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An Analysis on Different Methods of Texture Synthesis

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Abstract
Texture synthesis has obtained a great attention in the areas of Computer vision, human perception and computer graphics. Texture synthesis is the method of developing a large digital image from a small digital image having the same visual appearance of the input image. Synthesizing texture is one of the suitable method to create texture images of arbitrary size. In this Survey discussed about the various work done in the field of texture synthesis.

Keywords: Texture synthesis, procedural, Exemplar, Stochastic, pixel, Patch,

1. Introduction

Texture synthesis is an efficient method of developing textures and can be used to create texture images of varying input size. This method mostly used in the field of Computer graphics. Completion of image and synthesizing video are some of the applications of texture synthesis. This process generate a new texture image which having the same visual textual appearance of the sample texture. One of the main advantage of using texture synthesis is that it avoids visual repetition.

Texture synthesis algorithms are classified into two. They are the procedural based approach and exemplar based approach. Procedural based approach includes stochastic and specific structure texture synthesis. Pixel based, patch based, and tile based texture synthesis comes under the exemplar approach. Stochastic texture synthesizing algorithm randomly chooses the color of each pixels and the resulting pixels having minimal brightness, contrast and moderate color. Type of algorithm used only for strong textures and does not produce structural information. In order to synthesis an image a predetermined set of parameters and procedures are contained in the specific texture synthesis.

One of the most effective, simple and general purpose texture synthesis algorithms is the pixel based algorithm. The main function of this algorithm is to search and copy the pixels with the most identical neighbors from the exemplar based approach. In order to accelerate the searching procedure pixel based texture synthesis algorithm uses approximate nearest neighbors so this algorithm uses less time for searching process. Patch based texture synthesis algorithms are created on the basis of pixel based texture synthesis algorithm. The main difference between the pixel based texture synthesis and patch based texture synthesis is that the pixel based algorithms uses pixels for searching and copying process where patch based algorithm uses different texture offset patches for searching and copying method. Patch based texture synthesis produces better quality and much efficient and stronger than the pixel based ones.

Tile based algorithms tile the input image and forms large image with certain order. The outcome of this type of algorithm is less better than the patch based ones .Tile based approaches is less efficient than the patch based ones because patch based algorithm forms large textures in real time. Another more approach called novel approach .This approach uses different textures to enrich the surface of the input image.

2. Works on Texture synthesis

A.A Efros and T.K Leung proposed [1] a non parametric procedure for Texture synthesis. Single pixel processed at a time. Markov Random field model considered for synthesizing textures. Conditional probability distribution (PDF) of a pixel provides sample images given by its neighbors for texture synthesis. Sample image is finite uses Gaussian weighted SSD for finding the best match. Applications include three dimensional reconstruction, region based image compression and also applied in the area of motion synthesis.

Chih -Wei Fang and Jenn-Jier James Lien developed [2] a system consisting of two modules they are the texture analysis model and the texture synthesis model. Technique is commonly used for synthesizing a large image and also for the replacement of local removed regions in the image. Non periodic or periodic patterns are analyzed for sampling. Analysis module reduces the dimensions of the training data and clusters the data. Synthesize module synthesize large output image very quickly and keep their geometric structures. Performance of the system can be increased by using the Principal component analysis Technique (PCA) helps in reducing the most of the time complexity operations. Down sampling process compiles the training data for analysizing. Up sampling step is used for reconstruction process. Multi resolution approach is applied for image replacement process. Mechanism helps to provide realistic texture images quickly.

H.otori and S.kuriyama [3] proposed a method of embedding data on the texture image. Texture image can be synthesized by a technique of providing repetitive texture pattern by understanding the features of sample image. Synthesized image can hide the embedded data. An encoded method with a painted pattern called Local Binary pattern (LBP) mechanism is used to embed and detect the data. Compare the value of the centre pixel with the neighboring pixel. Improve the quality of the synthesized texture image from the initial painting of LBP are carried out by the concept of coating and recoating mechanism. Coherence and similarity map concepts are described for efficient and accurate computation of pattern similarity.

K.Xu et al proposed [4] a method for aligning the feature curves from textures and three dimensional shapes. Orientation of the curves and feature to feature texture synthesis are the two main issues. Detecting salient feature curves by computing the vector field on the surface. Optimize the orientation of the feature curves for obtaining a smooth computed vector field. Proposed an incremental algorithm for obtaining a proper curve orientation. Patch based texture optimization is carried out to align the texture features. To improve the visual effect feature to feature alignment techniques are proposed during texture synthesis.

M.F Cohen and J. shade [5] provides an attractive appearance for texture. Wang Tiles uses non periodic sample for texture generation. Square shaped tiles assigning color to each edge .Adjacent edges have matching colors. Two Dimensional textures are created by automatic texture synthesis. Texture synthesis method and Poisson like distribution are considered for automatic generation of wang tiles. Sampling is done on the basis of LDI level. Inside of the tiles can be filled by texture images, geometric points. Provide an interactive design so the user can fill the tiles as per the requirement.

C.Han, E.Risser, and R.ramamoorty developed [6] multiscale synthesizing of textures uses exemplar graph as the input. K coherence search algorithm and PCA projection are used for neighborhood matching. Super exemplar graphs are formed by combination of multiple exemplar graphs. Colorization and upscaling of gray scale texture images with small resolution and large resolution can be done. Multiscale texture synthesis allows increasing the resolution and removing the blurriness in an image. RGB multiscale texture synthesis or HSV multiscale texture synthesis is used for upscaling the grey level texture images.

Lexing Ying, Aaron Hertzmann, Henning Biermann used [7] common type of textures such as color, displacement, and transparency are considered for synthesizing texture images. Texture synthesis can be done directly on the surface and provides better quality images with no image distortion. Sample the needed texture with the neighborhood of the

previously synthesized texture image. Surface marshing and chart sampling methods are considered for sampling the neighborhood.

L.Y Wei and M.levoy Proposed a [8] an algorithm for realistic texture synthesis. Tree structured vector quantization (TSVQ) technique for compressing data. Input is the sample texture. Texture images are produced by carrying out a deterministic searching process. Uses Markov random field approach to generate texture image. Size of the image used can be specified by the user. Multi resolution pyramid and simple searching algorithm are considered to be the important components. Advantage of this algorithm is easy to implement and provides better quality and speed. Less computational time is required.

Alexei A. Efros and William T. Freeman developed a method based on image [9] provides a new image as output by joining together the small patches of the input image. Image quilting technique is a simple texture synthesis algorithm provides better result. Follows patch based texture synthesis approach. Texture transfer mechanism is described by transferring texture image into a new texture image by using the target image. That means that take the texture from one object and drawn it on another one. Image quilting approaches are similar to the tiling concept. Reduces the boundary error by giving the ragged edges in the tiles.

Li-Yi Wei1 and Jianwei Han et al proposed an Inverse texture synthesis method [10] works in the reverse direction of forward texture synthesis. Generates small texture as output from a large texture input. High quality images are generated with very small data size. Reconstruction of the original data through the concept of control map. Useful for GPU Application because of smaller compaction. Real time GPU synthesis method is proposed for textures.

Hirofumi Otori and Shigeru Kuriyama proposed an image coding mechanism using texture image synthesis. Image code can be detected by a digital camera in a mobile phone. Pixel based texture synthesis are used .Texture images are used in the place of barcodes. LBP is used to synthesize high quality images. Quality of the data embedding textures can be improved by the mechanism of LBP and recoating process. Hilbert Curve Sequence is introduced for regular iterative pattern. Efficient data mechanism implemented on mobile phone can read the coded data within a reasonable time.

3. Conclusion

Area of Texture synthesis gives a lot of invention by researchers. This paper discussed about the various work done in the field of texture synthesis. Texture synthesis is the method of developing a large digital image from a small digital image having the same visual appearance of the input image. Texture synthesis can handle boundary condition and also it can avoid repetitions. Used for synthesizing video, editing and the completion of an image. From the survey it can be found out that texture synthesis were used by many researchers and provide better result. Patch based texture syntheses are efficient and provide good quality image than the other synthesis approach.

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