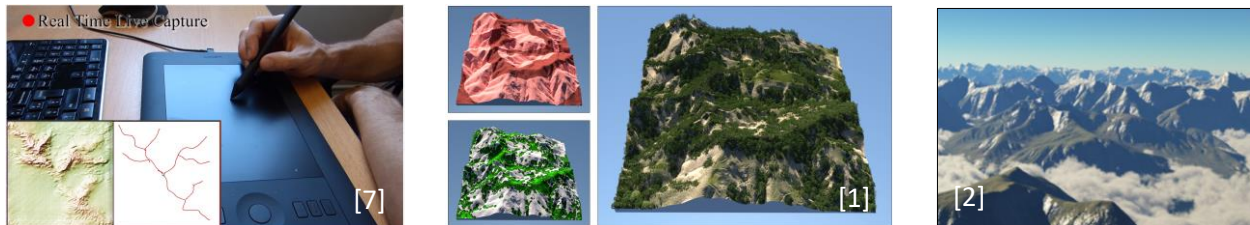# PhD position – Amplification and inverse procedural modeling

LIRIS CNRS – Origami – Arches team - Starting from September 2021

Context and objectives of the project

Virtual worlds are frequently used in the entertainment industry (video games, movies) to provide users with a unique and extraordinary experience. Among the fundamental elements that contribute to this experience, the quality of the setting, decorations, props, together with the dramatic character and extent of the domain is central. To obtain a vast and highly detailed virtual landscape, the entertainment industry is used to resorting massively to artists. This method is man-power intensive, costly, and has definite limitations. In parallel, an increasing number of Geographic Information Systems datasets (terrains, aerial photography, canopy height models) are now publicly accessible, which is made achievable by modern digitizing systems becoming standards.

The goal of the project is to propose high-level techniques to assist artists in authoring and creating virtual worlds [1,3,7]. This help will be provided as high-level tools that will support users in their tasks, without introducing any trade-off in the creative pipeline. This means that such tools should not hinder creativity, and particularly, artists should have access to different levels of control.

PhD subject

This PhD will focus on the following three topics:

- **Amplification of terrain**: inferring realistic details onto a coarse terrain;
- **Inverse procedural modeling**: given a real world example, generate a procedural model that is able to reproduce it;
- **Quality assessment**: is a generated map or model realistic or plausible? How to automate this quality assessment?

To achieve this work, Machine Learning will be used, in addition to the large public datasets and more focused datasets produced by the partners of the project.

Partners

The project is conducted by the LIRIS laboratory, in collaboration with **Ubisoft Paris**, and the **CIRAD**.

Team/location

The Arches/Origami/LIRIS team is located at Lyon in France. It has an international visibility on the virtual worlds research domain from terrains [2,6,7] to vegetation [1], rivers [4,8], atmospheric effects, simulation [5,6] and implicit modeling [3,8]. Machine learning methods have been used recently with encouraging results [1,2,7]. See https://arches.liris.cnrs.fr/ for more publications and information.

Skills

The computer science student should be fluent with C++ and 3D programming. Secondary skills are welcome such as: Machine Learning, geology, 3D artist, *etc.*

Funding

Contact

Please send applications to Eric Guérin (eric.guerin@liris.cnrs.fr), with your CV and a motivation letter.

References

[1] Data-driven Authoring of Large-scale Ecosystems. Konrad Kapp, James Gain, Eric Guérin, Eric Galin, Adrien Peytavie. ACM Transactions on Graphics, Proceedings of SIGGRAPH Asia, 2020.

[2] Orometry-based terrain analysis and synthesis. Oscar Argudo, Eric Galin, Adrien Peytavie, Axel Paris, James Gain, Eric Guérin. ACM Transactions on Graphics 2019. Proceedings of Siggraph Asia 2019, Brisane, Australia.

[3] Terrain Amplification with Implicit 3D Features. Axel Paris, Eric Galin, Adrien Peytavie, Eric Guérin, James Gain. ACM Transactions on Graphics 2019. Presented at Siggraph Asia 2019, Brisane, Australia.

[4] Procedural Riverscapes. Adrien Peytavie, Thibault Dupont, Eric Guérin, Yann Cortial, Bedrich Benes, James Gain, Eric Galin. Computer Graphics Forum 38(7). Proceedings of Pacific Graphics 2019. Seoul.

[5] Desertscapes Simulation. Axel Paris, Adrien Peytavie, Eric Guérin, Oscar Argudo, Eric Galin. Computer Graphics Forum 38(7). Proceedings of Pacific Graphics 2019. Seoul.

[6] Procedural tectonic planets. Yann Cortial, Adrien Peytavie, Eric Galin, Eric Guérin. Computer Graphics Forum, Wiley, 2019, 38 (2). Proceedings of Eurographics 2019, Genova.

[7] Interactive Example-Based Terrain Authoring with Conditional Generative Adversarial Networks. Eric Guérin, Julie Digne, Eric Galin, Adrien Peytavie, Christian Wolf, Bedrich Benes & Benoît Martinez. ACM Transactions on Graphics 2017. Proceedings of Siggraph Asia 2017, Bangkok, Thailand.

[8] Terrain Generation Using Procedural Models Based on Hydrology. J.D. Genevaux, E. Galin, E. Guérin, A. Peytavie, B. Benes. ACM Transactions on Graphics 32(4). Proceedings of Siggraph. 2013.