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Various Watermarking Techniques to Increase PNSR Value- A Review

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Abstract: Watermarking technique is the most common technique for protecting the multimedia data for unauthorized access. In this paper we focused on various watermarking technique to make image secure and protected. Due to increase in the PNSR value, the image, get very much distorted. In this paper, various watermarking techniques will be discussed like Gabor filtering, Salt and Pepper filtering which improves noise in the image.

Keywords: Gabor filtering, Watermarks, Kalman, DCT, SVD

1. Introduction

Digital watermarking is a process which gives rights to an individual to include hidden copyright notices and other valuable verification messages to digital audio, video, or image signals and documents. This hidden message contains important information. The technique takes its name from watermarking of paper or money as a security measure [1]. Digital watermarking is not a form of stenography, in which data is hidden in the message without the end user's knowledge. There are some techniques in stenography which can be viewed with human eye. This technique has been developed to provide security to the multimedia application so that secure data.

Watermarking is of various types which are discussed as follow[3]:

1. **Visible watermarks**: An extension of the concept of logos is visible watermarks. These types of watermarks are used for images only. They can be used with images and are easily visible to the eyes. Visible watermarks are not removed by cropping central part of the image. It can be protected from various types of the attacks.

2. Invisible watermark:
Invisible watermark is veiled under the content. Authorized agencies are easily detecting this watermark. It is used to find out unauthorized users.

3. Public watermark: Public watermark can be used by anyone for reading and retrieving purpose using special type of algorithm. Public watermark are not secure one. Furthermore public watermarks are valuable for carrying IPR information. They are good alternatives to labels[4].

4. Fragile watermark: Fragile watermarks are also known as tamper-proof watermarks. Such watermarks are smashed by data manipulation.

5. Private Watermark: Private watermarks are also known as secure watermarks. To read or retrieve such a watermark, it is necessary to have the secret key[6].

6. Perceptual watermarks: It is also known as a transparent watermark. It provides extremely high content data.

1.1 Types of watermarking: There are various types of watermarking. These are as follow:

1. Video Watermarking: It is one the superset of normal watermarking. Static images can be applied to the video watermarking. It comes under live video watermarking and having high data rate frames. There are no limitations if content is generated off-line. Visible watermarking is used in video watermarking[7].

2. Audio Watermarking: Audio watermarking is the technology which is in pipeline to overcome reproduction and modification problems. Audio compression comes under this watermarking technique. Audio watermarking can be successfully implemented at frequencies outside the normal human audible range [9].

3. Text Watermarking: In this approach text can be divided into raw formatted and unformatted text. There are different approaches which come under this category. One approach is adding white text character after each sentence. By using text editor it can be easily bypassed.

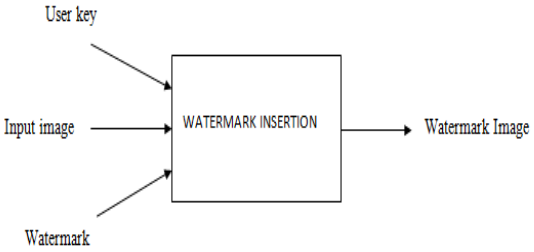

Fig.1.1 Watermark Insertion [2]

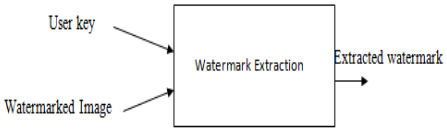

Fig.1.2 Watermark Extraction [2]

2. Review of Literature

In paper [1] they explained about implemented a robust image watermarking technique for the copyright protection based on 3-level discrete wavelet transform (DWT). In this technique alpha blending technique has been used with low frequency sub band with cover images. It is observed that insertion and extraction is better than other simpler watermark for embedded images. Furthermore proposed technique is compared with 1-level and 2-level DWT based watermarking in terms of PNSR and MSE parameters. In this paper, an image watermarking technique based on a 3-level discrete wavelet transform has been implemented. This technique can embed the invisible watermark into salient features of the image using alpha blending technique.

In paper [2] they examined various watermarking technique with new technique that is self embedding fragile technique. In this method watermarking embedding is done with two phases one is with original image and other is with watermarked image. Later on combination of these two techniques has been used to produce new watermarked image. In this paper they focused on temper block detection. Self embedding fragile watermark technique is useful for image recovery with higher recovery in tamper

region which gives more accurate recover image in comparison with other existing methods.

In this paper [3] DWT-BAT medical image watermarking is implemented. MRI, CT and US three different types of images has been used as a cover image and patient is used as a watermark image. The load on watermark image is optimized by using BAT algorithm. The whole process is done in wavelet transform domain and is used to retain quality of the image.

In this paper [4] they proposed a strong and secure image watermarking algorithm that embeds watermark in the shuffled images using wavelet transform. The proposed scheme provides very high payloads and imperceptibility when compared to similar transform-domain techniques. In addition to it, it is also concluded that proposed technique provides better way to detect attacks from the image and remove noise from it.

In this paper [5] they introduced a novel technique which is used to detect various types of attacks in watermarking and free from noise. This technique is used for multi-level bit embedding watermarking. Two level DCT has been used to extract image. They extract the watermark from the watermarked image by two-level DCT and can realize the watermark synchronization by the block-number-fixed segmentation and the feature vector extraction rule. Later on comparison is also done with other techniques and it is proved that proposed algorithm can not only resist common image processing attacks, but also has very good performance in resisting geometric distortions and their combined distortions.

In this paper [6] they proposed image adaptive SVD technique based on watermarking scheme. It is used for block mapping to find out where watermarks have to be attached in blocks. Experimental results have shown that the proposed algorithm is capable of producing good quality watermarked images in terms of objective and subjective matrices with less distortion even in case of potential attacks.

In paper [7], estimation for channel filters are based upon kalman filters. The main method is based upon pilot-symbol aided method in which parametric channel estimation is characterized as a propagation path. Kalman filters are used to reduce the problem of optimization. It is proved that kalman is very effective with Doppler frequency as well fading channel to decrease time taken.

3. Watermarking Techniques

There are various watermarking technique to improve image quality. These techniques are as follow:

1. Singular Value Decomposition: The SVD is the optimal matrix decomposition in a least square sense that it packs the maximum signal energy into as few coefficients as possible. Singular value decomposition (SVD) is a stable and effective method to split the system into a set of linearly independent components, each of them bearing own energy contribution. Singular value decomposition (SVD) is a numerical technique used to diagonalizable matrices in numerical analysis [11].

2. Kalman Filtering: As radio communication signals are often corrupted with noise, a good filtering algorithm is required to remove noise from electromagnetic signals while retaining the useful information. Kalman Filtering is an effective method to filter impurities in linear systems. The kalman filter basically consists of a set of mathematical equations that provides an efficient computational means to estimate the state of a process that minimizes the mean of the squared error. It operates recursively on streams of noisy input data to produce statistically optimal results. Kalman filter is supportive in number of ways. It can be used to predict past, present and future estimation. Using kalman filter estimation can be possible using unknown precision [10]. It is of two types. One phase kalman filter and other is two phase kalman filter. One phase kalman filter is based upon prediction and update. But it does not remove all the noise from the system. Similarly two phase kalman filter is also based upon prediction and update but it filters two times so possibility of noise in the system is extremely low.

3. Gabor Filtering: The images are filtered using the real parts of various different Gabor filter kernels. The mean and variance of the filtered images are then used as features for classification, which is based on the least squared error for simplicity [8].

4. Salt and Pepper Filtering: In this technique, some pixels are black and some are white. It can be used in the transmission of the image. It can be calculated on the probability based. It can introduce salt-and-pepper noise in an image by setting a fraction of r/2 randomly selected pixels to black, and another fraction of r/2 randomly selected pixels [6].

5. Discrete Cosine Transformation (DCT): It is one of essential function in signal processing. It converts signals from spatial to frequency domain. Due to its good performance it can be used in JPEG standard [6]. An image transformed by the DCT, it is usually divided into non-overlapped m ´ m block.

6. Discrete Wavelet Transform (DWT): DWT is a linear transformation that operates on a data vector whose length is an integer power of two, transforming it into a numerically different vector of the same length. It is a tool that separates data into different frequency components, and then studies each component with resolution matched to its scale. DWT is computed with a cascade of filtering followed by a factor 2 sub sampling. The Discrete Wavelet Transform (DWT) is used in a wide variety of signal processing applications. 2-D discrete wavelet transform (DWT) decomposes an image or a video frame into sub-images, 3 details and 1 approximation. The approximation sub-image resembles the original on 1/4 the scale of the original. The 2-D DWT is an application of the 1-D DWT in both the horizontal and the vertical directions [5].

1.1 Table of Comparison

Technique	**Advantages**	**Disadvantages**
SVD	**1. Reduce dataset containing large number of values** **2. Provide compact form of multivariate to find correlations**	**1. Data must be consists of anomalies.** **2. Data should be de-trended before applying SVD**
Kalman Filtering	1. Ability to provide quality of the estimate . 2. Low complexity 3. Able to account qualities which are ignored by other techniques.	1. Applicable for liner and Gaussian model.
Gabor Filtering	**1. It is optimal in nature** **2. reduce mean square estimated error**	**1. It provides only point estimation**
Salt and Pepper Filtering	**1. It is linear filtering** **2. Easy to implement**	**1. It removes some valuable information also**
DCT	**1. It converts spatial signals to frequency domain** **2. It can be**	**1. Complexity is more**

	used with JPEG standard	
DWT	**1. It can be used for 1-D, 2-D and 3-D images and videos,**	**1. Some Information is lost in DWT**

5. Conclusion

Watermarking is one of the important technique of the image processing. There are various techniques which comes under watermarking algorithms to improve image quality and make it noise free. In this paper various watermarking techniques have been reviewed. It is concluded that Kalman filtering is the best technique to improve robustness of the image. In future Kalman filtering can be used to enhance DCT-SVD techniques for the better results.

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