

SURVEY ON STEGANOGRAPHY TECHNIQUES USING TEXTURE SYNTHESIS

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ABSTRACT

Steganography is the art of covered or hidden writing. The purpose of steganography is covert communication-to hide the existence of a message from a third party. To achieve more success rate many authors work around texture synthesis process for steganography. A texture synthesis process re-samples a smaller texture image which synthesizes a new texture image with a similar local appearance and arbitrary size. Reversible data hiding, in which the stego-media can be reversed to the original cover media exactly, has attracted increasing interests from the data hiding community. So here in this paper we are going to study various methods and algorithms which uses texture synthesis for steganography.

RELATED WORK

- **A HIGH-CAPACITY STEGANOGRAPHIC APPROACH FOR 3D POLYGONAL MESHES [4]:**

Y.-M. Cheng and C.-M. Wang present a high-capacity steganographic approach for three dimensional (3D) polygonal meshes. They first used the representation information of a 3D model to embed messages. Their approach successfully combines both the spatial domain and the representation domain for steganography. In the spatial domain, every vertex of a 3D polygonal mesh can be represented by at least three bits using a modified multi-level embed procedure (MMLEP). In the representation domain, the representation order of vertices and polygons and even the topology information of polygons can be represented with an average of six bits per vertex using the representation rearrangement procedure (RRP).

The essence of a 3D shape can often be well captured by its salient feature curves. In this paper [15], K. Xu, D. Cohen-Or, T. Ju, L. Liu, H. Zhang, S. Zhou, and Y. Xiong explore the use of salient curves in synthesizing intuitive, shape-revealing textures on surfaces. Their texture synthesis is guided by two principles: matching the direction of the texture patterns to those of the salient curves, and aligning the prominent feature lines in the texture to the salient curves exactly. They have observed that textures synthesized by these principles not only fit naturally to the surface geometry, but also visually reveal, even reinforce, the shape's essential characteristics. They call these feature-aligned shape texturing. Their technique is fully automatic, and introduces two novel technical components in vector- field-guided texture synthesis: an algorithm that orients the salient curves on a surface for constrained vector field generation, and a feature-to-feature texture optimization.

ADVANTAGES:

1. Efficient and secure
2. Has high capacity and low distortion
3. Robust against affine transformations.

DISADVANTAGES:

1. The main limitation of the MMLEP is machine precision errors when considering small models.
2. Loss of quality of 3D models when embedding the message.
3. Visual degradation and distortion.

- **LINE-BASED CUBISM-LIKE IMAGE - A NEW TYPE OF ART IMAGE AND ITS APPLICATION TO LOSSLESS DATA HIDING [5]:**

A new method of combining art image generation and data hiding to enhance the camouflage effect for various information hiding applications is proposed by S.-C. Liu and W.-H. Tsai. First, a new type of computer art, called line-based Cubism-like image, which keeps a characteristic of the Cubism art - abstraction by prominent lines and regions from multiple viewpoints - is proposed. In the creation process with an input source image, prominent line segments in the image are detected and rearranged to form an abstract region-type art image of the Cubism flavour. Data hiding with the minimal distortion is carried out skilfully during the process of re-

colouring the regions in the generated art image by shifting the pixels' colours for the minimum amount of ± 1 while keeping the average colours of the regions unchanged. Based on a rounding-off property in integer-valued color computation, the proposed data hiding technique is proved by theorems to be reversible, and thus useful for lossless recovery of the cover art image from the stego-image. Four security enhancement measures are also adopted to prevent hackers from extracting embedded data correctly.

ADVANTAGES:

1. First, it generates Cubism-like images as stego-images to distract the hacker's attention to the message data embedded in them.
2. By using the minimum color shiftings of ± 1 to embed data bits, the resulting pixels' color differences between the generated Cubism-like image and the stego-image are so small that a hacker will take no notice of the existence of the hidden data.
3. The proposed data hiding technique is very suitable for use in covert communication or secret keeping.
4. Four measures of randomization of the input message data and the processing order of them with a secret key and several random-number generating functions have been adopted in the proposed method. This enhances greatly the security of the proposed method.

DISADVANTAGES:

1. Manual selection of appropriate art images for people.
2. The use of the proposed data hiding technique, besides covert communication and secret keeping, it may also be tried to conduct image authentication by embedding authentication signals into a generated art image for verification of possible tampering with the image.
3. Less data embedding capacity.

• **LOCAL-PREDICTION-BASED DIFFERENCE EXPANSION REVERSIBLE WATERMARKING [6]:**

In this paper I.-C. Dragoi and D. Coltuc investigates the employment of native prediction in distinction enlargement reversible watermarking. For every pixel, a least square predictor is computed on a block focused on the pixel and also the corresponding prediction error is distended. An equivalent predictor is recovered at detection with none further data. The projected native prediction is general and it applies in spite of the predictor order or the prediction context. For the actual cases of least square predictors with identical context because the median edge detector, gradient-adjusted predictor or the easy parallelogram neighbourhood, the native prediction-based reversible watermarking clearly outperforms the progressive schemes supported the classical counterparts.

• **VIDEO TEXTURE SYNTHESIS WITH MULTI-FRAME LBP-TOP AND Diffeomorphic GROWTH MODEL [8]:**

Video texture synthesis is the process of providing a continuous and infinitely varying stream of frames, which plays an important role in computer vision and graphics. However, it still remains a challenging problem to generate high-quality synthesis results. Considering the two key factors that affect the synthesis performance, frame representation and blending artifacts, we improve the synthesis performance from two aspects: 1) Effective frame representation is designed to capture both the image appearance information in spatial domain and the longitudinal information in temporal domain. 2) Artifacts that degrade the synthesis quality are significantly suppressed on the basis of a diffeomorphic growth model. The proposed video texture synthesis approach has two major stages: video stitching stage and transition smoothing stage. In the first stage, a video texture synthesis model is proposed to generate an infinite video flow. To find similar frames for stitching video clips, Y. Guo, G. Zhao, Z. Zhou, and M. Pietikäinen present a new spatial-temporal descriptor to provide an effective representation for different types of dynamic textures. In the second stage, a smoothing method is proposed to improve synthesis quality, especially in the aspect of temporal continuity. It aims to establish a diffeomorphic growth model to emulate local dynamics around stitched frames. The proposed approach is thoroughly tested on public databases and videos from the Internet, and is evaluated in both qualitative and quantitative ways.

• **MULTISCALE TEXTURE SYNTHESIS [11]:**

Example-based texture synthesis algorithms have gained widespread popularity for their ability to take a single input image and create a perceptually similar non-periodic texture. However, previous methods rely on single input exemplars that can capture only a limited band of spatial scales. For example, synthesizing a continent-like appearance at a variety of zoom levels would require an impractically high input resolution. In this paper, C. Han, E. Risser, R. Ramamoorthi, and E. Grinspun develop a multiscale texture synthesis algorithm. They proposed a novel example-based representation, which they call an exemplar graph that simply requires a few

low-resolution input exemplars at different scales. Moreover, by allowing loops in the graph, they can create infinite zooms and infinitely detailed textures that are impossible with current example-based methods. They also introduced a technique that ameliorates inconsistencies in the user's input, and show that the application of this method yields improved inters ale coherence and higher visual quality. They demonstrate optimizations for both CPU and GPU implementations of our method, and use them to produce animations with zooming and panning at multiple scales, as well as static gig pixel-sized images with features spanning many spatial scales.

ADVANTAGES:

1. Optimize for efficient and even real-time GPU synthesis.

DISADVANTAGES:

1. inconsistency correction
2. Sensitive to poorly designed input graphs.
3. Fail to capture semantic structures, particularly if the jitter parameter is set too strongly.

• **DATA-EMBEDDABLE TEXTURE SYNTHESIS [12]:**

Data hiding techniques onto images provide tools for protecting copyright or sending secret messages, and they are currently utilized as a simple input device of a cell phone by detecting a data embedded in an image with an equipped digital camera. This paper presents a method of synthesizing texture images for embedding arbitrary data by utilizing the smart techniques of generating repetitive texture patterns through feature learning of a sample image. H. Otori and S. Kuriyama extended the techniques so that a synthesized image can effectively conceal the embedded pattern, and the pattern can be robustly detected from a photographed image. They demonstrate the feasibility of their techniques using texture samples including an image scanned from real material.

• **TEXTURE SYNTHESIS FOR MOBILE DATA COMMUNICATIONS [13]:**

A digital camera mounted on a mobile phone is utilized as a data input device to obtain embedded data by analyzing the pattern of an image code such as a 2D bar code. This article proposed a new type of image coding method using texture image synthesis. Regularly arranged dotted-pattern is first painted with colors picked out from a texture sample, for having features corresponding to embedded data. Their texture synthesis technique then camouflages the dotted-pattern using the same texture sample while preserving the quality comparable to that of existing synthesis techniques. The textured code provides the conventional bar code with an aesthetic appeal and is used for tagging data onto real texture objects, which can form a basis for ubiquitous mobile data communications. This technical approach has the potential to explore new application fields of example-based, computer-generated texture images.

• **REVERSIBLE DATA HIDING [18][19]**

A novel reversible data hiding algorithm, which can recover the original image without any distortion from the marked image after the hidden data have been extracted, is presented in this paper. This algorithm utilizes the zero or the minimum points of the histogram of an image and slightly modifies the pixel grayscale values to embed data into the image. It can embed more data than many of the existing reversible data hiding algorithms. It is proved analytically and shown experimentally that the peak signal-to-noise ratio (PSNR) of the marked image generated by this method versus the original image is guaranteed to be above 48 dB. This lower bound of PSNR is much higher than that of all reversible data hiding techniques reported in the literature. The computational complexity of our proposed technique is low and the execution time is short. The algorithm has been successfully applied to a wide range of images, including commonly used images, medical images, texture images, aerial images and all of the 1096 images in CorelDraw database.

Histogram shifting (HS) is a useful technique of reversible data hiding (RDH) [19]. With HS-based RDH, high capacity and low distortion can be achieved efficiently. In this paper, X. Li, B. Li, B. Yang, and T. Zeng revisit the HS technique and present a general framework to construct HS-based RDH. By the proposed framework, one can get a RDH algorithm by simply designing the so-called shifting and embedding functions. Moreover, by taking specific shifting and embedding functions, they show that several RDH algorithms reported in the literature are special cases of this general construction. In addition, two novel and efficient RDH algorithms are also introduced to further demonstrate the universality and applicability of our framework. It is expected that more efficient RDH algorithms can be devised according to the proposed framework by carefully designing the shifting and embedding functions.

Kuo-Chen Wu and Chung-Ming Wang [1] proposed a novel approach for steganography using a reversible texture synthesis. A texture synthesis process re-samples a smaller texture image which synthesizes a new texture image with a similar local appearance and arbitrary size. We weave the texture synthesis process into

steganography to conceal secret messages. In contrast to using an existing cover image to hide messages, their algorithm conceals the source texture image and embeds secret messages through the process of texture synthesis. This allows us to extract secret messages and the source texture from a stego synthetic texture. Our approach offers three distinct advantages. First, their 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 our steganographic approach. Third, the reversible capability inherited from our scheme provides functionality which allows recovery of the source texture.

ADVANTAGES:

1. Patch-based methods to embed a secret message during the synthesizing procedure.
2. Source texture to be recovered in a message extracting procedure, providing the functionality of reversibility

DISADVANTAGES:

1. Low image quality of the synthetic textures.
2. Less embedding capacities.

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