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A Review on Lossless Image Compression using Reversible Watermarking

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Abstract: **De-identification is the method used to avoid a person's identity from being connected with information. Common uses of de-identification consist of human subject research meant for the sake of privacy for research participants. Common strategies for de-identifying datasets contain deleting or masking personal identifiers, such as name and social security number along with suppressing or generalizing quasi-identifiers, such as date of birth and zip code. Image compression technique can be used effectively in such applications. Lossless (reversible) image compression technique preserves the information so that exact reconstruction of the image is possible from the compressed data.**

Keywords - Image Compression, Lossless, Lossy, Region of Interest.

1. INTRODUCTION

Reversible compression or lossless compression refers to compression techniques in which the reconstructed data precisely match the unique. Near lossless compression denotes compression methods, which provide quantitative bounds on the nature of the loss that is introduced. Such compression techniques give the guarantee that no pixel difference between the original and the compressed image is above a given value. Equally lossless and near-lossless compression locates potential applications in remote sensing, space imaging, medical and multispectral image archiving. In these applications the volume of the data would call for lossy compression used for practical storage or transmission. However, the necessity to preserve the validity and precision of data intended for subsequent recognized diagnosis operations, forensic analysis, as well as scientific or clinical measurements, often imposes severe constraints on the reconstruction error. In situations like near-lossless compression becomes a feasible solution, as, on the one hand, it provides considerably higher compression gains lossless algorithms, with on the other hand it provides guaranteed bounds on the nature of loss introduced through compression. Another method to deal by the lossy-lossless dilemma faced in applications such as medical imaging and distant sensing is to utilize a successively refundable compression technique that provides a bit stream of leads to a progressive reconstruction of the image. Using wavelets, for example, one can obtain an embedded bit stream from which various levels of rate and distortion can be obtained. In fact, with reversible integer wavelets, one gets a progressive reconstruction capability all the way to lossless recovery of the original. Such techniques have been explored for potential use in tele-radiology where a physician typically requests portions of an image of increased quality (including lossless reconstruction) while accepting initial renderings and unimportant portions at lower quality, and thus reducing the overall bandwidth requirements. In fact, the new still image compression standard, JPEG 2000, provides such features.

Video surveillance cameras are attractive ubiquitous in various developed countries. This has raised several privacy concerns which have pressed policy makers to order their use. One approach to provide privacy is to obfuscate sensitive regions inside an image/video which prevents the recognition of the persons being captured. The authors [1][2] have proposed a permanent obfuscation method which, however, prevents the use of the captured video from aiding criminal investigation or to be used as evidence in court [3]. Reversible De-Identification is a process which, while still concealing the identity of individuals, enables persons in control of high security credentials to recover the original multimedia content containing private information. The authors [4] in encode the region of interest (ROI) and background in separate data layers using JPEG2000. Also, authors [5] [6] can employ encryption strategies directly on the pixel intensities of the ROI. However, these methods completely destroy the naturalness of the captured video. An ROI transforms-domain scrambling techniques [7] [8] [9] is used for dissimilar image/video compression standards. The scrambling process enhanced maintains the naturalness of the video. However, this method is less protected since it reveals the intensity levels of the unique content. Furthermore, the obfuscation and reversibility processes are needy on each other, and therefore cannot be used in combination with other obfuscation methods. Though, reversible watermarking method induces significant distortions within the obfuscated image themselves. This effort presents a Reversible De-Identification method meant for lossless images. This approach adopts Reversible Watermarking[10] to construct the system reversible. The proposed solution is completely independent from the obfuscation process, and is therefore generic. Nevertheless, this study employs the k-Same obfuscation process, which ensures k-anonymity, to obfuscate the face of frontal images. The dissimilarity between the original and obfuscated image is authenticated, compressed, encrypted in addition to embedded in the obfuscated image itself.

II. RELATED WORK

This section shows the existing water machining technique and their work. S.S.Gonge, A.A.Ghatol[11] entitled in Combination of Encryption and Digital Watermarking Techniques used for Security and Copyright Protection of Still Image represented in the emerging research area of Digital watermarking is a combination of concepts derived from computer science, cryptography, signal and image processing and communications.

N.H. Lenstriandoko et al[12] entitled in paper Reversible Watermarking Using Difference of Virtual Border for Digital Image Protection as Reversible watermarking has established a huge surge of experimentation in its domain in recent era as the need of recovering the original work image following extracting the watermark arises in various applications such as the law enforcement, military image system and medical it is important to restore the original image without any distortions. The main purpose of digital watermarking is to embed little amount of secret information, i.e., The watermark into the host digital productions similar to the image and audio, thereby assisting the extraction at a recovering stage for a range of functions including copyright assertion, authentication, and content integrity verification and many more [12]. In traditional watermarking techniques, our major anxiety is to embed and recover the watermark with min loss. The excellence of original work image we obtain following extraction is highly degraded and not restorable. But in applications like medical, law enforcement and military, in which better quality of image is needed, we cannot use these algorithms. In medical imaging, various prerequisite information concerning the patient is watermarked on it while transmitting and at the reception we require to have equalled, the original image and for information to be recovered lossless [12].

R. Dubolia, et al[13] entitled paper as Digital image watermarking by using discrete wavelet Transform and discrete cosine transform and Comparison based on PSNR represented Watermarking methodologies include haggard highly attention due to the remarkable results they produced. It is possible to utilize the Digital watermarking techniques for the protection of the cerebral rights of the data through the embedding of the proprietary information like a password or the company's logo, in the host data [13]. The two significant purposes of a watermark include identification of ownership and the detection of tampering. The reversible watermark technique we proposed uses the difference of the H virtual border to embed an image signature [12]. Virtual border is a mirror of image boundary line. Authentication is completed by comparing the extracting data from the virtual border with the hashing of the original image. This original image able to restore by the eliminating of virtual border and added a watermark. Because of this reversibility, it can be used to watermark a sensitive image that cannot allow a change, although it is a small change.

S.Kim, et al[14] entitled in paper A lossless color image compression method based on a new reversible color transforms presented as the original images generally used in the RGB color format and in the "png" file arrangement. Due to increased 2 points into the height, because of the watermarked figure dimension which caused by adding a virtual border since embedding media. Picture cross is gained from hashing image using a standard hash function.

Suresh Yerva et al [15] in paper entitled Lossless Image Compression Based on Data Folding author shown an approach for lossless image compression in spatial domain for continuous-tone images using a novel fidea of image folding. The planned method uses the property of adjacent neighbor redundancy for prediction. In their paper they represented the proposed method is compression algorithm with the existing standard lossless image compression algorithms and the results demonstrate comparative performance.

Fuangfar Pensiri et al[16] in their paper entitled A lossless image compression algorithm using predictive coding based on quantized colors, the experimental results show in [16] that the proposed algorithm outperforms some fine known lossless image compression algorithms such as JPEG-LS and PNG by factors of 2-3 in terms of bits for each pixel. The results as well show that the proposed algorithm gives the best compression rates when colors were quantized into two colors. Predictive coding has proven to be effective for lossless image compression. Predictive coding value a pixel color value based on the pixel color values of its neighboring pixels. To enhance the accuracy of the estimation, author suggest a new and simple predictive coding that estimates the pixel color value based on the quantized pixel colors of three neighboring pixels.

Jagadish H.Pujar, et al[17] in a new lossless method of image compression as well as decompression with Huffman Coding Techniques showed the need for an efficient technique for compression of Images still growing since the raw images need great amounts of disk space seems to be a big drawback during transmission & storage. Yet though there are so lots of compression technique already presents a improved method which is earlier, memory efficient and uncomplicated certainly suits the requirements of the user. In this paper author proposed the Lossless method of image compression in addition to decompression via a simple coding technique called Huffman coding. This method is easy in implementation and utilizes less memory. A software algorithm has been developed and implemented to condense and decompress the known image using Huffman coding techniques in a MATLAB platform. Compression of an image is considerably dissimilar then compression of binary raw data. To resolve these use dissimilar types of techniques for image compression. Currently there is question may be arise that how to image compress and

which types of technique is used. For this reason there are basically two types are method are introduced namely lossless and lossy image compression techniques. In nearby time some other techniques are added with basic method.

In paper of Gaurav Vijayvargiya et al[18] in paper entitled as A Survey: Various Techniques of Image Compression as addresses about various image compression techniques. On the beginning of analyzing the different image compression techniques this paper presents a survey of existing research papers. In this paper author analyze different types of existing method of image compression.

Dr.E.Kannan et al[19] as paper entitled Lossless Image Compression Algorithm For Transmitting Over Low Bandwidth Line presented to decrease the communication bandwidth and save the transmitting power in the wireless endoscopy capsule, this paper shows a new near-lossless image compression algorithm based on the Bayer format image suitable for hardware design. This algorithm can give low average compression rate (2.12 bits/pixel) with high image quality (larger than 53.11 dB) for endoscopic images. In addition, the algorithm can provide lossless compression for the region of interest (ROI) and high-quality compression for other regions. The ROI can be selected arbitrarily by varying ROI parameters. The proposed method produces a bit stream that results in a progressive and ultimately lossless reconstruction of an image analogous to what one can obtain with a reversible wavelet codes.There are many applications of image processing, such as medical imaging ,satellite imaging, and video where the image size or image stream size is also great and requires a large quantity of storage space or high bandwidth for communication in its original form. Image compression method can be used effectively in such applications.

B.C.Vemuri, et al[20] entitled as paper Lossless Image Compression represented the survey existing coding and lossless compression schemes and also offer an experimental evaluation of different state of the skill lossless compression algorithms that have been reported in the literature. In the case of coding algorithm, the author shown a comparison of the achieved compression for a range of linearization schemes applied to the image data set.

In the paper Roman Starosolski [21] entitled Simple Fast and Adaptive Lossless Image Compression Algorithm, the author present a new lossless image compression algorithm. To achieve the high compression speed,author use a linear prediction, modied Golomb Rice code family, and a very fast prediction error modeling method. We compare the algorithm experimentally through others for medical as well as natural continuous tone grayscale images of depths of despair of up to 16 bits. Its results are especially good for big images, for natural images of high bit depths, and for noisy images.

The author Simson L. Garfinkel in National Institute of Standards and Technology [22] represented De-identification removes identifying information as of a dataset so that individual data cannot be linked with specific individuals. De-identification can decrease the privacy risk associated with collecting, archiving, processing, distributing or publishing information. De-identification therefore attempts to stability the contradictory goals of using and sharing personal information while protecting privacy.

JinHa Hwang et al[23] in A Reversible Watermarking Based on Histogram Shifting ,author proposed a reversible watermarking algorithm everywhere an original image can be recovered from watermarked image data. Most watermarking algorithms reason degradation of image quality in unique digital content in the process of embedding watermark. In the planned algorithm, the innovative image can be obtained when the degradation is removed from the watermarked image behind extracting watermark information. In the planned algorithm, we utilize a peak point of image histogram and the location map as well as modify pixel values somewhat to embed data. Because the peak point of image histogram and location map are working in this algorithm, there is no need of extra information transmitted to receiving side. Also, because a minor modification on pixel values is conducted, highly imperceptibly images can be achieved. As locations of watermark embedding are recognized using location map, amount of watermark data can dramatically increases through recursive embedding.

G. Cotrieux et al[24] in paper Reversible Watermarking Based on Invariant Image Classification and Dynamic Histogram Shifting proposed a new reversible watermarking scheme. One primary contribution is a histogram shifting modulation which adaptively takes mind of the local specificities of the image content. By applying it to the image prediction-errors and by considering their instant neighborhood, the scheme we propose inserts data in textured areas where other methods fail to do so. Furthermore, our plan makes use of a categorization process for identifying parts of the image that can be watermarked with the mainly suited reversible modulation. This categorization is based on a reference image derived from the image itself, a calculation of it, which has the property of being invariant to the watermark insertion. In that way, the watermark embedder and extractor stay synchronized for message extraction as well as image reconstruction. The experiments conducted so far, on some natural images as well as on medical images as of different modalities, show that for capacities smaller than 0.4 bpp, our process can put in more data with lower distortion than any existing schemes. For the same capacity, we achieve a peak signal-to-noise ratio (PSNR) of in relation to 1-2 dB greater than with the scheme of Hwang, the most efficient approach actually.

Yong Zhang et al[25] in Reversible Watermarking for Relational Database Authentication entitled paper shows a

reversible watermarking system for relational databases is planned in this paper to achieve lossless and exact authentication of relational databases using expansion on data error histogram. This reversible watermarking scheme possesses the capability of great restoration of the original attribute data from the un-tampered watermarked relational databases, therefore a "clear and exact" guaranteeing tampered-or-not authentication without worry about causing any permanent distortion to the database. In this situation, just the secret key owner possesses the capability to exactly restore the database's original state. Simulations display the scheme's security and feasibility for low-correlated data in typical databases.

Fasiha Shereen et al[26] presented in their paper titled Highly Secure Reversible Watermarking Mechanism using Reversible De-identification is a procedure which can be used to make sure privacy by concealing the identity of individual's captured. This added de-identification method aids in achieving high security. One significant challenge is to create the obfuscation process reversible consequently that the original image can be improved by persons in possession of the right security credentials. This job presents a novel Reversible De-Identification method that can be used in conjunction by several obfuscation processes, at this time the obfuscation procedure used is k-same obfuscation method. The residual information essential to reverse the obfuscation process is dense, authenticated, encrypted and embedded inside the obfuscated image by a two-level Reversible Watermarking scheme. The proposed method ensures an in general single-pass embedding capacity of 1.25 bpp, anywhere 99.8% of the images considered required a smaller amount than 0.8 bpp while nothing of them required extra than 1.1 bpp. Experimental results additional demonstrate that the proposed process managed to get well and authenticate all images considered.

III. PROBLEM FORMULATION

Considered two different set of images such as first set images was composed the standard test images Lena, Aircraft, Barbara and Mandrill while the second set consisted of 2000 frontal images and converted in the YCbCr Color space using 4:4:4 sampling. It can be seen that in[28] a capacity smaller than 0.8 bpp is required 99.8% of the time as they never require more than 1.1 bpp. It must be mentioned that the planned scheme in[28] has a single-pass embedding capacity close to 1.25 bpp and is thus able to embed the information necessary to recover all images considered in this test. Similarly in [29] a capacity smaller than 0.8 bpp is needed 99.8% of the time while they never require more than 1.1 bpp. It must be mentioned that the proposed scheme as shown in[29],it has a single-pass embedding capacity close to 0.307 bpp and is thus able to embed the information necessary to recover all images considered in this test. Face Obfuscation method for lossless compressed images in [30] as it gives optimal set of thresholds and provides a single-pass embedding capacity close to 1.2120 bpp. It additional shows that 0.3520 bpp were sufficient to cater for 99.8% of the frontal images measured and none of the image needed more than 1.1 bpp. As per shown in the above papers, different authors planned a different reversible watermarking processes to obtain embedding capacity very close to 1.25 bpp. So either the procedures are different the embedding capacity should be close to 1.25 bpp. So here I am going to plan, a two level Reversible Watermarking Scheme which uses differential evolution to find the optimal set of thresholds and provides a single-pass embedding capacity close to 1.25 bpp.

III. CONCLUSION

This work proposes a novel Reversible De-Identification method for lossless compressed images. The proposed scheme is generic and can be employed with other obfuscation strategies other than-Same. Also overviewed different experimental results and procedure of lossless image compression with reversible watermarking. By using the two levels reversible watermarking scheme for the differential evolution to find the optimal set of thresholds and provides a single-pass embedding capacity close to 1.25 bpp such a procedure gone to studied and overviewed in this review paper entitled lossless Image Compression using Reversible Watermarking Techniques.

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