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A Survey on Features Combination for Image Watermarking

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Abstract - As the internet users are increasing day by day it is easy to transfer digital data. By this new problem of data piracy is increasing. For this different methods of watermarking are developed for protecting the digital data like video, audio, image, etc. Out of these many researcher are working on image watermarking field from last few decades. This paper focus on the image watermarking features combination with various techniques which are broadly categorized into spatial and frequency domain. Many features are studied with their different requirement and functionality. It has been observed that most of the researcher combines many features for achieving the prior goal of the watermark that is to embed watermark and extract from the carrier image in presence of different attack.

Keywords - Digital Watermarking, Frequency domain, DWT, LSB, Attack.

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 gives rise to new problem of piracy or in other words proprietary get easily stolen. To overcome this problem 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 [1, 2]. One of the basic causes 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 stored in the original signal. This text or image acts as the owner signature in the data so that pirated and original data can be easily classified. As the pirated data do not have the original watermark that may be in the form of text or image. Now watermarking technique is broadly classified into two fields 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 containing logo of their channel.

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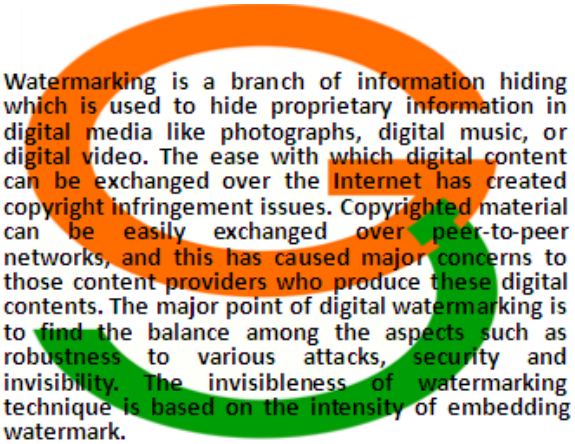

Figure1. Example of visible watermark in digital page

Figure 2. Example of visible watermark in video

Most of the watermarking techniques focus on the invisible watermarking [3, 4]. As embedding the watermark into the digital data is quite tough and challenging, although it is done by different methods. This paper focuses on the digital image invisible watermarking techniques. Watermarking process is done in two steps, first is embedding and other is extraction. In case of embedding digital watermark is hidden in the original data, such that visibility of the watermark by naked eyes is not possible. In case of extraction watermark should be successfully retrieved from the received data without any loss of information of the original data as well as watermark. Here as the network data get affected by different type of attacks so algorithm should be robust enough against those attacks [11]. So the quality of watermarking algorithm depends on the embedding and extraction of watermark in presence of different attacks.

II. LITERATURE SURVEY

In [7] watermark information is hidden in the edge portion of the image, and for finding the exact edge pixels in the image this paper adopts DAM and BCV technique. The Whole work is done for the binary image only as the DAM is based on the binary image. So here in this method image has to be in binary form and watermark information is also in binary format. With this limitation it is found that robustness of the algorithm is quite good against different attacks of noise, filter.

In [8] the extension of the paper [7] is done where hiding is done at the edge region only using same technique of DAM and BCV but here edge selecting region is increased by searching surrounding region of the evaluating pixel. It has shown in the result that with this new approach robustness increases and the watermark information can be increase in the original image.

In [10] new concept is developed by the paper which is termed as content reconstruction using self embedding, here watermark image is embedded in the original image using a fountain coding algorithm, where multiple packets are designed for the network. So if some of the packet gets corrupt by the attack then rest of the packets are use for regenerating the original watermark. As this method cover different attacks on the image and recover watermark in original condition up to few level of attack. One problem is that after embedding image get transformed in fountain codes packet, but embedded image is not

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available for the user to display and it get reconstruct into original only by decoding the fountain codes. So this algorithm is beneficial for data transferring purpose only.

In [13] instead of embedding the external watermark image, the original image is so utilized in the algorithm that it will generate its own watermark bits for the image. This paper focus on the image expansion where spatial domain is used for embedding and supporting information is stored for the image which is required during extraction. Robustness of the image is done against compression attack and scaling is also covered. But to cover both intra-codeblock and inter-codeblock method is utilized.

In [16] during embedding the algorithm uses DWT technique and modulus method for the pixel position selection. At the extraction end embedded image with some supporting information is supplied for generating the original image and watermark bits. This recovery of original watermark is reversible watermarking scheme.

In [14] carrier image is reverse into original matrix with the use of the Linear Prediction technique and error threshold value where watermark is embedded in the carrier image in those pixel positions only which have error in a fix range where other pixel are edited so that overall change in pixel values is always out of threshold range. This addition of noise will increase the robustness of the image against various attacks.

In [12] spatial common technique is used for the watermarking, here image is divide into Red, Green and Blue matrix then whole embedding is done at the Blue matrix of the image where some of the LSB's are replaced by the watermark bits while rest of the MSB's remain same. It has observed that image quality has not affected by the embedding of watermark. This paper work is robust against compression attack as it most affects the MSB's while LSB's remain unaffected during attack.

In [18] a new technique is introduced that is "visible watermark". Here the proprietorship is identified directly while image information remains same. It is robust enough such that any attempt of attack will present the watermark in same condition and removing of watermark will change whole image. But here image watermark can be easily copy and other can also use the same for their fake data.

In [22] introduction of the new technique that is image tagging, is done which enforce copyright, counterfeit access and controlled access. While complete description of the work is not explained but this concept gives dynamic direction for the image watermarking.

In [15] an electronic watermarking is done for the textual document, in form of word or line shifting. Here a secret key is distributed among different users for the extraction of the embedded text data. This can be applied on non-ascii text representation, and not to images.

In [20] a definition for the invisible watermarking is specified which are required for the embedding of image. There should be a proper place for the watermark which can be replaced by the watermark information. The embedding and extraction method is based on the secret key so that common method is used by the different users. Such as DWT are the collection of a specific class of pixel value and depend on the requirement particular class is utilized.

III. PROBLEM IDENTIFICATION

As the authentication of digital data is major problem and to resolve it watermarking technique is evolved where different methods or algorithms are developed for the same. One of the major focuses of

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the watermarking algorithm is retrieving of the watermark from the carrier image but the carrier image is not recovered in the algorithms so this is the major problem this is solved by few of the researcher who name it as a reversible watermark.

One more issue in the watermarking is the developing of the algorithm that will not only embed the image but also maintain the originality or the quality of the carrier signal [13, 10]. So the embedding method should be perfect enough that image will show the approx similarity as previous.

In [14] reversible watermarking scheme is developed, but the work focus only on the reversibility of the watermark while that work is not robust against the various attack this is the major drawback of the work. Although it has shown its superiority against various existing algorithms such as median edge detector, gradient-adjusted predictor or the simple rhombus neighborhood. So the work need to be done in this field that will regenerate the watermark as well as the carrier image with a minimum loss of the signal under various attacks such as addition of noise in the embedded image, or passing image from the different filter, or compression of the image, cropping of the image.

Few more flexibility for the system need to develop that is the amount of data to be inserted into the image should be control by the algorithm as most of the work focus on the embedding and that is totally depends on the type of image but, if the same image can be used for transferring the different amount of data then it is not always possible. This is a kind of limitation of the field which should be removed.

IV. FEATURES FOR WATERMARKING

As Image is a collection or sequence of pixel and each pixel is treated as single value which is a kind of cell in a matrix. 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 explained as follows:

4.1. Color Feature: Image is a matrix of light intensity values, these intensity values represent different kind of color. So to identify an object color is an important feature, one important property of this feature is low computational cost. Different Image files available in different color formats like images have different color format ranging from RGB which stands for red, green, and blue. This is a three dimensional representation of a single image in which two dimensional matrix represents single color and collection of those matrices tends to the third dimension. In order to make the intensity calculation for each pixel gray format is used, 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, 19].

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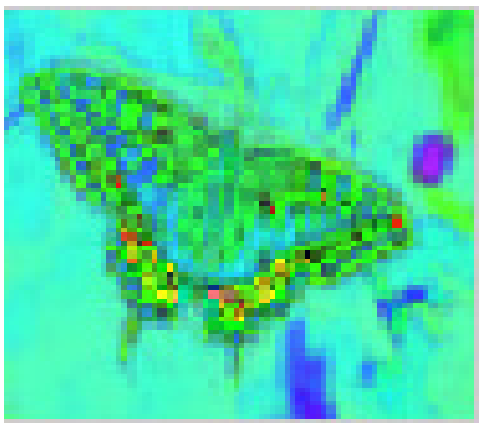

Figure 3. Represent the HSV (Hue, Saturation value) format of an image

4.2. 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 used for different type of image object detection such as building on a scene, roads, etc [5, 6]. There are many algorithms has been developed to effectively point out all the images of the image or frames, which are Sobel, perwitt, canny, etc. out of these algorithm canny edge detection is one of the best algorithm to find all possible boundaries of an image, this is shown in figure 4.

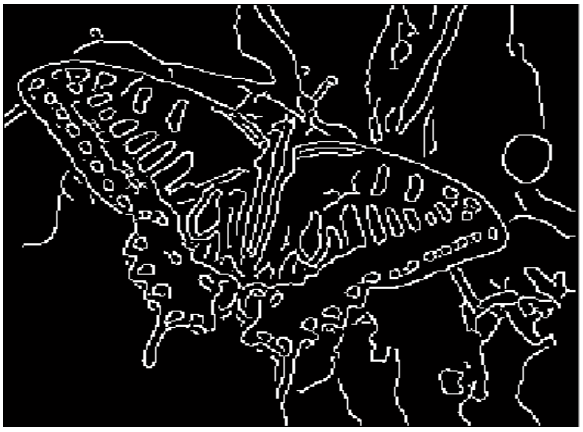

Figure 4. Represent the Edge feature of an image

4.3. Texture Feature: Texture is a degree of intensity difference of a surface which enumerates properties such as regularity and smoothness. 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.

4.4. 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 [21]. This feature is also used to find the angles as well as the distance between the object of the two different frames. As they represent points in the image so it is used to track the target object.

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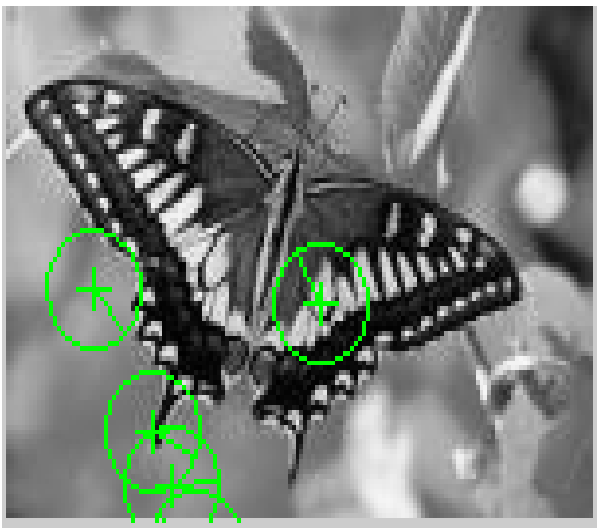

Figure 5. Represent the corner feature of an image with green point

V. CONCLUSION

In order to provide invisible image watermarking this paper provides a detailed literature survey for the 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 not done by any. A Watermark is mainly compared 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 required, which focus on both watermark and original image with high robustness against spatial as well as geometric attacks.

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