

Histogram Based Watermarking using Entropy and DWT with PSO in Digital Images

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Abstract : Watermarking plays a very crucial role in today's world where secrecy is important. Digital watermarking provides a lot of ideas like broadcast monitoring, data authentication, data indexing and so forth. It is a process where few instructions are installed within a digital media like the info introduced develop into the member of media. There are some trade-offs that a digital watermarking scheme essential favorably gratify, such agreements are among opposing necessities of intuitive clarity, robustness against attacks and data capacity. Such trade-offs are investigated from the perspective of theoretic information. In this paper histogram based watermarking is applied by using entropy and DWT with PSO. The approach applied for digital watermarking is verified as an efficient approach by using different parameters like mean squared error, PSNR and SSIM. Experimental results show that the proposed approach is powerful for images comparative to others.

Keywords : Watermarking, Entropy, PSO, DWT, PSNR.

1. INTRODUCTION

A hidden insignificant signal, called 'watermark' is embedded into the initial info in a method that it is continually exist until the content's appreciable character is at level of acceptance. In case of claims from multiple owners, the original holder of the info shows the ownership by derive the watermark from the watermarked content. The digital watermark comprises of authentication codes, or copyright or an essential legend for interpretation of signal [12-15]. These multimedia signals goes unnoticed except when passed through an appropriate detector, then the existence of these watermarks get in notice. A digital watermark is a type of marker secretly inserted in a noise-receptive signal like hearing or picture info and is formerly employed for identifying the copyright ownership of that signal. Watermarking is defined as a process of covering the digital instruction in a carrier signal.

In the watermarking approaches [8-11], different ways are hired to enclose the watermark information in the presenter signal, for example, multiplicatively or additively. A lot of watermarking strategies have been planned in early ten years, for protecting images with sensitive content such as military and medical images. These images are considered sensitive because any conversion may brunt their analysis. The techniques that are used for watermarking grant the consumer to build up the initial picture exactly from its watermarked image, by eliminating the watermark [2].

Recently, over years, tremendous effort has been made for understanding and modeling the Human Visual System (HVS) and for employing it to several applications of image processing. Both image compression and image watermarking are concerned with redundancy of image, which has to be minimized in compression case,

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while used for inserting the mark in watermarking case. The process of inserting watermark exploits the weakness of properties of HVS for making the imperceptible watermark with maximum strength [4].

The accuracy & copyright security are two main issues in managing digital multimedia. In this paper the Image watermarking is done by using discrete Wavelet Transform (DWT) [3] that executes 2 Level Disintegration of initial (protected) picture and watermark picture is inserted in Lowest Level (LL) sub band of protected pictures. Inverse Discrete Wavelet Transform (IDWT) [7] is employed to regain initial picture from watermarked picture. In this paper PSO (Particle Swarm Optimization) algorithmic rule is used that makes a secure optimized watermarking strategy for copyright security of images.

In PSO, each particle represents one complete solution; the particle in this case is the power of watermark for every selected coefficient. PSO technique [9] is an algorithm that is population based stochastic optimization technique. It involves swarming behavior of birds flocking. In PSO algorithmic rule, each result of optimization issue is observed as bird in search space (called particle). Each fragment has its own speed with which direction and gap of flying can be determined. In previous years' research, different kinds of watermarking algorithm based on different theory concepts were introduced.

In [1,5], the paper presented, the digital watermarking techniques like: DCT, DWT, Entropy Masking Model, and HVS Model with the accelerated advancement and large use of Internet, Transfer of knowledge has a large objection of safety. Community require a protected, stable method to transfer their info. Digital watermarking is a method of info covering that serves safety of info.

In [6] authors compare various image watermarking methods. The accuracy & copyright security are two main issues in managing digital multimedia. The picture watermarking is wide favored way for safety by discrete Wavelet Transform (DWT) that executes 2 Level Disintegration of initial (protected) picture and watermark picture is installed in Lowest Level (LL) sub band of hidden picture. Inverse Discrete Wavelet Transform (IDWT) is utilized to regain initial picture from watermarked picture. Discrete Cosine Transform (DCT) that change picture into Section of M bits and after that reorganizes applying IDCT. During this paper we will have co-related watermarking applying DWT & DWT-DCT scheme capability scrutiny supporting PSNR, Homology factor of watermark and regained watermark.

In [3], the implementation of audio watermarking in images employing wavelet families is suggested in this paper. The private info employed is audio and the input image is colour image. The algorithm is based on decay of images applying Haar wavelet basis, Daubechies wavelet, Bi-orthogonal wavelet, Reverse bi-orthogonal wavelet and discrete approximation of Meyer wavelet. The next part of the paper co-relates the watermarking conclusion of several wavelet families for feature metrics like PSNR, MSE, RMSE and Entropy. The recovery of private info is sufficient under certain charge like cropping, compression, noise effect, geometrical attacks and contrast enhancement.

In [9] a composite picture watermarking method was conferred as knowledge activity on vast decay spaces of a picture. The elemental arrangement of projected approach relies on inserting of watermark in authentic picture exploitation composite DWT SVD watermarking rule that can provide watermarked picture. Then achievement of projected rule are examined and correlated with current DWT SVD approach that has been enforced to whole picture. The projected rule can provide excellent outcome as inserting watermark on large decay spaces solely instead of whole picture. The picture watermarking approach on large decay space is a lot of sturdy than exploitation whole picture. The outcome can verify that projected approach upgrade each capability and feature of embedded data.

In [5,12], authors upgrade the power and quality of the algorithmic rule, a brand modern inserting and separating methodology with DWT-SVD is planned. The estimation matrix of the 3rd level of picture in DWT domain is changed with SVD to imbed the exceptional worth of watermark to the exceptional worth of DWT constant. The planned inserting and separating methodology was used to advance the composite DWT-SVD watermarking and to neglect the leakage of watermark. This composite approach results in upgrade each the essentially incompatible necessities. The exploratory outcome displays each the great lustiness underneath varied charges and the great loyalty. The time needed to implement the program is extremely weakened.

In [7,8] a digital image watermarking technique with Daubechies4 and PSO primarily based transformation has been given. The daubechies4 transform is enforced on the cover-up picture and DCT transform is applied on the watermark picture and also the watermark is inserted in PSO primarily based elect coefficients. The planed PSO primarily based watermarking strategy is tested on totally unlike pictures and is correlated with and while not PSO. The produced pictures features are created to be higher within the case of PSO primarily situated watermarking. Here, the watermark is created to be sturdy to ordinary picture process deformity like JPEG contraction, extra sound and filtering.

2. PROPOSED APPROACH

On the basis of following considerations it is define that how the watermarking is done and the extraction algorithm process is the inverse of the embedding process. It is assumed that the watermark as well as the see value is available at the receiver end to the authorized users. Here, digital watermarking is used by testing entropy and DWT along with PSO. Figure 1 shown below shows the flow chart of methodology.

Step 1 : Firstly a colour image is loaded and then it is transformed into gray along with more pre-processing steps.

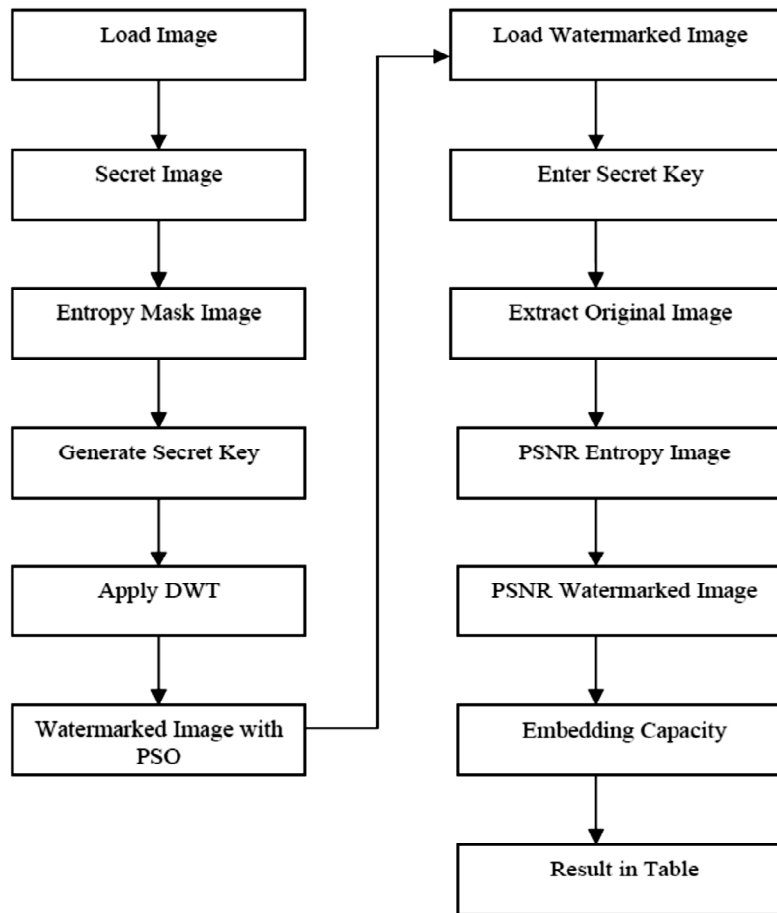


Fig. 1. Flowchart of Watermark Embedding and Extraction Process.

Step 2 : After that we originate a cipher for loading the directive picture or content for the inserted scheme. And we also originate a code for the watermark embedding. A private image is loaded and then later this image is embedded to the initial image.

Step 3 : Entropy masking is enforced on the images and private key is created. This private key is then employed for safety reason.

Step 4 : Here, DWT is enforced. Here every image is decayed into three colour elements (R.G.B) and then executes 2 Level Decay of initial (protected) picture and watermark image is inserted in Lowest Level (LL) sub band of protected picture.

Step 5 : Then enforce PSO algorithm. After enforce PSO algorithm a watermarked image is attained.

Step 6 : Finally load the watermarked image for the process of elimination of initial image by employing inverse DWT.

3. EXPERIMENT AND RESULT

The test set for this evaluation experiment watermark image randomly selected from the internet. Matlab 7.0 software platform is use to perform the experiment. The PC for experiment is equipped with an Intel P4 2.4GHz Personal laptop and 2GB memory.

The prime aim of the research was to support efficient digital watermarking approach based on entropy and DWT with PSO. The parameters such as SSIM, PSNR, MSE, are used to validate the approach proposed in comparison with the earlier used approaches. The comparison graph of PSNR between the proposed and previous approach is shown by figure 2. Peak Signal to Noise Ratio is a quality measure of the image. Higher the value of PSNR higher is the strength of the signal and lower is the distortion. The figure 3 shows the value of PSNR obtained by using previous and proposed work.

The figure 3 displays the ranges of PSNR for both previous & planned techniques. Here peak signal to noise ratio is estimated by using

$$PSNR = 10.\log_{10}(MAX^2_1/MSE)$$

PSNR is calculated and is a measure of signal strength to the noise. After estimating peak signal noise ratio, MSE is calculated. Lower the value of MSE, more efficient is the system. The comparison graph of MSE between previous and proposed work is shown in figure 4.

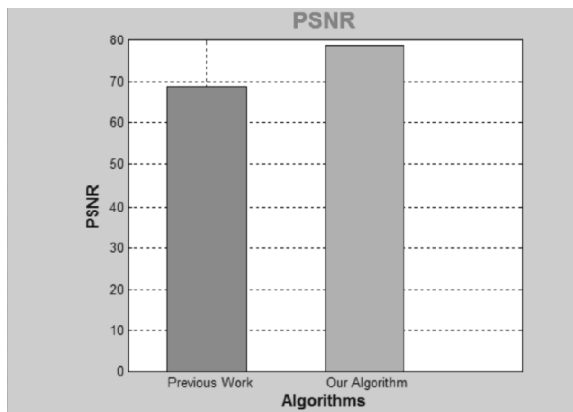


Fig. 2. Comparison of PSNR between Previous and Proposed techniques.

	Previous Work	Proposed Work
PSNR	68.8978	78.4791

Fig. 3. PSNR for Previous and proposed algorithm.

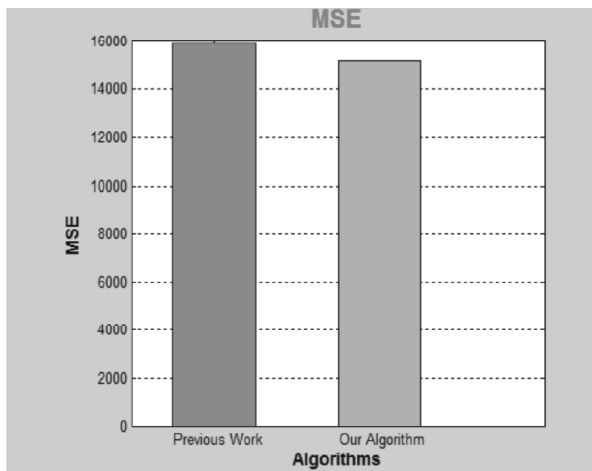


Fig. 4. Comparison of MSE between Previous and Proposed techniques.

	Previous Work	Proposed Work
MSE	1.5869e+04	1.5175e+04

Fig. 5. PSNR for Previous and proposed algorithm.

It is observed from figure 5 that the calculated value of mean squared error for proposed work is lower than that of previous approach. It shows that the approach proposed is more efficient, as reduced range for MSE shows minor inaccuracy and as shown by the opposite connection between the MSE and PSNR, this converts to a greater range of PSNR.

Reasonably a greater range of PSNR is great because it shows that the proportion of signal to noise is greater. The comparison of Structural Similarity between previous and proposed algorithm is shown below in figure 6.

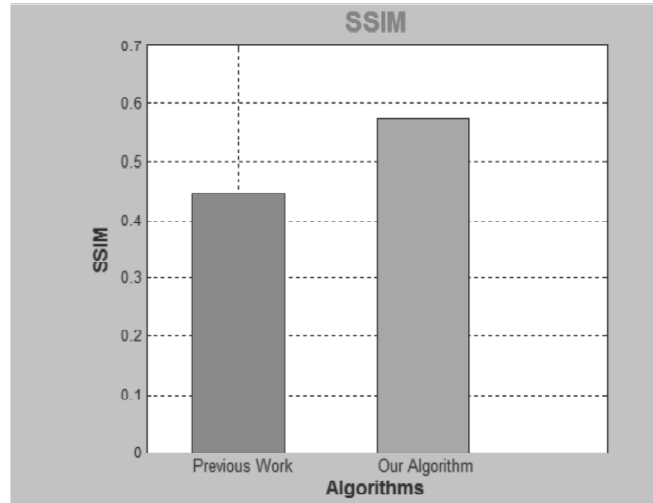


Fig. 6. Comparison of SSIM between Previous and Proposed techniques.

SSIM is a measure used for measuring the correlation among the 2 pictures that is the initial image and the image obtained after inverse DWT.

	Previous Work	Proposed Work
SSIM	0.4459	0.5732

Fig. 7. SSIM for Previous and Proposed techniques.

Fig. 7 shows the value of SSIM obtained in both the proposed and previous work. Higher the range of SSIM shows that the picture obtained is structurally identical to the initial picture. From all the experiments performed and the obtained results prove that the proposed digital watermarking technique using Entropy and DWT with PSO is more efficient and competent for digital image watermarking.

4. CONCLUSION

The technique proposed in this paper for digital watermarking is proven to be more efficient than the earlier used algorithms. The detailed discussion of results shows the efficiency of approach. The concepts involved in this paper further boosts advances in this research field. The precise watermarking depends directly on the nature of image which is to be watermarked and on its quality. From various studies, we have seen that the brilliance belief in recognizing portions of the picture that are watermarked employing various techniques like DWT. This scheme can still be improved yet; this approach is delicate as several conversions will force the watermark. Here, DWT embedding technique is used for watermarking to keep the balance of watermark's robustness and imperceptibility. For watermark extraction Inverse DWT is applied. The proposed scheme is validated by PSNR, MSE, and SSIM parameters.

Current research is directly concern to the digital images. So, the future work may involve further enhancement of results by applying some different algorithm and by using digital audio or video in place of digital image for watermarking.

5. REFERENCES

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