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Watermarking: Some Best Practices

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Abstract-To protects intellectual property rights, the amount of exchanged digital content calls are rapidly growing based on efficient and practical techniques. During the past two decades, watermarking techniques have been presented to embed and detect information within such contents, with different four key requirements at hand, that are – capacity, invisibility, robustness, and security. So far, researchers mainly focused on the first three. Earlier work used novel DFT watermarking scheme featuring perceptually optimal visibility versus robustness. The system should possess good quality of images. With time goes new techniques are evolved with different quality features. Each system's technique varies from one another. The techniques used, merits and demerits of different watermarking systems are studied and analyzed in this paper. We can get a detailed comparative study of different systems of watermarking.
Keywords – ULPM, ILPM, DFT

I. ERROR CORRECTING CODES FOR ROBUST COLOR WAVELET WATERMARKING

Watermarking provides a possible solution to ensure and safeguard copyright and intellectual property rights for multimedia content. The watermarking of color images has the issues of robustness against intentional or unintentional attacks. The watermarking problem is considered analogous to the transmission of a signal over a noisy channel and the underlying characteristics of the channel are defined by the different raids. Error correcting codes are being widely used to protect the signature (identification of a buyer/seller or transaction) of an image for watermarking applications. The robustness performance of this wavelet based watermarking algorithm which uses the relation between wavelet color coefficients, is improved with the support of error correcting codes. This work explore and demonstrate the use and effectiveness of the concatenation of repetition codes, Hamming codes and BCH codes to improve the robustness of the watermarking algorithm. Moreover, as watermarking algorithms do not usually consider color attacks and counter measures to protect the color images against such attacks have not been explored in earlier study. One of the goals of this article is to learn color attacks and propose adequate robustness measures.

A. Advantages

1) The method of using error correcting codes as a tool to enhance the robustness of watermarking schemes.

2) Discrete wavelet transform centered color image watermarking scheme is very useful itself to protect the watermark.

B. Disadvantages

1) The performance of noise and JPEG compression is not good because of the complete and semi-random nature of the two attacks, respectively.

2) If the change in saturation affects the color components beyond a certain limit, then the error correcting codes are not able to provide robustness for these high levels.

II. ROBUST AND TRANSPARENT WATERMARKING SCHEME FOR COLOUR IMAGES

In this work, a robust and transparent watermarking scheme for color images is done. The color characteristics for the human visual system are utilized to design the color watermarking scheme. Through the exploitation of the perceptual redundancy of color images, the proposed watermarking scheme is perceptually tuned to embed and detect the watermark in the perceptually significant sub-bands of luminance and chrominance components of color images in the wavelet domain. The employment of the uniformity in the uniform color space and the masking effect mainly due to local variations in luminance magnitude leads to that the perceptual redundancy of color images can be measured. By using the calculated perceptual redundancy in the form of error visibility thresholds of wavelet coefficients of the color image, high strength watermarks are invisibly embedded into coefficients of the host color image for resisting compression and malicious attacks.

A. Advantages

1) The proposed scheme provides better perceptual transparency of the watermark
2) The robustness achieved by the proposed system is better than Huang's scheme
3) It achieves higher performance

B. Disadvantages

1) Need to utilize the perceptual redundancy of color images to accurately locate embedding coefficients in the perceptually significant portion for improving the watermarking scheme more robust to malicious attacks and compression
2) The calculation of noise detection thresholds of color video signals is investigated to develop the watermarking scheme for color video.

III. DISCRETE FOURIER TRANSFORM–BASED WATERMARKING METHOD WITH AN OPTIMAL IMPLEMENTATION RADIUS

A very common technique is the implementation of the watermark in the frequency domain using some discrete transform. Thus, the energy of the watermark is distributed over the entire image after the transformation back to the spatial domain, which enables the implementation of stronger watermarks with less perceptual impact. The DFT approach has one advantage in comparison with the spatial domain methods. First, it is translation invariant and rotation resistant, which translates to strong robustness to geometric attacks. This research has two parts. In the first part, this work proposes a watermarking method, define the parameters of a watermark, and investigate the influence of the defined parameters on the overall perceptual quality of an image. In the second part, This work use the results of the investigation to modify the encoder of the proposed watermarking method and test its robustness to various attacks such as cropping, blurring, PS process, Print-Cam (PC) process, etc.

A. Advantages

1) The proposed method provide excellent robustness to the attacks from the StirMark benchmark, AM half toning, PS process, and PC process.
2) It minimizes the quality deterioration of the watermarked image by finding the optimal implementation radius.
3) It achieves improvement performance

B. Disadvantages

1) It would be highly difficult to remove the watermark without seriously affecting the image quality
2) The quality of a watermarked image strongly depends on the properties of the cover work

IV. CIRCULARLY SYMMETRIC WATERMARK EMBEDDING IN 2-D DFT DOMAIN

The watermarks must be robust to distortions such as those caused by image processing algorithms. Image processing does not modify only the image but may also modify thewatermark as well. Thus, the watermark may become undetectable after intentional or unintentional image processing attacks. Watermark embedding in the Fourier domain has certain advantages for scaling and rotation invariance. The Fourier–Mellin transform has been used for watermark embedding. In the technique proposed in this work also embed watermark in the Fourier domain. However, This work avoid employing the Fourier–Mellin transform in order to decrease computational complexity and to avoid the problems involved in log-polar coordinate system transformation errors. Furthermore, this work uses circularly symmetric watermarks in order to solve rotation invariance in an easy way.

A. Advantages

1) This method is robust to several image processing attacks such as filtering, noise addition, scaling, rotation, cropping, JPEG compression
2) This method is resistant to additive Gaussian noise corruption.

B. Disadvantages

1) Rotation causes the worst detection performance.
2) Compression affects the high frequencies of the Fourier transform.

V. EFFICIENT GENERAL PRINT-SCANNING RESILIENT DATA HIDING BASED ON UNIFORM LOG-POLAR MAPPING

Digital watermarking technology is popularly used for proof of ownership, content authorization, owner identification, etc. Though watermark robustness has been an active research issue in watermarking community, print-scan resilient data hiding has not been extensively studied. Some state-of-the-art multibit print-scan resilient data hiding schemes proposed to exploit the knowledge of the digital half-toning scheme employed by the LaserJet printer or boundary orientation of a print-scan image. This work proposes a multi bit watermarking scheme, which is robust to both the general print-scan and geometric distortion, based on a novel near ULPM. The proposed scheme completely removes the limitations of the ILPM-based methods, significantly improves over prior solutions, and has self-resynchronization capability.

A. Advantages

1) The proposed scheme achieves much better performance in terms of robustness against cropping and print-scan compared with the scheme

2) Much faster in watermark extraction.

3) The proposed scheme achieves much better ROC performance in both the case of prior to and after the attack of JPEG_70.

B. Disadvantages

1) Some geometric distortions such as mild aspect ratio change and cropping that occur in a practical print-scan process may not be eliminated.

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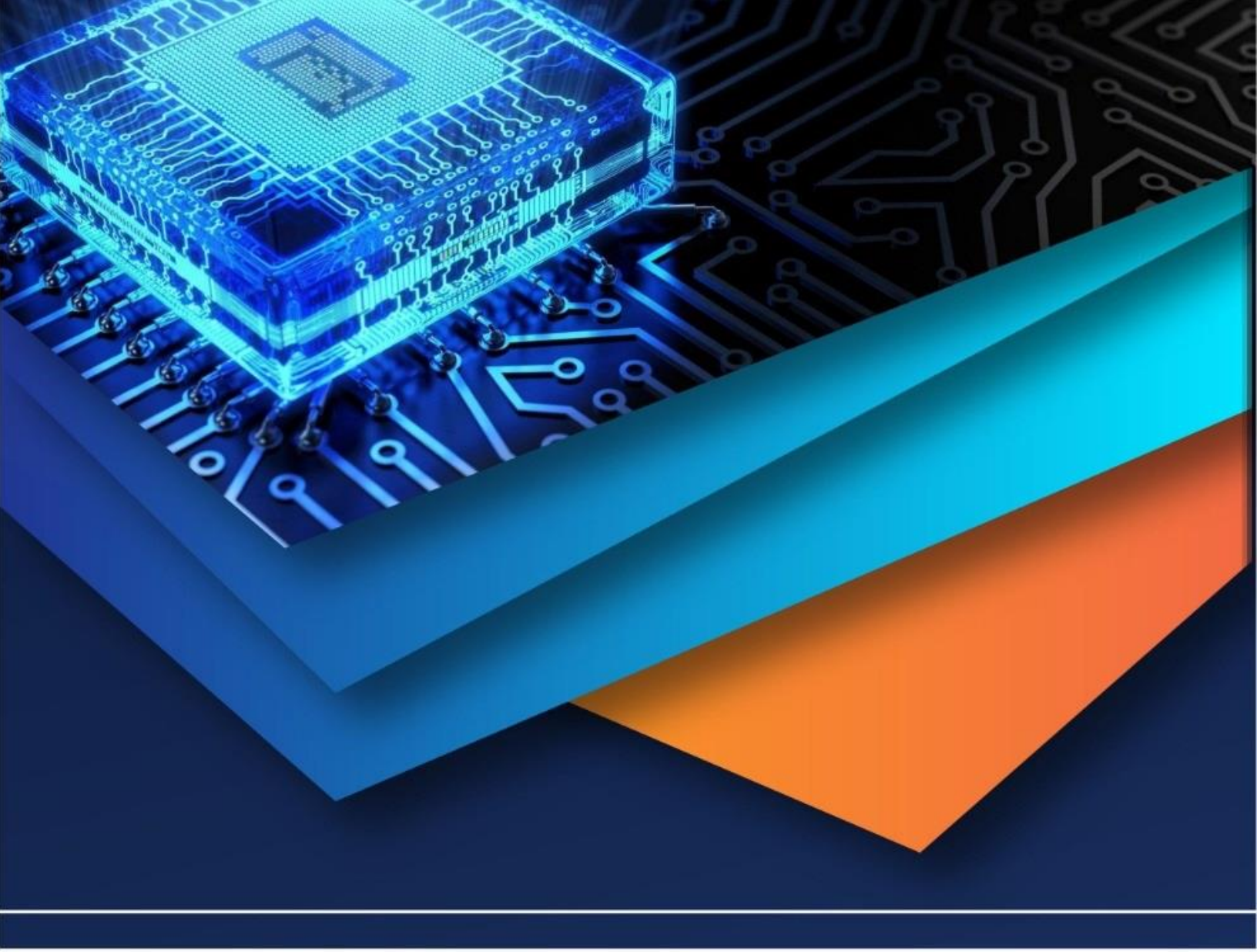

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