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A Survey on Combination of Different Features for Image Watermarking

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Abstract*— as the number of digital world user are increasing day by day it is easy to transfer digital data. This independency give rise to new problem where proprietorship of the user get lost. So researcher get new field and develop various approaches for the image watermarking of digital data like image, video, audio, etc. This paper give a brief survey on various features, attacks and evaluation parameter use in image watermarking field. Paper explain different features with proper image example.

***Index Terms*— Color Format,Digital Watermarking, Frequency domain, LSB.**

I. INTRODUCTION

WIth the increase in the digital electronics era most of the work get easy, one of them is transferring of data. But this technology give rise to new problem of piracy or in other words proprietary get easily stolen. So to overcome this different techniques are used for preserving the proprietary of the owner. One of such digital approach is watermarking which is a subsection of hiding information that is used to put some information in the original image which will specify the originality of the digital data like photographs, digital music, or digital video [1, 2, 4]. One of the basic cause of the copyright issue is the ease available of the internet and some software that can modify the content as per the user requirement.

Watermark is a kind of digital data in form of text or image which can be store in the original signal. This text or image act as the owner signature in the data so that pirated and original data can be easily classify. As the pirated data do not have the original watermark which may be in form of text or image. Now watermarking technique is broadly classify into two field first is visible watermarking while other is invisible watermarking. Example of visible watermarking in figure 1 and 2 is the digital page containing logo, T.V. channel contain logo of their channel, etc.

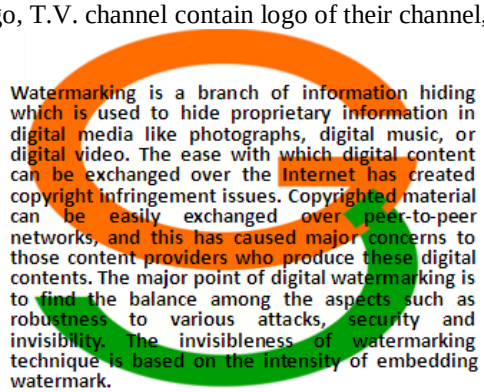

Fig. 1 Example of visible watermark in digital page.

Fig. 2 Example of visible watermark in video.

For invisible watermark use by photographer, movies, etc. who put their watermark which is invisible while it contain the watermark data either in form of text or image. Most of the watermarking techniques focus on the invisible watermarking. As embedding the watermark into the digital data is quite tough and challenge, although it is done by different methods.

This paper focus on the digital image invisible watermarking techniques. Then two steps are explained first is embedding and other is extraction in case of embedding digital watermark is hide in the original data such that visibility of the watermark by naked eyes is not possible. In case of extraction watermark should be successfully retrieve from the received data without any information loss of the original data as well as watermark [7, 8]. Here as the network data get affected by different type of attacks so algorithm should be robust enough against those attacks. So the quality of watermarking algorithm depend on the embedding and extraction of watermark in presence of different attacks.

II. FEATURES FOR WATERMARKING

As Image is collection or sequence of pixel and each pixel is treat as single value which is a kind of cell in a matrices. In order to identify an object in that image some features need to be maintained as different object have different feature to identify them which are explain as follows:

Color feature: Image is a matrix of light intensity values, these intensity values represent different kind of color. So to identify an object colure is an important feature, one important property of this feature is low computation cost.

Different Image files available in different color formats like images have different colure format ranging from RGB which stand for red, green, and blue. This is a three dimensional representation of a single image in which two dimensional matrix represent single color and collection of those matrix tends to third dimension. In order to make intensity calculation for each pixel gray format is use, which is a two dimension values range from 0 to 255. In case of binary format which is a black and white color matrix whose values are only 0 or 1. With the help of this color feature face has been detected efficiently in [8].

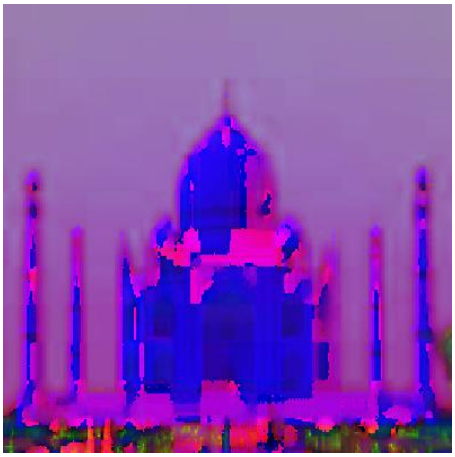

Fig. 3 Represent the HSV (Hue Saturation value) format of an image.

Edge Feature: As image is a collection of intensity values, and with the sudden change in the values of an image one important feature arises as the Edge as shown in figure 4. This feature is use for different type of image object detection such as building on a scene, roads, etc. [5]. There are many algorithm has been developed to effectively point out all the images of the image or frames which are Nobel, peewit, canny, etc. out of these algorithms canny edge detection is one of the best algorithm to find all possible boundaries of an images.

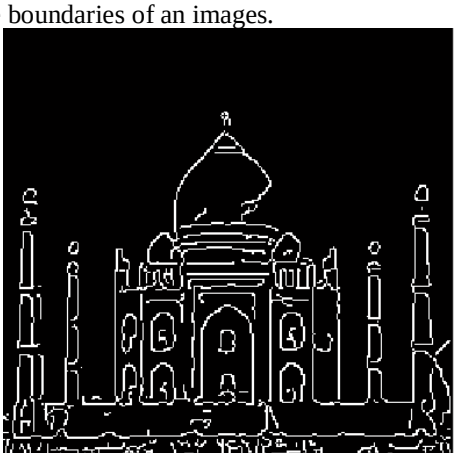

Fig. 4 Represent Edge feature of an image.

Texture Feature: Texture is a degree of intensity difference of a surface which enumerates properties such as regularity and smoothness [1]. Compared to color space model, texture requires a processing step. The texture features on the basis of color are less sensitive to illumination changes as same as to edge features.

Corner Feature: In order to stabilize the video frames in case of moving camera it require the difference between the two frames which are point out by the corner feature in the image or frame. So by finding the corner position of the two frames one can detect resize the window in original view. This feature is also use to find the angles as well as the distance between the object of the two different frames. As they represent point in the image so it is use to track the target object.

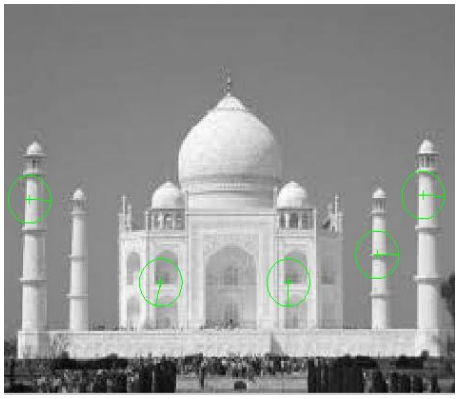

Fig 5 Represent the corner feature of an image with green point.

III. WATERMARK ATTACKS

Different kind of attacks are done on the digital watermarked video, the main effect of these attack is that extraction of watermark is quite difficult or not possible by the algorithm if proper precaution is not taken in prior steps of watermark embedding.

Noise Attack: As watermarked video is send in the channel for communication then some kind of noise normally generate by which exact water is not extract from the received data [6]. Different kind of noise are: Salt& Pepper Noise, Gaussian Noise Attack, Speckle Noise Attack, etc.

Filter Attack: Here video is pass through different filter, which is generally done after receiving signal from the network. So this attack is normally happen and for this the embedding as well as extraction algorithm of the video watermarking should be robust, so that effective method is developed. Some filtering attacks are: average filter, median filter, sharpen filter and motion filter [6, 7].

Compression Attack: Here video is pass through different compression techniques, which is generally done after receiving signal from the network [7]. So this attack is normally happen and for this the embedding as well as extraction algorithm of the video watermarking should be robust, so that effective method is developed. Some filtering attacks are: MPEG compression, Mp4 compression, etc.

Detection-disabling attacks

Sometime watermarking algorithm are based on the correlation and to make detection of the watermark so by changing this correlation make it impossible to fetch watermark from the received data. Correlation based detection and extraction fail when rotation or scaling is performed on the watermarked image because the embedded watermark and the locally generated version do not share the same spatial pattern anymore [3, 6]. Mostly, they make some geometric distortion like zooming, shift in temporal direction, rotation, cropping or pixel permutation, removal or insertion.

Ambiguity attacks

Here by introducing different watermark to confuse the detector by producing fake watermarked data to discredit the authority of the watermark by embedding several additional watermarks.

IV. EVALUATION PARAMETER

As combination of different features leads to various algorithms of embedding and extraction. In order to evaluate those algorithms it is required that some specific set of parameters are decide for the analysis of the various approaches. So algorithm having higher values on those parameter is better than lower values algorithm.

Peak Signal to Noise Ratio

PSNR is use to find the amount of data present from the received signal as it may corrupt by the presence of some noise. So it is term as the peak signal to noise ratio. PSNR is the ratio between the maximum possible received information and the noise that affects the fidelity of its representation.

$$\text{PSNR} = 10\log_{10}\left(\frac{Max\_pixel\_value}{Mean\_Square\_error}\right)$$

Bit Error Rate:

In this parameter one can obtain the ratio of number of error bit received after the extraction to the total number of bits use for embedding. BER is zero means no error is obtain or all the watermark bits are successfully retrieve.

$$\text{BER} = \frac{Total\_Watermark\_Bit - Correct\_Watermark\_bit}{Total\_Watermark\_Bit}$$

Structural Similarity index

SSIM term is a method for finding the similarity between two images. The SSIM method use for evaluating the image quality based on an initial uncompressed or distortion-free image as reference. It is introduce to improve the traditional schemes like PSNR and MSE, which have proven to be inconsistent with human eye perception.

Extraction Rate

This is the reverse of the BER where value is obtain by the ratio of the correct bits received after extraction to the total number of bits embed at the sender. The extraction rate η is defined as follows:

$$\eta = \frac{n_c}{n_a} \times 100$$

Where*nc* is the number of correctly extracted bits, and *na* is the total number of embedded bits.

V. CONCLUSION

This paper focus on invisible image different approaches follow by the various researchers. It has been observed that during extraction watermark is the main focus of most of the researcher but few of them work on original image as well but reverse process of both watermark and original image is still not done. Watermark is mainly compare on the basis of the attack but most of the paper work on the spatial attack and show effective results in various attacks with different levels. Concentration on the geometric attack is very less and not done by most of the papers. So Strength and weakness of the different papers, features, and techniques are well discussed in the paper. A unique algorithm is still reuired which focus on both watermark and original image with high robustness against spatial as well as geometric attacks.

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