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Digital Watermarking of Colour Images: A survey

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Abstract: Digital Watermarking is a method of embedding & extracting some identification information directly into digital carrier such that it does not affect its original document contents. This Paper illustrates various techniques used for such Watermarking especially for Colour images.

Keywords: Digital water-marking, SVD, DCT, DWT, NCC .

I. INTRODUCTION

The rapid evolution of the cyber world has greatly facilitated the manipulation and transmission of digital documents in text, image, audio and video forms.[8] Easy access and replication, however, have led to serious problems regarding copyright protection and distortion-prevention of multimedia documents. Conventionally watermarking is used for copyright protection of documents. Presently digital watermarking as an offshoot of computer technology has widened its field of application.[8] The technique of digital watermarking is considered one of the most powerful security measures in the transmission of multimedia digital documents. It is effectively used by media owners to insert watermark information into their document for the purpose of copyright protection.[6]

In general, we can classify digital watermark into two classes depending on the domain of watermark embedding, i.e., the spatial domain and the transform domain. The corresponding techniques exploit the properties of the underlying domain in order to create the watermark. Detailed comparative study of such techniques is presented in the sequel.

II. DOMAINS OF WATERMARK

A. Spatial Domain

The Watermark embedding is achieved by directly modifying the (LSB of) pixel values of the host image.

B. Transform Domain

The host image is first transformed to frequency domain using say Discrete Cosine Transform (DCT), Discrete Fourier Transform (DFT), Discreet Wavelet Transform (DWT) or Singular Vector Domain (SVD) etc. Then the Watermark is embedded in the coefficients of transform function. In Transform Domain, the transform techniques help in locating the most Significant Portion of the Host Image.

III. PROPERTIES OF WATERMARKING

A. Imperceptibility

The watermark embedding should cause as little degradation to the host image. In other words, if we cannot distinguish between host image and the watermarked image called as imperceptibility.

B. Robustness

The watermark must be robust to common signal processing manipulations and attempts to remove or impair the watermark. In other words, if it is difficult to remove or destroy watermark from watermarked image then it is said to be robust.

C. Security

The embedded information must be secured against tampering via different attacks.

D. Capacity

The amount of embedded information must be large enough to uniquely identify the owner of the image.

IV. SURVEY OF RESEARCH WORK RELATED TO WATERMARKING TECHNIQUES

A number of research papers appear in this area through various technical journals & conferences. Hence a survey of contents is useful to identify new research avenues. Some typical techniques appearing in recent publications are presented below:-

1. Multichannel Digital Watermarking of Colour Images using SVD[1]

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A invisible Watermark Scheme for color images using Singular Vector Domain. The singular vector domain based watermarking scheme demonstrates that it gives reasonably satisfactory results for color image watermarking without affecting its perceptual quality and robustness of the watermark, by balancing between the two factors robustness and invisibility by using appropriate scaling factor. In this approach, same or different watermarks can be embedded into the three color channels (R, G, B) of the host image in order to increase the robustness of the watermark. The main feature of our scheme is to use all channels of RGB color space to embed watermarks. We are embedding maximum amount of watermark and also make it more secure. It can be used for a variety of applications since we can perform single channel embedding to multichannel embedding.

2. Multiple Spatial Watermarking Technique in Colour Images[2]

This paper presents a novel multiple spatial watermarking technique in color images based on embedding four indentical watermarks into the blue component of host image. The host image is divided into four regions in order to embed multiple watermarks, only one watermark is detected or constructed from the five extracted watermarks according to the hightest value of normalized cross correlation (NCC).

The proposed scheme is robust for several attacking operations including median filter, JPEG2000, JPEG-loss compression, image cropping, image scaling, rotation, rotation-scaling, rotation cropping.

3. Digital Watermarking of Color Images in the Singular Domain[3]

The algorithm is based on the well-known matrix factorization technique of the singular vector decomposition. This is achieved by using the fact that a color image can be broken into the RGB channels. These channels are then treated separately as matrices on which the matrix factorization is applied. These matrices are then used to present the embedding and extraction algorithms. This manuscript has appropriately shown that the SVD based watermarking technique presented by us is quite good for rectangular color images of an arbitrary size.

4. A Digital Watermarking Algorithm for Color Images Based on DCT[4]

A digital watermarking algorithm based on the DCT domain is proposed to embed a true color watermarking image into the host color image for the purpose of protecting the copyrights of digital products. Before embedding the watermarking, the coordinates of R, G, and B components of the watermarking image are scrambled first by using the chaotic sequence, which will bring in good security to the watermarking. Using some characteristics of HVS, watermarking with different strength is embedded into the different regions of a host image, balancing the robustness and imperception of watermarking simultaneously.

5. Digital Watermarking in Singular Vector Domain[5]

An algorithm for digital watermarking using singular value decomposition is presented in the domain of the singular vectors of the image matrices. They have implemented method for gray and color images and shown that the technique is robust against noise, cropping and JPEG compression. The advantage of algorithm, as opposed to other SVD based techniques, lies in the fact that most of the previous methods rely on the singular values of the image matrix, thereby the information content of an n×n image was translated into just n values. In this approach, the scaled singular vectors are used to encode the watermark. The technique also inherently contains a level of security against the hacking of the watermark. The algorithm presented in the manuscript is not closed. `In fact there can be certain modification to the algorithm such that various other aspects can be included.

For example, one can decrease the computational time of embedding and extracting the watermarks by a segmentation of the image. Then the algorithm can be applied to these various segments individually. Apart from this the embedded image can be encrypted thereby enhancing the security of the image content.

6. Single Channel Watermarking For Video Using Block Based SVD[6]

This paper presents a digital watermarking scheme for color media using block based SVD approach. The proposed algorithm for watermarking handles the problem of false positive detection and can be used for color videos. Watermarking using SVD can be done more efficiently if watermark is embedded in the blue component of the host frame of the video, instead of embedding it in the frame without separating the color component. This paper presents an improved version of the earlier discussed block based SVD watermarking technique for protecting rightful ownership. In this scheme the efficiency of watermarking in terms of MSE and PSNR values and payload is improved by embedding the watermark image in the blue component from the[R,G,B] panel of the video frames.

The constraint on size of watermark is removed as bigger watermarks can be embedded in color images using block based approach as compared to the approach of embedding the watermark diagonally in S matrix of the SVD of the host frame. Also more watermark information can be added in the green and red channel of the host

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image. This algorithm can thus be used for digital watermarking in applications like fingerprinting, copy control, broadcast monitoring, video authentication and copyright protection.

7. A Reliable SVD based Watermarking Scheme[7]

In this paper a singular value based watermarking scheme is used, where they embed the principal components of the watermark in the original image rather than just the singular values. The fact that the principal components have been added to the singular values of original image achieves two useful purposes. Firstly, the information about the entire watermark is not available without a prior knowledge of the original watermark. This is of significance for the security of the watermark. Secondly, the method avoids the pitfall encountered by Liu and Tan, where the watermark was modified only along the diagonals, leading to the extraction of a reference watermark that is being searched using an arbitrary image. Hence, this method utilizes the property of SVD based watermarking algorithms and ensures rightful ownership of the digital watermark image.

V. CONCLUSION

From the above discussion it is clear that a number of techniques are used for embedding the watermark in the color image/video. Very little work, however appears on the security related aspects of the watermarked image. Hence a
masters level project is proposed in this area. This will lead to the both authentication and security of the watermarked images.

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