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Enhancing the Capacity of Steganography Using Reversible Texture Synthesis with Edge Adaptive and Tree-Based Parity Check (TBPC) Methods -A Detailed Survey

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Abstract-A major necessity for any steganography method is to decrease the changes happening in the cover image by the data embedding process. The project proposes a unique way for steganography using a reversible texture synthesis based on edge adaptive and tree based parity check methods to improve the embedding capacity. This approach offers three distinct advantages. First, the scheme offers the embedding capacity that is proportional to the size of the stego texture image. Second, a steganalytic algorithm is not likely to defeat this stegnographic approach. Third the reversible capability inherited here provides functionality, which allows recovery of source texture.

Keywords: Data embedding, Reversible texture synthesis, Tree based parity check (TBPC)

I INTRODUCTION

Steganography is the method of hiding a message, file, image, or video within another file, message, image, or video. The word steganography combines from the two Greek words "steganos" means "protected", and "grapheins" means "writing". The advantage of steganography than cryptography is that the secret message does not attract the attention of the attackers by simple observation. The cryptography protects only the content of the message, while steganography protects the both messages and communication environment.

In most of the image steganographic methods, uses the existing image as their cover medium. This leads to two drawbacks. Since the size of the cover image is fixed, embedding a large secret message will results in the distortion of the image. Thus a compromise should be made between the size of the image and the embedding capacity to improve the quality of the cover image. The distortion of the image results in second drawback, because it is feasible that a steganalytic algorithm can defeat the image steganography and thus reveal that a hidden message is conveyed in a stego image.

The paper will proposes a good approach for steganography using reversible texture synthesis based on edge adaptive and tree based parity check to improve the embedding capacity. A texture synthesis process is of creating a big digital image with a similar local appearance of the original image and has an arbitrary size. And the paper is also using another two methods named edge adaptive and tree based parity check to improve the embedding capacity. The paper fabricates the texture synthesis process into steganography concealing secret messages as well as the source texture. In particular, in contrast to using an existing cover image to hide messages, our algorithm conceals the source texture image and embeds the secret messages through the process of texture synthesis. This allows us to extract the secret messages and the source texture from a stego synthetic texture.

The proposed approach offers three advantages. First, since the texture synthesis can synthesize an arbitrary size of texture images. Since the Human Visual System (HVS) is less sensitive to changes in sharp regions compared to smooth regions, edge adaptive methods has been proposed to find the edge regions and hence improve the quality of the stego image as well as improve the embedding capacity and TBPC to hide the secret data into the cover image. Secondly, a steganalytic algorithm is not to defeat the steganographic approach since the texture image is composed of a source texture rather than by changing the existing image contents. Third, the reversible capability used in the project results in the recovery of the source texture so that the same texture can be used for the second round of message redirect.

II LITERATURE SURVEY

Texture synthesis has attained a lot of heeds presently in computer vision and computer graphics[1].Most of the present work has concentrated on texture synthesis for example, in which a source texture image is re-sampled using either pixel-based or patch-based algorithms to create a new synthesized texture image with similar appearance and variable size.

Pixel-based algorithms [2]–[4] create the generated image pixel by pixel and use spatial neighborhood comparisons to select the most closely related pixel in a sample texture as the output pixel. Since each output pixel is identified by the already generated pixels, any wrongly generated pixels during the process influence the rest of the result causing propagation of errors.

Otori and Kuriyama in [5] and [6] developed the work of integrating data coding using pixel-based texture synthesis. Secret messages to be hided are encoded into colored dotted patterns and they are directly painted on a blank image. A pixel-based algorithm tunic the rest of the pixels by the pixel-based texture synthesis method, thus masking the existence of dotted patterns. To withdraw messages the printout of the stego synthesized texture image is photographed before applying the data-detecting technique. The capacity given by the method of Otori and Kuriyama depends on the number of the dotted patterns. However, their method has a small error rate of the message extraction.

Patch-based algorithms in [7] and [8] attach patches from a source texture rather than a pixel to synthesize textures. The method of Cohen et al. and Xu et al. improves the image quality of pixel-based synthetic textures because texture structures inside the patches are preserved. However, since patches are attached with a small overlapped region during the synthetic process, one has to make an effort to ensure that the patches agree with their neighbors.

Liang et al. [9] established the patch-based sampling method and used the rowing approach for the coincide areas of nearby patches. Efros and Freeman [10] present a patch stitching methodology called “image quilting.” For each rising patch to be combined and seamed, the algorithm first looks for the source texture and select one candidate patch that fulfill the pre-defined error endurance with respect to neighbors along the overlapped region. Next, a dynamic programming technique is used to confide the minimum error path through the overlapped region. This canonizes an optimal boundary between the selected candidate patch and the synthesized patch, producing visually credible patch stitching.

Ni et al. [11] put forward an image reversible data hiding algorithm which can extract the cover image without any deformation from the stego image after the hidden data have been extracted. Histogram shifting is better technique among existing approaches of reversible image data hiding because it can control the modification to pixels, thus limiting the embedding distortion, and it only requires a small size.

Li et. al. [12] introduced a data hiding method called TBPC to enhance the embedding efficiency by decreasing the unsimilarity between the cover and the stego images. In order to reduce the distortion in the cover pixels, TBPC correspond to the LSB of the cover pixels using a complete N−ary tree. The method in [13] can be developed as another specific matrix embedding, which was improved by Hou et. al. [14], where they put forward a majority-vote parity check (MPC) instead of the original matrix embedding. In [15] Liu et. al. introduced an adaptive steganography algorithm based on block complexity and matrix embedding.

This paper will be taking the advantage of the patch-based method to embed a secret message during the synthesizing procedure. This allows the source texture to be extracted in a message extracting procedure, giving the purpose of reversibility.

III METHODOLOGY

The proposed method is described as follows. The basic unit of the steganographic texture synthesis is introduced to as a “patch.” A patch represents an image block of a source texture where its size is user-specified. The patches are combined together to form the composition image in which we are embedding our secret message. The project includes mainly three major steps.1) *Message Embedding Procedure*2) *Source Texture Recovery, Message ExtractionandMessageAuthenticationProcedure3) CapacityDetermination*

1. *Concepts involved in Message Embedding Procedure*

The message embedding procedure involves mainly four steps. They are A) Index Table Generation B.Patch Composition Process C.Combined TBPC and Edge Adaptive Process D.Message Oriented Texture Synthesis Generation.

A. Index Table Generation

The first process of this project is the index table generation where here will create an index table to preserve the location of the source patch set inside the synthetic texture. The index table will allow us to access the synthetic texture and extract the source texture wholly. The texture of any size according to our wish can be generated using this index table.

B.Patch Based Composition

The second step that has to be used in this project is to attach the source patches into a workbench to create a composition image. First here will set up an empty image as the workbench where the size of the workbench is proportional to the synthetic texture. By referring to the source patch IDs stored in the index table, we then attach the source patches into the workbench. During the attaching process, if no imbrications of the source patches are found, we can attach the source patches directly into the workbench.

C.Combined TBPC and Edge Adaptive Process

Embedding capacity is one of the most important requirements for steganography methods, and it is important for steganography process not to leave any noticeable traceable to the human eyes after hiding the secret data. Here will give a hybrid image steganography method that combines edge adaptive and TBPC methods together. The proposed method exploits the high contrast regions of an image as embedding locations. It is known that human eyes cannot discover modifications in the edge areas since they can do in smooth areas. Therefore, the number of hidden bits is on the basis of the variation value between the two pixels of each block. The integration of TBPC leads to a better embedding capacity. Thus, the proposed method mixes up the strengths of edge adaptive and TBPC.

D.Message Oriented Texture Synthesis Generation.

After the creation of the composition image we have to embed the secret message through the message-oriented texture synthesis to generate the final stego synthetic texture.

2. *Concept Involved In Source Texture Recovery, Message Extraction, and Message Authentication Procedure*

The message extracted for the receiver side consist of creating the index table, attaining the source texture, performing the texture synthesis, and extracting and authenticating the secret message hidden inside the stego synthetic texture.

3. *Capacity Determination.*

The next step is to look for how much data can be embedded in the stego texture image.The embedding capacity can be related to the capacity in bits that can be hidden at each patch(BPP, bit per patch), and to the number of embeddable patches in the stego synthetic texture (*EPn).* Each patch can hide at least one bit of the secret message.

$$TC = \text{BPP} \times EPn = \text{BPP} \times (TPn - SPn)$$

IV CONCLUSION

This project proposes a reversible steganographic algorithm using texture synthesis based on edge adaptive and tree based parity check. Given an original source texture, first we have to produce a large stego synthetic texture hiding the secret messages. By using a conventional patch-based method the textures are synthesized. The project will also provides reversibility to retrieve the original source texture from the stego synthetic textures, making possible a second round of texture synthesis if needed. This paper also introduce another image steganography method that combines the edge adaptive and TBPC algorithms to heighten the payload and imperceptibility of the stego image, and thus minimizing the possible distortion during the embedding process to minimize the probability of discovering the secret message data from unauthorized users and also resulting in high embedding capacity.

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