

Appraisal Of Improving the Robustness Of Multiresolution Watermarking

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Abstract

In recent advancements in the information technologies, a new set of challenging problems regarding security is increased. Most of the industries providing security to their own as well as hired/leased data. Digital watermarking has provided a powerful way to claim intellectual protection. Generally, watermarking plays a pivotal role to provide the security on authorised access. The main scope of this paper is to study the multiresolution watermarking algorithms and also choosing the effective and efficient algorithm which is improving the resistance to data compression. This paper proposed a new idea for enhancing the robustness of extracted watermarks. Watermark can be treated in this research work as a transmitted signal, while the destruction from attackers is regarded as a noisy distortion in the channel. Two various watermarking algorithms can be taken for this paper namely Corvi and Wang algorithm. In all graph, we have plotted X axis as peak signal to noise ratio (PSNR) and Y axis as Correlation with original watermark. The threshold value α is set to 5. When the result is smaller than the threshold value then it is feasible, otherwise, it is not.

Keywords: Watermarking, Multiresolution, Watermarking Algorithms, Noise Distortion

INTRODUCTION

Digital watermarking means placing a hidden watermark (or signature) signal in image or video media by making small changes in the media content. Correct detection result, Embedding effectiveness, Resisting distortions, Robustness and Security are the main properties in watermarking (1). The older methods in watermarking techniques should be perceptually invisible but later means that the watermark should be difficult to remove or destroy before the resulting

in severe degradation in visual fidelity. When we want to invisible the watermark, we would intuitively pick a watermark signal with small energy and hide it in the perceptually insignificant regions. However, the main thrust of this part is the placement of the watermark in the perceptually significant regions of an image for robustness (2).

In generally, digital watermarking is a method of embedding information in an image in such a manner that it cannot be removed. This watermark can be used for many security areas like ownership protection, copy control and authentication. A digital watermark is a secret message that is embedded into a “cover message”. Only the knowledge of a secret key allows us to extract the watermark from the cover message (3). It may be visible or invisible and it is a method that uses a secret key to select the locations where a watermark is embedded.

The main key point of the watermarking technique is the trade-off between the transparency and the robustness. The user must determine where to insert the watermark and how it will be enhanced the robustness of it.

MULTIRESOLUTION WATERMARKING

The above multiresolution watermarking algorithm uses the techniques from wavelet image compression, namely the Discrete Wavelet Transform DWT. At the resolution level l , the coefficients of the approximation image (LL_l) will be called as $v_l(x,y)$. The coefficients of the detail image H_l will be called $f_{1,l}(x,y)$, of LH_l will be called $f_{2,l}(x,y)$ and of HL_l will be called $f_{3,l}(x,y)$. For some algorithms, the coefficients are visited in a zig-zag fashion. Then call them $v_l(i)$, $f_{1,l}(i)$, $f_{2,l}(i)$, $f_{3,l}(i)$

A. Corvi Algorithm

Corvi Algorithm is one of the non-blind watermarking algorithms (4) because in this algorithm the host image is needed for extracting the watermark. The non-blind scheme is the original non-watermarked cover-signal; the extraction key and the signal to be tested are required for the detection. It belongs to the category of the DWT domain watermarking algorithm and it uses a sequence of text to embed as a watermark in the image. The DWT is iterated to a level l , where the approximation image has about one thousand coefficients.

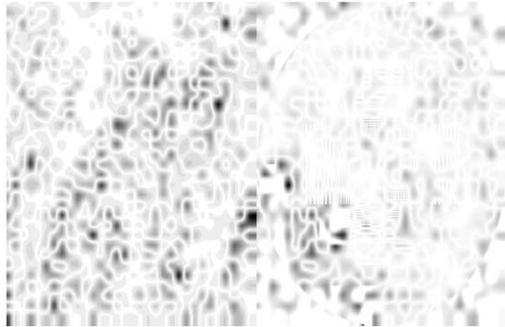


Figure 1: Watermark created by Corvi

The average and variance of the images make the algorithm robustness against the contrast enhancement transformations and luminance changes.

B. Wang Algorithm

In this algorithm, the original image is needed for watermark extraction (5). So it is also a non-blind watermarking algorithm. The mark is a Gaussian sequence of pseudo-random real numbers matching the number of selected coefficients.

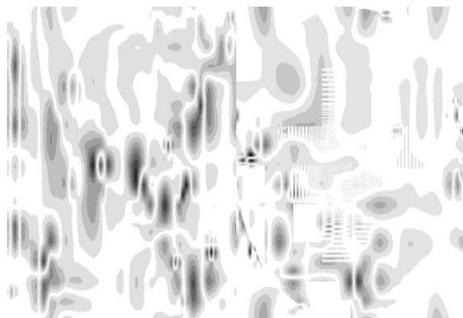


Figure 2: Watermark created by Wang

This algorithm is inspired by the principle for the design of the multi-threshold wavelet co-dec (MTWC).

C. Kundur Algorithm

In this algorithm, the host image is not needed for watermark extraction. The watermark consists of a string of bits $\{-1,1\}$. The watermark has to cover all available sites. The watermark is embedded into the coefficients of the entire detail image up to level L (6). One bit can be encoded in a triple of coefficients. Random site selection is used.



Figure 3: Watermark created by Kundur

D. Xia Algorithm

In this algorithm, the original host image is needed for watermark extraction (7). The watermark is a zero-mean unit-variance Gaussian. The large coefficients at the high and middle-frequency bands are manipulated.

E. Barni-DWT Algorithm

In this algorithm, the host image is not needed to detect the watermark (8). The watermark is a pseudo-random sequence of bits $s_i \in \{-1, +1\}$. The coefficients of the first level detail sub-bands of the image $(f_{1,l}(x,y), f_{2,l}(x,y), f_{3,l}(x,y))$ are the possible sites.

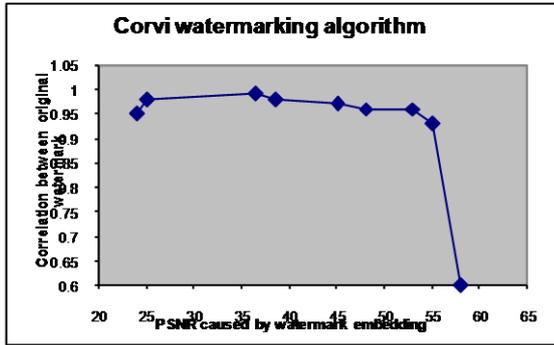
EXPERIMENTAL RESULTS

This paper the Corvi and Wang watermarking algorithms is taken to process. The results graph of this entire process, we have plotted X-axis as peak signal to noise ratio (PSNR) and Y-axis as Correlation with an original watermark. The threshold value $\hat{\alpha}$ is set to 5. When the result is smaller than the threshold value the efficiency of the algorithm is proved otherwise not.

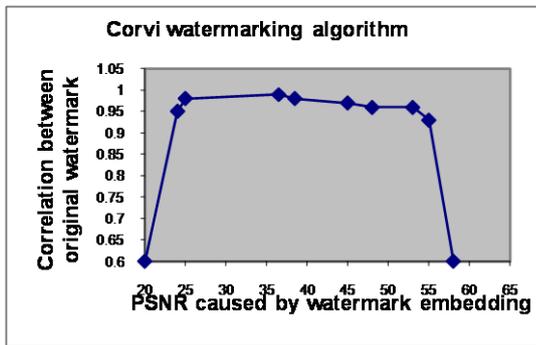
A. Corvi Algorithm

This algorithm is very robust against wavelet compression. This can resist to JPEG compression up to a level. In this algorithm, the original curve started from the lower right corner of the graph (9). It is clearly understood that the original curve more or less looks like the $\frac{1}{2}$ of the normal distribution curve. First to extend the last co-ordinate position i.e (20,0.6) and also minor smoothing the 4th coordinate position (48,0.96) and 6th coordinate position (38.5,0.98).

Now the Curve makes smoother and its resemblance looks like a parabolic curve. In this stage the number of coordinates is ten. The number of process finished for transformation process is only one. So it does not exceed the threshold value $\hat{\alpha}$. It forms a smooth normal distribution curve within the boundaries and within the three steps.



a) The original curve



(b) After extending the co-ordinate (20,0.6)

Figure 4: Corvi watermarking algorithm

B. Wang Algorithm

In the algorithm, the curve starts in the lower right corner in the graph. It is similar to a curve Cox algorithm. In this curve, the first and the second coefficients are only inclining then all other coefficients are retained in the same position without inclining or declining (10). It is viewed like a semi-plotted curve in the right side. To fulfill the left side of the curve there will be the two options are yet to be decided. The first option is, the curve is extended with the dummy co-ordinate and the second option is to form the smooth parabolic curve to extend in right side, make a y-axis reflection (i.e. 180-degree rotation and the change in position of an object that has been reflected about the line $x = 0$). The matrix for this transformation is

$$\begin{pmatrix} X' \\ Y' \\ 1 \end{pmatrix} = \begin{pmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} X \\ Y \\ 1 \end{pmatrix}$$

Here, extending the curve by using the second option hence by reflecting the y-axis reflection is the best option to choose to draw the curve. Hence the left side is identical to the right side of the curve. But it is not to reside inside the boundaries. To make a fit inside the boundaries, the curve must be translated the 35.5 values in the x-axis by using the matrix as

$$\begin{pmatrix} X' \\ Y' \\ 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 & tx \\ 0 & 1 & ty \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} X \\ Y \\ 1 \end{pmatrix}$$

Here $X' = X + tx$

$Y' = Y + ty$

The distance pair of (tx, ty) is called a translation vector or shift vector.

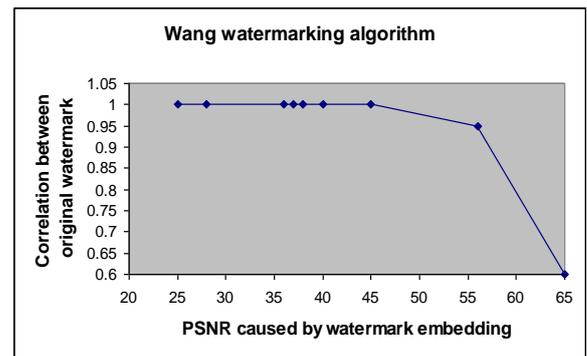
To express the translation equations using matrix by row vectors to represent co-ordinate positions and the translation vector.

$P = (X \ Y)$ and $T = (tx \ ty)$

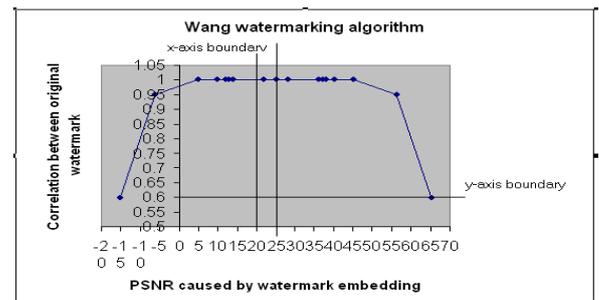
Then $P' = (X' \ Y')$.

Hence in the shortest form as $P' = P + T$

Therefore, the smooth curve is formed and it is fit inside the boundaries.



a) The original curve



(b) After reflecting the curve from right side to left side using 180 degree rotation

Figure 4: Wang watermarking

Table 1: Resistance level based on threshold (second triples)

Algm	No of original Coordinates	No of coordinates after transformation	No of process	Support %	status
Corvi	9	10	1	80	Highly Accepted
Wang	9	9	2	60	Accepted

C. Comparison between Corvi and Wang Algorithm

For all the curves the curve started from the lower right corner of the graph. Here all the three curves are with in the fixed threshold value (\acute{u}).

Using the Corvi algorithm, it is formed a smooth normal distribution curve within the boundaries. Its reliability supportive ratio is 80%. So it is highly accepted. Next to Corvi algorithm, the Wang algorithm its performance is better than the Cox, because its supportive rate is best. Except for the Corvi algorithm, the curve ended with outside the boundary. Comparing to the Corvi algorithm, the Cox and Wang algorithm it also reaches the target as same as the y-axis value of 1.0. But the Corvi algorithm reaches the target of the y-axis value is 0.99.

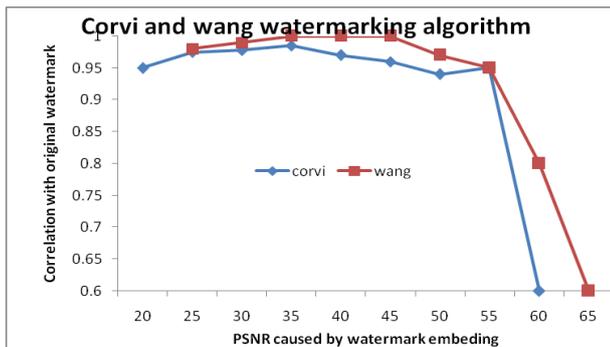


Figure 5: Before modification of Corvi and Wang

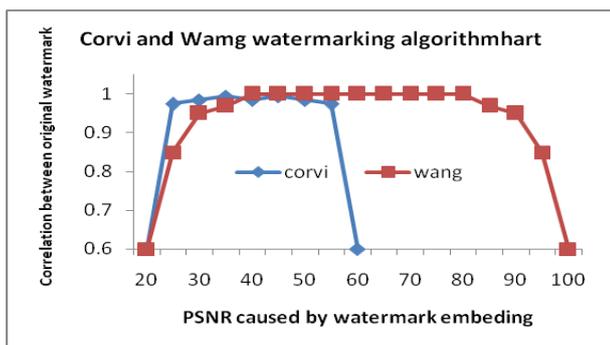


Figure 6: After modification of Corvi and Wang

CONCLUSION

The main objective of this paper is to identify the effective and efficient watermarking algorithm for improving resistance to data compression. The entire overview of the paper, it is clearly understood that the noise is the unwanted thing for both text and images. Here the effectiveness and efficiency are measured in Corvi watermarking algorithm for improving resistance to data compression as JPEG. In future, we have to propose, the development of the watermarking algorithm robustness with efficient noise removing capability algorithm.

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