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DIGITAL WATERMARKING IN SPATIAL DOMAIN USING PARTICLE SWARM OPTIMIZATION

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Abstract - Particle swarm optimization is a proven technique for optimizing the objective function under consideration. It can find an application in deciding candidate location within the cover image where watermark can be inserted with an objective of optimizing the fidelity and robustness of the watermark post attacks and can also be used minimizing the inverse trade-off between the robustness and fidelity. The work is carried out and the results are tabulated indicating the success of the applied technique. The watermark bits are hidden utilizing the fractional component of the pixel intensity values.

Keywords - Watermarking, PSO, Random Matrices, Fidelaity, Roubstness.

I. INTRODUCTION

This paper discusses a new technique which utilizes the insignificant portion of the fractional parts of the cover image pixel intensity values to hide the water mark bits in the selected pixel using PSO and then later successfully extracted from there to reconstruct the watermark. The objective function of PSO will make sure that the right pixel be chosen for inserting the watermark bits in the fractional parts of the covered image pixel values.

II. APPROACH: WATER MARKING APPROACH

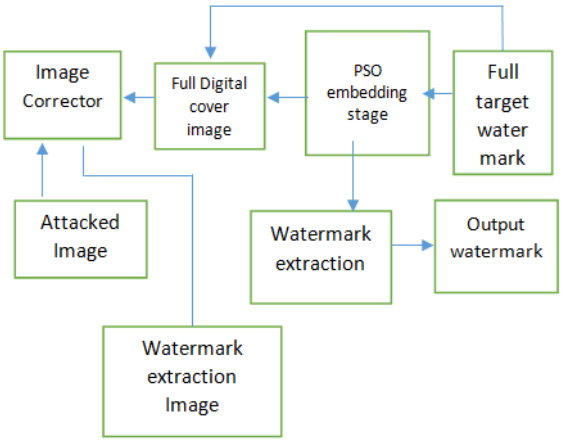
The general approach for the insertion and extraction of watermark bits may be describe as follows.

Heading the watermark bits into the cover image.

1. Use PSO to identify the locations in the cover image where the watermark bits are to be inserted.
2. At the end of the pixel values intensity append "0.0000" pickup watermark bit which has to be inserted after this. This shall not affect the original pixel value intensity to a significant extend as least significant bits in the fractional parts of the pixel values have been used.
3. Now the PSNR of the image is calculated and recorded.
4. Take the locations identified by PSO.
5. Insert the watermark bits into the identified locations by PSO.

Extraction of watermark bits on the cover image.

1. Take the locations identified by PSO.
2. Get the modified pixel values.
3. Separated the original number and the watermark bits.
4. Now assemble the watermark bits to constitute the watermark again.



III. EXPERIMENTS CONDUCTED AND RESULTS OBTAINED

In the experiment conducted a gray scale image of this dimension 117*114 pixel was chosen as a cover image. Now the watermark bits were inserted into insignificant portion of the fractional parts of the pixel intensity values of the cover image. The location chosen were as decided by PSO. After this various image attacks were made and watermark was again extracted from the identified location and the bits were assembled to the build the watermark. The normalized correlation are obtained was done with the original watermark to find the robustness of watermark under the various image attacks. The results were tabulated and given in the paper.

Trade-off between Robustness and fidelity (PSO with hiding watermark bits within fractional part of cover image)

It is evident from the above table that even with stronger embedding of watermark in to cover image the fidelity is unordered as the robustness to various attack is directly dependent and the strength of the insertion of watermark. The fidelity remains unordered with variation in robustness in this technique.

Cover Image	Watermark Image	PSNR(dB) of watermarked Image and NC of watermark extracted (no attack situation)PSNR,NC	Size of water mark inserted	Attack	PSNR(dB)of extracted watermark and NC after attack
		41.65 , 0.997	117*114 pixels with 256 grey values	Blurred (0.5%) 3*3 averaging filter	41.66,0.955 41.62 ,0.950
				Cropped (30%)	41.33,0.943
				Contrast and Enhanced (40%) 3*3 contrast enhancement filter	40.58,0.942 41.64,0.955
				Compressed CR = 10.75 QF= 50%	41.64,0.955
				Gaussian Noise(25%) with variance =0.1	41.62,0.962 40.80,0.927
				Sharpened (30%) 3*3 lapacing filter	41.64,0.955 41.60,0.962
				Rotated(15 degree)	41.62,0.961
				Scaled (50%)(1-1/2-1) 1-3-1	41.64,0.952 41.60,0.959

Sr. No.	Fidelity-PSNR(dB) (watermarked Image)(un-attacked)	Normalized Correlation (Extracted Watermark) (Unattached)	Trade Off
1	41.65	0.855	NO
2	41.65	0.861	
3	41.65	0.863	
4	41.65	0.811	
5	41.65	0.890	
6	41.65	0.964	
7	41.65	0.997	

CONCLUSION

In this technique the fidelity of watermark image with hidden watermark bits is constant at a PSNR values of 41.65 db and does not depend on location of PSO. There exists no trade off the fidelity is high because we use the least significant bits of the fractional parts of the pixel intensity values. The payload of the watermark used in this technique is 117 * 114 pixel with 256 gray values which is equivalent to 117* 114 into 8 bits.

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