapping, with DNA encoding even perform in this work. The DNA and as well as image cube is combined dependent of chaotic cube during DNA addition, with the couple of random DNA sequences is selection by DNA mutation. following undergoing DNA mutation encoded cube was final decoded by use of DNA[28].

Table 1. Comparisons between previous works locations.

Ref.	Year	Method	Problem	Solution
[9]	2017	encryption of color image dependent of DNA sequences with 2 simple chaotic systems within excellent chaotic performance.	to strengthen a security and cryptosystem sensitivity.	four processes: key streams generation process, DNA sequences confusion process, DNA sequences diffusion process and pixel-level diffusion process
[10]	2017	Integrated components as the generated key randomly, Encryption of sensitive data for patient examination, embedding with selecting process, and last is extracting process for sensitive patient data.	This for make a harder of a recognize or the interpret when security will attack.	Medical images as colored was selection to be cover image in lossless compression in a PNG formatted. Sensitive data, that was of patients' data with examination data are firstly encrypted based on Block Encryption process and also embedded within image.
[11]	2017	RDH is process for recovers the original data afterward of embedded data when removed. Also, imperative method which broadly by medical, military with law forensics imagery. The case of no distortion of unique cover was acceptable. meanwhile first step is presented, RDH as involved	For recover an X-ray images without of any loss for detail after of recovering a patient's personal data.	Embedding distortion also possible removed at totally from the marked images afterward the embedded data has been extracted.

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		substantial investigating attention.		
[12]	2018	BAQALC compression work based on DNA data an initially input. Method subsequently processes by parallel when data input as a multi thread. DNA data (FASTQ) by ASCII characters that were converted to a corresponding integer. That was alphabets / characters converted finally to DNA-optimized LZW.	To compared a decrease based on cost and time should be needed to DNA sequencing, for management of such bigger volume of data is still a problem.	Present solution by envisioned for contribute of providing the secure with efficient transmission and storage platform also in following generation medical data.
[13]	2018	In the first stage of the presented algorithm, convert the original color images I,0 to be red, green, and blue images components and randomly encode by DNA rules. They obtain 3 DNA to Red1, Green1, and Blue1 matrices. By next stage they perform of DNA Xor process based on DNA matrices to product 3 new DNA matrices. Then, decode of DNA matrices to transform it to be color image. Finally, a process of diffusion was applied in image I4 for enhance a cryptosystem security. Thus, they produce an encrypted image C.	proposed algorithm has a good encryption effect and can withstand various typical attacks.	proposed scheme is robust against some common image processing operations such as noise adding, cropping, JPEG compression, contrast adjustment
[14]	2019	present hides authentication data method based on DNA sequence, to extracts authentication data as well as reconstructs DNA sequence and should be no loss of any data.	Hiding data inside DNA sequence results based on permanent data loss for DNA sequence. Therefore, propose work was not blind approached / inappropriate to ensuring security of DNA sequence for	Hides data authentication inside DNA sequence, extracts secure data with reconstructs of DNA sequence to should be no loss of any data.

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			Mobile Cloud.	
[15]	2019	The proposed scheme performs three stages of encryption operations. Those are selection-level hyper-chaotic sequence-based DNA-shuffling operation, key-image-based DNA-diffusion operation, and hyper-chaotic sequence-based DNA-shuffling	There is a major challenging task for used image in the most of networks as hence security of images is very important	The combined chaos and hyper-chaos based of encryption method to secure images. proposed work, by single round of diffusion with multistage of bit plane permutation method were performed to produce of perfect results of encryption process.
[16]	2019	Proposed based on a competitive prediction between weighted stochastic repeat with weighted context. probabilities were redirected to an arithmetic encoder. Also used reference-free method uses a competitive prediction to estimate.	To arrival of big throughput percentage of DNA sequencing method was created a deluge of biological data. So, complete genomes are increasing widely by low sequencing costs of following generation sequencing metagenomics ancient genomes with biomedical applications.	Present work as a method proposed to attains a higher compression ratio than state of the art, the level of competitive of computational resources applied by a balanced and diverse benchmark.
[17]	2019	proposes the single pass framework of lossless compression within reversible data hiding for remote sensing data. It produces a marked and compressed image in a single pass, which can be decompressed and restored or decompressed only. The framework combines data compression with hiding methods, so that be allowing a hiding of a	By lossy compression methods that be achieve a perfect compression ratio than lossless methods, they introduce distortion and make the data usable only by applications where a certain level of distortion is allowed.	To evaluates of a compression performances of the present work by comparing of results achieved with the compression method alone by the results achieved when data payloads are embedded.

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		payload for the input hyperspectral images.		
[[18]	2020	Three steps of a proposed method works within compression / decompression process, DNAC-SEB is an each bit even each block encoding dependent of nucleotide base distribution for each input file.	Based on huge of genomic data that was produced daily, mainly DNA sequences that craving for more bandwidth and storage. So, analyzing, specifically with managing storing these huge of data become a main scientific challenge. by compression can be overcome of these challenges and be more necessary.	A new SEB method dependent for exploitation of each position of neighboring of bits with a block by use 2 different methods.
[[19]	2020	Compression Algorithm for DNA Sequences	For conserving biological method across these spaces. By use a random forest model reduction feature space by overall isolate size with an 80 to 90 % reduction.	Applied of lossless string compression through tokenization of frequently repeated segments of DNA, they reducing of size of an isolates to be counted in k-Mers for classification process. By the proposed work they applied a previously established feature sampling method to dramatically reduce the feature space.
[[20]	2021	The present work as a security method to be manage a huge of data in healthcare application using encryption techniques and secret sharing to enhance the security of medical data	Huge of data analytics in the healthcare application can support medical used to facilitate improvement. By data analysis can clinically image of patients to detect certain medical conditions.	Security method dependent for hyper chaotic equation, logistic equation with DNA sequence encoding. Subsequently, a CSIS lossless method can be using for convert an encrypted secret image to be sharing for distributed storage at a cloud server.
[21]	2021	The proposed method as efficient cryptosystem based on medical images for security approach based on	Medical products as healthcare are connected via network to be	Proposed perfect crypto system for security of medical images dependent of exploiting the advantages of

		DNA rules and chaos maps, ensuring high security and resistance to various attacks.	accessible anywhere and anytime were expected to deal with confidential and critical data like patient medical image. So, encryption of medical images is very important process in healthcare and telemedicine applications.	chaos maps and DNA rules. This work is medical images crypto system as DNA encoding, LCM and PWLCM were processed. The secret key image was generated by applied PWLCM.
[[22]	2022	proposed a lossless method as a bio signal steganography process to be applied for authenticating data sources of patient bio signals. The present work as lossless bio signal steganography method used a Hamming Code-based error correction method.	When attackers or unauthorized persons enter the system, they can tamper with it by entering incorrect data or modifying stored data, the goal of which is to obstruct or sabotage data analysis processes.	The key challenge of developing a steganography images based on IoT data authenticity approach in edge-AI is that the steganography process should be lossless method to ensure the usability of bio signals
[[23]	2022	Authors developed many of compression methods be used individual framework of DNA sequence. For long of DNA sequence the RP seeking engine basically worked on sensitive and fast homology search techniques. For the proposed work matching substring is replacing based on the ASCII code with matching substring also placed in a library file. So, other method was developed in the proposed work for string matching by applied changing string orientation calculating file size etc.	For minimizing a time execution with lossless compression rate of DNA sequence length by increasing in large amount. The challenging question is to be protection a DNA sequence in database from hackers.	compression method was developed based on searching for exact Repeat and Palindrome (RP). called as lossless DNA sequence which is based One of the hidden characteristics of DNA by used approximate repeats, The feature of Repeat with Palindrome also taken for their consideration in this work.

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[[24]	2022	They proposed lossless compression method applied for DNA sequences and stored it in FASTA format which can act as a layer above g-zip file compression.	Genomic sequences of the huge of enormous obtained demand they should be availability a large of storage space in require to be kept for analysis.	DNA sequences stored in FASTA as a lossless compression method was proposed for g-zip file to be applied compression.
[[25]	2023	Present ACO dependent to quality score of compression method. Used 2 contributions of adaptive coding order is adaptive scan order to replace of traditional raster scan require forms a lot of stationary signals. By applied of compound context process with also considers the influence of base change while exploring of potential 2-D correlations between of quality score	Although, a compression method based on DNA bases in recent years has achieved significant improvement but quality score compression is still challenging.	compressor process of lossless quality score based on ACO. the objective of adaptive coding order was traverse of quality score adaptively in the lot of correlative trajectories based on sequencing method.
[[26]	2023	For image de-noising issues with low bandwidth, they proposed encryption method to achieve security during image transmission. They proposed a Chevrolet transformation to reduce storage space, enhance denoising, and improve image compression quality.	During transmission and compression of any image, it inevitably corrupted by noise due to the influence of the transmission channels, other factors and environment resulting in the degradation and damage of digital images.	DNA encoding with 3-D chaotic logistic map and Tuna Swarm Optimization was proposed together for innovative image encryption. They present encryption method by built a Xilinx model generator tool based of a FPGA.
[[27]	2023	chaotic maps with DNA encoding and Least significant Bit (LSB) was proposed as hybrid image encryption method. In the present work a comparison and tested medical images are made with another existing methods to make a detailed analysis. Based on results advantageous of a present work was stated its	Medical image of patient report should be needs to transmitted through hospitals for medical expert's opinions on a critical situation with sharing among chains of hospitals to make a patient data as available	Hybrid method as combines of LSB method with ADO along with a Canny edge detection process. Image will subsequently be encrypted based on keys of 6 various chaotic maps sequentially with XOR function. The output of encrypted image is further converted by DNA sequence based on DNA encoding rule with compressed by applied

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		effectiveness in providing secure encryption and robust of medical data during transmission.	that may be cause a threats and delay to the data.	Bz2 method.
[28]	2023	2-D images of unlimited length and number present in the proposed work by the theoretical capability of encrypting to utilizing an infinitely large cube. The present encryption of image method has been rigorously tested via different experimental simulations and cyberattack analysis, that was views an efficiency with reliability of present method.	For transmitted height quality color medical image through insecure network presents significant security risks which could be threaten patient's data privacy. even burden of limited bandwidth of a communication in network based on internet channel, driving to delayed data transmission.	divides different of images via creating a regular cube through layering planes of a constant length. every image was rotated in the anticlockwise direction, based on column and row also face swapping with DNA encoding for processing. The image cube encoding based on a DNA combined through chaotic cube via DNA addition, and a couple of random DNA sequences are chosen for DNA mutation.

COUNTERMEASURES FOR POWER AND FAULT ANALYSIS

In this section, we benchmark the analysis of all the previous methods related to ciphering, hiding, and compression operations using DNA, especially lossless methods, and reviewing all the sources mentioned in the previous studies section, we can clarify a group of paragraphs related to the analysis of previous methods that can be relied upon in future studies in the field of lossless data compression based on the structure and composition DNA.

For research and studies by researchers Wang, X., Wang, K., and Al-Saiyd, N. An also. Likewise, researchers have adopted their studies and research on the use of DNA in encryption processes, key generation processes, and a small part of compression work, all in the field of work lossless. Where their studies showed high security, and fast encryption speed increases a complexity with cost of a system since it based on operations of exponential mathematical. While through our knowledge of their works, we did not see any preference between them or any differences between their works. But Bartwal, M., & Bharti, R. performance is different from other existing data lossless steganography schemes, which demonstrates the superiority of the search. The image histogram first processes which pixels are selected to hide each bit of secret data, and then through the logistic chaotic map calculates the hiding order of each bit stream. It is not considered a radical solution and an effective treatment for all problems.

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In other studies provided by referring to the BAQALC compression unit, DNA data is entered at the beginning. So, in case of the multi-threaded was inputted, the method will subsequently be processing as a parallel step. DNA sequences with FASTQ files exist in ASCII symbols, that were converted to be a corresponding integer. Which was symbols alphabets or letters are converted. The integers are also calculated using the delta method before last being placed at a LZW optimized for DNA. In this case they must point out that this method requires more tests to achieve a high compression ratio compared to previous methods. As for converting the original color image I0 into components R, G, and B, and encoding the components R, G, and B randomly using DNA coding rules, in the first stage of the presented algorithm. Obtains three DNA arrays R1, G1, and B1. We also perform a DNA XOR function at a DNA array Red, Green, and Blue, resulting in 3 DNA arrays, Red2, Green2, and Blue2. Next, the researchers decoded the DNA arrays Red3, Green3, and Blue3, and converted them in to a color images. In this method, we ensure that they have a system that is robust against some of a widespread image processing methods and algorithms like adding cropping, noise, JPEG compression, and contrast adjustment.

While some methods added the use of DNA in operations by hiding authentication data within the DNA sequence, extracting authentication data, and reconstructing the DNA sequence without losing any information capacity, here their methods used achieved 99 % in a lot of cases with a maximum expansion rate at 0.006 and at in same time They need a real matching rate to show their high degree of work compared to existing methods used in many types of research. Another study in the field of using DNA showed the use of three stages of encryption processes. These are the hyper-chaotic sequence-based DNA shuffling process at the selection level, the key images dependent on a DNA diffusion process, the hyper chaotic sequence dependent on a DNA shuffling process, highly confusion with key space, or randomness of each pixel, and very sensitivity of keys and plain text pixels, robust noise resistance, and lossless encryption.

Pratas, D., et al & Pinho, A., et al. in their method, the researchers used a competitive prediction method for appreciate of better class of methods for use for each code before applying algorithmic cryptography. Both of them, classes of methods also used specified subprograms to handle inverted repeat sequences effectively. From their results they achieve a higher compression ratio than older methods applying the diverse and fair benchmark.

Carpentieri, B, et al. in their proposed method, they use the resulting hyperspectral image for different purposes, as it is not necessary to extract the original data and an acceptable degree of degradation is tolerated. They also carried out a proof of concept of their proposed work to evaluate the effectiveness of their contribution. They also report the experimental results they achieved, which outperform other similar methods according to their experiments and testing of their work.

While some research has lacked of 3 steps during compression or decompression process [18], DNAC-SEB was each bit of each block encryption method dependent on a nucleotide base distribution for each inputted file, which demonstrates rather moderate compression rates, while

other methods such as the DNA sequence compression algorithm do this [19]. The method to better performance with a higher compression ratio is also the case in the method of a security structure to managing huge of data at smart medical using encryption and secret sharing techniques to enhance the security of medical data that has very strong key sensitivity, which is the same as in the method of an effective encryption system for the security of medical images based on DNA bases. And chaos maps, ensuring high security and resistance to various attacks. High security procedures with acceptable processing time.

Rahman, M. S. et al. at their proposed method involves conducting various experiments for prove of an execution of their work. The experimental of proposed results they conducted while testing their work showed a lossless property whereas maintaining another of data hiding properties. From our observations of their work, it is not an efficient and reliable method for operations, so Edge-AI validates IoT data before using it for data analytics.

Researchers have developed several compression methods and algorithms applying a special framework of DNA sequences. At a long of DNA sequences, the RP search engine mainly processed on sensitive and fast homology search techniques. Their proposed method replaces the corresponding substring with an ASCII code and then places the corresponding substring in a library file. Here another algorithm is also developed by them to match the string, change the direction of the string, calculate the file size, etc. The lossless DNA sequencing algorithm uses fewer bits/base for storage and saves execution time new reference-based lossless compression. Other research has suggested another work based on a technology for DNA sequences that was stored as FASTA format that can be also act as the layer on top of g-zip compression. Through their study the results can be clarified that the experimental results about HADC have acceptable and sometimes competitive compression ratio and velocity. As for the quality score of compression technology dependent on ACO. Both ACO contributions applied the adaptive scanning arrangement to replacement of the traditional of raster scanning arrangement which forms a more stable signal. Use complex context modeling that takes into account the impact of fundamental change while exploring potential 2D correlations between quality scores for succeed of a state-of-the-art for lossless of compression performance.

Recent works describe cryptographic schemes for achieving security as a lower bandwidth with images noise removal problems through image transmission. Chevrolet's processing proposal was implemented to improve quality of image compression, with reduce of storage space, as well as to enhance excellent noise reduction quality and low noise. In this study, a hybrid image coding system using the chaotic maps, LSB method, with DNA coding was also tested of medical report and comparisons with another available methods were made for detailed about analysis. Results are useful for a present work, as they indicated its efficiency at providing secure and strong encryption of medical data in medical reports for transfer in digital healthcare purpose. Through all of this, we can say that encryption is strong and secure for medical images in medical reports for transmission in the field of digital health. Their new method has the theoretical ability to encode two-dimensional image at infinite length and number

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through the use of an infinitely large cube. The method of image encryption inside the system was carefully tested through different experimental simulations with electronic attack analysis, that is demonstrates the reliability and effectiveness of the present encryption system. Large key space, high secret key sensitivity, low key management (LKMO).

CONCLUSION

The development of many modern ciphering, hiding, lossless compression, and coding methods well be centered about a healthcare section. For our paper, the thorough dive also made to research on lossless compression based on DNA data was applied to available image encoding methods. Clearly and comprehensively classification for a different image encoding methods in process today by presented in our work. As noticed from the literature survey, a most of an attempts goal at determining the perfect path of image pixels embedding or utilizing a manipulation mechanism via secret data to be improved an image steganography process.

Conflict of interests.

There are non-conflicts of interest.

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الخلاصة

تحتوي قواعد بيانات المعلومات الصحية على معلومات حساسة للمرضى، بما في ذلك أسمائهم وعناوينهم واختباراتهم وتشخيصاتهم وعلاجاتهم وتاريخهم الطبي. وينبغي تأمين هذه المعلومات وحمايتها من التلاعب والاستخدام الاحتيالي من قبل أطراف ثالثة. الهدف من هذه الورقة هو تقديم دراسات لحماية نقل البيانات الحساسة عبر شبكة غير آمنة باستخدام تقنيات الحمض النووي لتعزيز الأمن. يتم استخدام تحليل المقارنة لإظهار المشكلات الأمنية لمختلف تقنيات البيانات المستندة إلى الحمض النووي (التشفير والإخفاء والضغط) التي تمت دراستها والتحقيق فيها. الهدف الرئيسي من هذه الدراسة المقارنة هو تزويد الباحثين المستقبليين بالمعرفة اللازمة لإجراء أبحاث أمن البيانات لتطوير أو تحسين تشفير البيانات المستندة إلى الحمض النووي، واستراتيجيات إخفاء الضغط التي تكون أكثر موثوقية وأمانًا وكفاءة. وبالتالي، يحتاج الباحثون المستقبليون إلى اقتراح تقنيات موثوقة للبيانات المعتمدة على الحمض النووي (التشفير والإخفاء والضغط). تكشف نتائج الدراسة الحالية مدى تعرض البيانات الطبية للمخاوف الأمنية، والقضايا الأمنية المشتركة، وطبيعة هذه المخاوف الأمنية المشتركة، والتأمين الصحي للحد من مخاطر أمن البيانات الطبية.

الكلمات الرئيسية: إخفاء الحمض النووي، التشفير، خصوصية البيانات السريرية، ضغط الحمض النووي، البيانات الطبية

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