International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 3 Issue 2, February - 2014

Survey of Watermarking Techniques

[1.] Prof. R. D. Chaudhari, [2.] Prof. K. S. Bhagat
[1,2.] Asst. Professor, Dept. of Electronics and Telecommunication Engineering, J. T. Mahajan College of Engineeirng, Faizpur. Faizpur.-425524, India.

***Abstract*— Digital watermarking embeds a known message in a piece of digital data as a means of identifying the rightful owner of the data. These techniques can be used on many types of digital data including still imagery, movies, and music. This paper incorporates types of watermarking techniques where prime concern is colour image and method for watermarking is wavelet transform.**

***Keywords*— robustness, watermark.**

I. INTRODUCTION

The concept of digital watermarking arose while trying to solve problems related to the copyright of intellectual property in digital media. It is used as a means to identify the owner or distributor of digital data. Watermarking is the process of encoding hidden copyright information since it is possible today to hide information messages within digital audio, video, images and texts, by taking into account the limitations of the human audio and visual systems.[1]

A. Digital watermarking concept

It seems that digital watermarking is a way to protect intellectual property from illegal copying. It provides a means of embedding a message in a piece of digital data without destroying its value. Digital watermarking embeds a known message in a piece of digital data as a means of identifying the rightful owner of the data. These techniques can be used on many types of digital data including still imagery, movies, and music.

Digital Watermarking describes methods and technologies that hide information, for example a number or text, in digital media, such as images, video or audio. The embedding takes place by manipulating the content of the digital data, which means the information is not embedded in the frame around the data. The hiding process has to be such that the modifications of the media are imperceptible. For images this means that the modifications of the pixel values have to be invisible. Furthermore, the watermark must be either robust or fragile, depending on the application. By "robust" we mean the capability of the watermark to resist manipulations of the media, such as lossy compression (where compressing data and then decompressing it retrieves data that may well be different from the original, but is close enough to be useful in some way), scaling, and cropping, just to enumerate some. In some cases the watermark may need to be fragile. "Fragile" means that the watermark should not resist tampering, or would resist only up to a certain, predetermined extent.[1]

Figure 1.1 Example of watermark

The example above shows that digital watermarking allows hiding information in a totally invisible manner. The original image is on the left; the watermarked image is on the right and contains the name of the author. The rapidly growing field of digitized images, video & audio has urged the need of copyright protection, which can be used to produce evidence against any illegal attempt to either reproduce or manipulate them in order to change their identity. Digital watermarking is a technique providing embedded copyright information in images

B. Classification of Watermarking

With reference to various survey articles[1] watermarking techniques can be divided into four categories according to the type of document to be watermarked as text watermarking, image watermarking, audio watermarking, video watermarking. Image watermarking can be done both in special domain as well as in the frequency domain. The taxonomy of watermarking techniques is depicted in figure 1.2. In images, the Watermarking techniques can be classified into three types as Visible watermark, Invisible fragile watermark, and invisible robust watermark.

A Visible watermark is a secondary translucent overlaid over primary image. The watermark appears visible to a casual viewer on careful inspection. The invisible fragile watermark is embedded on the primary image in such a way that any manipulation or modification of the image would alter or destroy the watermark. The invisible robust watermark is embedded on the primary image in such a way that an alteration mode to the pixel value is perceptually not noticeable and it can be recovered only with an appropriate decoding mechanism.

IJERT

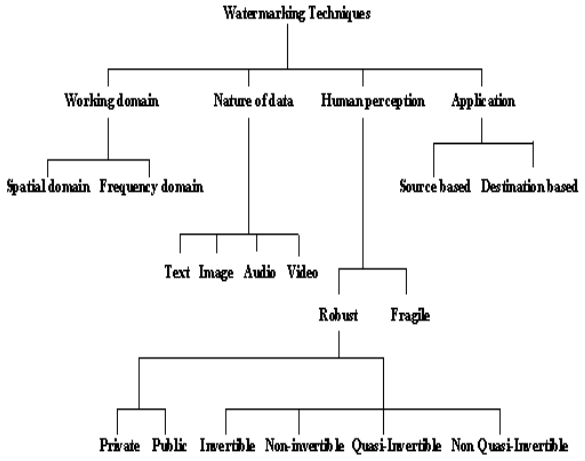

Figure 1.2 Taxonomy of watermarking techniques

II. LITERATURE REVIEW OF DIGITAL WATERMARKING

K. Jun et.al [2] presented a watermarking algorithm based on image segmentation, in order to improve the security of the watermark, take the DFT (Discrete Fourier Transform) algorithm to deal with the watermark process, also analyze the robustness of the algorithm. Robust of the algorithm is relatively good. It also has Very strong resistance against some attack such as histogram equalization, intensified image, darken image, reducing contrast and etc.

J. Li et.al [3] detailed a method based on the FCM algorithm. In the scheme, the watermarks are encrypted by double phase encoding technique. The proposed method is blind and it does not need the host image during the extraction process. With the features of HVS, FCM algorithm is used to classify blocks and select suitable blocks to embed watermark. To guarantee the imperceptibility and robustness of the embedded watermark, an iterative embedding algorithm is adopted. Without the correct private keys, the encrypted watermark cannot be decrypted correctly.

L Ghouti et.al.[4]proposed a robust watermarking algorithm using balanced multi wavelet transform. The embedding scheme is image adaptive using a modified version of a well-established perceptual model. Therefore, the strength of the embedded watermark is controlled according to the local properties of the host image. This has been achieved by the proposed perceptual model, which is only dependent on the image activity and is not dependent on the multi filter sets used, unlike those developed for scalar wavelets. S. Liao et.al.[5] proposed a novel DMWT(discrete multi wavelet transform) algorithm of DCIW(dual color image watermarking). The technique greatly improves the watermarking efficiency, because its realization only requires taking DMWT or inverse DMWT (IDMWT) to the R, G, B elements of the color host image and watermarked image respectively. There are two channels in a DMWT. They have taken two low pass filters as, L1, L2 and the two high pass filters as, H1 H2. A DMWT to a 2-dimensional image results in sixteen sub-blocks. Balanced multi wavelets are computationally more efficient than the unbalanced ones. Furthermore, balanced multi wavelets have high energy compaction efficiency. This method can be more efficient for real time processing such as video watermarking. It gives better result than above method.

S. Che,[6] presented the paper which first brings up the idea which embedding watermark based on the attacks' characteristic, brings forward the region segmentation operator and the image segmentation embedding method, puts forward the characteristic and its representation in DWT(discrete wavelet transform) transform domain based on visual features model, and brings forward the quantized central limit theorem which applies to adjusting the coefficients in general transform domain. These all make semi-fragile watermarking embedded through dynamic quantization achieve the greatest robustness. It gives wavelet transform domain coefficient redressal operator and the best restoration probability of the pixel value adjusting in experiments when the images were under attack. It leads up to a better invisibility of carrier image, a better robustness to the image processing, such as JPEG compression, noise adding, filtering, and the larger amount of embedded information.

V. Jabade et.al [7] presented a comprehensive review of the existing literature available on wavelet based image watermarking methods. They described a method which emphasizes wavelet based watermarking which is widely used today and analyses various methods and approaches to wavelet based image watermarking in detail. Also, it reviews the applications and attributes of image watermarking. It provides B. Gunjal et.al [8], described the multilayer secured DWT-DCT and YIQ color space based image watermarking technique with robustness and better correlation. The security levels are increased by using multiple pn sequences, Arnold scrambling, DWT domain, DCT domain and color space conversions. Peak signal to noise ratio and Normalized correlations are used as measurement metrics. The 512x512 sized color images with different histograms are used for testing and watermark of size 64x64 is embedded in HL region of DWT and 4x4 DCT is used. 'Haar' wavelet is used for decomposition and direct flexing factor is used. They got PSNR value is 63.9988 for flexing factor k=1 for Lena image and the maximum NC 0.9781 for flexing factor k=4 in Q color space. The comparative performance in Y, I and Q color space is presented.

M. Zhao et.al [9], presented a watermarking algorithm based on DWT and DCT. The visual characteristics of low frequency sub-image of DWT and the ability of DCT are combined to remove correlation between DWT coefficients. This method applies DCT sub-sampling blind strategy to DWT field to solve the visual distortion problem when embed the mark into low frequency sub image of DWT field and then adds the self-adapted embedding color component choosing strategy to process the color image. While the extraction procedure is the inverse procedure of embed. Firstly, the embedding path was found out by evaluating different color components of watermarked image. Then author applied DWT, sub sampling and DCT to it as the same manner of embedding. Thirdly the same coefficient selector was used to recover the watermark embedding positions.

S. Amira et.al [10] described a technique based on the chaotic logistic map by use of a texture segmentation method in wavelet confirm the imperceptibility of the watermark and its robustness against JPEG compression and other

IJERT

transformations. In future, it would be very interesting to test the robustness of the algorithm against several attacks such as geometric transforms. it is possible to obtain high fidelity and robustness. Yu Wei [11] presented a multipurpose digital watermarking algorithm based on DWT of color images which take full account of masking characters of Human Visual System (HVS) in color images. Firstly, the original images will be converted from the RGB color space to the YCbCr space, which has excellent independence of every channel. Secondly, the information of the carrier image is deeply mined in every channel. Finally, the robust and fragile watermarking encrypted are embedded in the image.

D. Zhu et.al [12], proposed image normalization based robust digital watermarking scheme in contourlet domain. Compared to wavelet, the contourlet has richer basic functions. It uses fewer coefficients to represent smooth edges and combines the discontinuity points in the same direction into a discontinuity line or a discontinuity face Firstly, the geometrically invariant space is constructed by using image normalization and the significant region is obtained from the normalized image by utilizing the invariant centroid theory. Then, the contourlet transform is performed on the significant region. Finally, the digital watermark is adaptively embedded into the significant region by quantizing the low-frequency contourlet coefficients according to the human visual system (HVS). F. Rahimi et.al. [12] presented a contourlet-based watermarking technique. In this method, for embedding each bit of watermark, a coefficient was chosen in a selected scale and formed a block using corresponding coefficients in adjacent sub bands. To store one bit in the selected block, the average of block was quantized. As number of coefficient in each block is small, it gives high capacity. The contour let transform use some concentric squares to separate scales. The low frequency coefficients are gathered in the central square and by the increase of the scales, the squares are broadened. The sensitivity of HVS to high frequency coefficients is small, but low frequency coefficients are more robust against attacks and usually high frequency coefficients of attacked object are ruined.

M. Imran [14], detailed a watermarking scheme in which a color mark is embedded into a color image. Principle component analysis is used to uncorrelated R, G and B channels of both the images. Each channel of color watermark is embedded into singular values of corresponding channel of cover image after discrete wavelet decomposition. DWT decomposition is performed on each channel of color cover image to obtain (LL, LH, HL and HH) bands and corresponding channel of color watermark is embedded into singular values of LH and HL bands. The scheme was tested against various attacks (including histogram equalization, Gaussian noise, cropping, Y-shearing, X-shearing, affine transformation, salt & pepper), to check the robustness.

Qingtang Su [15], proposed a digital watermarking algorithm for a color watermark embedded into a color host image, based on color space transform and IWT (Integer Wavelet Transform). First of all, with the DCT static image compressing techniques, the algorithm compresses and codes the watermark into a one dimensional binary sequence, and then random scrambling. During the embedding, the color host image is transformed into YIQ color mode. Then, the luminance Y is obtained and transformed by IWT. By considering the peculiarity of the HVS, the embedding positions of the watermark are determined.

D. Liu et.al.[16] detailed a new semi-fragile watermarking scheme based on Non sub sampled Contour let Transform(NSCT) for color image authentication, in which the watermarking is embedded in the SVs(singular values)of the blocks within NSCT sub bands by an adaptive quantized method. The encrypted binary watermarking is then embedded in the SVs (singular values) by an adaptive quantized method for authentication. The NSCT has more redundancy than the DWT and has fully shift invariable characteristic that can increase the capacity of the watermarking. They have applied the two-dimensional transformed network generated by the low-dimensional Tent chaotic map to encrypt the embedded watermarking.

M. Ouhsain et.al. [17] described an improved digital image watermarking technique using multiple parameter discrete fractional Fourier (MPDFRF) and discrete wavelet (DW) transforms. The original cover image is decomposed into four wavelet sub-bands using the DW transform, followed by a segmentation of each sub-band into blocks. The cover image is decomposed into four wavelet sub-bands (LL, HL, LH, HH): the approximation coefficient LL, and the detailed coefficients HL, LH, and HH. Then, each sub-band is segmented into blocks, followed by applying the MPDFRF transform to each block, and then the watermark is embedded into all the blocks.

A. Bouridane et.al. [18] investigated different methods to increase imperceptibility and robustness of color watermarks embedded in color host images using the Complex Wavelet Transform (CWT). The Complex Wavelet Transform was chosen because experimentation results are more robust than other transforms under compression, additive noise, affect median and mean filtering attacks. Fusion based images watermarking has been chosen since it provides a visual authentication of the watermark. Four-level CWT decomposition, with the Antonini filter, was used to decompose the host and watermark images for embedding. The watermark strength parameter, a, was chosen as a constant for each sub band to ensure the imperceptibility of the watermark in the watermarked image. They investigated different methods to increase imperceptibility and robustness of color watermark embedded into a color host image using Complex Wavelet Transform (CWT). The CWT, however, consists of six different sub bands in each decomposition level whose orientations are 19, 79, 45', -IS",-79,-45. A four-level CWT decomposition, with the Antonini filter, was used to decompose the host and watermark images for embedding.

J. Zhang et.al.[19] detailed a new geometric distortion correcting algorithm for wavelet-based watermarked image. The watermark is embedded into the low frequency sub-bands of the host image, which guarantees large embedding capacity and good invisibility. The modified Harris-Laplace detector is utilized to extract steady feature points used for image correcting. From result it is cleared that it is not only invisible but also robust against many image geometric attacks such as rotation, translation and scaling, etc.

IJERT

III. CONCLUSION

Digital watermarking techniques have been developed to protect the copyright of media signals. Different watermarking schemes have been suggested for multimedia content (images, video and audio signal). The watermark is hidden in the host data in such a way that it is inseparable from the data and so that it is resistant to many operations not degrading the host document. Thus by means of watermarking, the work is still accessible but permanently marked. In this paper we reviewed the papers of digital watermarking based on wavelet transform. Discrete wavelet transform gives better result as compared to others.

REFERENCES

[1] "Multimedia security: staganography and digital watermarking techniques for protection of intellectual property", Chun-Shien Lu , Institute of Information Science Academia Sinica, Taiwan, ROC, Idea Group Publishing.

[2] Kang Xiao Jun, Dong Li Jun,"A Digital Watermarking Algorithm Based on Image Segmentation and DFT", Conf. ICISE2009, pp.1511-1514, 2009.

[3] Jianzhong Li, Xiaojing Chen, "An Adaptive Secure Watermarking Scheme Using Double Random-Phase Encoding Technique", Support Project of Hanshan Normal University,2009 IEEE.

[4] Lahouari Ghouti, Ahmed Bouridane, Mohammad K. Ibrahim, and Said Boussakta, "Digital Image Watermarking Using Balanced Multiwavelets" , IEEE Transactions On Signal Processing, Vol. 54, No. 4,pp.15-19, April 2006.

[5] Shujiao Liao, "Dual Color Images Watermarking Algorithm Based on Symmetric Balanced Multiwavelet", International Symposium on Intelligent Information Technology Application Workshops, pp.439-442, IEEE 2008.

[6] Shengbing Che,Bin Ma, Jinkai Luo, Shaojun Yu," Semi-fragile Image Watermarking Algorithm Based on Region-Segmentation", I.J. Image, Graphics and Signal Processing, in MECS, pp. 59-66, 2009.

[7] Vaishali S. Jabade Dr. Sachin R. Gengaje," Literature Review of Wavelet Based Digital Image Watermarking Techniques", International Journal of Computer Applications (0975 – 8887) Vol.31– No.1, pp/28-35, October 2011

[8] Baisa L. Gunjal and Suresh N.Mali, "Secured Color Image Watermarking Technique In DWT-DCT Domain", International Journal of Computer Science, Engineering and Information Technology (IJCSEIT), Vol.1, No.3, August 2011.

[9] Mingwei Zhao and Yanzhong Dang," Color Image Copyright Protection Digital Watermarking Algorithm Based on DWT & DCT", 4th IEEE International Conference on Wireless Communications, Networking and Mobile Computing, 2008.

[10] S. Amira-Biad M. Bouab, M. Khamadja, "Chaotic Watermarking System for Color images Based on Texture segmentation in Wavelet Transform Domain", In IEEE Transactions ,2006.

[11] Yu Wei, Yanling Hao and Yushen Li," A Multipurpose Digital Watermarking Algorithm Of Color Image", Proceedings of the 2009 IEEE International Conference on Mechatronics and Automation ,pp.112-117,August 9 - 12, Changchun, China.

[12] Qiang Tong,"A New Image Watermarking Algorithm Using CT and Normalization",IEEE International Conference on Systems, Man, and Cybernetics , pp.3239-3244,October 14-17, 2012, COEX, Seoul, Korea.

[13] Farhad Rahimi and Hossein Rabani,"A Visually Imperceptible and Robust Image Watermarking Scheme in Contourlet Domain "ICSP 2010,Proceedings, IEEE 2010.

[14] Muhammad Imran andAbdul Ghafoor, "A PCA-DWT-SVD based Color Image Watermarking",IEEE International Conference on Systems, Man, and Cybernetics October 14-17, 2012, COEX, Seoul, Korea.

[15] Qingtang Su, Xianxi Liu, Wenchao Yang," A Watermarking Algorithm for Color Image Based on YIQ Color Space and Integer Wavelet Transform" , IEEE.

[16] Dongyan Liu, Wenbo Liu and Gong Zhang ,"An Adaptive Watermarking Scheme Based on Nonsubsampled Contourlet Transform for Color Image Authentication" The 9th International Conference for Young Computer Scientists, IEEE 2008.

[17] Mohamed Ouhsain, Emad E. Abdallah, and A. Ben Hamza," An Image Watermarking Scheme Based On Wavelet And Multiple-Parameter Fractional Fourier Transforms",2007 IEEE International Conference on Signal Processing and Communications (ICSPC 2007), 24-27 November 2007, Dubai, United Arab Emirates.

[18] A. Bouridane, F. KurugoIlu, R. Beggs and S. Boussakta," Colour Image Watermarking In The Complex Wavelet Domain", Preceding of 10 th IEEE International Conference on Electronic, Circuits and System ICECS, 2003.

[19] Jun Zhang, Mei-na Sun, Mei-Jing Ge, Zheng-Ling Yang, Jun-Tao Xue, Liang Wang," Robust Watermarking Of Digital Image Based On Feature And DWT", Proceedings of the 2012 International Conference on Machine Learning and Cybernetics, Xian, 15-17 July, 2012

IJERT