

Texture Synthesis Rendering

Doctoral Thesis Topic

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Texture synthesis, and in particular Image Analogies [Hertzmann01] are very powerful tools for image synthesis. However, their use has been largely restricted to 2D image generation, usually used as texture maps. In this project we will investigate how to use these approaches to actual render scenes with a 3D appearance.

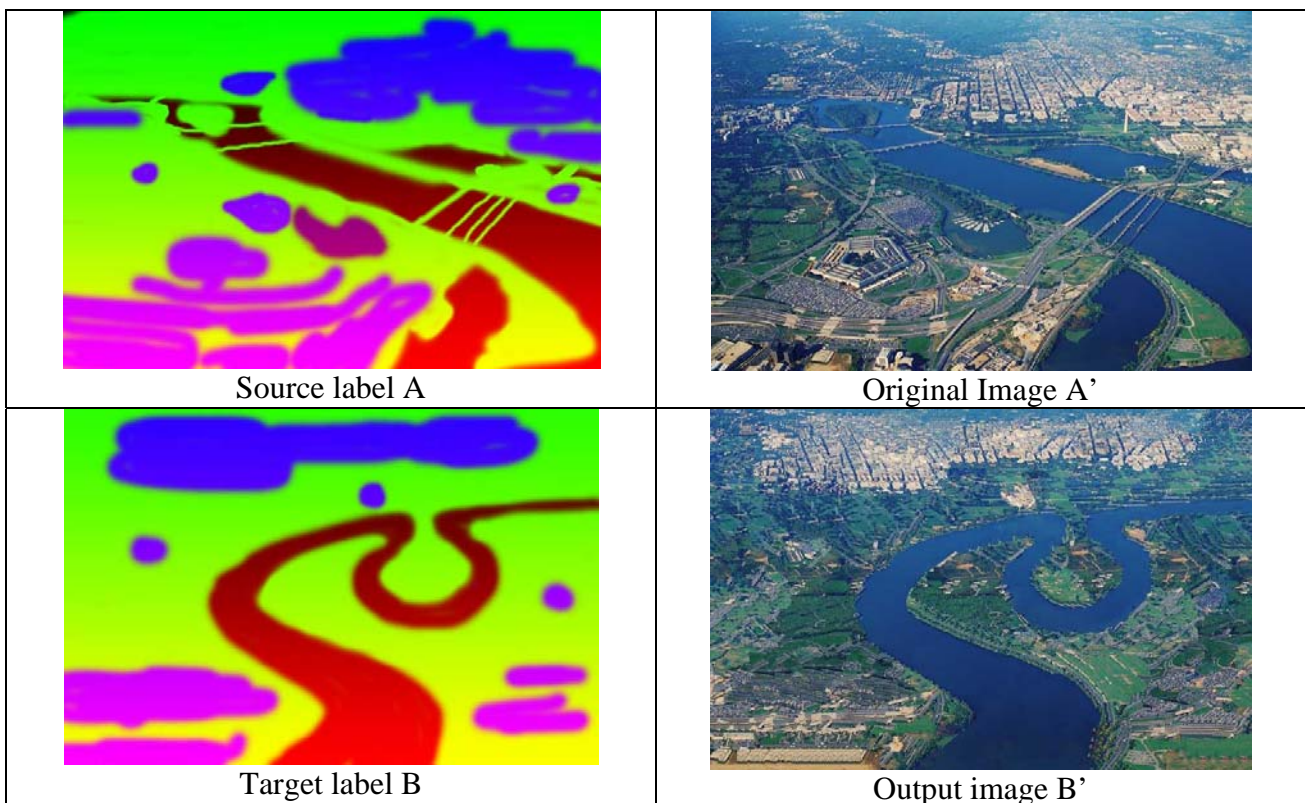


Image Analogies approach: The original image is augmented with a manual label A. By drawing a target label B, we can obtain a new image B. In this thesis we will harness the power of texture synthesis to use such approaches for general rendering.

Our approach will be based on the idea of generating a first approximation to depth and rendering using simple approximate geometry and an approach akin to Image Analogies, using one or more example images. We will then develop ways to enforce coherence over time in the texture synthesis process, and develop ways to generate enough geometric/depth information at each frame to ensure the generation of rich visual detail. This will allow the generation of animation/walkthrough sequences with high quality imagery without the overhead of creating and texturing a detailed 3D model. In subsequent steps we will investigate the possibility of generating geometry on-the-fly, thus allowing further flexibility in terms of the images we can generate. The overall approach will

involve an in-depth analysis of the sampling and reconstruction techniques [Yang 09] used to create the frames, and examine their behaviour over time.

We will first resolve the theoretical issues, and develop an appropriate framework for experimentation, and then develop real-time GPU-based solutions, allowing the wide-spread usage of such approaches for visually rich rendering. We will base our approach on fast parallel texture synthesis approaches [Lefebvre 2005].

In a second step, we will investigate appropriate models to generate more structured elements from images, and integrate them into the framework initially developed.

Requirements

The successful candidate should have a Masters degree in Computer Science, and have preferably taken courses in computer graphics and have experience in computer graphics programming, with knowledge of OpenGL or DirectX, and some experience with shading languages such as GLSL/HLSL/Cg.

References

[Hertzmann01] Image Analogies

A. Hertzmann, C. Jacobs, N. Oliver, B. Curless, D. Salesin.
SIGGRAPH 2001 Conference Proceedings

[Lefebvre 2005] Parallel controllable texture synthesis.

S. Lefebvre, H. Hoppe.

ACM Transactions on Graphics (Proc. SIGGRAPH 2005), 24(3), 777-786.

[Yang 09] Amortized supersampling.

L. Yang, D. Nehab, P. Sander, P. Sitthi-amorn, J. Lawrence, H. Hoppe.

ACM Transactions on Graphics (Proc. SIGGRAPH Asia 2009), 28(5), 135.