International Journal of Current Engineering and Technology
E-ISSN 2277 – 4106, P-ISSN 2347 - 5161

Available at http://inpressco.com/category/ijcet

General Article

Spatial Domain base Image Watermarking by Edge Features

Ashwary Rajpoot[Á*], Ranjana Batham[Á] and Navin Chourasia[Á]

[Á]EC Dept., Swami Vivekananda College of Technology, Bhopal, India

Accepted 10 Oct 2014, Available online 20 Oct 2014, **Vol.4, No.5 (Oct 2014)**

Abstract

The development of a geometrical invariant watermarking theme while not degrading image quality is challenging work. Watermarking is that the method that embeds data called a watermark, a tag, or a label into a multimedia object, like pictures, video, or text, for his or her copyright protection. In step with human perception, the digital watermarks can either be visible or invisible. A visible watermark may be a secondary clear image overlaid into the first image and looks visible to a viewer on a careful scrutiny. The invisible watermark is embedded in such a way that the modifications created to the image elements (pixels) value is perceptually not detected, Associate in its usually recovered only with associate applicable secret writing mechanism. So protects the originality of the information this paper has planned a watermarking methodology. This propose works among the spatial domain of the image it embedded watermarking and improve the standard of pictures or powerful against fully completely different fairly attack like noise, filter, compression. The Results show that the work has associated out stand performance at intervals the invisible watermarking theme.

Keywords: *Digital Watermarking, Image. Filter, noise, compression, spatial domain*

1. Introduction

Watermarking is the process that embeds data called a watermark, a tag, or label into a multimedia object such that the watermark can be detected or extracted later to make an assertion about the object. The object may be an image, audio, video, or text.

Changed over peer-to-peer networks, and this has caused major considerations to those content suppliers who manufacture these digital contents. The key purpose of digital watermarking is to seek out the balance among the aspects like robustness to numerous attacks, security and invisibleness. The invisible of watermarking technique relies on the intensity of embedding watermark. Higher invisible is achieved for fewer intensity watermark. Thus we tend to should choose the Optimum intensity to embed watermark. Generally there is slightly balance between the embedding strength and quality (the watermark invisibility). Magnified robustness needs a stronger embedding, that successively will increase the visual degradation of the images. For a watermark to be effective, it ought to satisfy the subsequent options.

a). Unobtrusive -A digital watermark is an invisible data embedded inside an image to show authenticity and ownership. An effective digital watermark should be perceptually invisible to prevent obstruction of the original image.

b). Robustness -Robustness refers to the ability to detect the watermark, even if the quality of the host data is degraded, intentionally (malicious) or unintentionally (non-malicious). In general, there should be no way in which the watermark can be removed or altered without sufficient degradation of the perceptual quality of the host data so as to render it unusable.

The Exact level of robustness the hidden data must possess cannot be specified without considering a particular application.

c). Unambiguous - The retrieved watermark should uniquely identify the copyright owner of the content, or in case of fingerprinting applications, the authorized recipient of the content.

d). Loyalty and Computational cost -A watermark has a high reliability, if the degradation it causes is very difficult to perceive for the viewer. Embedding and extraction of watermark from the video both should be fairly fast and should have low computational complexity.

2. Related Work

In march2003 Wai C. Chu proposed in DCT-based image watermarking algorithm is de-scribed, where the original image is not required for watermark recovery, and is achieved by inserting the watermark in sub images Obtained through subsampling.

In May 2011 Swanirbhar Majumder &Tirtha Sankar Das they present a robust and imperceptible methodology of watermark embedding in the transform domain using Discrete Wavelet Transform (DWT). The robustness is brought about by hiding the watermark in the Eigen values after computing the Singular Value Decomposition (SVD) on low frequency sub-band after DWT. While for the imperceptibility the Contrast Sensitivity Function (CSF)

*Corresponding author **Ashwary Rajpoot** is a M.Tech Research Scholars; **Ranjana Batham** is Guide and **Navin Chourasia** is working as HOD.

has been employed here along with the Noise Visibility Function (NVF). Human beings are sensitive to visual contrasts so CSF is used to take care of that while NVF characterizes the local image properties of texture, edge and smoothness to determine the optimal watermark locations and strength at the wavelet sub-bands for watermark embedding

In 2011 J. Wu, and J.Xie propose an adaptive watermarking technique in DCT domain using HVS model and fuzzy c-means technique (FCM). In this method FCM technique is used to classify non-overlapping 88×original blocks into categories: one is suitable for watermarking with high imperceptibility and robustness and the other is unsuitable. Watermark is inserted in DCT mid-frequency coefficients of selected blocks.

In august 2012 Sebastiano Battiato, Senior Member, IEEE [1] He proposed image hash encodes the spatial distribution of the image features to deal with highly textured and contrasted tampering patterns. A block-wise tampering detection which exploits and histograms of oriented gradients representation is also proposed. A non-uniform quantization of the histogram of oriented gradient space is used to build the signature of each image block for tampering purposes.

J. Wu, and J.Xie propose an adaptive watermarking technique in DCT domain using HVS model and fuzzy c-means technique (FCM). In this method FCM technique is used to classify non-overlapping 88×original blocks into categories: one is suitable for watermarking with high imperceptibility and robustness and the other is unsuitable. Watermark is inserted in DCT mid-frequency coefficients of selected blocks.

C. Podilchuk, and W. Zeng propose a watermarking technique for digital images that is based on utilizing visual models, which have been developed in the context of image compression and image can tolerate without affecting the visual quality of the image. The watermark encoding scheme consists of a frequency decomposition based on an 88×framework followed by just noticeable difference (JND) calculation and watermark insertion. The watermark scheme is robust to different attacks such as JPEG compression, additive noise, scaling etc.

3. Proposed Work

This work focus on the spatial basis watermarking method or quality of images where watermark is hide in the image by the change in the pixel value. So whole process is divide into following two steps:

Step 1: Embedding

Embedding

Embedding where water which may be an image or text can be hide into the carrier image. Embedding procedure follows these sub-steps, thus we can understand by algorithms which is given in Figure 1.

Here as the image is the collection of pixels where each pixel is representing a number that is reflecting a number over there now for each number depend on the format it has its range such that for the gray scale format it is in the range of 0-255. So read an image means making a matrix of the same dimension of the image then fill the matrix correspond to the pixel value of the image at the cell in the matrix.

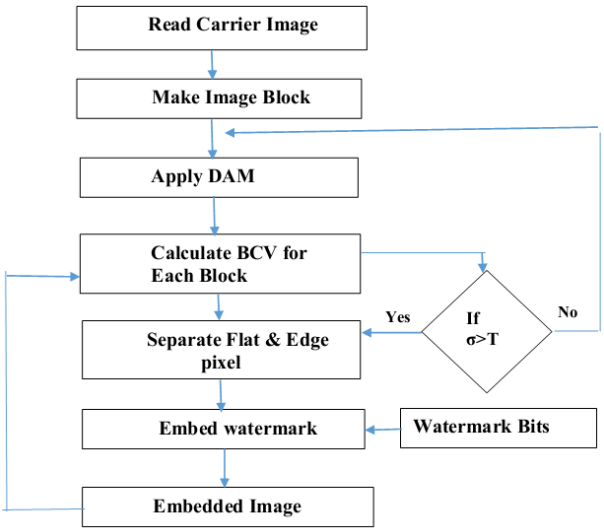


Figure 1 Procedural algorithm of embedding image Read Carrier Image

This can be understand as the let below image consist of four pixel having dimension of 2X2 then for this image a matrix is Of same dimension 2X2 and its four cell contain value as per the pixel color and representing format.

Make Image Block

In order to make the block exact first it is required to resize the image so that blocks may get divide the image into fix size. This can be understand as if an image have an dimension of the 30X30 then it get exactly divide into 100 blocks but if an image has the dimension of 29X28 then it need to resize it either in 30X30 or in 27X27 so that it gat exactly divide the image into fix size blocks.

Apply Discriminant Analysis Method (DAM)

This is the method to convert a gray scale image into binary image. For this analysis of each pixel is done. Following are the steps for converting Gray image to binary.

1. Read image and convert to matrix M size
2. Find average pixel value in the image as A.
3. Loop i=1:n%% n represent number of pixel in the image
4. If M[i] > A

M[i] =0

5. Otherwise

M[i] = 1

6. Endif%%End condition loop.
7. Endloop

From above algorithm each block obtain from the image is convert into binary format.

Calculate Between-class variance (BCV)

Now in order to find the edge in the block it is required to calculate the BCV σ term. On the basis of this σ it will be decide that wither a block contain a edge or not.

$$\sigma_b^2 = \frac{\omega_0\omega_1}{\omega^2}(\mu_0 - \mu_1)^2$$

Where $\omega 0$ and $\omega 1$ are the number of pixels in C0 and C1, (named C0 as low peak class and C1as high peak class) and $\mu 0$ and $\mu 1$ are the mean luminance of pixels in C0 and C1, respectively. The total number of pixels in the block is denoted as ω. So for each block σ is different as it is depend on the local values of the block.
So if a block σ or BCV value is above the threshold then it can be chosen for the embedding as it contain the edge.

1. Loop i = 1:m % m represent number of blocks
2. If σ[i] > T
3. Select_block = i
4. Endif
5. Endloop

Identify edge and flat pixels of Block

Here as the block is in binary form then simple step is to identify the color changing in the block is done. The pixels whose color get change are consider as the edge boundary in the block. As shown in above figure the pixel positions where different color are obtain are consider as the edge boundary. For this Let the block size be m × n pixels and the pixel luminance at the position (i, j) in the binarized block be B (i, j) ($0 \le i \le m-1$, $0 \le j \le n-1$). If B (i, j) satisfies the following below conditions, the pixel is assumed as an edge boundary pixel. If not, it is assumed as a flat pixel.

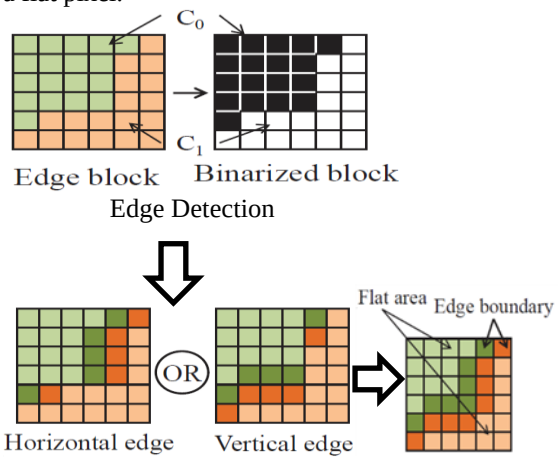


Fig.2 Representing the Edge detection

The pixel is assumed as an edge boundary pixel. If not, it is assumed as a flat pixel.

B (i, j) ≠ B (i+1, j)
B (i, j) ≠ B (i, j+1)
B (i, j) ≠ B (i+1, j+1)
i , j + 1i+1, j+1
i , j i+1, j

Embed Watermark at Edge pixels

Here as the block contain edge pixel are identified and then put the watermark pixel value at this value so that watermark is embedded at that position, in this way all the pixel values of the watermark are embed in the different block of the pixel. **Proposed Embedding Algorithm**

Step 1

Input: O, W
OutPut: WI
BLock[n] <- Block (O) %Divide image into fix size blocks
Loop i = 1: n
B ← Block[n]
C←DAM(B) % Make pixel into two group
σ← BCV(C) % this find Block has /edge or not
If σ>Thresh
If B(x, y) ~= B(x, y+1) % Find the pixel are edge or not
EP ← [x, y; x, y+1] %EP Edge pixel position in i block
If B(x, y) ~= B(x+1, y)
EP ← [x, y; x, y+1]
If B(x, y) ~= B(x+1, y+1)
EP ← [x,y; x, y+1]
Loop EP~=Null
B (EP) ← W (m, n) %% Put watermark at Edge pixels m, n are edge row, column
End Loop

Step 2: Extraction

Extraction

Extraction is done where water mark is extract from the carrier image which is obtained after the embedding. Here embedding steps are so taken that it can save the originality identity that is water mark of the carrier image from different attack.

It is same like as done in the embedding step except here the working start with the watermark embed Image while result will be watermark. It is shown in the below block diagram that all sub steps are repeat here.

Extracting Watermark at Edge pixels

Here as the block contain edge pixel are identified and then read the pixel value of that position and store it in the matrix. A small information is already known at the extraction end that is dimension of the watermark because if is not known then generated the pixel value is not put the correct position in the matrix of the watermark.

Proposed Extraction Algorithm

Input: WI
OutPut: W
BLock[n] <- Block (O) %Divide image into fix size blocks
Loop i = 1: n
B ← Block[n]
C←DAM (B) % Make pixel into two group
σ← BCV(C) % this find Block has /edge or not

If σ>Thresh
If B(x, y) ~= B(x, y+1) %Find the pixel are edge or not
EP ← [x, y; x, y+1]
If B(x, y) ~= B(x+1, y)
EP ← [x, y; x, y+1]
If B(x, y) ~= B(x+1, y+1)
EP ← [x, y; x, y+1]
End If
W[i] ←B (EP)
End Loop

4. Experiment and Result

Hardware and Software platform

The experiments were performed on a 2.10 GHz Intel Core i3 machine, equipped with 4 GB of RAM, and running under Windows 8. MATLAB (version 7.14) is the tool use for the implementation of this work.

Here for the experiment different images are use at the initial level but as the standard images for watermarking are use such of Girl.jpg 256X256, strawberry 512X512, few of random images of Tajmahal.jpg 225X225 dimension and watermarking image74x66 dimension.

Attacks and Evaluation parameter

Attacks is completely different reasonably attacks are done on the digital watermarked image, the most result of those attack is that extraction of watermark is quit troublesome or out of the question by the algorithm if correct precaution isn't taken in prior steps of watermark embedding

a).Original image (b) grayscale image (c) Edge image (Dimensions 512x512)

Watermarking image (Dimensions 74x66)

Noise Attack

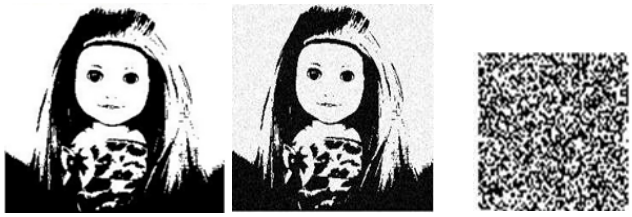
Noise attacked in watermarked image is send in the channel for communication then some kind of noise normally generate by which exact water is not extract from the received data Different kind of noise are: Salt & Pepper Noise, Gaussian Noise Attack, Speckle Noise Attack, etc.

Result shows due to noise attacked

(a) (b) (c)

(a) Embedded image (b) Noise Attacked image(c) Extracted Watermarking image

Our proposed Mythology produce result

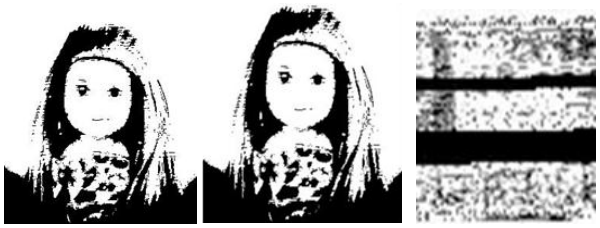


(a) Embedded image (proposed) (b) Noise Attacked (proposed) (c) Extracted Watermarking proposed

Filter Attack

Here image is pass through different type of filter, which is generally done after receiving signal from the network. So this attack is normally happen and for this the embedding as well as extraction algorithm of the image watermarking should be robust, so that effective method is developed

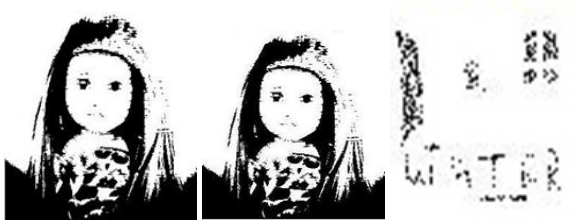
Result shows due to filter attacked



(a) (b) (c)

(a) Embedded image, (b).Filter Attacked image,(c). Extracted Watermarking image

Our proposed Mythology produce result



(a) (b) (c)

(a)Embedded image (proposed), (b) Compression Attacked image (proposed), (c), Extracted Watermarking (proposed)

5. Evaluation parameter

Signal to Noise Ratio and Peak Signal to Noise Ratio

The ratio between the possible data (information) and the noise that affects the fidelity of its representation.

$$\text{SNR} = 10 \log_{10} \frac{Pixel\ Value}{Error}$$

Peak Signal to Noise Ratio

The ratio between the maximum possible data and the noise that affects the fidelity of its representation

$$\text{PSNR} = 10\log_{10}\left(\frac{Max\_pixel\_value}{Mean\_Square\_error}\right) \text{ in db.}$$

Structural Similarity index (SSIM)

SSIM term is a method for finding the similarity between two images. The SSIM method use for evaluating the image quality based on an initial uncompressed or distortion-free image

Extraction Rate

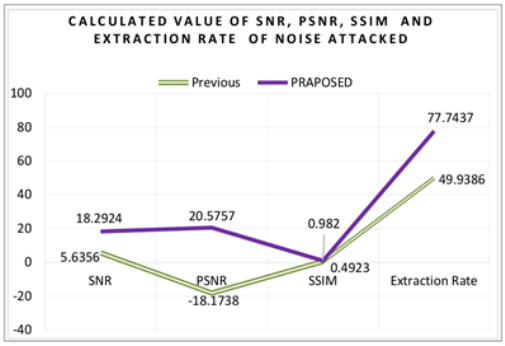
The extraction rate η is defined as follows:

$$\eta = \frac{n_c}{n_a} \times 100$$

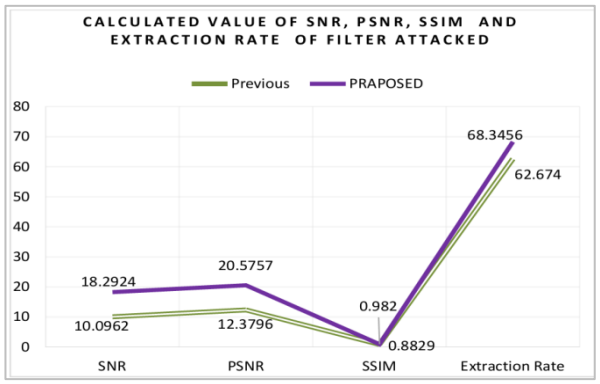
Where n_c is the number of correctly extracted bits, and $n_a$is the total number of embedded bits.

The analysis parameter SNR, PSNR, SSIM between the embedded image and therefore the original image, and extraction rate is calculated with revered spatial domain of pictures that's given below graphs. Also .Comparison of proposed work and former work once totally different-different attacks and originate that with the effective embedding and extraction methodology adopt in proposed work it get robust enough against different attacks. The watermark obtain from the embedded image is evaluate by the extraction rate parameter is showing values against the Noise attack, filter attack and compression attack.

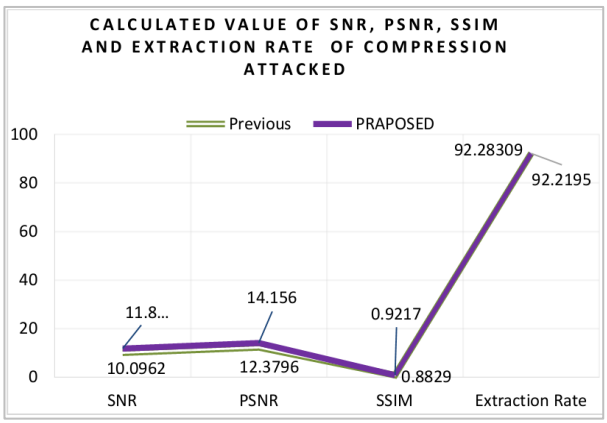
Corresponding graphs is given below



Graph 1 Noise Attacked



Graph 2 Filter Attacked



Graph 3 Compression Attacked

Conclusion

This analysis paper we tend to approach of Invisible watermarking technique. The results demonstrations that the proposed work is manufacturing the results that area unit maintain the size and image quality likewise as robustness against the varied attacks. Watermark get from the extraction technique has 87% of originality that is better than previous results.

References

Hanieh Khalilian (December 2013), *Student Member, IEEE*, and Ivan V. Bajic Video Watermarking With Empirical PCA-Based Decoding IEEE transactions on image processing, vol. 22, No. 12.

C. Podilchuk, and W. Zeng A novel DWT-SVD video watermarking scheme using side view 978-1-4577-1180-0/11/$26.00 ©2011 IEEE.

TamannaTabassum, W. Zhang et el., S.M. Mohidul Islam (July 2003) A Digital Image Watermarking Technique Based on Identical Frame Extraction in 3-Level DWT vol. 13, no. 7, pp. 560 –576.

YifeiPu. et el. Frank Hartung, Jonathan K. Su, and Bernd Girod Spread Spectrum Watermarking: Malicious Attacks and Counterattacks. of Multimedia Contents International Journal of Research in Engineering and Technology

Nallagarla.Ramamurthy and Dr.S.Varadarajan (2012,) Effect of Various Attacks on Watermarked Images. International Journal of Computer Science and Information Technologies, Vol. 3 (2), 3582-3587

Authors Profile

Ashwary Rajpoot is research scholor at Swami Vivekanand College of Science & Technology Bhopal under Rajiv Gandhi Proudyogiki Vishwavidyalaya Bhopal She is Pursuing M.Tech in Digital communication .She has keen to work on for technique of spatial Domain base Image Watermarking by Edge Features.

Asst. Prof. Ranjana Batham is a college guide at Swami Vivekanand College of Science & Technology Bhopal.

Prof. Navin Chourasia is a HOD Electronics and communication department at Swami Vivekanand College of Science & Technology Bhopal.