Text Steganography in Image depending on Radon _ Barker code Transforms

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Abstract - With the widespread usage of the internet around the world, both public and private data are now widely disseminated on the internet. The security of these online records is a pressing issue that must be addressed immediately. Text watermarking is a technique for adding watermarks to text documents to help preserve their authenticity and credibility. For many years, text watermarking has been a hot topic of research. This paper describes a new method for embedding text in a picture that uses a radon transform-based Barker code to make the device more reliable and ensure that the text is returned without error. The main advantages of this research are the high security and the big capacity of data to be hiding since the use of radon transform is very helpful in extracting the data. All the image noise does not effect on the stego-image except the paper and salt noise effect on Root Mean Square (RMS) since its value is 0.274 and contract enhancement effect on RMS and Mean Square Error (MSE) by the values 0.586 and 0.343 respectively. Also the SSIM value is very acceptable since there is an obvious similarity between the original image and the stego-image (after stegonagraphy process).

Keyword: Barker Code, Radon Transform, Text Watermarking, Image Watermarking.

1 INTRODUCTION

The rapid advancements in information technology, like storage devices, digital content, and communications have all contributed to the development of a vast electronic environment that allows information to be transmitted, replicated, copied, and distributed through digital media without compromising quality. Nonetheless, due to the sheer amount of technology revolution in the online distribution of digital multimedia, such data is subject to cyber-attacks, unlicensed income, and the other risks. [1].
As a result, analysis of data protection, which involves not only encryption but also traffic security, which entails hiding data, is becoming more common [2]. To protect intellectual property rights, recognize ownership, keep an eye on the digital content to make sure it's authenticated and protected, digital watermarking appears to be the most appropriate application. Digital steganography is a type of information concealment technique. It is based on the principle of embedding copyright data in digital data using an algorithm. This copyright information may take the form of text, an image, or a signature, depending on the person's preference [3, 4].

Thus, Watermarking is used to protect the interests of digital media users. Even if an unauthorized copy is made or minor changes are made to the watermarked document, the owner can still prove his original ownership. Watermarking is used to secure the information on the cover. As of now, digital data has infiltrated almost all forms of public media, including audio, video, image, and text. When it comes to information hiding, the text is the least debated of the digital content media. Any type of textual material, such as monographs, documents, and webpages, is considered a digital text. The texts you've uploaded are vulnerable to a number of attacks and copying, making their security and privacy a necessity [5]. In 2016 [6] a new image of watermarking scheme is presented by Dhekra and his group, they suggested the work with the idea of radon transform. The color image is taken the radon domain and they found that The proposed algorithm can resist to geometrical attacks.

This paper concerned with increasing the security of the information to be hiding and increasing the information to be hiding. The hiding information here is Text which denoted to the COVID19 medicine. These objectives can be done in this research by combining the benefit of radon transform with the coding idea. Here the code that will be use is Barker Code. The stego-image (after the hiding text) then will tested by applying different image noise on it.

2 Barker code

Pseudo Random Noise (PN) sequence may also be a periodic. Such sequences are known as Barker sequences. Barker codes, which are subsets of PN sequences, are commonly used for frame synchronization in digital communication systems. Barker codes have length at most 13 and have low correlation sidelobes. Barker sequences are too short to be of practical use for spectrum spreading. A correlation sidelobe is the correlation of a codeword with a time-shifted version of itself. Autocorrelation function of the balanced 11 chip barker code is shown in figure 1. The correlation sidelobe, $C_k$ for a $k$-symbol shift of an N-bit code sequence, $\{X_j\}$ is given by: [6]

$$C_k = \sum_{j=1}^{N-k} x_j x_{j-k} \ldots (1)$$
Where $X_j$ an individually code letter takes value $(+1)$ and $(-1)$, $(0<j<N)$, and side symbols are supposed be zero. The Barker code generation scheme provides the codes that are listed in the table below [7]:

**Table (1):** the Barker codes

| length of code | Barker code                  |
|----------------|------------------------------|
| 1              | [-1]                         |
| 2              | [-1 1]                       |
| 3              | [-1 -1 1]                    |
| 4              | [-1 -1 1 -1]                 |
| 5              | [-1 -1 -1 1 -1]              |
| 7              | [-1 -1 -1 1 1 -1 1]          |
| 11             | [-1 -1 -1 -1 1 1 1 1 -1 -1 1 1] |
| 13             | [-1 -1 -1 -1 -1 1 1 -1 -1 1 1 -1 -1] |

### 3 Radon Transform:

The Radon transform is widely used in tomography, which is the method of generating an image from scattering data collected from cross-sectional scans of an object. If a function represents an unknown density, the Radon transform represents the scattering data obtained from a tomographic scan. As a result,
the inverse of the Radon transform can be used to reconstruct the original density from scattering data, forming the mathematical basis for tomographic reconstruction. Since a Dirac delta function's Radon transform is a distribution plotted on a sine wave graph, the Radon transform data is often referred to as a sinogram. Because of this, the Radon transform of a group of small objects is represented graphically by a series of varying amplitudes and phases of distorted sine waves in computed axial tomography (CAT scan), electron microscopy of macromolecular assemblies, such as viruses and protein complexes, resection seismology, and solving hyperbolic partial unwanted equations, the Radon transform is useful.

For certain set of angles, applying Radon transform to the image \( f(x, y) \) is equivalent to computing the image's projection along those angles. The resulting projection is a line integral, which is equal to the total of the pixel intensities in each direction. As a result, another image \( R(\rho, \theta) \) formed. This is illustrated in Figure2 in this page. It can be expressed in mathematical relationships [8]:

\[
\rho = x \cos \theta + y \sin \theta \quad \ldots (2)
\]

Radon can then be written as

\[
R_{(p,\alpha)} = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} f(x, y)\delta(\rho - x \cos \theta - y \sin \theta) \, dy \, dx \quad \ldots (3)
\]

where \( \delta(\cdot) \) is the Dirac delta function.

**Figure2**: Source and Sensor control are spins around the object's core. The sensor accumulates density of substance through which rays emitted from source travel at each angle \( \theta \). This is done for a specific set of angles, normally starting at \( \theta \in [0;180] \). Since the result will be similar to the angle 0, the angle 180 is not included.

The Radon transforms. image strength is projected onto a radial line positioned at a particular angle. The values along the x-axis, which is rotated at degrees counterclockwise from the x-axis, are known as radial coordinates. The root of both axes is the image's center pixel. The line integral off \((x, y)\) in the vertical direction, for example, is the x-axis projection of \( f(x, y) \). The projection of \((x, y)\) onto the y axis is the
line integral in the horizontal direction. The horizontal and vertical projections for a basic 2-dimensional equation are shown in Figure 5. The general equation of the Radon transform, as shown in the equation, can be used to compute projections along any angle $\theta$ [9].

$$R(x') = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} f(x, y) \delta(\rho - x \cos \theta - y \sin \theta - x') dy \, dx \quad ... (4)$$

$$X' = x \cos \theta + y \sin \theta \quad ... (5)$$

**Figure 3:** Horizontal and Vertical Projection of Simple Function.

**Figure 4:** Geometry of Radon Transforms

4 The Proposed Text-Steganography Scheme:

The proposed system is shown in figure and it can be seen that the addition is the using of radon transform for encoding the text file, then the result of it will embedded with the host encoded image to produce the watermarking image.
4.1 Embedding process:

The method of embedding can be broken down into the following steps:

1. convert the original cover photo to gray of size N*N.

2. apply the Barker code on the cover image which is the original image.

3. apply the radon transform on the text file.

4. embed the text file after radon transform in the Barker code coefficient by using the Leest Significant Bit method (LSB).

5. Finally, use the Barker code invers to constrict the watermarked image's original image.

4.2 Extraction process

The text file can be introduced from the watermarking image by using the extraction process as seen in figure 6.
Figure 6: Block Diagram of The Text File Introduced from The Watermarking Image

The extraction process can be described in the following steps:

1. read the watermarked image of size N*N.
2. apply the Barker code on the watermarked image.
3. extract the water marked text from the code.
4. finally apply the inverse radon transform and read the text file.

5 Results and Discussion

The effect of the embedding algorithm on the cover image is discussed in this section, which uses Peak Signal to Noise Ratio (PSNR) and Entropy to compare perceptual similarity between the original and watermarked photos. To take advantage of the frequency insensitivity of Barker code and Radon transformations, the proposed technique embeds the data using Barker code and Radon transformation domains. The host image Is (corona.png)

cover image a size 512*512 show in Figure 9. On watermarked grayscale images, various image processing algorithms, Rotation, adding salt, pepper noise, and contrast enhancement are only a few examples, and adding Gaussian noise, can be used to determine the extraction quality. Table 2 depicts a variety of various attack styles.

| Parameters      | No attack          | Salt &Paper noise | Gaussian noise | contract enhancement |
|-----------------|--------------------|-------------------|----------------|----------------------|
| PSNR            | 84.8719247400508  | 68.3728292181472  | 92.4513606908782 | 60.6826508360468     |
| SNR             | 47.4330467226491  | 8.47208684683310  | 50.0976501432427 | 23.4950228109067     |
| 'BER'           | 0.00034523010253  | 0.0004711151123046| 0.0003137588500976 | 0.08304119110107     |
| RMS             | 0.05255321893388  | 0.273618801501571 | 0.0246279691658564 | 0.58542154937062     |
| 'MSE'           | 0.00276184082031  | 0.0748672485351563| 0.0006065368652343 | 0.343093872070313     |
| SSIM            | 0.997             | 0.96              | 0.98            | 0.98                 |

It is obvious from Table 1 that the proposed algorithm performs admirably and is resistant to a variety of attacks this is because the Bit Error Rate (BER) is very low. Figure 7 depicts the effect of various noise
levels on the cover image, while Figure 8 depicts the original text file, while Figure 9 depicts the extracted text file and the effect of noise on the text file.

![Image](image1.png)

**Figure (7)** the effect of noise on the Stego-Image a) the original image b) the Gaussian attack c) the poison attack d) the salt and pepper attack and d) the contract enhancement

![Image](image2.png)

**Figure 8:** The Text File After Watermarking
Farther more, the Structural Similarity Index Measurement (SSIM) is very good and acceptable so that the image after steganography process is very similar to the image after steganography process till after adding noise to it. Also as seen in figure (8 and 9), the noise did not effect on the text that embedded inside the cover image; this is because the robustness of radon transform with the aid of barker code for security.

6 Conclusions

The proposed algorithm is based on a stenographic scheme that is used as a protection method for the Covid19 diagnosis and medication. Since it embeds the information within the MRA of the Lung, such as the steganography pattern employing cover image as a host and Covid19 medicine information text as a watermark, this method provides a high degree of reliability and saves time. In this paper, a Radon transform is used for steganography with the help of Barker code to improve protection and combat image noise attacks. The suggested model in this article is to design and simulate a high-secret level with a high-performance steganography algorithm using the standard LSB as an embedding algorithm. When the Stego-Image is compared to the original Image, the Testing program shows that the Stego-Image outperforms it in terms of data concealment. Furthermore, since the MSE is the lowest, HVS cannot differentiate the Stego-Image from the original Image, resulting in a high PSNR with excellent image quality (SSIM) 0.997. As a result, by incorporating Radon-Barker Code and LSB techniques, the proposed approach effectively combined Cryptography and Steganography, resulting in a high-performance and efficient technique that combines the advantages of both methods in terms of high confidentiality and information concealment.

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