M2 Research internship – 2017

Management of content transitions in patch-based composite texture synthesis

Host team: IGG (Computer Graphics and Geometry group) at ICube lab

Advisors: Rémi Allègre (remi.allegre@unistra.fr), Jean-Michel Dischler (dischler@unistra.fr)

Starting date: From January 2017

Ending date: 6 months from the starting date

Funding: About 525 euros per month, net salary

Location: Strasbourg area, France

Prerequisites: Computer Graphics, Signal and Image Processing, C++ programming

Possible continuation in Doctoral (PhD) thesis: funded by the HDWorlds ANR project

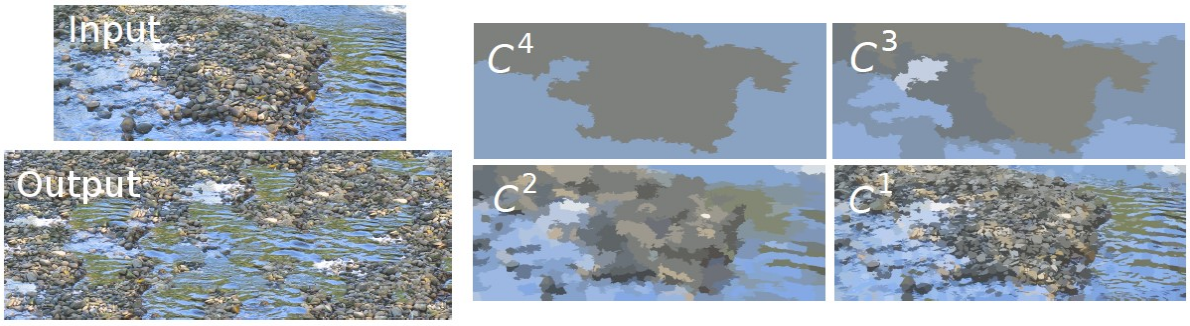

Fig. 1 – Left: An input image and a composite texture synthesized from it. Right: Analysis of the texture patterns of the input image at 4 scales (images from [LSA+16]).

Context and problem statement

Textures contribute in a prominent way to the realism of 3D virtual environments. The goal of example-based texture synthesis is to automatically produce textures from input images, which facilitates the work of artists who have to cope with the increasing demand of highly detailed digital content in the computer graphics industry. Patch-based texture synthesis produces textures by selecting contents in one or several input image(s) and assembles corresponding patches in an output image. The challenges for these techniques are threefold: 1) control of contents in the synthesized texture, 2) realistic stitching and 3) scalability. Most existing patch-based texture synthesis algorithms consider stationary textures, and do not enable direct processing of textures involving spatial variations or *composite* textures, i.e. textures composed of multiple patterns. The multi-scale label maps recently proposed by Lockerman et al. [LSA+16] bring a solution to the control of composite contents or contents exhibiting spatial variations, through the ability to define per-pixel and per-region descriptors, for multiple scales of patterns (Fig. 1). In this context, patch stitching

is a major issue when different contents are put side by side, both from the point of view of visual quality and from the point of view of computation cost and/or memory cost.

Internship goal

The first goal of this internship is to evaluate and compare several methods for managing transitions between the contents of composite texture patches: methods for computing cuts [EF01, LT08], as well as *blending* methods [PGB03, DSB+12]. The second goal is to study a descriptor based on the multi-scale label maps proposed by Lockerman et al. [LSA+16], and develop a patch stitching method making the best possible use of this descriptor. The neighborhood relations that exist between the patterns in the input images at multiple scales could be also considered, in a way similar to the PatchNet model [HZW+13].

The implementation will be done in C++ and will be part of the texture analysis and synthesis platform of the IGG group, ASTex. The topic could be continued in a Doctoral thesis (PhD thesis) funded by the HDWorlds ANR project.

References

[EF01] A. A. Efros and W. T. Freeman. Image Quilting for Texture Synthesis and Transfer. In Proc. SIGGRAPH'01, pages 341–346, 2001.

[PGB03] P. Pérez, M. Gangnet, and A. Blake. Poisson image editing. ACM Transactions on Graphics (Proc. SIGGRAPH'03), 22(3):313-318, 2003.

[LT08] Y.-Y. Lai and W.-K. Tai. Transition texture synthesis. Journal of Computer Science and Technology, 23(2):280-289, 2008.

[DSB+12] S. Darabi, E. Shechtman, C. Barnes, and D. B. Goldman, and P. Sen. Image Melding: Combining Inconsistent Images using Patch-based Synthesis. ACM Transactions on Graphics (Proc. SIGGRAPH'12), 31, 4, 82:1-82:10, 2012.

[HZW+13] S.-M. Hu, F.-L. Zhang, M. Wang, R. R. Martin, and J. Wang. PatchNet: A Patch-based Image Representation for Interactive Library-driven Image Editing. ACM Transactions on Graphics (Proc. SIGGRAPH Asia 2013), 32, 6, 196:1-196:12, 2013.

[LSA+16] Y. D. Lockerman, B. Sauvage, R. Allègre, J.-M. Dischler, J. Dorsey, and H. Rushmeier. Multi-Scale Label-Map Extraction for Texture Synthesis. ACM Transactions on Graphics (SIGGRAPH'16 Tech. Papers) 35, 4, 140:1-140:12, 2016.