2022-05445 - Research internship: Subcell erosion for terrain generation

Type de contrat : Convention de stage
Niveau de diplôme exigé : Bac + 4 ou équivalent
Autre diplôme apprécié : M2
Fonction : Etudiant de recherches

A propos du centre ou de la direction fonctionnelle

The Inria Sophia Antipolis - Méditerranée center counts 34 research teams as well as 7 support departments. The center's staff (about 500 people including 320 Inria employees) is made up of scientists of different nationalities (250 foreigners of 50 nationalities), engineers, technicians and administrative staff. 1/3 of the staff are civil servants, the others are contractual agents. The majority of the center's research teams are located in Sophia Antipolis and Nice in the Alpes-Maritimes. Four teams are based in Montpellier and two teams are hosted in Bologna in Italy and Athens. The Center is a founding member of Université Côte d'Azur and partner of the I-site MUSE supported by the University of Montpellier.

Contexte et atouts du poste

The internship will take place at Inria Sophia Antipolis in the GRAPHDECO group (http://team.inria.fr GRAPHDECO). Inria will provide a monthly stipend of around 1100 euros for EU citizens in their final year of masters, and ~600 euros for other candidates.

Mission confiée

Digital terrains are used by many industries, from entertainment to construction or marketing. They are also fundamental in a variety of educational or vulgarization tasks, and this need is nowadays brought to the forefront by the tragic impact of climate change on the mountains. In this context, the generation of large-scale terrains is of critical importance. It allows creating educational material, better understanding the subsurface geology, and simulating possible futures for our landscapes. Inspired by laws commonly used in geomorphology [6], we can now efficiently generate mountains at the scale of the mountain range [12]. However, these approaches are limited by the special resolution, where the smallest elements are around 20-100m large. Our goal is to model the physical effects that occur below this scale, and to use machine learning to 1) feed this information back into the large-scale simulation, and 2) produce highly detailed, yet physically accurate terrain texture.

Approach

In a second step, we will use neural networks to learn the statistics of the high-resolution simulations, for two complementary applications. The first one is to propagate the effect of debris flow to the original large-scale model, without the cost of a fine-drained simulation. Learning sub-cell dynamics is already explored in fluid simulations [4] but will lead to additional challenges, for instance, because our erosion model processes the cells by order of elevation. A second application will be to generate a high-definition texture of the terrain after erosion, to recover all the fine details below cell size, thanks to data-driven supper-resolution [5]. Here again, the challenge will be to preserve the geological consistency of the generated texture, and in particular the connectivity of the drainage pattern.
References


Principales activités

Research: bibliography, experimentation, prototype

Compétences

- Candidates should have strong programming and mathematical skills with knowledge in computer graphics and experience in Python data science libraries.
- Interest in geology/mountaineering/outdoors activities is a plus.
- The project might extend to a Ph.D. position on a topic that relates terrain generation to machine learning, and for which experience in optimization and machine learning is required.

Avantages

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage
- Employer’s contribution to mutual insurance (subject to conditions)