A Review on Modern Trends on Image Watermarking Technique

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Abstract: In the today's high scale communication of data, a pressing need is generated for protection of the data information from many of the illegal duplication and modifications. For this purpose image watermarking is getting a very growing focus for a solution to the theft and tampering by involving the applications of advanced digital image processing operations to watermark copyright and authenticate information inside the image content.

Keywords-- Watermarking, image processing, DCT, DWT, SVD and image encryption, security.

1. Introduction:

The Internet is an excellent sales and distribution channel for digital assets, but copyright compliance and content management can be a challenge. These days, digital images can be used everywhere – with or without consent. Images that are leaked or misused can hurt marketing efforts, brand image and, ultimately, sales. The possible implications of this situation include the unauthorized distribution of such material with the purpose of making illegal profit or otherwise damaging the legal owner. Inevitably the business world and the authorities have expressed great concern over this issue, and as a result, the scientific community has become extremely active trying to provide techniques for copyright protection of digital material. One way to address this problem is Image Watermarking. It is the process of inserting hidden information in an image by introducing modifications of minimum perceptual disturbance. Robustness, perceptual transparency, capacity and blind watermarking are four essential factors to determine quality of watermarking scheme [1]. Image watermarking techniques can be divided into two groups in accordance with processing domain of host image. One is to modify the intensity value of the luminance in the spatial domain [2] and the other is to change the image coefficient in a frequency domain [3][4]. In recently, a transform called Singular Value Decomposition (SVD) was explored for watermarking [5][6]. Frequency domain techniques are used commonly because of their robustness to various types of attacks like JPEG compression, cropping, rotation, noise, blur etc. SVD-based watermarking algorithms are also very robust against these attacks. DWT has excellent spatial localization and multi-resolution characteristics, which are similar to the theoretical models of the human visual system. DCT and SVD based watermarking techniques offer compression. Further Performance improvements in DWT-based digital image watermarking algorithms, DCT-based watermarking algorithms and SVD-based watermarking algorithms could be obtained by combining DWT, DCT and SVD. The idea of combining these transforms is based on the fact that combined transforms could compensate for the drawbacks of each other, resulting in effective watermarking.

In Singular Value Decomposition, singular values correspond to the luminance of the image (i.e. image brightness) and the corresponding singular vector specifies the intrinsic geometry properties of the image [2]. Many singular values have small values compared to the first singular value. If these small singular values are ignored in the reconstruction of the image, the quality of the reconstructed image will degrade only slightly. Slight variations of the singular values do not affect the visual perception of the image, i.e., singular values do have a good stability. Based on these properties of SVD, diagonal matrix containing singular values is mainly used to embed watermark. The DCT has special property that most of the visually significant information of the image is concentrated in low frequency coefficient of the DCT.

2. Related Work:

In 2000, Chiou-Ting Hsu et. Al. (IEEE), proposed their work related to image watermarking by wavelet decomposition. In this work, they stated that, digital watermarking has been increasingly recognized as a highly effective means of protecting the intellectual property rights associated with multimedia data. Based on the multi-resolution structures of wavelet decomposition, both, on a real field and binary field, a multi-resolution watermarking technique was proposed. Since the Human Visual System (HVS) inherently performs a multi-resolution structure, each decomposed layer of a binary watermark is embedded into the corresponding decomposed layer of a host image. Therefore, in case of attacks or progressive transmission, the coarser approximation of a watermark is preserved in the coarser version of an image. In a progressive transmission, adding higher frequency components, allows us to obtain higher resolution image, and, correspondingly, extract a higher resolution watermark. There experimental results demonstrated the robustness and validity of the watermarking process.

There work presented a novel multi-resolution watermark embedding algorithm based on wavelet decomposition. Both the image and the binary watermark were decomposed into multiple layers with different resolution and different frequency bands. With the characteristics of successive approximation, a higher resolution watermark was extracted. When only coarse resolution of the image was available, the coarser approximation of the watermark can be extracted. To identify the copyright owner or the receiving client, an individual "user key" was adopted to describe the involved parameters deemed necessary to extract the relevant watermark. For instance, the user key can designate the number of decomposition level, the seed of the pseudo-random number generator for each decomposed band, the measurement used to perform the image-dependent permutation, the patterns of the residual masks, and the specific bands for embedding the lowest band of the binary watermark. Without knowing the user key, even the

embedding and extracting methods were known the removal of the watermark was still difficult to the extent that it interfered with the host image. Filters of DWT and binary wavelet also influenced the quality and robustness to compression attacks of the watermarked image. From the watermarking perspective, the redundancy within the decomposed bands was used to hide watermarking information and is hopefully not easily discarded by lossy compression. Efforts are already underway to evaluate the wavelet filters. Moreover, in light of the video coding standards (such as H.261, MPEG-1 and MPEG-2), they were also interested in developing the hybrid watermarking approach by combining both wavelet decomposition and DCT-based watermarking techniques [19].

In 2005,Maha Sharkas et. Al. (IEEE) proposed their work related to dual digital-image watermarking technique. In their work, they presented that image watermarking has become an important tool for intellectual property protection and authentication. In this work a watermarking technique was suggested that incorporated two watermarks in a host image for improved protection and robustness. A watermark, in form of a PN sequence (will be called the secondary watermark), was embedded in the wavelet domain of a primary watermark before being embedded in the host image. The technique has been tested using Lena image as a host and the camera man as the primary watermark. The embedded PN sequence was detectable through correlation among other five sequences where a PSNR of 44.1065 db was measured. Furthermore, to test the robustness of the technique, the watermarked image was exposed to four types of attacks, namely compression, low pass filtering, salt and pepper noise and luminance change. In all cases, the secondary watermark was easy to detect even when the primary one was severely distorted.
They found that a dual watermarking technique in the DWT domain is suggested and implemented using the MATLAB software. The measured performance of the technique proves its robustness against several kinds of attacks. Hence it can serve as a good means to prove the authenticity and ownership of intellectual properties and it can also detect any alteration or modification by any illicit user since the correlation peak that corresponds to the presence of the secondary watermark differs every time the watermarked picture is exposed to a different attack as illustrated in the experimental results [20].

In 2006 Chih-Yang Lin et. Al proposed their work related to robust image hiding method using wavelet technique. There work stated that a robust wavelet-based image hiding methods, that hide still images, E, inside a covered image, C, to establish a composite image, P, are presented. We can hide up to three full-size embedded images inside a cover image while maintaining the quality of the composite image. The embedded images retain easily recognizable when extracted. The embedded images can be extracted fairly completely even when lossy compression or cropping is applied to the composite image. The proposed method does not require the original cover image to extract the embedded image.
They presented an easy, yet effective method to embed one to three images into another image. The PSNR of the composite images were above 32 db for cases when one image or three images were embedded. In both cases, perceptible embedded images can be extracted. This method is very robust. I have shown that I can extract recognizable embedded image even when one quarter of the composite image was removed. When other operations, such as JPEG compression and adding noise, were applied to the composite images, the embedded images can still be extracted. In all of my experiments, I embedded one full size image or three full size images. If the size of the embedded image is smaller, the PSNR of the extracted embedded images would be further improved. I believe that the robustness can also be improved[21].

In 2007 Ibrahim Nasir et. Al (IEEE) proposed their work related to a new robust watermarking scheme for color image in spatial domain. This work presented a new robust watermarking scheme for color image based on a block probability in spatial domain. A binary watermark image was permutated using sequence numbers generated by a secret key and Gray code, and then embedded four times in different positions by a secret key. Each bit of the binary encoded watermark was embedded by modifying the intensities of a non-overlapping block of 8*8 of the blue component of the host image. The extraction of the watermark was by comparing the intensities of a block of 8*8 of the watermarked and the original images and calculating the probability of detecting '0' or '1'. Tested by benchmark Stirmark 4.0, the experimental results showed that the proposed scheme was robust and secure against a wide range of image processing operations.
A robust watermark scheme based on a block probability for color image was presented, which operated in spatial domain by embedding the watermark image four times in different positions in order to be robust for cropping attack. The extraction of the watermark depended on the original image, so it was a non-blind watermarking scheme. The experimental results showed that our scheme is highly robust against various of image processing operations such as, filtering, cropping, scaling, compression, rotation, randomly removal of some rows and columns lines, self-similarity and salt and pepper noise. It is also secure scheme, only the one with the correct key can extract the watermark [22].

In 2007, Chin-Chen Chang et. Al. presented there work related to an SVD oriented watermark embedding scheme with high qualities for the restored images. In this work, they stated that SVD-based watermarking scheme, which successfully embeds watermarks into images, and its hidden watermarks can resist various attacks. In this work, we further extended their idea so that the hidden watermarks can be removed to provide authorized users better image quality for later usage after the ownership of purchased images has been verified. To achieve our objective, we modified their embedding strategy, and the extra information required for later restoration is embedded into the least important non-zero coefficients of the S matrices in the image. Experimental results confirmed that our scheme not only provided good image quality of watermarked images but also successfully restored images with high restoration quality.
In this work, they extended Chang et al.'s concept to provide a removable watermarking scheme for binary logos. To make sure the watermarked images can be restored with high image quality to support different application requirements by authorized users; the proposed scheme not only modified the embedding strategy of Chang et al.'s scheme but also hided extra information in the fourth non-zero coefficients of the S matrices in the image during the watermark embedding procedure. Because the proposed scheme improved on Chang et al.'s scheme, it inherited the robustness of their scheme. Furthermore, according to the experimental results, our proposed scheme has been proved to maintain acceptable

image quality in watermarked images and good bcrs in extracted watermarks. Even for the compressed images under parameter 70, the average psnrs of watermarked images and restored images were still up to 30 db and 32 db, respectively. The average BCR was also up to 89%. In other words, authorized users can always restore images with high image quality for later usage after they verify ownership of their purchased images. Therefore, the proposed watermarking scheme is very suitable for the protection of rightful ownership of digital images and for on-line image purchasing [23].

In 2007 Ali Al-Haj et. Al proposed their work related to combined dwt-dct digital image watermarking .In this work, they stated that the proliferation of digitized media due to the rapid growth of networked multimedia systems has created an urgent need for copyright enforcement technologies that can protect copyright ownership of multimedia objects. Digital image watermarking is one such technology that has been developed to protect digital images from illegal manipulations. In particular, digital image watermarking algorithms which are based on the discrete wavelet transform have been widely recognized to be more prevalent than others. This is due to the wavelets' excellent spatial localization, frequency spread, and multi-resolution characteristics, which are similar to the theoretical models of the human visual system. In this work, we described an imperceptible and a robust combined DWT-DCT digital image watermarking algorithm. The algorithm watermarks a given digital image using a combination of the Discrete Wavelet Transform (DWT) and the Discrete Cosine Transform (DCT). Performance evaluation results showed that combining the two transforms improved the performance of the watermarking algorithms that are based solely on the DWT transform.
The discrete wavelet transforms (DWT) and the discrete cosine transform (DCT) have been applied successfully in many digital image watermarking. In this work, we described a combined DWT-DCT digital image watermarking algorithm. Watermarking was done by embedding the watermark in the first and second level DWT sub-bands of the host image, followed by the application of DCT on the selected DWT sub-bands. The combination of the two transforms improved the watermarking performance considerably when compared to the DWT-Only watermarking approach. In conclusion, in DWT-based digital watermarking applications, combining appropriate transforms with the DWT may have a positive impact on performance of the watermarking system [24].

In 2008 B.Chandra Mohan et. Al. Proposed their work related to robust image watermarking scheme using singular value decomposition. In their work, they presented a robust image watermarking scheme for multimedia copyright protection. In this work, host image is partitioned into four sub images. Watermark image such as 'logo' was embedded in the two of these sub images, in both D (singular and diagonal matrix) and U (left singular and orthogonal matrix) components of Singular Value Decomposition (SVD) of two sub images. Watermark image was embedded in the D component using Dither quantization. A copy of the watermark was embedded in the columns of U matrix using comparison of the coefficients of U matrix with respect to the watermark image. If extraction of watermark from D matrix was not complete, there was a fair amount of probability that it can be extracted from U matrix. The proposed algorithm is more secured and robust to various attacks, viz., JPEG2000 compression, JPEG compression, rotation, scaling, cropping, row-column blanking, row-column copying, salt and pepper noise, filtering and gamma correction. Superior experimental results were observed with the proposed algorithm over a recent scheme proposed by Chung et al. In terms of Bit Error Rate (BER), Normalized Cross correlation (NC) and Peak Signal to Noise Ratio (PSNR).
In this work, a robust watermarking scheme based on SVD was proposed. The watermark image was embedded in both D and U matrices. Since, the same watermark was embedded twice in the same image, the rate of watermark survival was high. Robustness was achieved by using the Dither quantization for D matrix and altering coefficients of U matrix. The quality of the watermarked image was good in terms of perceptibility and PSNR (43.11db). This method was superior to Chung et al. Method in terms of both PSNR and robustness (low BER & high NC). The proposed algorithm was shown to be robust to JPEG2000 compression, JPEG compression, rotation, scaling, cropping, median filtering, low pass filtering, row-column copying, row-column blanking, bit plane removal, salt and pepper noise and gamma correction. This indicated that an embedded watermark was still recoverable even after the common image processing operations on the watermarked image and hence highly suitable for the copyright protection [25].

In 2009, Mei Jiansheng et. al proposed their work related to digital watermarking algorithm based on Dct and dwt This work introduced an algorithm of digital watermarking based on Discrete Cosine Transform (DCT) and Discrete Wavelet Transform (DWT). According to the characters of human vision, in this algorithm, the information of digital watermarking which has been discrete Cosine transformed, was put into the high frequency band of the image which has been wavelet transformed. Then distilled the digital watermarking with the help of the original image and the watermarking image. The simulation results showed that this algorithm was invisible and has good robustness for some common image processing operations.
This work introduced a discrete wavelet transform (DWT) digital watermark algorithm based on human vision characters. By using the block technology, watermarking signal was embedded into the high frequency band of wavelet transformation domain. And before embedding this watermark image has been dicrete cosine transformed in order to improve its robustness. The simulation results suggested that this watermarking system not only can keep the image quality well, but also can be robust against many common image processing operations of filer, sharp enhancing, adding salt noise, image compression, image cutting and so on. This algorithm had strong capability of embedding signal and anti-attack [26].

In 2009, A MANSOURI proposed that, there work related to SVD-based digital image watermarking using complex wavelet transform. In this work, they stated a new robust method of non-blind image watermarking. The suggested method was performed by modification on singular value decomposition (SVD) of images in Complex Wavelet Transform (CWT) domain while CWT provided higher capacity than the real wavelet domain. Modification of the appropriate sub-bands leads to a watermarking scheme which favourably preserved the quality. The additional advantage of the proposed technique was its robustness against the most of common attacks. Analysis and experimental results showed

much improved performance of the proposed method in comparison with the pure SVD-based as well as hybrid methods (e.g. DWT-SVD as the recent best SVD-based scheme).

A new non-blind SVD-based watermarking method in CWT domain was introduced. Modifying svs of the host image in CWT domain provided high robustness against the common attacks. High PSNR of watermarked image was another beneficial point of the algorithm as the result of CWT implementation. Making trade off between PSNR of the watermarked image and correlation between extracted watermark and the original data lead to selecting the best value of the scaling factor in both variant and non-variant implementations of our method. Although all SVD-based watermarking algorithms were enough robust against the geometrical attacks such as cropping and rotation, they were less robust against some distortions like Gaussian noise, blurring and histogram equalization. Since the proposed algorithm took the advantages of the wavelet Transform and SVD methods simultaneously, the extracted watermarks were more robust against all mentioned attacks. The additional privilege of suggested algorithm was its compatibility with human visual system characteristics to embed the watermark by selecting the best sub-bands in CWT domain. In this way, high capacity of CWT domain was applied to embed the watermark information along with preserving the quality of the watermarked image [27].

In 2010, ms. kapre bhagyashri et. Al proposed there work related to robust image watermarking based on singular value decomposition and discrete wavelet transform .In their work ,they stated the robustness against geometric distortions one of the crucial important issues in watermarking. In this work, a new singular value decomposition-discrete wavelet transform (SVD-DWT) composite image watermarking algorithm that is robust against watermarking processing was presented. We used DWT and IDWT transform to obtain four different frequency images. A point that assumed watermarking should be embedded watermarking in low or middle frequency to have good robustness. Experimental evaluation demonstrated that the proposed algorithm was able to withstand a variety of attacks including common geometric attacks.

Their observations regarding the proposed watermarking scheme can be summarized as follows:

1) In their scheme, the most difference from traditional scheme was that the watermarking was embedded in high frequency. It has good performance in a variety of image processing.

2) SVD decomposition belonged to spatial domain transform and has robustness to geometrical attack. For considering this, they used DWT and IDWT transformation to obtain the high frequency image. Accordingly the scheme has robustness to geometrical attack. .

3) They noticed, there are three frequency image (low frequency image, middle-low frequency image, middle-high frequency image) not used. Different watermarking can be embedded in them [28].

In 2010, Say Wei Say Foo proposed their work related to normalization-based robust image Watermarking scheme using svd and dct. In this work, they stated that digital watermarking is one of the techniques for copyright protection. In this work, a normalization-based robust image watermarking scheme which encompassed singular value decomposition (SVD) and discrete cosine transform (DCT) techniques was proposed. For the proposed scheme, the host image was first normalized to a standard form and divided into non-overlapping image blocks. SVD was applied to each block. By concatenating the first singular values (SV) of adjacent blocks of the normalized image, a SV block is obtained. DCT was then carried out on the SV blocks to produce SVD-DCT blocks. A watermark bit was embedded in the high frequency band of a SVD-DCT block by imposing a particular relationship between two pseudo-randomly selected DCT coefficients. An adaptive frequency mask was used to adjust local watermark embedding strength. Watermark extraction involved mainly the inverse process. The watermark extracting method was blind and efficient. Experimental results showed that the quality degradation of watermarked image caused by the embedded watermark was visually transparent. Results also showed that the proposed scheme was robust against various image processing operations and geometric attacks.

In this work, a novel robust image watermarking scheme is described. The host image was first normalized. A 4 X 4 SV block was constructed by concatenating first svs of 16 adjacent 4X4 image blocks in the normalized image. DCT was then performed on SV blocks and watermark bits were embedded in the high-frequency DCT coefficients. An adaptive frequency mask was calculated to adjust local watermark embedding strength. The watermark extracting method was blind. Fidelity loss of watermarked image was very low. Experimental results showed that the proposed scheme was very robust against various image processing operations and geometric attacks. Although the proposed scheme was described for embedding watermark in image, it can be readily adapted for audio watermarking and other forms of watermarking [29].

In 2010, Jamal A. Hussein proposed their work related to spatial domain watermarking scheme for colored images based on log-average luminance. In this work, a new watermarking scheme was presented based on log-average luminance. A colored-image was divided into blocks after converting the RGB colored image to ycbcr color space. A monochrome image of 1024 bytes was used as the watermark. To embed the watermark, 16 blocks of size 8X8 are selected and used to embed the watermark image into the original image. The selected blocks were chosen spirally (beginning form the centre of the image) among the blocks that have log-average luminance higher than or equal the log-average luminance of the entire image. Each byte of the monochrome watermark was added by updating a luminance value of a pixel of the image. If the byte of the watermark image represented white color (255) a value α is added to the image pixel luminance value, if it is black (0) the α is subtracted from the luminance value. To extract the watermark, the selected blocks are chosen as the above, if the difference between the luminance value of the watermarked image pixel and the original image pixel is greater than 0, the watermark pixel was supposed to be white, otherwise it supposed to be black. Experimental results showed that the proposed scheme was efficient against changing the watermarked image to grayscale, image cropping, and JPEG compression.

In this work a color image watermarking technique was proposed based on log-average luminance. This technique is tested on various images. The watermark is a monochrome image. The best blocks are selected spirally, beginning from the centre, among those blocks that have logaverage luminance greater than or equal to the logaverage luminance

of the entire image. Experimental test results show best watermark invisibility when the addition factor α is 3. Many tests are performed on different color images and showed some robustness against various attacks. More robustness can be achieved by adding the watermark in frequency domain using transforms like (DFT, DCT, or DWT). They also can use grayscale or color watermark instead of the monochrome watermark used in this work[30].

In 2011, Manjit Thapa et. Al presented their work related to secure digital image watermarking techniques. In this work, they stated that digital watermarking was used to hide the information inside a signal, which cannot be easily extracted by the third party. Its widely used application was copyright protection of digital information. It was different from the encryption in the sense that it allowed the user to access, view and interpret the signal but protect the owner-ship of the content. One of the current research areas was to protect digital watermark inside the information so that ownership of the information cannot be claimed by third party. With a lot of information available on various search engines, to protect the ownership of information is was a crucial area of research. In latest years, several digital watermarking techniques were presented based on discrete cosine transform (DCT), discrete wavelets transform (DWT) and discrete Fourier transforms (DFT). In this work, we proposed an algorithm for digital image watermarking technique based on singular value decomposition; both of the L and U compo-nents are explored for watermarking algorithm. This technique referred to the watermark embedding algorithm and watermark extracting algorithm. The experimental results proved that the quality of the watermarked image was excellent and there was strong resistant against many geometrical attacks.
Digital watermarking was one of the emerging areas of research. In this work, they proposed a digital image watermarking algorithm based on singular value decomposition. The algorithm is used for watermarking embedding and watermark extraction. The feature of the D component and the relationship between the U Component coefficients were explored in the proposed technique that provided stronger robustness against different attacks and better image quality. So, Digital image watermarking techniques was secure on this algorithm. If alpha has a less than 0.2 value then quality of the original image and watermarked image is good. The experimental results also recognized the effectiveness of the proposed technique. Because of these properties, SVD is used for DCT, DFT, and DWT transformations,
and one-way non-symmetrical decomposition. These provide the advantages of various sizes of transformation and more security. That was a good performance of the proposed scheme both in terms of robustness and security [31].

In 2012, Kaushik Deb proposed their work related to combined dwt-dct based digital image watermarking technique for copyright protection .There work stated a combined DWT and DCT based watermarking technique with low frequency watermarking with weighted correction is proposed. DWT has excellent spatial localization, frequency spread and multi-resolution characteristics, which were similar to the theoretical models of the human visual system (HVS). DCT based watermarking techniques offer compression while DWT based watermarking techniques offer scalability. These desirable properties were used in this combined watermarking technique. In the proposed method watermark bits were embedded in the low frequency band of each DCT block of selected DWT sub-band. The weighted correction was also used to improve the imperceptibility. The extracting procedure reversed the embedding operations without the reference of the original image. Compared with the similar approach by DCT based approach and DWT based approach, the experimental results showed that the proposed algorithm apparently preserved superior image quality and robustness under various attacks such as JPEG compression, cropping, sharping, contrast adjustments and so on.
In this work, a combined DWT and DCT based watermarking technique with low frequency watermarking with weighted correction has been proposed. In this technique watermark was mainly inserted into the low frequency of each DCT block of selected coefficient set of DWT domain. To increase the imperceptibility, the watermark image was adjusted by the weighted correction in the spatial domain. The results of experiments have showed that the algorithm has better visibility and has stronger robustness when it was attacked by JPEG compression, cropping, contrast adjustments, filtering, noises and so on. The experimental result showed that in most of the cases the correlation between the original watermark and the extracted watermark was more than 0.9. These results demonstrated that the proposed method was suitable candidate for copyright protection [32].

In 2012, Yusuf Perwej et. Al. Proposed their work related to an adaptive watermarking technique for the copyright of digital images and digital image protection .In this work they stated that internet as a whole does not use secure links, thus information in transit may be vulnerable to interruption as well. The important of reducing a chance of the information being detected during the transmission is being an issue in the real world now days. The Digital watermarking method provides for the quick and inexpensive distribution of digital information over the Internet. This method provides new ways of ensuring the sufficient protection of copyright holders in the intellectual property dispersion process. The property of digital watermarking images allows insertion of additional data in the image without altering the value of the image. This message is hidden in unused visual space in the image and stays below the human visible threshold for the image. Both seek to embed information inside a cover message with little or no degradation of the cover-object. In this work investigate the following relevant concepts and terminology, history of watermarks and the properties of a watermarking system as well as a type of watermarking and applications. We are proposing edge detection using Gabor Filters. In this work they proposed least significant bit (LSB) substitution method to encrypt the message in the watermark image file. The benefits of the LSB are its simplicity to embed the bits of the message directly into the LSB plane of cover-image and many techniques using these methods. The LSB does not result in a human perceptible difference because the amplitude of the change is little therefore the human eye the resulting stego image will look identical to the cover image and this allows high perceptual transparency of the LSB. The spatial domain technique LSB substitution it would be able to use a pseudo-random number generator to determine the pixels to be used for embedding based on a given key. They were using DCT transform watermark algorithms based on robustness. The

watermarking robustness have been calculated by the Peak Signal to Noise Ratio (PSNR) and Normalized cross correlation (NC) is used to quantify by the Similarity between the real watermark and after extracting watermark.

Digital Watermarking defines methods and technologies that hide information, for example a number or text, in digital media, such as images, copyright protection, tamper proofing, video or audio. In this work they briefly defined the concepts of watermarking, history of watermarks and the properties of a watermarking system as well as an application. I am proposing edge detection from Gabor Filter method. In this work they were using data hiding by the simple LSB substitution method. In the method a set of pixels that constitute a block jointly share the bits from the watermark .The values for the mean square error (MSE) and peak signal to noise ratio (PSNR) are measured. The results indicate the method introduces low noise and hence ensures lesser visible distortions. The PSNR value of about 58 db attained is much higher when compared with any other proposed methods. We have successfully implemented the LSB method and got satisfactory results as they also took into account the filtering option for making sure that the image is noise-free before transmission. The techniques in the spatial domain still have relatively low-bit capacity. The frequency domain based techniques can embed more bits for watermark and are more robust to attack. In this work, they used DCT transform watermark algorithms based on robustness. The hardiness of the watermarking evaluated have been measured by the Peak Signal to Noise Ratio (PSNR) of the watermarked Image and similarity between real Watermark and after extract Watermark using Normalized Cross Correlation (NC) method. In this work results showed that the imperceptibility of the watermarked image is acceptable [33].

In 2013 Bhupendra Ram et. Al. (IEEE) proposed their work related to digital image watermarking technique using discrete wavelet transform and discrete cosine transform. In this work they stated that digital watermarking has been proposed as a viable solution to the need of copyright protection and authentication of multimedia data in a networked environment, since it makes possible to identify the author, owner, distributor or authorized consumer of a document. In this work a new watermarking technique to add a code to digital images is presented: the method operates in the frequency domain embedding a pseudo-random sequence of real numbers in a selected set of DCT coefficient and a new method for digital image watermarking which does not require the original image for watermark detection. The watermark is added in select coefficients with significant image energy in the transform domain in order to ensure non-erasability of the watermark. Advantages of the proposed method include: improved resistance to attacks on the watermark, implicit visual masking utilizing the time-frequency localization property of wavelet transform and a robust definition for the threshold which validates the watermark.. Experimental results demonstrated that this proposed technique was robust to most of the signal processing techniques and geometric distortions.

In this dissertation, a digital image watermarking technique based on discrete wavelet transform and discrete cosine transform has been presented, where the method operates in the frequency domain embedding a pseudo-random sequence of real numbers in a selected set of DCT coefficients. And the watermark is added in select coefficients with significant image energy in the discrete wavelet transform domain in order to ensure non- erasability of the watermark. Experimental results demonstrate that the watermark is robust to most of the signal processing techniques and geometric distortions. Result suggest that the proposed scheme can be used to extract a good quality watermark for various image processing attacks like JPEG compression, average filtering, median filtering and cropping. There is a scope of future work in this dissertation, as is observed from the qualitative results that the proposed scheme shows comparable results with that of the scheme proposed by earlier. These results can be improved to increase the utility of the proposed scheme for varying levels of compression [34].

3. Conclusion:

The former is based on the Discrete Cosine Transform (DCT), and the latter the Discrete Wavelet Transform (DWT). It has been found that many watermarking schemes have been using these popular transforms. In these frequency domain methods there is a conflict for robustness and transparency. It has been observed that the watermark is embedded in perceptually most significant components, the scheme would be robust to attacks but the watermark may not be completely masked. If the watermarked image is less significant components, it would be easier to hide the watermark but the scheme may be less robust to the attacks. We have shown the use of Singular Value Decomposition (SVD) for image watermarking .The SVD is helps to determine whether a real bilinear form image can be made equal to another.

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