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# Steganography Using Reversible Texture Synthesis: The Study

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***Abstract*****—*****It is a unique approach for steganography using a reversible texture synthesis. The texture synthesis process re-create a smaller texture image, this image synthesizes a new texture image with a similar local appearance. The new image may be in arbitrary size. This concept includes the texture synthesis process into steganography to hide secret messages. Instead of using an existing cover image to hide messages, the algorithm lurk the source texture image and embeds secret messages by using texture synthesis. It permits us to extract secret messages and the source texture. The technique has several advantages like proffer the embedding capacity that is directly proportional to the size of the stego image. The steganography approach is not likely to discomfiture by the steganalytic algorithm. Because of reversible capability it gives allowance of recovery of the source texture. It give the embedding capacities, produce a visually plausible texture images and recover the source texture.***

***Index Terms*****—Steganography, Data embedding, Texture synthesis.**

## I. INTRODUCTION

In most of the previous approaches for the cover image, an existing image is used. Due to this image there is distortion when embedding secrete message. And it introduces two drawbacks [1]. First, it limits the capacity of embedding message because it gives result as image distortion. So the embedding capacity and quality of cover image is reduced. Second, it is possible to reveal the hidden message in a stego image by using any image stegnalitic algorithm. This paper contain a texture synthesis process to re-samples a small texture image which may be captured or drawn to generate a new texture image with an arbitrary size and similar appearance .To hide source texture and secret messages it introduce a new technique in steganography called as texture synthesis process. In process of texture synthesis instead of using cover image to hide secrete message, this algorithm use texture synthesis to embed message and hide source texture. First, it creates a stego image from source texture which gives the advantage of reversibility. This approach has three advantages. First, though the texture synthesis provides the ability to synthesize texture images of arbitrary size, the embedding capacity is become proportional to the stego texture image size. Secondly, steganography approach unable to defeat by the steganalytic algorithm because instead of modifying the contents of existing image this approach compose the stego texture image from source texture. Third, to recover the original source texture this scheme offers the capability called reversibility. The reversibility technique generates the exactly similar and visually plausible source texture image to the original texture give opportunity to apply second round of steganography for more secrecy of the message.

## II. LITERATURE SURVEY

### *A. Line-Based Cubism-like Approach [2]*

Now days, the subject of automatic generation of art image creation by using the computers increases the interests of many computer users. In the paper the author invent new algorithms of producing art images by the method of stroke-based rendering. This is an automatic method for producing non-photorealistic imagery, but it uses the stipples and paint strokes. The primary goal is to create the art image which is same like the other type of images.

The mosaic image is a made up with tiny identical tiles for example squares, triangle and circles and so on. This mosaic image is one type of computer art image .Instead of the normal nature of mosaic image is tiles are arranged in a fixed pattern. The author creates one new method for mosaic image is which the tile of mosaic image is created by placing tiles to follow the edges in input image. This gives the smother image. When we try to follow line type Cubism paintings to produce automatically art image, called line-based Cubism-like image by using source image. The Source image contains the line segment. Appropriate image processing technique is used to detect line segment. After removing noise line segments the notable one is to be kept. The number of notable lines are combine for making region and the pixels are re-colored by the average color of the region but the color is identical . The method of creating line base cubism like image is as follows: The creation of line based cubism image contains various shapes. In first step the following function are done.

1) Prominent line extraction - the extraction of line segment from given source image by Hough transform which is best method for feature extraction used in image analysis, computer vision and digital image processing. Than next filtering of short line segment from given source image.

2) Region re-coloring- By extending the line segment to the image boundary to partition the space of image. Than recolor the region and give white color to boundary of region.

Than in next step, the algorithm of creation of cubism image is applied and various functions will done like line extraction and region re-coloring, region partitioning, and line extension. This approach has various advantages like it distract the hacker's attention.

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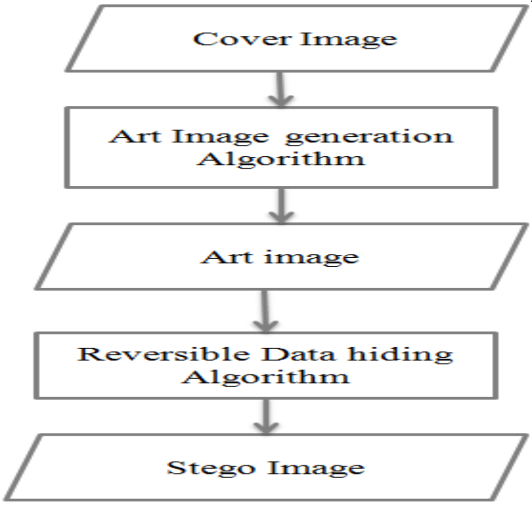


**Fig 1: Line-Based Cubism-like Approach**

### *B. Markov Random Field (MRF) Method [3]*

In the paper, "Fast Texture Synthesis using Tree-structured Vector Quantization", Author Li- Yi Wei and Marc Levoy present a simple algorithm that can synthesize different type of textures. The inputs to the algorithm contain any random noise image with user specified size and an example texture patch. To make the visually plausible image like given example the algorithm makes modifications in random noise image. Since this technique require only example texture patch it becomes flexible and easy to use. Though it will take some time to generate new texture it gives the guaranty of tileability of image. There are two major components in the algorithm, the searching algorithm and multi resolution pyramid. The advantages of this algorithm are its image processing speed and image quality: The algorithm give better quality of synthesized image texture than previous techniques, while it increase the computation speed twice faster order of magnitude than older approaches which generate same result as this algorithm. This allows us to use this algorithm in those applications where texture synthesis is considered as very expensive method. The algorithm is extended to include motion texture synthesis and image editing.

The algorithm use Markov Random Fields (MRF) for the texture model, since it has been proven that MRF is useful to cover the wide variety of texture types. It develops a synthesis procedure to avoid sampling, explicit probability construction, expenses in computation of MRF. In MRF process each pixel is characterized by a set of neighboring pixels, and this is the same for all pixels if image. There are two assumptions in MRF technique: whether image is stationary or local. If under a fix window size the pattern will appear similar then the image is stationary. If each and every pixel is easy to predict from set of neighboring pixels and independent from other images then this image is local. Based on this assumption the algorithm synthesis new image having similar appearance as example texture patch. To preserve similarity new texture is generated pixel by pixel. In the synthesis procedure the probability distribution is not explicit and also it is deterministic completely. This method is efficient and capable to accelerate further.

### C. *Wang Tile Method [4]*

This paper represents a simple stochastic system for patch with a small set of Wang Tiles. The tiles are made up with patterns, texture or geometry that when aggregate create a representation which is continuous. Wang Tile is nothing but the process of filling the tiles by using non-periodic pattern. This process is very efficient in runtime. Wang Tiles have square like structure and edges have particular color. When shared edges of different tiles have same color than this tile called as valid tile. This paper represent the algorithm which represent method of non periodically tiling the plane in small set of Wang tiles, and another new methods for filling the tiles with 2D Poisson distributions, 3D geometry or 2D texture to create non-periodic texture, distributions or geometry at runtime but this can happen according to need. This paper demonstrates filling of individual tiles with Poisson distributions that does not destroy their statistical properties when it is aggregated. This mention technique is used to create arrangement of terrains' objects or plants. This paper show how the environment like terrain can be shown easily by lighting the each Wang tiles which contain the geometry like structure. Wang tiles are further elaborated to include the coding of tile corners. This coding is used to allow discrete object, and this object is used to carry the overlapping of two or more edge. If there is large set of given tiles then it is wind up that there is maximum degree of freedom.

When we capture the complexity of real world by modeling and rendering the scenes is really difficult task. This problem is overcome by creating small example of complexity. This example can reuse many times. This approach also face one problem that is when we use same example used many times in a periodic way, this repetition is distracting. Than this paper represent new stochastic algorithm for tiling the plane in a minimum set of Wang tiles. It give the major advantage that Wang tile can do repetition in using example tiles for creating the pattern or expanses of complex texture. Wang Tiles are made up with multiple squares, in each tile there is colored edges. The edges are representing in alignment fashion that have same color. At last the author concludes that the eight tiles are required to cover the plan.

### *D. Feature Aligned Shape Texturing Method [5]*

This synthesis process use two principles to compute feature-aligned shape textures. First, to match salient curves direction we require the position of the synthesized texture. This will help to make the flow of texture with surface features. Second, an eminent line feature of exemplar texture is needed to be placed totally along with the curve to disclose the shape of salient curves.

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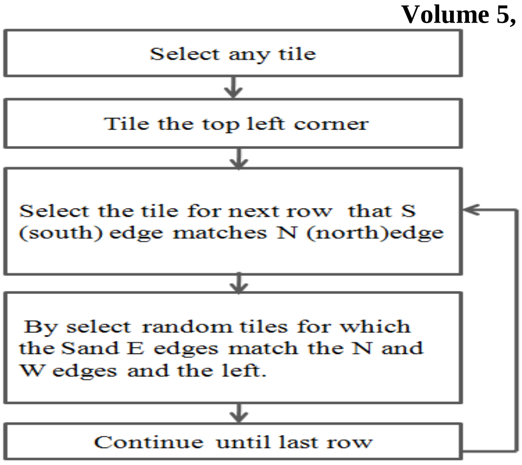


**Fig 2: Wang Tile Method**

The input to this process is an exemplar texture and a 3D surface having excerpt salient features. The synthesis process is going through two steps. First step is vector field generation. In this step the tangent vector field is quantify on the surfaces that describe the alignment of textures. The incremental algorithm is suggested by the author to decide the position of curves and alignment of curve direction with vector field. It is an effective way to calculate smooth and limited vector field by minimizing the energy. The important intention is to gain proper placement of curve which generate a smooth curve-guided vector field with minimum peculiarities. The second step is texture optimization. In this step by following the patch-based texture optimization structure we quantify the texture through the vector field. To set the texture features entirely along the primary surface features, we expand the optimization formulation with an exact feature-to-feature alignment limitation.

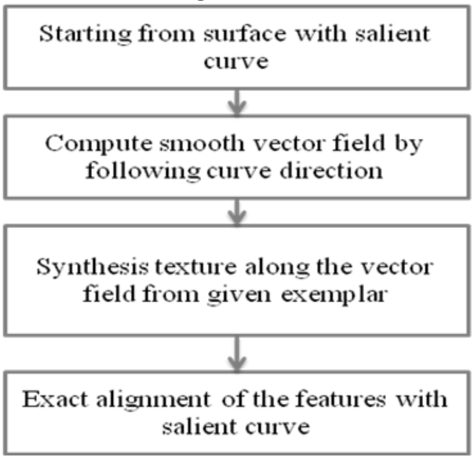


**Fig 3: Step of feature aligned shape texture.**

### *E. Multiscale Texture Synthesis [6]*

In this paper the author uses the Example-based texture synthesis algorithms to generate the form of novel images. This algorithm is used to create the infinite scale of exemplar which contains numerous information. The exemplar graph is to be created which give the detailed view of different scales for example from satellite distance.

The author uses exemplar based texture synthesis which minimizes the disadvantage of the previous approach which is based on the single input exemplar. When we give the input as exemplar image to exemplar based texture synthesis, the output is novel image. The described algorithms make it practical to produce a non-periodic texture, large infinite, while designing a small exemplar of the texture. One of the disadvantage is that exemplar have finite resolution. Therefore it conveys information for tiny band of spatial scales. When exemplar is small than texture feature and the texture feature is smaller than exemplar pixel, are combined. The exemplar graph is combination of vertices and edges. it is a directed weighted graph in which vertices shows the exemplar and edges denote similarity between the exemplar. In real time texture include the features which are frequently changed the spatial scales. Therefore to remove this shortcoming the author invents technique for multi scale texture synthesis from small amount of input exemplars. The author give the better approach for example based representation.

The Exemplar graph contain loop which represent self identical texture as shown in above diagram. This can provide smooth way to transform finite input resolution to infinite output resolution. Loops give the more expressive look than single exemplar because single exemplar can't give infinite level of details as shown in following figure.

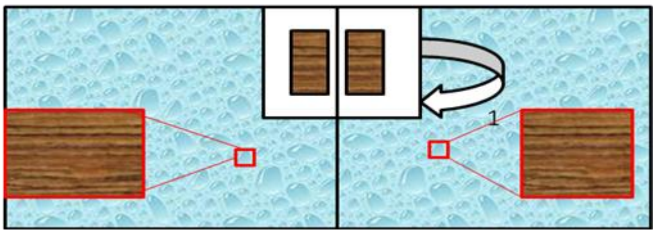

**Fig 4: Concept of looping used in texture synthesis [6].**

This all technique is used for optimization for CPU and GPU. Finally this is used in animation and zooming. At first time we must define the construction called super exemplar which is used to map the exemplar graph into different forms. The exemplar graph contains the different exemplar. The Gaussian stacks for each exemplar are computed after observing all exemplar in exemplar graph. The super exemplar are stored as data structure in which there are two types of identification like black edges are used to indicate the pair of stack level. The black edges are used to indicate the chain of vertex. It is beneficial technique but have different shortcomings like it behave poorly for identification of the exemplar when the same identical neighborhoods. There may be possibility that it uses the algorithm uses the same exemplar many times for synthesis.

## III. STEGANOGRAPHY USING REVERSIBLE TEXTURE SYNTHESIS

The method of steganography using reversible texture synthesis is mainly used for hide the secret messages. A new texture image is synthesizes from several tiny texture images

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by using the texture synthesis process. The method consists of combination of both texture synthesis process and stegonography. It contains mainly two procedures [1].

1: Message embedding procedure

2: Message extracting procedure

In message embedding procedure, the first procedure is dividing the source texture image into different image block. This image block is called as patches. To record the corresponding source patch's location the index table is used. The workbench is blank image whose size is same as that of synthetic texture. With the help of source patch ID which is placed in the index table, the corresponding source patches are paste into the workbench to generate a composite image. After pasting the source patch the next step is to find mean square error (MSE) of overlapped region. This overlapped area is found in between the patch which we want to insert in the workbench and the synthesis area. The resultant patches are ranked as per the ascending order of mean square error (MSE). And finally the patches are selected from given list in such way that the rank of patches is equals to decimal value. The decimal value is nothing but the n-bit value of our secret message.

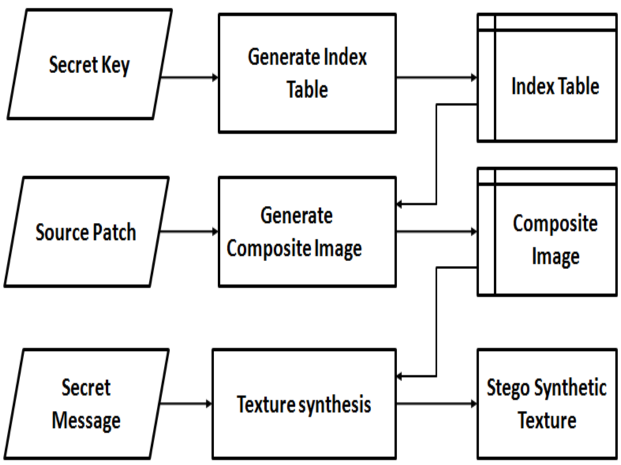


**Fig 5: Message embedding procedure**

At receiver side, the index table is generated by using secrete key which the receiver already have. To retrieve the size of the expected source texture we can refer each patch region and its related order which is present in the index table. After retrieving the size the blocks are arranged as per their corresponding order. Next step is authentication - We were going to suppose the present working location of workbench and similarly the working location of stego synthetic texture to predict the stego block region. The stego block region is used to search candidate list and to check whether there is any patch from candidate list having similar kernel region as the corresponding stego block region. If such similar patch is found, The rank is given to this matched patch. We can represent the value of secrete bits in patch which is in decimal format. This process is called as message extracting procedure.

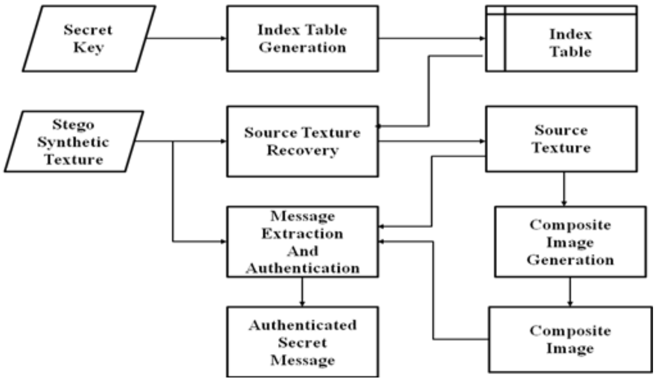


**Fig 6: Message extracting procedure.**

## IV. APPLICATIONS

Steganography Using Reversible Texture Synthesis method is used widely for many real world applications. Some of the application areas are:

1. Online Shopping
2. Banking

## V. CONCLUSION

In this way we contemplate few techniques which are meant for texture synthesis. Some of the technique use patches and synthesis information into that patches, another technique uses exemplar graph which contain infinite resolution which give benefits to the larger information synthesis into texture like spatial images. But there is also some drawback like chances of multiple time processing of same exemplar. Therefore approach proposed by Kuo-Chen Wu and Chung-Ming Wang have additional capabilities like reversibility to extract the original image from given stego texture. We can also apply another round of synthesis of source texture. The image recovery is possible by using this approach.

## REFERENCES

[1] Kuo- Chen Wu and Chung-Ming Wang, "Steganography Using Reversible Texture Synthesis", IEEE Transaction On Image Processing ,vol.24,no.1,pp.2015.

[2] S.-C. Liu and W.-H. Tsai, "Line-based cubism-like image—A new type of art image and its application to lossless data hiding," IEEE Trans. Inf.Forensics Security, vol. 7, no. 5, pp. 1448-1458, 2012.

[3] L.-Y. Wei and M. Levoy, "Fast texture synthesis using tree-structured vector quantization," in Proc. of the 27th Annual Conference on Computer Graphics and Interactive Techniques, 2000, pp. 479-488.

[4] C. Han, E. Risser, R. Ramamoorthi, and E. Grinspun, "Multiscale texture synthesis," ACM Trans. Graph., vol. 27, no. 3, pp. 1-8, 2008.

[5] M. F. Cohen, J. Shade, S. Hiller, and O. Deussen, "Wang Tiles for image and texture generation," ACM Trans. Graph., vol 22, no. 3,pp 287-294,2003.

[6] K. Xu, D. Cohen-Or, T. Ju, L. Liu, H. Zhang, S. Zhou, and Y. Xiong, "Feature-aligned shape texturing," *ACM Trans. Graph.*, vol.28, no.5, pp.1-7-2009.

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