A LITERATURE STUDY OF WATERMARKING TECHNIQUES ON CONTRAST ENHANCEMENT OF COLOR IMAGES

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Abstract: In this paper a watermarking method with contrast enhancement is presented for digital images. Digital Watermarking is a technology which is used to identify the owner, distributor of a given image. If the watermarked images is low contrast & poor visual quality or due to poor illumination in some imaging system, the contrasts of the obtained images are often needs to be improve. In recent years, digital watermarking plays a vital role in providing the appropriate solution and various researches have been carried out. In this paper, an extensive review of the literature related to the color image watermarking is presented together with contrast enhancement by utilizing an assortment of techniques. This method outperforms other present algorithm by enhancing the contrast of images well without introducing undesirable artifacts.

Key Words: Watermarking, Histogram equalization, CLAHE, CAHE, PSNR, MSE.

I. INTRODUCTION:

DIGITAL image watermarking has become a necessity in many applications such as data authentication, broadcast monitoring on the Internet and ownership identification. Various watermarking schemes have been proposed to protect the copyright information. There are three indispensable, yet contrasting requirements for a watermarking scheme: robustness, invisibility and capacity. Therefore, a watermarking scheme should provide a trade-off between these features [1].

Due to the advancement of digital multimedia tools the storage and distribution of multimedia content is become very easy. Issues on security have emerged and there is a vital need for protecting the digital content against counterfeiting, piracy and malicious maniple. **Watermark**--A visible or invisible signature embedded inside an image to show authenticity or proof of ownership. The hidden watermark should be inseparable from the host image, robust enough to resist any manipulations while preserving the image quality. Thus through watermarking, intellectual properties remains accessible while being permanently marked. This digital signature approaches use in authenticating ownership claims and protecting proprietary hidden information, discourage unauthorized copying and distribution of images over the internet and ensure a digital picture has not been altered [2].

Contrast enhancement is an important area in image processing for both human and computer vision. It is widely used for medical image processing and as a preprocessing step in speech recognition, texture synthesis, and many other image/video processing applications Different methods have already been developed for this purpose .Some of these methods make use of simple linear/nonlinear gray level transformation functions while some of the others use complex analysis of different image features such as edge connected component information and so on [3].

In the past few years, several researches are performed in the digital watermarking by a huge number of researchers. In this paper, we present a comprehensive review of extremely important researches on Digital image watermarking together with their contrast enhancement. The popular literature existing in the digital image watermarking is categorised and reviewed comprehensively. Here, we present a wide-ranging review of image watermarking, which is robust against diverse attacks.

2.LITERATURE REVIEW:

Hamidreza Sadreazami et.al: Author's proposes "Multiplicative Watermark Decoder in Contourlet Domain Using the Normal Inverse Gaussian Distribution" A novel watermark decoder in the contourlet domain. It is known that the contourlet coefficients of an image are highly non-Gaussian and a proper distribution to model the statistics of the contourlet coefficients is a heavy-tailed PDF. The proposed watermark extraction approach is developed using the maximum likelihood method based on the NIG distribution. Closed-form expressions are obtained for extracting the watermark bits in both clean and noisy environments. Experiments are performed to verify the robustness of the proposed decoder. The results show that the proposed decoder is superior to other decoders in terms of providing a lower bit error rate. It is also shown that the proposed decoder is highly robust against various kinds of attacks such as noise, rotation, cropping, filtering, and compression [1].

Pratibha Sharma et. al: " Digital Image Watermarking Using 3 Level Discrete Wavelet Transform". In this paper author's presented digital image watermarking based on 3 level discrete wavelet transform (DWT) is presented & compare it with 1 & 2 levels DWT. In this technique a multi-bit watermark is embedded into the low frequency sub-band of a cover image by using alpha blending technique. Performance of method for different value of scaling factor is analyses & compare by using statistical parameters such as peak-signal-to-noise-ratio (PSNR) and mean square error (MSE) [2].

M. Abdullah-Al-Wadud et.al: has proposed Dynamic Histogram Equalization (DHE) technique takes control over the effect of traditional HE so that it performs the enhancement of an image without making any loss of details in it. DHE partitions the image histogram based on local minima and assigns specific gray level ranges for each partition before equalizing them separately. These partitions further go through a repartitioning test to ensure the absence of any dominating portions. This method outperforms other present approaches by enhancing the contrast well without introducing severe side effects, such as washed out appearance, checkerboard effects etc., or undesirable artifacts [3].

Zhao Jian et.al has proposed "A Watermark Technique Based On Extended Shearlet And Insertion Using The Largest Information Entropy On Horizontal Cone". Author's proposed the algorithm in which firstly, 1-level extended discrete shearlet transform decomposes the test image into directional components on horizontal cone; each directional component reflects directional features and textured features differently. Next, the directional component whose information entropy is the highest is selected to carry watermark. Compared with related algorithms based on DWT and DCT, the proposed algorithm tends to obtain preferable invisibility when it is robust against common attacks [4].

D.V.N.Koteswara Rao et.al has proposed a "ROBUST IMAGE WATERMARKING TECHNIQUE USING DCT & WAVELET PACKET DENOISING". Author proposed a joint DWT-DCT Transformation algorithm for digital image watermarking. Presented method is tested by most of the common image processing attack such as: different size of Gaussian filtering as an enhancement attack, adding salt and paper noise, scaling with two common factors: 50% and 75%, cropping, and compression attack. Specially, in case of adding noise and enhancement attack, proposed method show a significant improvement in robustness compare to previous DWT-DCT based method [5].

Mustafa Osman Ali et.al "INVISIBLE DIGITAL IMAGE WATERMARKING IN SPATIAL DOMAIN WITH RANDOM LOCALIZATION" author's implemented new algorithms for embedding and extracting watermark. Author's algorithm works on spatial domain of digital images where it can embed invisible watermark. A secret key is used to embed and extract watermark. The watermark, according to the secret key, locates in a random manor vertically or horizontally across the base-image [6].

AKHIL PRATAP SINGH et. al has proposed "WAVELET BASED WATERMARKING ON DIGITAL IMAGE". Author's proposed a robust watermarking technique based on DWT (Discrete Wavelet Transform) is presented. In author's proposed technique the insertion and extraction of the watermark in the grayscale image is found to be simpler than other transform techniques. Proposed watermarking technique on digital images based on discrete wavelet transform is analyzing by various factors like PSNR's and MSE's [7].

N.Koteswara Rao et.al has proposed a "TWO LEVEL DCT AND WAVELET PACKETS DENOISING ROBUST IMAGE WATERMARKING". Firstly apply block based DCT on this approximation image, then a pseudo random noise sequence is added into its high frequencies. For detection, we extract the approximation image from the watermarked image, then the same pseudo random noise sequence is generated, and its correlation is computed with high frequencies of the watermarked approximation image. In proposed method author's obtained the, higher robustness of embedding the watermark in low frequency. Robustness of the author's proposed technique against many common attacks such as JPEG compression, additive Gaussian noise and median filter is evaluated & Compared with related works, author's proposed method proved to be highly resistant in cases of compression and additive noise, while preserving high PSNR for the watermarked images [8].

Koyi Lakshmi Prasad et.al has proposed "A HYBRID LWT-DWT DIGITAL IMAGE WATERMARKING SCHEME USING LSVR AND QR-FACTORIZATION". In this proposed article author's present an efficient and hybrid approach that integrates features of lifted wavelet transform (LWT) and discrete wavelet transform (DWT) based on linear support vector regression (LSVR) and QR-factorization for watermarking. Precisely the integrated hybrid approach produces less distortion rate. The experimental results are analyzed with other models and offers high reliability on watermark embedding and authenticity along with less computational cost [9].

Kaiser J. Giri et.al has proposed "A ROBUST COLOR IMAGE WATERMARKING SCHEME USING DISCRETE WAVELET TRANSFORMATION". A number of schemes and algorithms have been proposed and implemented using different techniques. The effectiveness of the technique depends on the host data values chosen for information hiding and the way watermark is being embedded in them. However, in view of the threats

posed by the online pirates, the robustness and the security of the underlying watermarking techniques have always been a major concern of the researchers. In this paper author's presents a secure and robust watermarking technique for color images using Discrete Wavelet Transformation. The results obtained have shown that the technique is robust against various common image processing attacks [10].

H. Sadreazami et.al has proposed: "A Robust Multiplicative Watermark Detector for Color Images in Sparse Domain": A blind multichannel multiplicative color image watermarking scheme in the sparse domain is proposed. In order to take into account the cross correlation between the coefficients of the color bands in the sparse domain, a statistical model based on the multivariate Cauchy distribution is used. The statistical model is then used to derive an efficient closed-form decision rule for the watermark detector. Experimental results and theoretical analysis are presented to validate the proposed watermark detector. The performance of the proposed detector is compared with that of the other detectors. The results demonstrate the improved detection rate and high robustness against the commonly used attacks such as JPEG compression, salt and pepper noise, median filtering, and Gaussian noise [11].

Jayprakash Upadhyay et.al has proposed: "A joint implementation of adaptive histogram equalization and interpolation" A new method to improve the visibility and contrast of color images. The proposed method is a joint technique scheme of Color Adaptive Histogram Equalization (CAHE) and interpolation method. CAHE is an effective algorithm for image contrast enhancement, and interpolation method enhances the image by increasing the number of pixels without missing any intermediate component of image. Hence, the combination of both may give the good agreement of image visuality and contrast [12].

Hao-Tian Wu et.al has proposed : "A reversible data hiding method with contrast enhancement for medical images" Areversible data hiding method with contrast enhancement is presented for medical images. Firstly, image background segmentation is performed and the principal gray-scale values in the segmented background are identified. By excluding the corresponding histogram bins from being expanded for data hiding, the contrast of region of interest (ROI) in medical images can be selectively enhanced. With the proposed method, an original image can be exactly recovered from the corresponding enhanced image by hiding the side information within it. The experimental results on a set of medical images show that the visibility of ROI can be improved. Compared with the previous method, the proposed method can achieve more contrast enhancement effects and better visual quality for medical images [13].

D. Kannan et.al has proposed: "An extensive research on robust digital image watermarking techniques: a review" Digital watermarking is a probable solution for digital content owners that offer security to the digital content. In recent years, digital watermarking plays a vital role in providing the probable solution and numerous researches have been carried out. In this paper, an extensive review of the prevailing literature related to the image watermarking is presented together with classification by utilizing an assortment of techniques. In addition, a terse introduction about the digital watermarking is presented to get acquainted with the vital information on the subject of digital watermarking [14].

Jean-Luc Starck has proposed: "Gray and Color Image Contrast Enhancement by the Curvelet Transform" A new method for contrast enhancement based on the curvelet transform. The curvelet transform represents edges better than wavelets, and is therefore well-suited for multiscale edge enhancement. We compare this approach with enhancement based on the wavelet transform, and the Multiscale Retinex. In a range of examples, we use edge detection and segmentation, among other processing applications, to provide for quantitative comparative evaluation. Our findings are that curvelet based enhancement out-performs other enhancement methods on noisy images, but on noiseless or near noiseless images curvelet based enhancement is not remarkably better than wavelet based enhancement [15].

Chun-Shien Lu et.al has proposed: "Denoising and Copy Attacks Resilient Watermarking by Exploiting Prior Knowledge at Detector" methodology is to exploit prior knowledge available at the detector side and then use it to design a "nonblind" embedder. We prove that the proposed scheme can resist two famous watermark estimation-based attacks, which have successfully cracked many existing watermarking schemes. False negative and false positive analyses are conducted to verify the performance of our scheme. The experimental results show that the new method is indeed powerful [16].

P.Shanmugavadivu et.al has proposed: "Modified Histogram Equalization for Image Contrast Enhancement Using Particle Swarm Optimization" A novel Modified Histogram Equalization (MHE) technique for contrast enhancement is proposed in this paper. This technique modifies the probability density function of an image by introducing constraints prior to the process of histogram equalization (HE). A median adjustment factor is then added to the result to normalize the change in the luminance level after enhancement. This factor suppresses the effect of luminance change due to the presence of outlier pixels. The outlier pixels of highly deviated intensities have greater impact in changing the contrast of an image. This approach provides a

convenient and effective way to control the enhancement process, while being adaptive to various types of images. Experimental results show that the proposed technique gives better results in terms of Discrete Entropy and SSIM values than the existing histogram-based equalization methods [17].

Jayshri Patel et.al has proposed: "Efficient Reversible Watermarking Technique with Contrast Enhancement for Color Images" histogram bin shifting based reversible data hiding algorithm for color images has been proposed. In this technique binary bits are embedded directly by addition and subtraction in two highest bin chosen and this process is repeated in modified histogram. Embedding of binary secret data is done on the each color component (Red, Green, and Blue) of color images. Secret Binary data bits are embedded in random permutation manner to secure the data from unauthorized receiver. Extraction of embedded binary bits is done by inverse algorithm of embedding process & proposed algorithm provide high embedding capacity with low distortion of original quality of image which may be used in different medical, military and satellite application [18].

Ante Poljičak et.al has proposed: "The Influence of Image Enhancement Filters on a Watermark Detection Rate" image enhancement before detection not only improves overall detection rate, but also enables the use of higher threshold values, which in turn gives better detection performance with smaller probability of false positive detection. Furthermore, we conclude that unsharp filtering is more appropriate than blind deconvolution since it gives slightly better results with considerably faster computation. The type of enhancement filtering should be chosen according to the type of the attack on a watermarked image [19].

Hao-Tian Wu et.al has proposed: "Reversible image watermarking on prediction errors by efficient histogram modification" A reversible data hiding algorithm is proposed, in which the efficiency of modifying a pair of histogram bins is considered. Multiple pairs of histogram bins can be further selected for data embedding in sequence, while pre-process of pixel values is performed to prevent the possible overflow and underflow. Embedding with the prediction errors is investigated with a new prediction scheme. In each of the four prediction modes, a large amount of prediction errors can be produced from the host image. Moreover, all combinations of the four modes to generate a number of histogram pairs are enumerated to obtain the best performance. Blind extraction and recovery are enabled by embedding a pre-computed location map and other overhead information into the watermarked image. Promising experimental results are obtained on a variety of test images. Compared with the existing algorithms, the image content is better preserved in high payload data hiding [20].

Debashis Sen *et.al has proposed :* "Automatic Exact Histogram Specification for Contrast Enhancement and Visual System Based Quantitative Evaluation" The desired histogram is obtained by first subjecting the image histogram to a modification process and then by maximizing a measure that represents increase in information and decrease in ambiguity. A new method of measuring image contrast based upon local band-limited approach and center-surround retinal receptive field model is also devised in this paper. This method works at multiple scales (frequency bands) and combines the contrast measurement. In comparison to a few existing methods, the effectiveness of the proposed automatic exact histogram specification technique in enhancing contrasts of images is demonstrated through qualitative analysis and the proposed image contrast measure based quantitative analysis [21].

Rajib kumar jha et.al has proposed: "Dark and low-contrast image enhancement using dynamic stochastic resonance in discrete cosine transform domain" .The proposed technique significantly enhances the image contrast and color information without losing any image or color data by optimization of bistable system parameters. The performance of the proposed methodology has been measured in terms of relative contrast enhancement factor, perceptual quality measure, and color enhancement factor. When compared with the existing enhancement techniques, such as adaptive histogram equalization, gamma correction, single-scale retinex, multi-scale retinex, modified high-pass filtering, multicontrast enhancement with dynamic range compression, color enhancement by scaling, edge-preserving multi-scale decomposition, automatic control of imaging tool, and various spatial/frequency-domain SR-based techniques, the proposed technique gives remarkable performance in terms of contrast and color enhancement while ascertaining good perceptual quality[22].

PRABHAKAR C.J et.al has proposed : "AN IMAGE BASED TECHNIQUE FOR ENHANCEMENT OF UNDERWATER IMAGES" technique which comprises a combination of four filters such as homomorphic filtering, wavelet denoising, bilateral filter and contrast equalization. These filters are applied sequentially on degraded underwater images. For smoothing the image, the image based preprocessing algorithms uses the anisotropic filter. The main drawback of the anisotropic filter is that iterative in nature and computation time is high compared to bilateral filter. In the proposed technique, in addition to other three filters, we employ a bilateral filter for smoothing the image. We evaluated the technique using quantitative based criteria such as a gradient magnitude histogram and Peak Signal to Noise Ratio (PSNR). Further, the results are qualitatively evaluated

based on edge detection results. The proposed technique enhances the quality of the underwater images and can be employed prior to apply computer vision techniques [23].

Gou xin-ke et.al has propsoed: "Study on Algorithm of Digital Image Watermarking Based on DWT", watermarking algorithm using digital watermarking technology based on the discrete wavelet (DWT) multi-resolution decomposition algorithm. Three-level wavelet decomposition is employed so that images are divided into three serial sub-graphs with high frequency band and one sub-graph with low frequency band. Since low-frequency information is more sensitive to human eyes than high-frequency information, watermarking is embedded into the high-frequency coefficients of the wavelet image. In our experiment, watermarking information is embedded into the original images by Matlab simulation [24].

3. PROBLEM FORMULATION:

The field of watermarking has undergone through research over the last few decades and lot of work has been reported in the paper. However the pace at which the multimedia data is increasing, there is definitely a need to have more secure & robust watermarking algorithms & techniques. The techniques presented so far are mostly utilizing gray scale images or monochrome digital content, however since most of the organizations and business concerns nowadays mostly use color data such as logos, tags and labels, which demands the equal focus towards the design of schemes for color data as well. After studying different approaches we still there is need of an approach which may provide better result i.e. reduces the mean square error (MSE) & high PSNR as compared to the other conventional algorithm.

4. PROPOSED WORK:

After analyzing several techniques we proposed a new novel watermarking technique with high contrast color images by properly analyzing the image data to identify the significant portion of the image for embedding the watermark. Later on during the extraction phase, reverse process is used to extract the watermark. After that high contrast image is obtained with contrast enhancement algorithm. The proposed technique results are measured in terms of PSNR & MSE.

5. CONCLUSION:

Digital image watermarking with high contrast is a rising research area that has received great attention from the research community over the past decade. In this paper, a comprehensive survey of the significant researches and techniques existing for digital watermarking with high contrast image has been studied. Here, existing researches that are robust against attacks are analyzed. An introduction about the digital watermarking and its applications has also been presented and the existing researches are organized according to the techniques implemented. This survey paves the way to the budding researchers to know about the numerous techniques available for digital image watermarking & contrast enhancement of color images. With the help of my proposed technique significantly enhances the image contrast and color information without losing any image or color data.

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