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Performance Evaluation of Watermarking Technique Based on Discrete Cosine Transformation

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ABSTRACT

The worldwide life access of web innovation has made the correspondence and course of advanced mixed media substance like pictures, sound and video extremely simple. Nonetheless, this accommodation likewise causes a generous increment in unlawful activities, for example, duplication, alteration, fabrication, copyright infringement and others in advanced media. The assurance of computerized media has thusly turned into a basic issue. As a conceivable arrangement, advanced watermarking acts the hero. Computerized watermarking implies stowing away or embeddings a message (picture, sound, video or content) inside the advanced media in such way that it must not make genuine corruption the first computerized media.

1. Introduction

At first, watermarking combines an installing technique, keeping straightforward division of the watermark from the substance. Advanced marks, of course, are attached to the documents as headers, which may be erased by or changed by association change. Encoded signals, once decoded, would have no security against further controls. Watermarks commonly experience unclear changes from the main substance. It is possible, by examining the alterations in watermarks, to distinguish the zones and the kind of controls in the main banner. This could be practiced, to a particular degree, using advanced marks. Regardless, after and following is troublesome in encoded signals. A watermark is commonly inconspicuous. Along these lines, it doesn't make trouble people who don't think about the watermark.

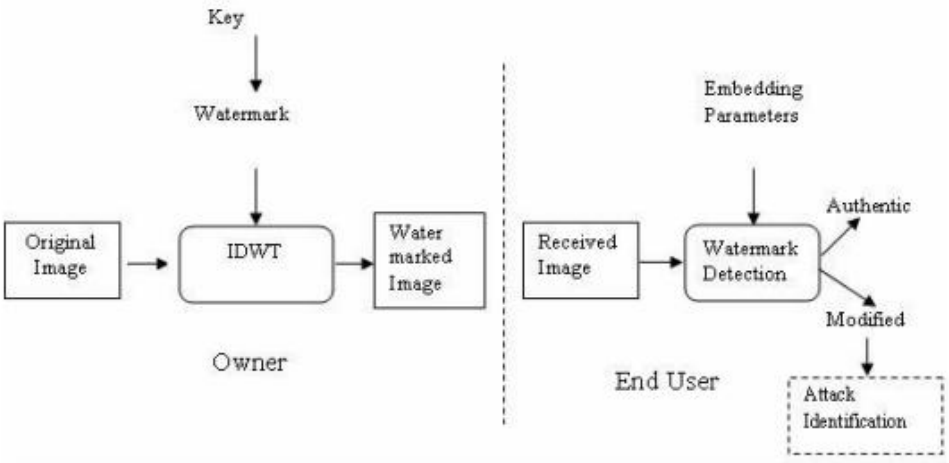

Figure 1: Watermark Embedding System

The purpose behind inserting the watermark may be for copyright protection, content confirmation by modifies recognizable proof or may be basically to stow away secure information. In watermarking the spread medium is noteworthy, while in information hiding the covered information is seen as huge.

2. Watermarking Technique Based On Discrete Cosine Transformation

To assess the execution of the proposed watermark confirmation system utilizing Weber's descriptor, dim dimension pictures of various nature have been utilized as host pictures. These are the standard pictures having various attributes like "lady" is a low differentiation picture, "lena" is a high complexity picture, "pepper" is a ceaseless tone picture, "mandrilla" is a picture of discrete tone picture classification and "cameraman" is a picture with sharp and clear edges. Through comprehensive experimentation, it has been demonstrated that the proposed watermark verification system can confirm the watermarked picture of any nature. Diverse watermark bit designs have been embedded utilizing DCT Attacked watermarked picture coefficient alteration procedure.

The normal estimation of PSNR between host picture and watermarked pictures is 41.06db for 256 watermark bits. The estimations of PSNR for watermark of various sizes are given in Table 1.

Table 1: Value of PSNR for different sized watermark patterns

Number of watermark bits	Average *PSNR*(db)
1024 bits	38.75
512 bits	39.62
256 bits	41.06
128 bits	43.14
64 bits	46.12
32 bits	49.06

According to Y. Xin et.al PSNR ought to be more noteworthy than or equivalent to 40 for better straightforwardness of watermarked picture and it very well may be seen that the proposed method restores the ideal PSNR. It obviously implies that the proposed method (aside from the instance of 1024 bits, where PSNR is very near 40db) has better straightforwardness notwithstanding for vast number of watermark bits. It is seen from Table 4.10 that countless can be embedded in the 64x64 pixels have picture without corrupting the visual nature of the watermarked picture. The most extreme number of bits that can be embedded utilizing the proposed strategy is multiple times the quantity of 8x8 DCT squares (nblocks) of the host picture, which can be determined utilizing Eq. (4.1).

$$nblocks = \frac{size\ of\ host\ image}{8 \times 8} \times 16$$

Consequently greatest number of bits that can be embedded without debasing the nature of picture is 1024 bits for 64□ 64 picture. As the measure of host picture expands, the most extreme number of bits that can be embedded likewise increments. Various tests have been performed to dissect the execution of the proposed watermark verification system and it has been seen that the Weber's descriptor-based watermark confirmation method is especially vigorous against all the geometric and photometric assaults. To discover the closeness between transmitted watermarked and got watermarked picture after a conceivable assault, NC (η) and the Euclidean separation between two histograms (ρ) is processed. In this arrangement of tests, is greater η is set to 107. On the off chance that the factor η is set to 0.7 and T2 for η threshold esteem T1 for is under T2, got picture is confirmed as□than equivalent to T1 and factor watermarked picture, else it isn't validated.

According to the review done by M. Kutter and Petitcolas, the assaults against which watermarking framework ought to be judged are: geometric assaults which incorporate flipping, pivot, trimming and so forth., upgrade assaults like honing, low pass separating and so forth and clamor expansion which can degenerate the watermarked picture to incredible degree. Watermarking frameworks are additionally tried against JPEG pressure. In the accompanying subsections, we give point by point conduct of our proposed methodology against every one of these varieties.

3. Geometric Attacks

- ***Effect of rotation***

To break down the power of proposed watermarking procedure against pivot, all the watermarked pictures are turned at different points in MATLAB 7.0 utilizing bilinear interjection and trimming technique. We have turned just that piece of watermarked pictures which is inside the plate. It has been watched utilizing tests that the descriptor of the pivoted watermarked picture is near the descriptor of the non-turned watermarked picture. Estimations of η and ρ, for the turned pictures are abridged in Table 2.

Table 2: Comparison of original watermarked image and rotated watermarked images

S.No	Angle of rotation	*"woman"*		*"lena"*		*"cameraman"*		*"pepper"*		*"mandrilla"*	
		ρ	η	ρ	η	ρ	η	ρ	η	ρ	η
1	5°	61.61	0.94	52.42	0.94	58.10	0.93	65.65	0.90	64.64	0.89
2	10°	61.61	0.94	54.97	0.93	61.74	0.92	59.75	0.93	54.85	0.92
3	15°	65.48	0.93	58.82	0.92	58.29	0.93	57.93	0.93	62.05	0.90
4	20°	69.53	0.93	56.36	0.93	60.33	0.92	64.92	0.91	58.89	0.91
5	25°	70.80	0.92	62.74	0.91	59.33	0.92	65.73	0.90	59.65	0.91
6	30°	67.38	0.93	67.27	0.82	64.88	0.90	65.89	0.90	59.51	0.91
7	35°	67.28	0.93	65.05	0.90	63.87	0.90	72.40	0.87	61.11	0.90
8	40°	80.98	0.90	70.76	0.88	63.70	0.91	83.62	0.83	68.10	0.87
9	45°	78.00	0.90	78.47	0.85	66.18	0.89	86.60	0.81	64.25	0.89
10	50°	80.72	0.90	86.66	0.81	64.17	0.90	92.15	0.78	65.13	0.89

The distinction in descriptor of pivoted and unique watermarked picture is because of the way that power estimations of turned pictures are not actually rise to the force estimation of unique pictures. This is because of the way that there is calculation blunder in the calculation used to turn the pictures.

• ***Effect of flipping***

To dissect the vigor of proposed watermark confirmation system against flipping activity, watermarked pictures are flipped both evenly and vertically in Paint Shop Pro 5.0.

Estimations of the components η and ρ for the flipped watermarked pictures are abridged in Table 3.

Table 3: Comparison of unique watermarked picture and flipped watermarked pictures

S. No.	Direction of flipping	*"woman"*		*"lena"*		*"cameraman"*		*"pepper"*		*"mandrilla"*	
		ρ	η	ρ	η	ρ	η	ρ	η	ρ	η
1	Horizontal	54.82	0.93	61.3	0.92	43.77	0.83	16.02	0.91	45.25	0.70
2	Vertical	51.09	0.94	56.1	0.94	28.24	0.93	45.34	0.86	40.19	0.79

It has been seen that Weber's descriptor is powerful against flipping assault for both even also a vertical flipping.

• ***Effect of cropping***

Watermarking dependent on Weber's descriptor is likewise strong against trimming assault.

Vertical and irregular trimming is connected to the pictures. These trimmed pictures (appeared in Fig. 2) are then used to break down the power of the proposed watermark verification method. The likeness of these edited pictures with unique watermarked picture is given in Table 4.

Figure 2: Cropped watermarked images

Table 4: Comparison of original watermarked image and cropped images

S. No.	*"woman"*		*"lena"*		*"cameraman"*		*"pepper"*		*"mandrilla"*	
	ρ	η	ρ	η	ρ	η	ρ	η	ρ	η
1	81.61	0.93	65.85	0.86	42.23	0.88	29.69	0.94	33.94	0.76
2	43.41	0.98	49.34	0.86	66.64	0.75	64.74	0.73	65.81	0.85

• ***Effect of scaling***

So as to make Weber's-based watermarking scale invariant, scale standardization is utilized. In scale standardization, the watermarked picture is scaled to a predefined measure. At that point descriptor of the scaled picture is contrasted and the descriptor put away in register document to verify the watermarked picture. To break down the vigor of proposed system against scale variety, watermarked pictures have been scaled up with factor of 2 and 4. These scaled up pictures are then standardized to standard size of 32x32 pixels and their descriptors are contrasted and the descriptor put away in register document to discover the estimations of ρ and η as appeared Table 4 From Table 5, it is inferred that the proposed strategy is scale invariant.

Table 5: Comparison of original watermarked image and scaled up images

	"woman"		*"lena"*		*"cameraman"*		*"pepper"*		*"mandrilla"*	
	ρ	η	ρ	η	ρ	η	ρ	η	ρ	η
Scaling by factor of 2	31	0.98	49	0.94	31	0.91	37.5	0.9	48	0.82
Scaling by factor of 4	46	0.86	58	0.91	49.2	0.87	54.5	0.79	50	0.81

• ***Effect of translation***

The proposed watermark verification method is additionally hearty against interpretation. To break down the impact of interpretation, we have deciphered the watermarked picture 16 pixels along x-pivot and 16 pixels along y-hub for 32*32 picture utilizing 2-dimensional interpretation. The estimations of ρ and η acquired from the standardized interpreted picture are appeared Table6.

Table 6: Comparison of original watermarked and translated images

	"woman"		*"lena"*		*"cameraman"*		*"pepper"*		*"mandrilla"*	
	ρ	η	ρ	η	ρ	η	ρ	η	ρ	η
Translation about centroid	35	0.97	35	0.98	52.9	0.81	33.5	0.92	33	0.86

• ***Noise addition***

To examine the vigor of proposed watermark confirmation system against clamor assault, the Gaussian commotion with various mean and difference has been added to various watermarked pictures in MATLAB 7.0. The clamor assaulted pictures are appeared in Fig. 3.

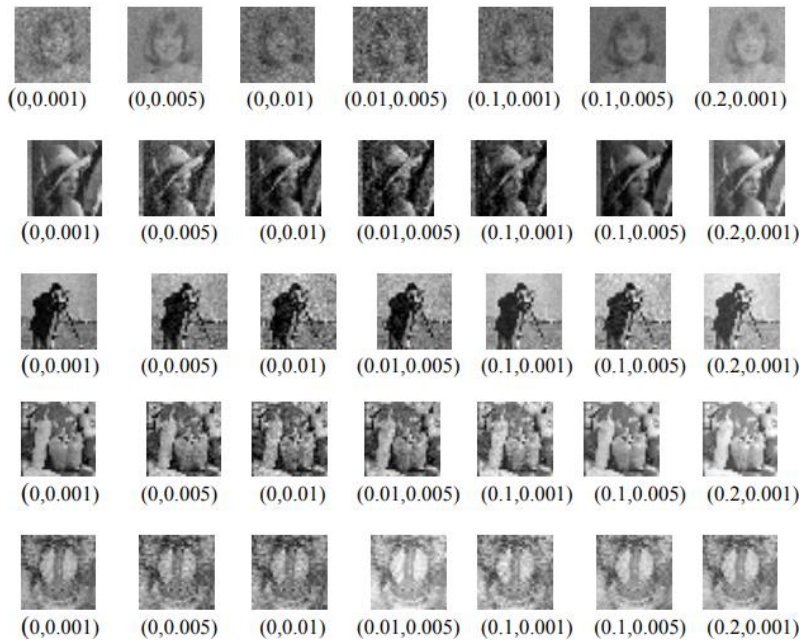

Fig. 3: Watermarked images after noise attack with different mean and variance

Estimations of the components ρ and η for the watermarked pictures (appeared in Fig.4.8) are abridged in Table 7.

Table 7: Comparison of original watermarked image and noise attacked images

S.No	Mean and variance of Noise (μ,σ^2)	*"woman"*		*"lena"*		*"cameraman"*		*"pepper"*		*"mandrilla"*	
		ρ	η	ρ	η	ρ	η	ρ	η	ρ	η
1	(0,0.001)	51.09	0.72	48.31	0.90	43.49	0.81	52.23	0.79	25.88	0.88
2	(0,.0.005)	73.91	0.73	65.98	0.83	67.88	0.76	72.56	0.74	50.71	0.77
3	(0,0.01)	87.23	0.70	76.11	0.80	85.14	0.71	89.33	0.71	60.39	0.76
4	(0.01,0.005)	75.35	0.71	72.12	0.81	74.06	0.78	69.62	0.72	42.84	0.72
5	(0.1,0.001)	93.81	0.76	56	0.89	49.39	0.74	47.89	0.83	86.42	0.70
6	(0.1,0.005)	50.81	0.78	66.43	0.82	62.88	0.76	58.79	0.73	44.02	0.76
7	(0.2,0.001)	82.19	0.75	81.08	0.72	48.04	0.75	45.16	0.85	42.75	0.79

It has been seen from the estimations of connection coefficient that the impact of clamor is more on low difference pictures like "lady" when contrasted with high complexity pictures like "lena". In spite of this, the proposed technique can effectively confirm all the boisterous pictures.

4. Enhancement Techniques

• ***Effect of brightness/contrast change***

With the assistance of careful experimentation, it has been demonstrated that Weber's descriptor is especially hearty against power variety. To investigate the heartiness of proposed watermark validation procedure against force variety, brilliance of watermarked pictures has been changed in Adobe Paint Shop Pro 5.0. The watermarked pictures with change in brilliance are appeared in Fig. 4.

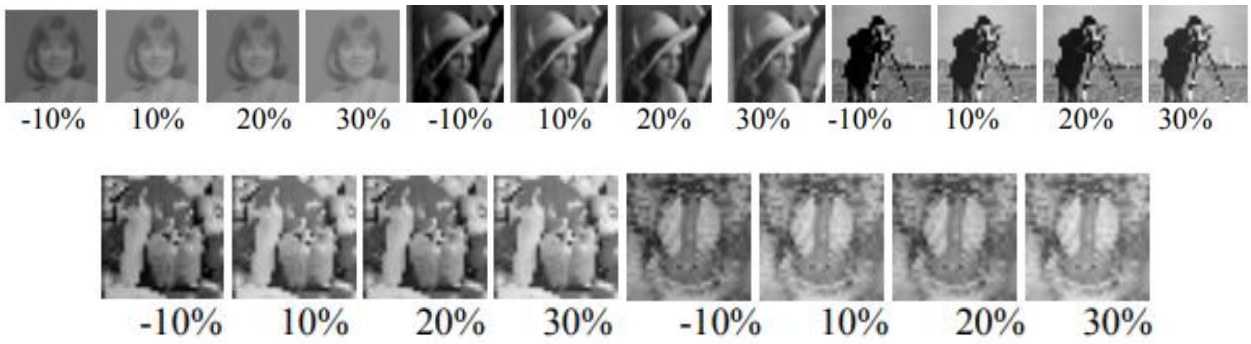

Fig 4: Watermarked images after change in brightness with different factors

5. Conclusion

Our proposed procedure is quick and returns zero BER and supports high payload because of the utilization of period of q-recursive ZMs. At that point we have looked at the proposed Weber's descriptor-based watermark verification system with SIFT and LBP descriptor-based watermarking methods. We have demonstrated that the proposed watermark confirmation method is quick, not so much mind boggling but rather more powerful when contrasted with the customary SIFT or LBP descriptor-based watermarking procedures. The delicate watermarking procedure proposed, is contrasted and existing delicate watermarking methods that are utilized for verifying medicinal pictures and it has been demonstrated that our proposed Weber's law-based strategy underpins high limit when contrasted with existing delicate watermarking strategies. Additionally, it is more delicate and intangible than these current procedures.

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