Texture Feature Analysis Based On Digital Watermarking Scheme for Image Processing

Pardeep Kaur
Research Scholar
Computer Science Engineering
KC College of Engineering &
Information Technology,
Nawanshahr(punjab)

Dr. Vijay Kumar Joshi
Principal
Computer Science Engineering
KC College of Engineering &
Information Technology,
,Nawanshahr (Punjab)

Abstract : The digital watermarking is the technique which is used to provide security to sensitive data which is stored in the form of image. The watermarking is the process in which features of the original and sensitive image is calculated and in the second step, the original image is embedded into the watermark image. In this research paper, the neural network based watermarking technique is improved using GLCM and PCA algorithm. The GLCM and PCA algorithm extracts the features of the original image. The output of PCA algorithm defines the scaling factor which is used for the embedding. The proposed algorithm is implemented in MATLAB and simulation results demonstrated that proposed algorithm performs well in terms of PSNR and MSE.

***KEYWORDS*: GLCM, PCA, SVD, DWT**

Introduction

Digital watermarking is a process in which some information is embedded within a digital media so that the inserted data becomes part of the media. This technique serves a number of purposes such as broadcast monitoring, data authentication, data indexing and so forth. A digital watermarking system must successfully satisfy trade-offs between conflicting requirements of perceptual transparency, data capacity and robustness against attacks. These trade-offs are investigated from an information-theoretic perspective [1]. Watermarks have two categories of roles: In the first category, the watermark is considered as a transmission code and the decoder must recover the whole transmitted information correctly. In the second category, the watermark serves as a verification code. In the latter system, the watermark detector must simply determine the presence of a specific pattern. Since the footprint of the verification watermarking, that is, the number of pixels per watermark code bit is typically higher, this case has higher robustness as compared to the subliminal channel (transmission code) case. A digital watermark is a digital signal or pattern inserted into a digital image. Since this signal or pattern is present in each unaltered copy of the original image, the digital watermark may also serve as a digital signature for the copies [2]. A given watermark may be unique to each copy (e.g., to identify the intended recipient), or be common to multiple copies(e.g.,to identify the document source). In either case, the watermarking of the document involves the transformation of the original into another form. This distinguishes digital watermarking from digital fingerprinting where the original file remains intact, but another file is created that "describes" the original file's content. As a simple example, the checksum field for a disk sector would be a fingerprint of the preceding block of data. Similarly, hash algorithms produce fingerprint files. Video watermarking can be considered as a superset of normal image watermarking. As such, all the techniques applicable to static images can be applied to video images. However, due to the high frame rate of video, the embedding process must occur almost in real time for live transmissions [3]. Audio watermarking is currently at the forefront of technology development in an attempt to prevent illegal reproduction and redistribution. One implementation receiving widespread attention is the MP3 approach to audio compression and watermarking. Digital Watermarking software looks for noise in digital media and replaces it with useful information. A digital media file is nothing more than a large list of 0's and 1's. The watermarking software determines which of these 0's and 1's correspond to redundant or irrelevant details. For example, the software might identify details in an image that are too fine for the human eye to see and flag the corresponding 0's and 1's as irrelevant noise. Later the flagged 0's and 1's can be replaced by a digital watermark. The following two sequences of images demonstrate a typical watermark embedding and extraction process applied to a static image [4]. It is notable that a slight degradation of the original image occurs when the watermark is embedded. Howe ver, the retrieved watermark is very close to the original watermark, which can help resolve ownership issues. Singular Value Decomposition (SVD) is said to be a signi ficant topic in linear algebra by many renowned mathemat icians. SVD has many practical and theoretical values; sp ecial feature of SVD is that it can be performed on any rea l (m, n) matrix. The SVD is the optimal matrix decomposition in a least square sense that it packs the maximum signal energy into as few coefficients as possible. Singular value decomposition (SVD) is a stable and effective method to split the system into a set of linearly independent

components, each of them bearing own energy contribution [5]. The discrete wavelet transform (DWT) is a linear transformation that operates on a data vector whose length is an integer power of two, transforming it into a numerically different vector of the same length. It is a tool that separates data into different frequency components, and then studies each component with resolution matched to its scale. DWT is computed with a cascade of filtering followed by a factor 2 sub sampling. A neural network is defined as "...a computing system made up of a number of simple, highly interconnected processing elements, which process information by their dynamic state response to external inputs." The idea of ANNs is based on the belief that working of human brain by making the right connections, can be imitated using silicon and wires as living neurons and dendrites [6]. ANNs are composed of multiple nodes, which imitate biological neurons of human brain. The neurons are connected by links and they interact with each other. The nodes can take input data and perform simple operations on the data. The result of these operations is passed to other neurons. The output at each node is called its activation or node value.

Literature Review

T. Vimala, (2012) proposed a Modified Decision Based Unsymmetrical Trimmed Median Filter (MDBUTMF) followed [7] by Fuzzy Noise Reduction Method (FNRM) for the restoration of color images that are highly corrupted by salt and pepper noise. The proposed filter (MDBUTMF) replaces the noisy pixel by trimmed median value when some of the elements with values 0"s and 255"s are present in the selected window. The proposed method is tested. against different color images and it gives excellent Peak Signal-to-Noise Ratio (PSNR) than the Median Filter (MF), Switching Median Filter (SMF), Boundary Discriminative Noise Reduction Algorithm (BDNRA), Decision Based Algorithm (DBA), and Decision Based Unsymmetric Trimmed Median Filter (DBUTMF).

Anthony T.S.Ho et.al, (2011) proposed [8] a robust image-in-image watermarking algorithm based on the fast Hadamard transform (FHT) for the copyright protection of digital images. To increase the invisibility of the watermark, a visual model based on original image characteristics, such as edges and textures are incorporated to determine the watermarking strength factor. All the AC Hadamard coefficients of watermark image is scaled by the watermarking strength factor and inserted into several middle and high frequency AC components of the Hadamard coefficients from the sub-blocks of original image. The experiment uses container image of size 512×512×8bits and the watermark image of
size 64×64×8bits. It survives about 60% of all Stirmark attacks. The simplicity of Hadamard transform offers a significant advantage in shorter processing time and ease of hardware implementation than the commonly used DCT and DWT techniques.

Surya Pratap Singh, (2012) proposed [9] a robust watermarking technique for color and grayscale image. The proposed method involves many techniques to conform a secure and robust watermarking. In the proposed technique the watermark is embedded in 3rd level of DWT (Discrete Wavelet Transform) and before embedding the watermark image is passed through chaotic encryption process for its security, other important thing is that in the proposed method watermark is embedded in the form of DCT (Discrete Cosine Transform) with special coefficient shifting algorithm to minimize the impact on main image. The performance of the proposed watermarking is robust to a variety of image processing techniques, such as
JPEG compression, enhancement, resizing, and
geometric operations.

Navnidhi Chaturvedi, et.al (2012) [10] described about the authenticity & copyright protection are two major problems in handling digital multimedia. The Image watermarking is most popular method for copyright protection by discrete Wavelet Transform (DWT) which performs 2 Level Decomposition of original (cover) image and watermark image is embedded in Lowest Level
(LL) sub band of cover image. Inverse Discrete Wavelet Transform (IDWT) is used to recover original image from watermarked image. And Discrete Cosine Transform (DCT) which convert image into Blocks of M bits and then reconstruct using IDCT. In this paper we have compared watermarking using DWT & DWT-DCT methods performance analysis on basis of PSNR, Similarity factor of watermark and recovered watermark.

Nikita Kashyap, (2012) introduced [11] about implemented a robust image watermarking technique for the copyright protection based on 3-level discrete wavelet transform (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. The insertion and extraction of the watermark in the grayscale cover image is found to be simpler than other transform techniques. The proposed method is compared with the 1-level and 2-level DWT based image watermarking methods by using statistical parameters such as peak-signal-to-noise-ratio (PSNR) and mean square error (MSE). The experimental results demonstrate that the watermarks generated with the proposed algorithm are invisible and the quality of watermarked image and the recovered image are improved.

Fang Li, (2009) proposed [12] a two-stage method for demising images heavily contaminated by salt and pepper noise. In the first stage, we use adaptive median filter to detect the noisy pixels. All the pixels are marked as noisy or noise-free pixels. In the second stage, we take the noisy pixels as inpainting regions and noise-free pixels as true information. The inpainting task is done by the normalized mean curvature flow. The method is generalized to color image. Experimental results show that the proposed algorithm has advantages over nonlinear filtering or regularizing methods in terms of edge preservation and noise removal and is competitive with other two-stage methods in the literature.

Research Methodology

The watermarking is the efficient technique to provide security to the image data. The watermarking techniques are broadly classified into blind and semi-blind watermarking techniques. In the base paper, the semi-blind watermarked image is generated using the OS-ELM technique which the machine learning technique. The four levels DWT technique is applied to extract the features of the original and watermark images. The training images which are analyzed with the DWT algorithm is given as input to generate final training sets for the generation of semi-blind watermarks. The DWT algorithm will analyze textual features of the images which can be replaced with the glcm algorithm which has less complexity and easy to generate training sets for the generation of blind watermarks.

The proposed algorithm can be applied in the following steps:-

1. Pre-processing Phase: - In the pre-processing phase, the two image are taken as input. The first image is the original image and second image is the image which needs to encrypt. The first image is used to generate key and second image will be encrypted with the key of first image

2. Feature extracted:- In the second phase, the textual features of the first image is extracted using the glcm algorithm. The glcm algorithm will extract the features like energy, entropy etc. image.

Experimental Results

The proposed technique is implemented in MATLAB and results are analyzed in terms of PSNR, MSE.

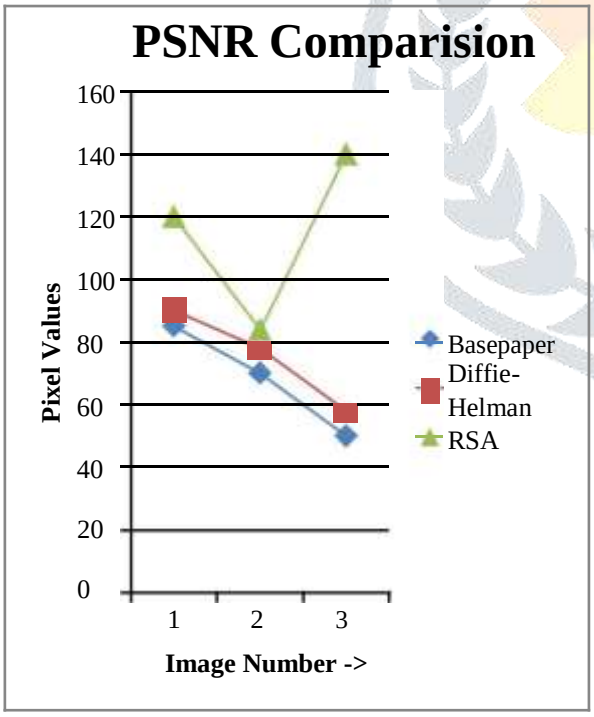

Fig 2: PSNR Comparison

As shown in figure 2, the comparison of proposed and existing algorithm is done in terms of PSNR. The algorithm which has maximum PNSR value is more reliable as compared to algorithm which has minimum PSNR value.

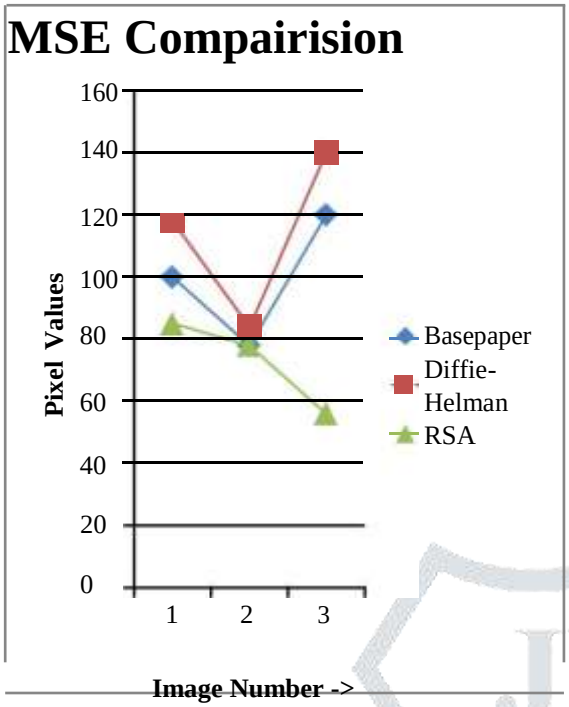

Fig 3: MSE comparison

As shown in the figure 3, the MSE of the proposed and existing algorithm is compared and it is been analyzed that algorithm which has high MSE value less reliable than the algorithm which has less MSE value.

	Parameter values	Base	Proposed
Watermarked image	PSNR	13.3917	18.0129
	MSE	3001.26	2874.83
	Correlation Coefficient	0.01	0.01
	Entropy	7.9990	7.9989
Contrast Attack	PSNR	20.0542	26.0537
	MSE	647.22	547.30
	Correlation Coefficient	0.96	0.01
	BER	4.2319	4.2200
Sharpened Attack	PSNR	23.6209	29.4842
	MSE	284.70	243.80
	Correlation Coefficient	0.97	0.98
	BER	7.003	6.9047
Salt & pepper Attack	PSNR	22.4476	27.484
	MSE	373.00	293.80
	Correlation Coefficient	0.96	0.91

	BER	7.9012	7.9036
Decrypted image	PSNR	13.3848	18.0130
	MSE	3006.02	3274.75
	Correlation Coefficient	0.01	0.00
	BER	7.6833	3.4237
Elapsed time		0.011795 sec	0.011994 sec

Table 1: Result comparison

As shown in table 1, the results of the proposed and existing schemes are compared and it has been analyzed that proposed method performs well in terms of PSNR, MSE, BER and coefficient correlation

Conclusion

In this paper, the efficiency of the watermarking approach is concluded as it hides all the sensitive information which is stored in the form of images. In this research paper, GLCM and PCA algorithm has been utilized in order to improve the working capability of the neural network based watermarking technique. The extracted features of an image are selected by the PCA algorithm and the features of the original image are extracted by the GLCM algorithm. The scaling factor defines the output of the PCA algorithm which is used for implementation. On the basis of simulation results it is concluded that proposed algorithm performs well in terms of PSNR and MSE.

References

[1] J.-K. Kamarainen, V. Kyrki, and H. K ¨ alvi¨ ainen, “Invariance properties of Gabor filter based features - overview and applications,” IEEE Trans. on Image Processing, vol. 15, no. 5, pp. 1088–1099, 2006.
[2] D. Gabor, “Theory of communication,” Journal of Institution of Electrical Engineers, vol. 93, pp. 429–457, 1946.

[3] J. Ilonen, J.-K. Kamarainen, P. Paalanen, M. Hamouz,
J. Kittler, and H. K¨ alvi¨ ainen, “Image feature localization by multiple hypothesis testing of Gabor features,” IEEE Trans. on Image Processing, vol. 17, no. 3, pp. 311–325, 2008.

[4] J. Ilonen, J.-K. Kamarainen, and H. K ¨ alvi¨ ainen, “Fast extraction of multi-resolution gabor features,” in 14th Int Conf on Image Analysis and Processing (ICIAP), 2007, pp. 481–486.

[5] E. Simoncelli, W. Freeman, E. Adelson, and D. Heeger, “Shiftable multiscale transforms,” IEEE Transactions on Information Theory, vol. 38,no. 2, pp. 587–607, 1992.

[6] J. Sampo, J.-K. Kamarainen, M. Heili ¨ o, and H. K¨ alvi¨ ainen, “Measuring translation shiftability of frames,” Computers & Mathematics with Applications, vol. 52, no. 6-7, pp. 1089–1098, 2006.

[7] T. Vimala, “Salt and Pepper Noise Reduction Using Mdbtum Filter With Fuzzy Based Refinement”, IJMIE, Volume 2 Issue 5, 2012

[8] Anthony T.S.Ho et.al, “A Robust Digital Image-in-Image Watermarking Algorithm Using the Fast Hadamard Transform”, Springer, 2011

[9] Singh, Surya Pratap, Paresh Rawat, and Sudhir Agrawal. "A robust watermarking approach using DCT-DWT." International Journal of Emerging Technology and Advanced Engineering (ISSN 2250-2459, Volume 2, Issue 8 (2012).

[10] Chaturvedi, Navnidhi, and S. J. Basha. "Comparison of Digital Image watermarking Methods DWT & DWT-DCT on the Basis of PSNR." image 2 (2012): 1.

[11] Kashyap, Nikita, and G. R. Sinha. "Image watermarking using 3-level discrete wavelet transform (DWT)." International Journal of Modern Education and Computer Science (IJMECS) 4.3 (2012): 50.

[12] Fang Li, "Salt and Pepper Noise Removal by Adaptive Median Filter and Minimal Surface Inpainting", Image and Signal Processing, 2009. CISP '09. 2nd International Congress on, 2009