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Reversible Watermarking for Low Distortion Using Transform

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Abstract:

Reversible watermarking enables the embedding of useful information in a host signal without any loss of host information. Tian's difference-expansion technique is a high-capacity, reversible method for data embedding. However, the method suffers from undesirable distortion at low embedding capacities and lack of capacity control due to the need for embedding a location map. The propose a low distortion transform for prediction- error expansion reversible watermarking. The transform is derived by taking a simple linear predictor and by embedding the expanded prediction error not only into the current pixel but also into its prediction context. The proposed transform introduces less distortion than the classical prediction-error expansion for complex predictors such as the median edge detector or the gradient-adjusted predictor. Reversible watermarking algorithms based on the proposed transform are analyzed.The Bit-rate and PSNR values are compared. A reversible watermarking algorithm with very high data hiding capacity has been developed for color images. The algorithm allows the watermarking process to be reversed, which restores the exact original image. In addition, to maximize the amount of data that can be hidden into an image, the embedding algorithm can be applied recursively an across the color components.

Key words: Reversible watermarking,Tian's difference-expansion technique, Low distortion transform, Bit-rate, Peak Signal Noise Ratio(PSNR).

I. INTRODUCTION

The process that embeds an object is called as watermark. Digital watermarking is based on the science of stegnography or hiding. The object may be an image or audio or video or text.A digital watermark is a kind of marker covertly embedded in a noise-tolerant signal such as an image or audio data. "Watermarking" is the process of computer-aided information hiding in a carrier signal. Digital watermarks may be used to verify the authenticity or integrity of the carrier signal. It is prominently used for tracing copyright infringements and for tracing copyrights infringements and for banknote authentication.

Traditional watermarks may be applied to visible media (like images or video), whereas in digital watermarking, the signal may be audio, pictures, video, texts or 3D models. A signal may carry several different watermarks at the same time.Both stegnography and digital watermarking employ stegnographic techniques to embed data convertly in noisy signals. But whereas stegnography aims for imperceptibility to human senses, digital watermarking tries to control the robustness as top priority. Since a digital copy of data is the same as the original, digital watermarking is a passive protection tool. It just marks data, but does not degrade it nor controls access to the data.

Reversible means lossless. In watermarking scheme the data can be lost. To overcome, reversible watermarking is used. Reversible watermarking is a special digital watermark with an intriguing feature that reversible watermarking techniques rely on lossless when watermarked content has been authenticated, one can data compression on the original values in the embedding area, remove the watermark to retrieve the original, unwatermarked and the space space saved from compression will be used for embedding content. Such reversibility to get back original content is highly the payload the need of lossless data.For color images, there are several options. One can decorrelate the dependence among different color components, and then reversibly watermark the decorrelated components. One can reversibly watermark each color components individually. A new reversible watermarking algorithm based on the difference expansion of colored images has been developed. Since the watermark is completely reversible, the original image can be recovered exactly. The algorithm uses spatial and spectral triplets of pixels to hide pairs of bits, which allows the algorithm to hide a large amount of data. A spatial triplet is any three pixel values selected from the same spectral component, while a spectral triplet is any three pixel values selected from different spectral components. The algorithm is recursively applied to the rows and columns of the spectral components of the image and across all spectral components to maximize the hiding capacity.

II. TYPES OF WATERMARKING

A.TEXT WATERMARKING

Text can be added into image is called text watering. Text watermark is a translucent and visible copyright symbol. Text Watermark can helps you protect your photo's copyright and verifies pictures are protected from unauthorized use. It can add name, company name, date... to images, These are all text watermark. To protect images copyright use text watermark. First, need a photo watermark software to do it, Text watermarking is an approach for text document copyright protection. Watermarking ensures that a text document carries a secret message containing copyright information so that copyright infringed can be recognized

B. IMAGE WATERMARKING

Image can be added into an original image is called image watermarking. The amount of data one can embed into an image depends highly on the nature of the image. A digital image watermark is a kind of marker covertly embedded in a noise-tolerant signal such as audio or imagedata.

It is typically used to identify ownership of the copyright of such signal. "Watermarking" is the process of hiding digital information in a carrier signal; the hidden information should, but does not need to contain a relation to the carrier signal. Digital watermarks may be used to verify the authenticity or integrity of the carrier signal or to show the identity of its owners. It is prominently used for tracing copyright infringements and for banknote authentication. Like traditional watermarks, digital watermarks are only perceptible under certain conditions, i.e. after using some algorithm, and imperceptible anytime else. If a digital watermark distorts the carrier signal in a way that it becomes perceivable, it is of no use. Traditional Watermarks may be applied to visible media (like images or video), whereas in digital watermarking, the signal may be audio, pictures, video, texts or 3D models. A signal may carry several different watermarks at the same time. Unlike metadata that is added to the carrier signal, a digital watermark does not change the size of the carrier signal.

C.AUDIO WATERMARKING

Some audio signals are added into audio clip is audio watermarking. An audio watermark is a kind of digital watermark and marker embedded in an audio signal, typically to identify ownership of copyright for that audio. One of the most secure techniques of audio watermarking is spread spectrum audio watermarking (SSW). Spread Spectrum is a general technique for embedding watermarks that can be implemented in any transform domain or in the time domain. In SSW, a narrow-band signal is transmitted over a much larger bandwidth such that the signal energy presented in any signal frequency is undetectable. This type of watermarking is robust since to be confident of eliminating a watermark, an attack must attack all possible frequency bins with modifications of certain strength. This will create visible defects in the data.

D.VIDEO WATERMARKING

Some video clips are added into video is video watermarking. Video watermarking is a new technology that has been proposed to solve the problem of illegal manipulation and distribution of digital video. A robust video watermarking algorithm is proposed which employs frame-by frame.

III. EXISTING SYSTEM

In the existing system the transforms which are used MED transform and TIAN'S DE transform**.** The transform is used to map or transform from one domain to another domain. Here the proposed transform is compared with the MED transform and TIAN's DE transform.

A. MED TRANSFORM

MED is a high-performance predictor used in JPEG-LS standard .In this case, the gain of using the optimized version is very significant. If MED selects the two other predictors, one cannot evaluate a priori which scheme gives better results. Most of the embedded pixels are selected from rather uniform regions. One can suppose that for such regions, the prediction errors provided by the three linear predictors of MED are not significantly different. The distortion introduced by embedding into the current pixel of the classical MED scheme is larger than the one introduced by
embedding into the pixel and its context of the JPEG4 optimized scheme, provided that the prediction error given by MED is not less than half of the one given by JPEG4. If MED selects the two other predictors, one cannot evaluate *a* priori which scheme gives better results.

B.DIFFERENCE EXPANSION (DE)

Difference expansion (DE) reversible watermarking, introduced by Tian creates space by expanding a difference. The data and the auxiliary information are further added to the expanded difference and embedded into the image. The expanded difference is the one between adjacent pixels original and predicted pixels of a block and the mean value of the block pixels of a block and the median value of the block. By expanding two times the difference, one data bit can be embedded. The embedding is possible if it does not generate overflow or underflow. At detection, as long as the expanded difference is recovered, the embedded bit is extracted and the original pixels are recovered.

The 8-bit and 256 gray images are used as watermark signal. The bit decomposition method of gray images which was proposed to decompose images into 8-bit planes. If watermark is added with high coefficients, image will be easily distorted. But if watermark is added at the position with little coefficients, the watermark will have the shortcomings of weak resistance to image compression, filtering, cropping.

A.WAVELET TRANSFORM

Implementing digital signal processing algorithms on field programmable gate arrays (FPGAs) becomes a growing trend, for the reason that FPGAs have merit on merging digital signal processing algorithms with other control logic. Discrete wavelet transform (DWT) is a classical signal transform algorithm.

With the fast proliferation of high-bandwidth personal modems (especially ADSL and cable modems), the exchange of digital multimedia contents has drastically increased. This exchange is also greatly facilitated by the emergence of digital communities that share many files across peer-to-peer networks.Among these shared files, many are copyrighted, and in this context, it is necessary to control their distribution in an open network such as the Internet.

The Motion Picture Association of America (MPAA), the Consumers Electronics Manufacturers Association (CEMA), and members of the computer industry put together an *ad hoc* group called Copy Protection Technical Working Group (CPTWG) to discuss the technical problems of protecting digital video from piracy, particularly in the domain of digital versatile disk (DVD).

V. PROCESS OF WATERMARKING

A.PROBLEM ANALYSIS

The rapid development and widely application of network technique and digital multimedia technology, the requirement of an effective copyright protection method of digital production such as digital video, audio, images become more and more processing. As an effective method to protect the security of digital information, digital watermark has attained much interest and attention in recent years. According to the place where the information is embedded, the method can be classified into spatial domain and transformation domain algorithm.

Analyzing the process to embed the watermark information into suitable wavelet coefficients in wavelet domain. Whether the original image or watermark image is needed, watermark algorithm can be divided into blind watermark, semi blind watermark and non blind watermark. The distortion of the image that transformed by wavelet is used to gray image. The image that has been transformed into wavelet domain. For wavelet transformation has good time frequency property, it is widely used in digital watermark technology.

B. SOVERVIEW OF THE WATERMARKING SYSTEM

Due to the linear phase and compact supported properties of the wavelet. The distortion of the image that transformed by wavelet is used to gray image. The image that has been transformed into wavelet domain and reconstructing signal stability is also very good. The wavelet coefficients at the location of (x,y) of sub band at the layer. Ensemble of {LL, LH, HL, HH}, LL means horizontal and vertical frequency are both low frequency. LH means horizontal frequency is low and Vertical frequency is high. HL means horizontal frequency is low and vertical frequency is high. HH means both are the high frequency.

The security of the algorithm is provided by random selection of appropriate sub-macro blocks. This random selection is performed based on the generated content based key. If the same key is used for watermark embedding in all frames, this will make the method vulnerable to intra-collision attack.

An efficient algorithm uses the properties of frames to extract the appropriate features in order to select the suitable area for embedding. These features should be robust enough to enhance the robustness of the algorithm along with supplying the security.

VI. STAGES OF THE EMBEDDING ALGORITHM

To generate a proper key, the structural properties of the sub-macro blocks are exploited. In doing so, the decision has been made after a simple texture classification based on the quantized DCT coefficients

The different stages of the embedding algorithm are as follows:

- Generating the content based key
- Selection of suitable sub-macro blocks
- Determine the appropriate coefficients through a priority matrix
- Embedding the watermark bit

In this case, two bits are assigned for each structure. For instance, in MPEG-2 standard in each 16×16 macro blocks, there are six 8×8 sub-macro blocks; two of them are related to the Cb and Cr and the rest four sub macro blocks are related to luminance or Y component. All of these sub-macro blocks are explored .

A.WATERMARK GENERATING

The 8-bit and 256 gray images are used as watermark signal. Here the bit decomposition method of gray images which was proposed to decompose images into 8-bit planes. Each pixel of every plane only contains 0 or 1. A image with size of 3*3 can be decomposed into nine 8-bit planes. The gray value of original image is the highest bit plane after decomposing, is the lowest bit plane. Part of the decomposed information can be used as watermark, the rest are used as the key for watermark extraction.To make the extracted public key robust, a feature of the macro block should be used to which the human eye is sensitive. One such feature is the DC coefficients of the 4×4 blocks.

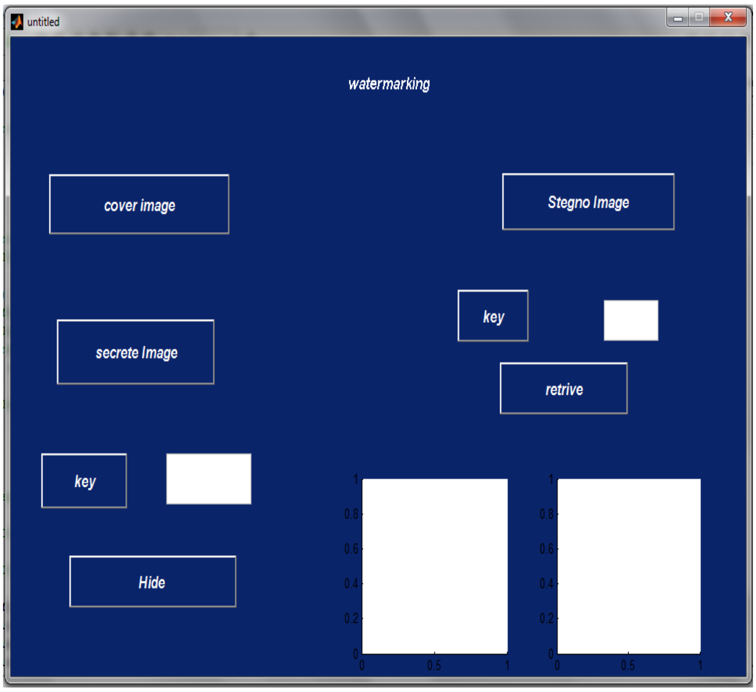
If the DC coefficient itself is used for public key extraction, the attacker can change the DC coefficient of every block by the same amount, which would make watermark detection impossible. This would result in a darker or brighter frame, but the perceptual quality of each frame would be preserved.However, if the relative difference of the DC coefficients of 4×4 blocks is used to determine the public key, the attacker has to increase or decrease the DC coefficient of one block or more to make the public key extraction impossible for the copyright owner. This results in visible artifacts.

B.WAVELET TRANSFORM

The purpose of the wavelet transform is to remove irregular redundancy in the digital image, embed regular redundancy into the digital image, for the purpose of original content recovery. The regular redundancy could be a hash of the image, a compressed bit stream of the image, or some other image content depend watermark. The integer wavelet transform maps integers to integers and allows for perfect invariability with finite precision arithmetic. The wavelet filters for integer wavelet transform are dyadic rational integers. Thus the integer wavelet transform can be implemented with only three operation, addition, subtraction and shift on a digital computer. The fast multiplication-free implementations is another advantage of the integer wavelet transform over standard discrete wavelet.

VII. RESULT

A.SCREEN SHOTS



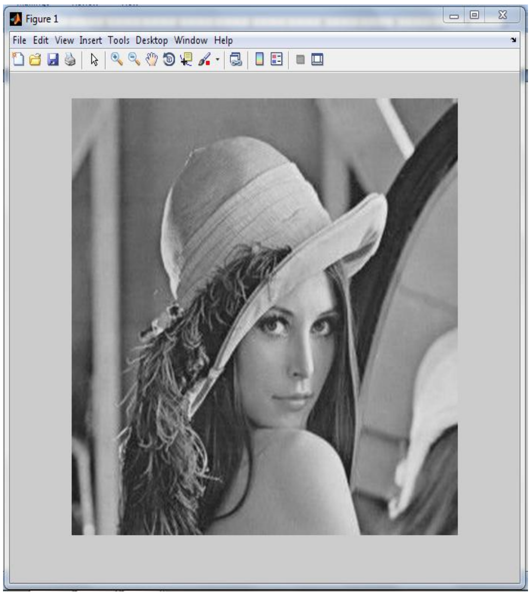


Fig1. Output display

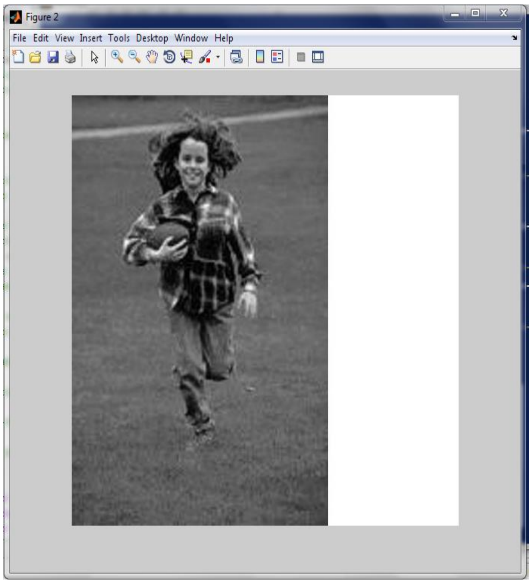


Fig 3.secret image

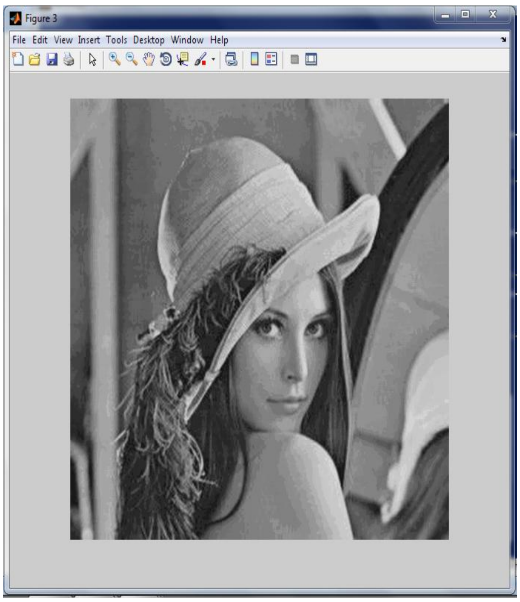


Fig 4 .Hide image

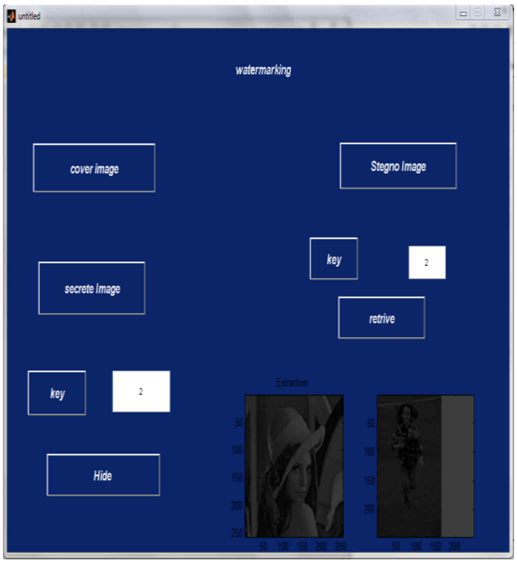


Fig 5.Output in the form of gray scale

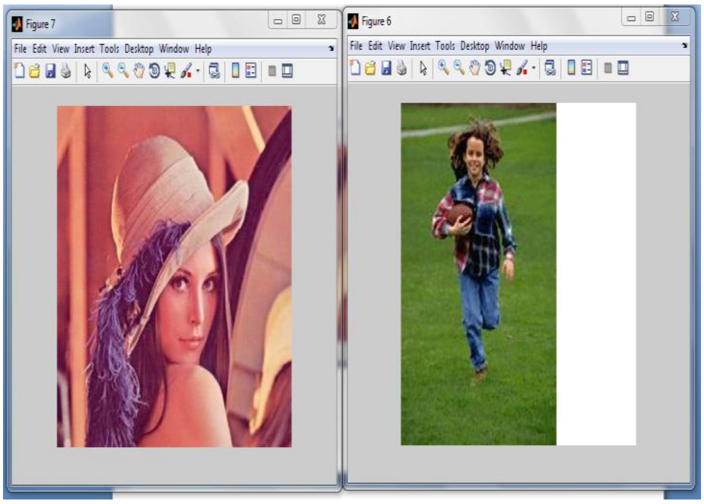


Fig6. Output in the form of color(RGB image)

VIII. CONCLUSION

The robustness of the blind watermark is not better than non blind. The result of the experiment shows that the algorithm of digital watermark analysis in wavelet domain is not only a blind watermark algorithm, but also have stronger robustness to adding noise, filtering, JPEG compression and cutting. The result shows that the embedded watermark has good transparency and with strong robustness in a variety of common attacks. The proposed transform introduces lower distortions than the ones based on high- performance predictors such as MED and TIAN's. the proposed method outperforms a representative prior art of wavelet transform and the wavelet transform has improved embedding than a predictor-error expansion of a simple linear predictor.

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