



Hierarchical motion representation for stylized rendering

Proposal for a PhD student at IRIT (Toulouse)

Location : Laboratoire IRIT, STORM research team, Université Paul Sabatier – Toulouse

Advisor : David Vanderhaeghe, vdh@irit.fr, www.dlyr.fr

Funding : ANR project *Structures* ANR-19-CE38-0009-01

Keywords : stroke-based rendering, painterly animation, example-based methods, computer graphics

Context. Animation movies show great media of artistic expression, allowing artists to convey powerful narrations, while not being limited to the existing range of shapes and motions. Unfortunately, they are significantly tedious and time consuming to produce. It is particularly the case for 2D animation composed of sets of marks, such as paint or drawings.

Standard stroke-based rendering methods can automatically produce stylized content made of marks such as paint strokes [5] or hatching [4]. They either focus on a specific style or technique to propose a fully automatic process, or allow to tweak style along large sets of parameters [3], which may not be the more intuitive solution for an artist. They usually do not take into account style features related to motion, which is an important aspect of animation design [6].

PhD Project. The goal of this thesis is to propose a structured representation for animation that combines the level of control and rendering quality of hand-made approaches with the efficiency of automatic authoring.

The first objective is to establish a representation of motion features that are important for stylization, and express it with mathematical formulation. Then, the student will use this representation to propose an algorithm to generate stylized animation with flexible and intuitive style control. This part would be inspired by example-based approaches, to encapsulate and transfer style using a minimal example of stylized item [1, 2]. One of the challenges implied by such techniques is the definition of a dictionary of motion event, meaning a minimal set of animation needed to define the style of a whole animation.

This work will be done in close collaboration with partners from the art and animation domain, to guide and validate the research work.

Candidate's profile. Potential candidates for the thesis should have :

- Master degree in Computer Science, or equivalent.
- Strong background in real time computer graphics, mathematics, and c++ programming.
- Additional skills in some of the following topics would be appreciated: expressive rendering, user interface, numerical optimization.
- Fluent french or english speaking.



Application. Send your application to David Vanderhaeghe (vdh@irit.fr) with

- a complete CV,
- grades report from M2
- reference name/email address

About STORM-IRIT STORM is a research team part of the IRIT Laboratory (UMR CNRS 5505). We conduct research on computer graphics, including geometric modeling, 3D animation and rendering. See our webpage for more details about recent research <https://www.irit.fr/STORM/site/>. The PhD will take place on the Rangueil campus, in the IRIT building, south of Toulouse, nearby all facilities and ground public transport to reach the city.

References

- [1] Marek Dvorožňák, Pierre Bénard, Pascal Barla, Oliver Wang, and Daniel Sýkora. Example-based expressive animation of 2d rigid bodies. *ACM Transactions on Graphics (TOG)*, 36(4):1–10, 2017.
- [2] Jakub Fišer, Ondřej Jamriška, Michal Lukáč, Eli Shechtman, Paul Asente, Jingwan Lu, and Daniel Sýkora. Stylist: illumination-guided example-based stylization of 3d renderings. *ACM Transactions on Graphics (TOG)*, 35(4):1–11, 2016.
- [3] James Hays and Irfan Essa. Image and video based painterly animation. In *Proceedings of the 3rd International Symposium on Non-Photorealistic Animation and Rendering*, NPAR '04, page 113–120, New York, NY, USA, 2004. Association for Computing Machinery.
- [4] Evangelos Kalogerakis, Derek Nowrouzezahrai, Simon Breslav, and Aaron Hertzmann. Learning hatching for pen-and-ink illustration of surfaces. *ACM Transactions on Graphics (TOG)*, 31(1):1–17, 2012.
- [5] Peter O'Donovan and Aaron Hertzmann. Anipaint: Interactive painterly animation from video. *IEEE transactions on visualization and computer graphics*, 18(3):475–487, 2011.
- [6] Frank Thomas, Ollie Johnston, and Frank Thomas. *The illusion of life: Disney animation*. Hyperion New York, 1995.