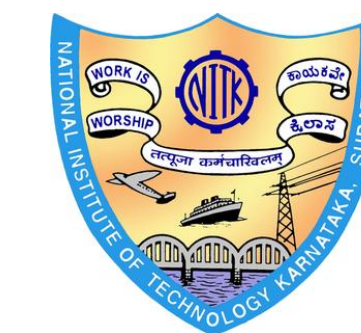


Digital Watermarking of Colour Images

A Visual Cryptography-based Scheme



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Introduction

- This method works on a random selection of pixels generated by using the passkey as the seed.
- The algorithm is based on the relationship between the randomly selected pixels and their nearest neighbour pixels.
- Even if the most significant bits of some random pixels have been changed, the technique is robust enough to handle such attacks.
- The marked image is in all respects identical to the original image.

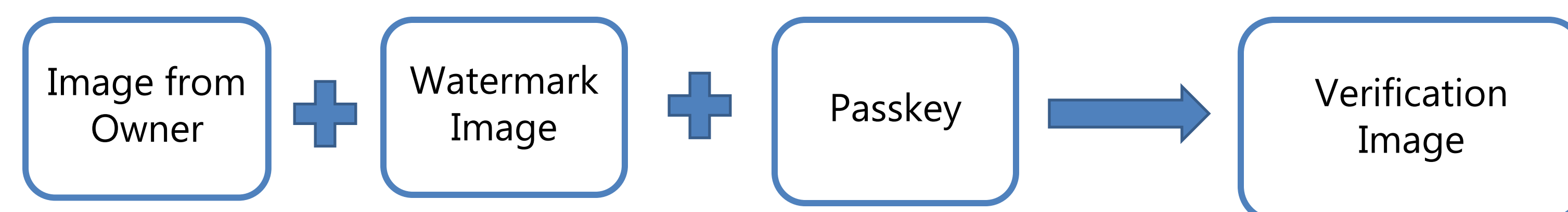
Algorithm for Watermarking

- Read the original image img
- Read the watermark wmk
- Separate the 24-bit image img into red, green and blue streams to get three gray level images of size $[R,C]$
- Divide the watermark wmk into three binary images each of size $[r,c]$
- For each of the three shares thus generated perform the steps below
 - Using the passkey as a seed, generate an array 'a' of $r \times c$ random numbers between 1 and $R \times C$
 - For every a_i
 - More = No. of pixels among the nearest 8 neighbours of $img(a_i)$ whose intensity value is greater than $img(a_i)$
 - Less = No. of pixels among the nearest 8 neighbours of $img(a_i)$ whose intensity value is less than or equal to $img(a_i)$
 - If $less \leq more$ && $wmk(i) = 1$, $V = [1 \ 0]$
 - If $less > more$ && $wmk(i) = 1$, $V = [0 \ 1]$
 - If $less \leq more$ && $wmk(i) = 0$, $V = [0 \ 1]$
 - If $less > more$ && $wmk(i) = 0$, $V = [1 \ 0]$
 - The verification information V of all pixels is combined to form the verification image of size $[r, 2 \times c]$
- These form the red, green and blue streams of the final verification image.

Algorithm for Authentication

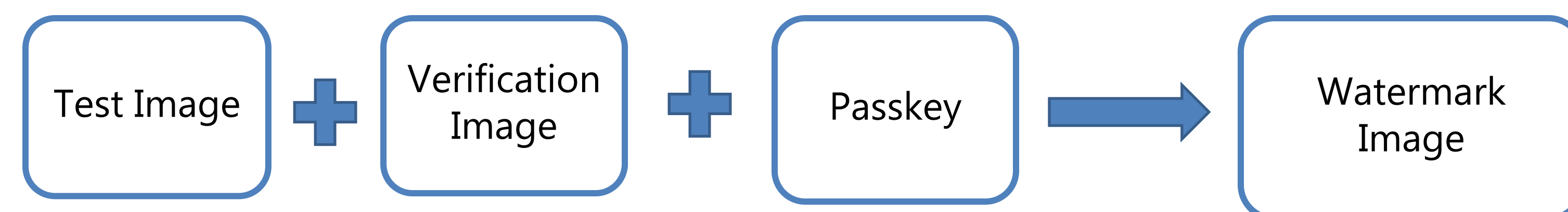
- Read the test image img
- Read the verification image
- Separate the test image img into red, green and blue streams
- Separate the verification image into its red, green and blue streams
- Using verification image of size $[r, 2 \times c]$ and test image of size $[R,C]$ of each stream generate the three shares of the watermark image as given below
 - Using the passkey as a seed generate an array 'a' of $r \times c$ random numbers between 1 and $R \times C$
 - For every a_i
 - More = No of pixels among the nearest 8 neighbours of $img(a_i)$ whose intensity value is greater than $img(a_i)$
 - Less = No of pixels among the 8 nearest neighbours of $img(a_i)$ whose intensity value is less than or equal to $img(a_i)$
 - If $less \leq more$ && $V == [1 \ 0]$, $wmk(i) = 1$
 - If $less > more$ && $V == [0 \ 1]$, $wmk(i) = 1$
 - If $less \leq more$ && $V = [0 \ 1]$, $wmk(i) = 0$
 - If $less > more$ && $V = [1 \ 0]$, $wmk(i) = 0$
- The image wmk is now compared with the original watermark for authentication.

Watermarking

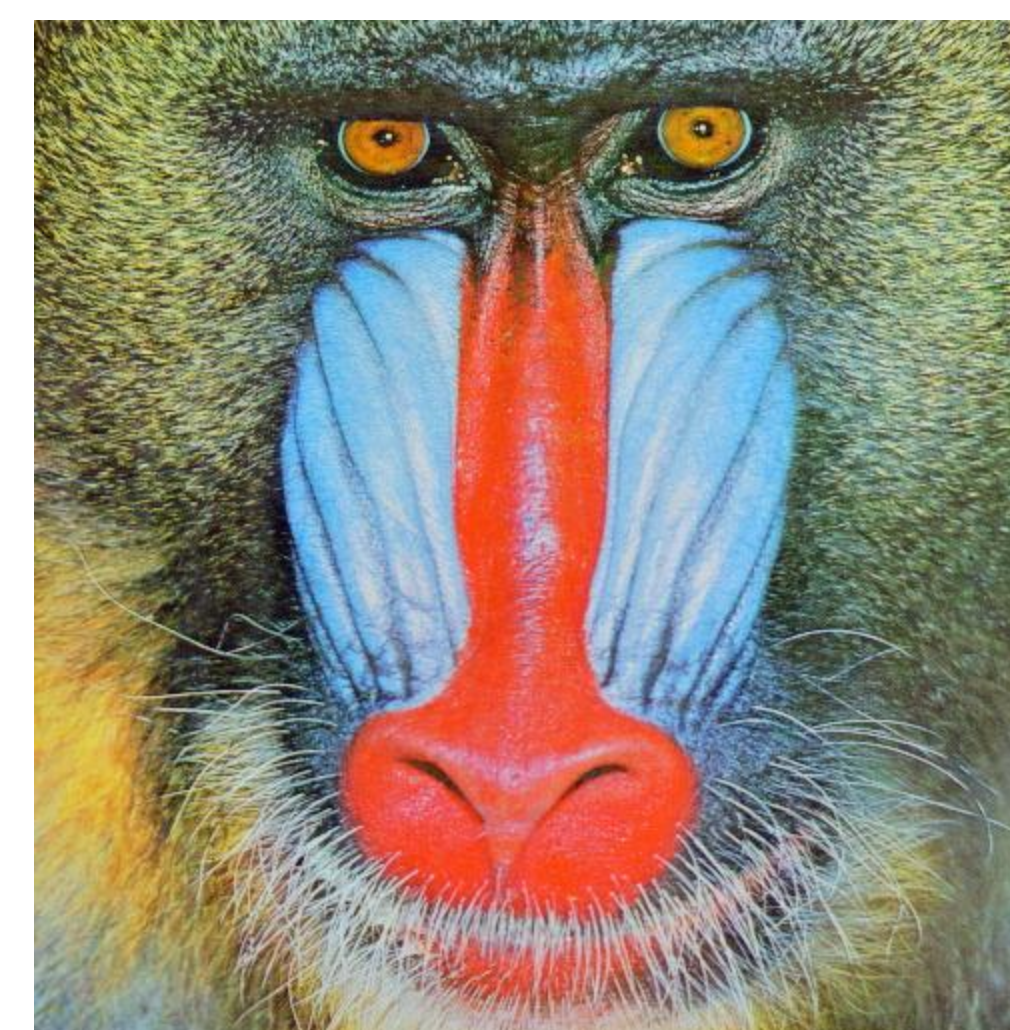


The watermark and verification image are registered with a neutral authority. The owner of the image is in possession of the passkey which he must provide to validate an ownership claim.

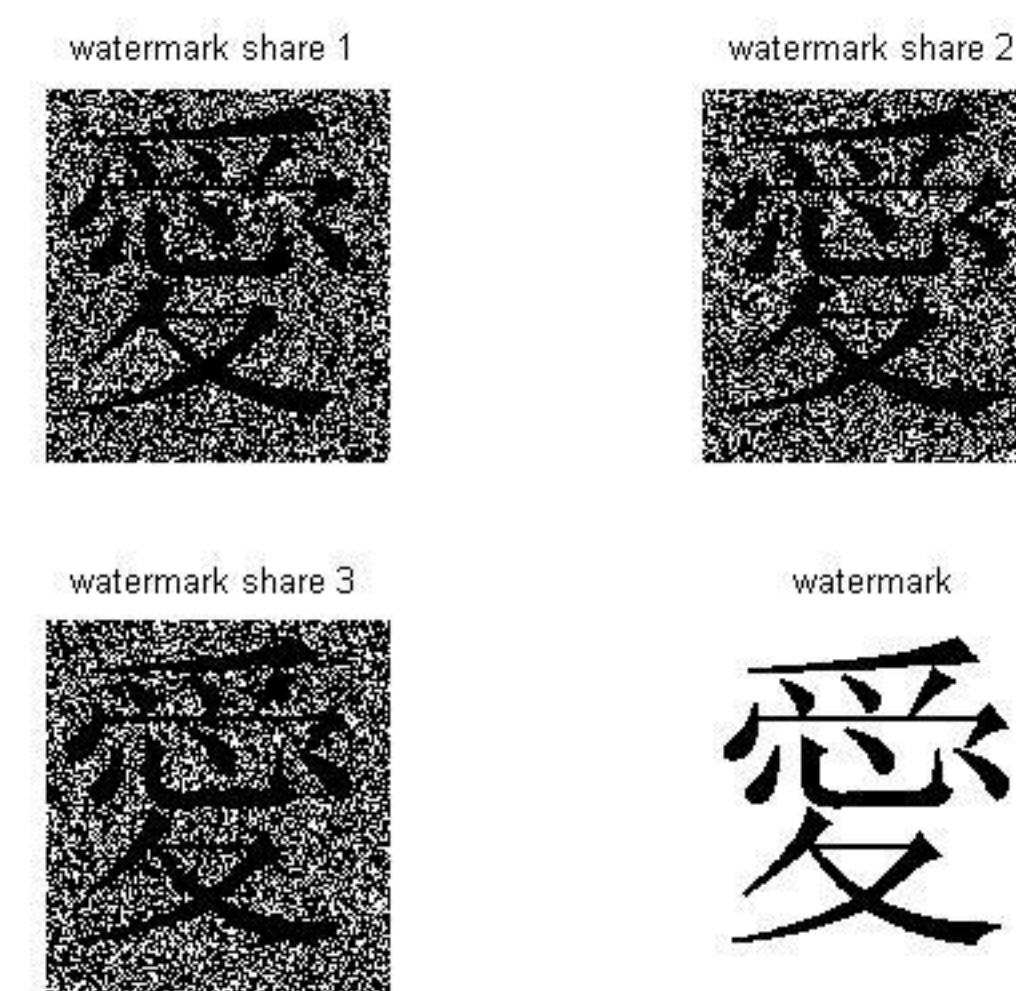
Authentication



Using the test image, passkey and verification information, it is possible to generate the watermark which should match the original if the claim is true.



Original Image



Watermark and its three shares

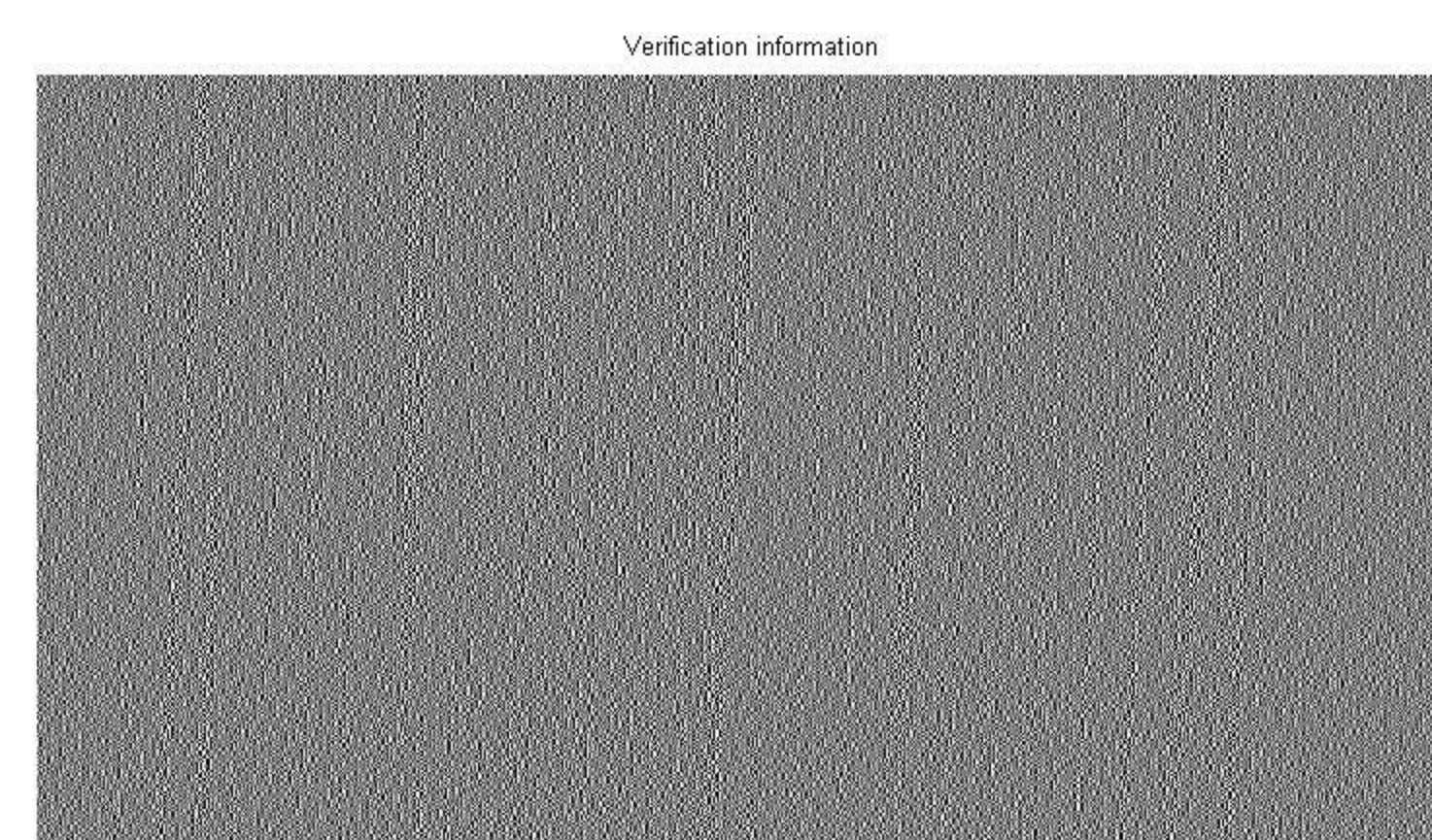


Image containing Verification information



Final Comparison

References

- [1] 'A Visual Cryptography Based Digital Image Copyright Protection', Adel Hammad Abusitta, Journal of Information Security, March, 2012.
- [2] Image Captcha Based Authentication using Visual Cryptography, Mrs. A. Angel Freeda, M.Sindhuja, K. Sujitha, IJREAT April- May, 2013
- [3] 'Visual Cryptography for Colour Images', Young- Chang Hou, The Journal of The Pattern Recognition Society, June, 2002
- [4] 'Protecting Digital Media Content', Nasir Memon and Ping Wah Wong, Communications of ACM, July, 1998.

- [5] 'Visual Cryptography', Moni Naor and Adi Shamir, Eurocrypt 1994.

- [6] An Exploitation of Visual Cryptography to Ensure Enhanced Security in Several Applications, Md. Tanbin Islam Siyam, Kazi Md. Rokibul Alam and Tanveer Al Jami, International Journal of Computer Applications, March, 2013

- [7] 'Visual Cryptography and its Applications', Jonathan Weir and Weiqi Yan, Ventus Publishing Aps