Arun Rana, Nitin Sharma, Amandeep Kaur / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com
Vol. 2, Issue 3, May-Jun 2012, pp.2234-2236

IMAGE STEGANOGRAPHY METHOD BASED ON KOHONEN NEURAL NETWORK

Arun Rana[1], Nitin Sharma[2], Amandeep Kaur[3],

ECE Department, N.C College of Engineering, Israna,
Panipat, Haryana, India
ECE Department, N.C College of Engineering, Israna,
Panipat, Haryana, India
ECE Department, N.C College of Engineering, Israna,
Panipat, Haryana, India

Abstract

A new high capacity image steganography method based on kohonen neural network is introduced. Kohonen network is trained according to the absolute contrast sensitivity of pixels present in cover image. Trained network classify the pixels in different classes of sensitivity. Data embedding is performed in less sensitive pixels by LSB substitution method, which replaces the least significant bits of cover image with secret information that would be embedded. We implement Optimal Pixel Adjustment Process (OPAP) to obtain an optimal mapping function to reduce the difference error between the cover and the stego-image, therefore improving the hiding capacity with low distortions. On the receiving side, the original image is not needed for extracting the embedded data. It is observed that the capacity and security is increased with acceptable PSNR in the proposed algorithm compared to the existing algorithm.

***Keywords*: Kohonen; neural, OPAP .**

1. Introduction

Steganography is the technique of hiding the message in such a way that no one except the intended recipient is aware of its existence. Digital images, audio files, video files, text files, executable files can be used for this purpose. Generally speaking, a good steganographic technique should have good visual imperceptibility and a sufficient capacity of hidden secret data. One of the common techniques is based on manipulating the least-significant-bit (LSB) planes by directly replacing the LSBs of the cover-image with the message bits. LSB methods typically achieve high capacity [Zhi,2003]. Although LSB maintains a good visual quality of stego-image, it can hide litter information. Considering the drawback of LSB, some methods begin to take account of the visual identity that human eyes are insensitive to edged and textured areas when embedding secret information, such as BPCS(bit-plane complexity segmentation[Niimi,2005] and DCT (Discrete Cosine Transform) embedding[Kumar,2007] . With these methods, more secret information is embedded into violent changed areas, less in smooth areas. The capacity of embedded information is thereby greatly improved while the quality of visual imperceptibility is maintained.

This paper is organized as follows. In the second sections, we give a brief introduction to self-organizing map. Then in section 3, we illustrate the algorithm proposed in detail, where after the experimental results are given in section 4. The last section of this paper is the conclusion.

2. Review of the Kohonen Neural Network

The Kohonen neural network contains only an input and output layer of neurons. There is no hidden layer in a Kohonen neural network. Next, we review the Kohonen algorithm briefly:

The training utilizes competitive learning [Ritter, 1988]. When a training example is fed to the network, its Euclidean distance to all weight vectors is computed. The neuron with weight vector most similar to the input is called the best matching unit (BMU). The weights of the BMU and neurons close to it in the Self Organising Lattice (SOM) lattice are adjusted towards the input vector. The magnitude of the change decreases with time and with distance from the BMU. The update formula for a neuron with weight vector Wv(t) is.

$$Wv(t + 1) = Wv(t) + \Theta(v, t)\, \alpha(t)(D(t) - Wv(t)) \qquad \text{(A.1)}$$

where $\alpha(t)$ is a monotonically decreasing learning coefficient and $D(t)$ is the input vector. The neighborhood function $\Theta(v, t)$ depends on the lattice distance The entire memory of the Kohonen neural network is stored inside of the weighted connections between the input and output layer. The weights are adjusted in each epoch. An epoch occurs when training data is presented to the Kohonen neural network and the weights are adjusted based on the results of this item of training data. e between the BMU and neuron *v*.

3. Proposed method

According to contrast sensitivity, Kohonen network is trained. This method exploits all pixels present in cover image to estimate the degree of sensitivity of pixels with trained neural network so that pixels can be classified into different classes of sensitivity. Pixels in less sensitive areas can carry more hidden data as compare to those which are in high sensitive area of human vision

3.1. *Algorithm for embedding:*

The detailed secret data hiding steps are as follows.

(1) Divide the cover image into 8*8 blocks. Decompose each block of the cover image by Discrete wavelet transform

(2) Calculate the absolute sum of wavelet contrast coefficients C. The smaller the value of C is, the lesser the secret information is.

(3) Train the Kohonen network according to the calculated character C. Use trained network to classify the blocks into 3 categories. Blocks with largest C is a class A_1, while that with smallest is a class A_2, and rest is A_3.

(4) Imbed secret information into image. Imbed the number of block into a pixel, imbed *i* into class A*i*. According the result of Kohonen, Imbed secret information with *mi* ($m1<m2<m3$).

(5) Apply the optimal Pixel Adjustment Process over stego Image [Tseng, 2008].

3.2. *Algorithm for extraction:*

The extraction of embedding data is easy. The detailed secret data extracting steps are as follows.

(1) Divide image and decomposed by wavelet. Divide image into 8*8 blocks, then decomposed each blocks by Extract the number of block.

(2) Use steganography based on module extract secret. The pixel noting the number is not used for extraction.

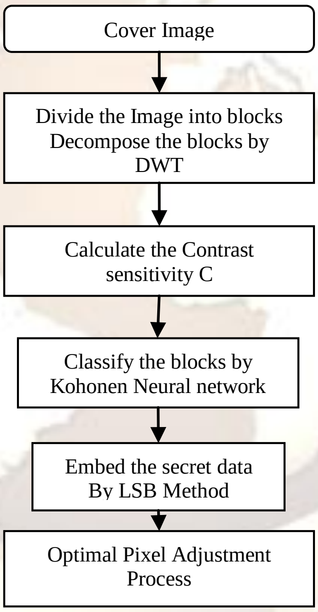

Fig.1 Flow chart of proposed method

4. Results

We have applied Gaussian noise attacks on the previously discussed Steganography algorithms. It is important to evaluate an image Steganography algorithm on many different images. We have the Data Base as a standard evaluation for Steganography Algorithms. Figure 4.1 presents some of the sample images that have been used in the experiments. They are four images: “LENA” (151875 bytes), “MOON” (151875 bytes), “BABOON” (1440000 bytes), PEPPERS” (230400 bytes).A comparison between our proposed and Discrete transform based image steganography method [Kumar, 2007] is shown.




LENA PEPPERS BABBON MOON

Table 4.3 Performance Evalutation of DWT Based Steganography Algoritm

Images		Proposed Method		DCT
		Capacity(Bytes)	PSNR	PSNR
LENA	(256*256)	1000	60.3033	17.206
Moon	(800*600)	1000	60.3939	17.2699
BABBON	(256*256)	1000	60.2393	16.3665
PEPPERS	(256*256)	1000	60.1	16.345

5. Conclusion

In this paper, we present a novel steganographic method based on Kohonen NNs and wavelet contrast. The proposed method adopts the character that human eyes are not sensible to the dark and texture block. More secret information is embedded into the dark and texture areas, less in smooth areas. Compared with DCT, the proposed method hides much more information and maintains a better visual quality of stego-image. On the other hand, the amount of information carried by individual pixels is decided by NNs trained, which is a secret key. Therefore, any third party will be unable to detect or extract the embedded data when he or she does not know the secret key.

References

[1] Anil Kumar, Deepak Gambhir and Navin Rajpall," Robust and Secret Data Transmission Over the Noisy Channel", International Conference on Signal Processing, Communication and networking (ICSCN) , pp. 199-203, 2007.

[2] M.Niimi, H.Noda and B.Segee," A Robust BPCS-Steganography against Visual Attacks," 5th International Conference on Information Communication and Signal Processing (IICSP), pp. 1116-1120 , 2005.

[3] H.Ritter, K.Schulten: Kohonen's Self Organizing maps: exploring their Computational Capabilities. International Conference on Neural Networks, ICNN, pp. 109-116,IEEE, (1988).

[4] Lin-Yu Tseng, et. *al.*," Image Hiding with Improved genetic Algorithm and Optical Pixel Adjustment Process," *8th* International Conference on Intelligent system design and Application (IISDA), pp. 320-325 , 2008.

[5] Li Zhi, Sui Ai Fen and Yang Yi Xian: A LSB steganography detection algorithm, Proceedings of the 14th International symposium on Personal Indoor and Mobile Radio Communication, pp. 2780 – 2783, PIMRC (2003).