

A Novel Color Image Watermarking Scheme Based on Arnold Transform and DWT Using B Channel

Priyad D. Desai¹ Prof. Harshita C. Kanani²
^{1,2}Lecturer

^{1,2}Department of Computer Engineering
^{1,2}LDRP-ITR, Gujarat, India

Abstract— The expansion of the Internet has frequently increased the availability of digital data such as audio, images and videos to the public. In this paper we have presented a Novel technique using Arnold transform and discrete wavelet transform for color images. The binary watermark is processed by using error correcting coding. Arnold transform is applied for the best scrambling and the watermark is embedded in the B channel of the scrambled pixels. Discrete wavelet transform method is applied on the embedded image for further security. The proposed method concludes to give better results comparatively in aspects of image transformations and enhancement.

Key words: Watermarking, Arnold, DWT, B channel, Image transformations and Enhancement

I. INTRODUCTION

A watermark is a form, image or text that is impressed onto paper, which provides evidence of its authenticity. Digital watermarking is a technology being developed to ensure and facilitate data authentication, security and copyright protection of digital media. It is a concept of embedding a special security pattern into cover image. Digital watermarking is an extension of this concept in the digital world. In recent years the phenomenal growth of the Internet has highlighted the need for mechanisms to protect ownership of digital media with watermarking that may be visible as well as invisible.

II. ARNOLD TRANSFORM

The transformation of point (x, y) in the unit square changes to another point (X', Y').

This transformation is called two-dimensional Arnold scrambling. To be specific to digital image, we need to change the two-dimensional Arnold scrambling of mod 1 to:

$$\begin{bmatrix} X' \\ Y' \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix} \begin{bmatrix} X \\ Y \end{bmatrix} \pmod{N} \quad [16] \quad (1.1)$$

It is mod2 which is Arnold scrambling. For x,y ∈ {0,1,2,...N-1}, N is the order of digital image matrix. The transformation of mod2 is matrix A. (x, y)^T in the right is the input, (x', y')^T in the left is the output, considering the feedback, iterative process which can do as the following. Where: n representative of the time of iterations, n = 0, 1, 2.... Image information (such as the gray value) with the replacement of the discrete lattice for transplantation, they generated a new image after all of the points of the original image have been traversed.

$$\begin{aligned} P_{xy}^{n+1} &= AP_{xy}^n \pmod{N} \\ P_{xy}^n &= (x, y)^T \end{aligned} \quad [16] \quad (1.2)$$

III. DISCRETE WAVELET TRANSFORM (DWT)

The basic idea of DWT in which a one dimensional signal is divided in two parts one is high frequency part and another is low frequency part. Then the low frequency part is split into two parts and the similar process will continue until the desired level. The high frequency part of the signal is contained by the edge components of the signal. In each level of the DWT (Discrete Wavelet Transform) decomposition an image separates into four parts these are approximation image (LL) as well as horizontal (HL), vertical (LH) and diagonal (HH) for detail components. In the DWT decomposition input signal must be multiple of 2n. Where, n represents the number of level. To analysis and synthesis of the original signal DWT provides the sufficient information and requires less computation time. Watermarks are embedded in these regions that help to increase the robustness of the watermark. A one level DWT decomposition process is shown in Figure below:

IV. PROPOSED METHOD

Input: Watermark Image, Color Image

Output: Watermarked Color Image

Step 1: Read watermark image

Step 2: Watermark is made Secure by first applying error correction method on it i.e. hamming code

Step 3: Read color image I(x, y)

Step 4: We obtain scrambled positions by scrambling the colored cover image using Arnold Transform method using

the equation $\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 1 & 1 \\ 1 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \pmod{N}$ where x, y ∈ {0, 1, 2, 3... N-1}

Step 5: Select B channel from the scrambled positions

Step 6: Embed the watermark into the B channel

Step 7: Apply DWT on the image for more secure and robust results in the middle and higher level bands i.e. {HL,LH,HH}

A. Explanation:

First the watermark image is read and made secure using error correction method that is by using hamming code. Also the Cover image that is a colored image is read. On the Cover image a spatial domain method Arnold Transform is applied on it through which different scrambling positions are obtained. From the scrambled positions the watermark is embedded into the B channel (that is the Blue channel, as Blue color is least sensitive to the human eye, so embedding the watermark in the Blue color gives us much robust results. Further for more robustness Discrete Wavelet Transform method is applied on the Cover image in the Higher and Middle level Bands.

V. EXPERIMENTAL RESULTS

Hawk.png color image of size 512X512 is selected as a cover image and coins.jpg color image of size 128X128 is chosen as a watermark. Blue channel of the cover image is selected for embedding process, as blue channel is more resistance to changes compared to red and green channels, because Blue color is least sensitive to the human eye so embedding the watermark in the Blue color channel gives us better robust results. Figure 1 shows the original dataset images of Hawk, Mandrill, Lena, Flower, Strawberry and peppers and the watermark image of coins. Image results in figure 2 are obtained for various transformation techniques like cropping, scaling and rotation and image enhancement techniques like sharpening, smoothing and noise tolerance. Experimental results are shown below in Table 1. The Results are compared on the basis of the PSNR (Peak Signal to Noise Ratio) values. The PSNR values obtained for different cover images for different types of images and geometrical attacks is shown with a graphical result in Figure 3. The algorithm is compared with Discrete wavelet transform technique and experimental results show much improvement with my approach. Results are differentiated on the basis of PSNR values, i.e. higher the PSNR than better the result will be. All images are tested and conclude to produce better results in at least sharpening, smoothing, noise tolerance, cropping and scaling of the image.

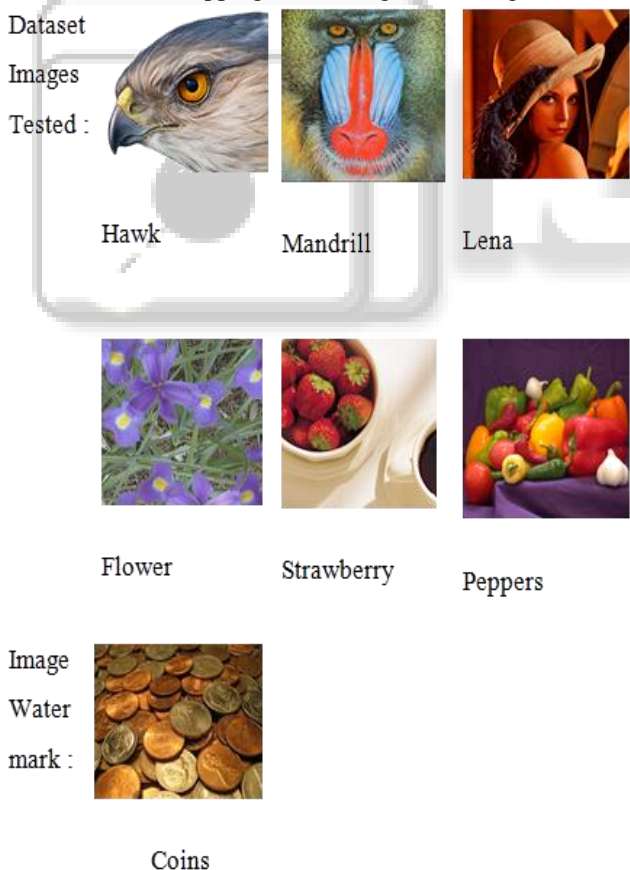


Fig. 1: Dataset images (Cover) and Watermark Images

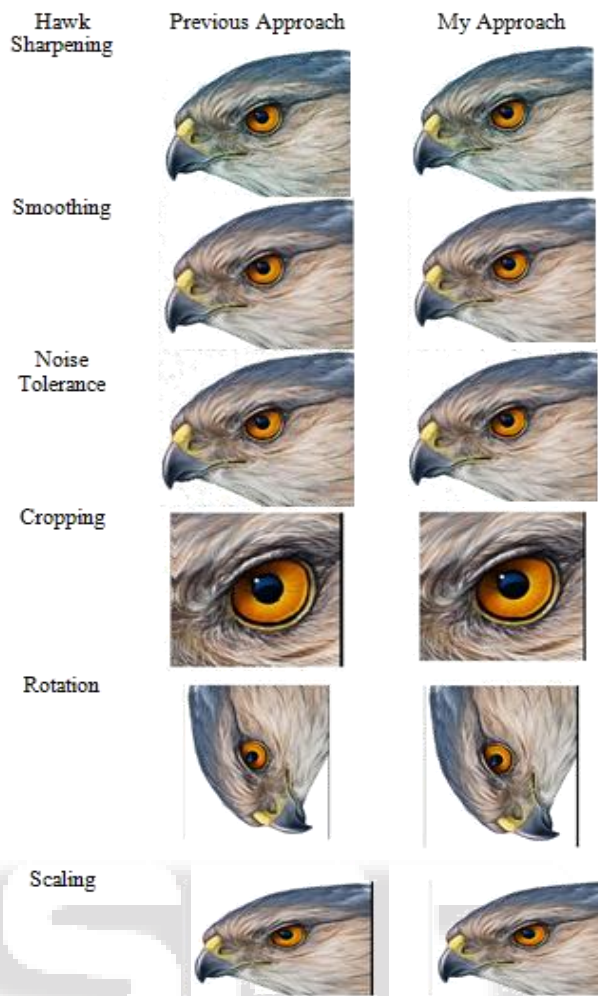


Fig. 2 Experimental Image Results on Image transformation and Image enhancement

Hawk	sharpening	smoothing	noise	cropping	Rotation	scaling
psnr1	7.724	7.724	7.724	7.724	7.729	7.725
psnr2	7.824	7.725	7.737	7.74	7.725	7.739
% Difference	10.033	0.081	1.316	1.523	-0.387	1.402

TABLE 1: Results for Hawk Image

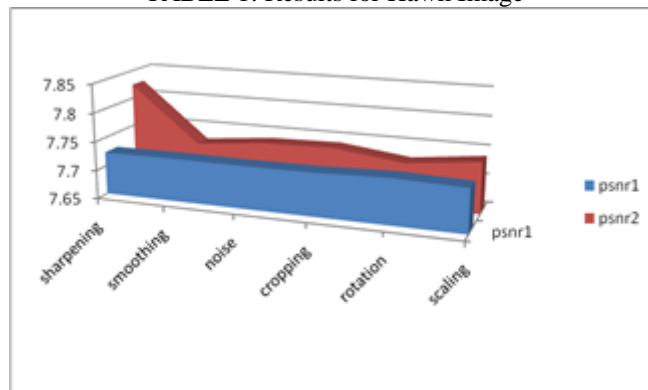


Fig. 3: Graphical Representation of Results

VI. CONCLUSION

We conclude to produce better Robust results on transformations like Scaling and Cropping of image and image enhancement techniques like Sharpening, Smoothing and Noise tolerance when using both Robust methods of Spatial and Frequency Domain and embedding watermark in blue color channel as blue color is least sensitive to the human eye, so embedding the watermark into the blue color gives us better robust results comparatively.

REFERENCES

- [1] U.V.Chandra Shekhar M.tech (Ph.d), "A Novel security techniques based on watermarking and encryption for LSB digital Images", International Journal of Application or Innovation in Engineering & Management (IJAIEEM), Volume 3, Issue 6, June 2014
- [2] Jitendra Jain, Punit Johari," Digital Image Watermarking Based on LSB for Gray Scale Image", IJCSNS International Journal of Computer Science and Network Security, VOL.14 No.6, June 2014
- [3] Anita Gupta, Mr. Atul Barve,"A Review on Image Watermarking and Its Techniques", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 1, January 2014
- [4] Rajni Verm, Archana Tiwari "Copyright Protection for Watermark Image Using LSB Algorithm in Colored Image", Research India Publications, Volume 4, 2014
- [5] Min Li, Ting Liang, Yu-jie,"He Arnold Transform Based Image Scrambling Method", 3rd International Conference on Multimedia Technology (ICMT), 2013
- [6] M. Yesilyurt, Y. Yalman, A. T. Ozcerit ,"A New DCT based Watermarking Method using Luminance Component", International Journal of elektronika elektrotehnika, Volume 19, no. 4, 2013
- [7] Radhika V. Totla, K.S.Bapat, "Comparative Analysis of Watermarking in Digital Images Using DCT & DWT", International Journal of Scientific and Research Publications, Volume 3, Issue 2, February 2013
- [8] Bhonde Nilesh, Shinde Sachin, Nagmode Pradip, D.B. Rane," Image Compression Using Discrete Wavelet Transform ", International Journal of Computer Technology and Electronics Engineering (IJCTEE), Volume 3, Special Issue, March-April 2013
- [9] Prabhishkek Singh, R S Chadha, "A Survey of Digital Watermarking Techniques, Applications and Attacks", International Journal of Engineering and Innovative Technology (IJEIT) ,Volume 2, Issue 9, March 2013
- [10] Pallavi Patil, D.S. Bormane," DWT Based Invisible Watermarking Technique for Digital Images", International Journal of Engineering and Advanced Technology (IJEAT) ISSN: Volume-2, Issue-4, April 2013
- [11] Nidhi Bisla, Prachi Chaudhary, "Comparative Study of DWT and DWT-SVD Image Watermarking Techniques", International Journal of Advanced Research in Computer Science and Software Engineering, June 2013
- [12] Md. Maklachur Rahman," A DWT, DCT and SVD based watermarking technique to protect the image piracy", Published in IEEE explore, July 2013
- [13] K. Chaitanya, E. Sreenivasa Reddy & K. Gangadhara Rao ," Digital Color Image Watermarking using DWTDCT Coefficients in RGB Planes ", Global Journal of Computer Science and Technology Graphics & Vision, 2013
- [14] Ghazali Bin Sulong, Harith Hasan, Ali Selamat, Mohammed Ibrahim, Saparudin, "A New Color Image Watermarking Technique Using Hybrid Domain", IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 6, No 1, November 2012
- [15] Saqib Saleem, Qamar-ul-Islam, "On Comparison of DFT - Based and DCT Based Channel Estimation for OFDM System", IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 3, No. 2, May 2011
- [16] WANG Hui-qin, HAO Ji-chao, CUI Fu-ming, "Color Image Watermarking Algorithm Based on the Arnold Transform", IEEE Computer Society, 2011
- [17] Baisa L. Gunjal and Suresh N. Mali, "Comparative Performance Analysis of DWT-SVD Based Color Image Watermarking Technique in YUV, RGB and YIQ Color Spaces", International Journal of Computer Theory and Engineering, Vol. 3, No. 6, December 2011
- [18] Chin-Chen Chang, Kuo-Nan Chen, Ming-Huang Hsieh," A Robust Public Watermarking Scheme Based on DWT", IEEE Computer Society, 2010
- [19] K. Ramani Professor, E.V. Prasad Professor, V. Lokanadham Naidu , D Ganesh, "Color Image Watermarking using Bi-Orthogonal Wavelet Transform", International Journal of Computer Applications , 2010