Crowd Simulation: Creating Variety in Crowds

Type d'offre : Master Recherche
Lieu de travail : Inria Rennes, équipe MimeTIC
Thème de recherche : Perception, cognition, interaction
Projet : MimeTIC / LAGADIC
Responsables scientifiques : Ludovic Hoyet / Julien Pettré

Subject

Virtual crowds are nowadays a requirement to create realistic digital worlds, as the beneficial effects of a lively background made of many moving characters in terms of visual quality and enjoyment is undeniable. However, because they are all animated by similar procedures, crowd characters often display a certain level of uniformity which can be detrimental for the plausibility of the virtual scenes. In this internship, we are interested in exploring how variety can be introduced at the simulation step of a crowd engine.

To render animating such large amounts of characters in interactive applications possible, crowd engines are typically based on a two-step process: 1) the characters' global 2D trajectories are generated by a crowd simulator, while avoiding collisions with other characters and the environment and walking towards given goals, and 2) an animation system animates the full body motion of each individual (often using motion capture data) on top of these global trajectories. While this two-step process is interesting for interactive applications for computational reasons, it also brings limitations in terms of variety of behaviours and motions. A certain level of uniformity can be visible in terms of global trajectory strategies, e.g. all characters usually display similar avoiding behaviours because they are all driven by a unique underlying simulation model. Uniformity can also be visible in terms of body motions as the animation engine is often only driven by the local position and velocity of the agents, without considering the presence of neighbours.

Breaking this sensation of uniformity can be beneficial in terms of visual realism and quality. Most of previous works on the creation of variety in crowds focused on the number of distinct motions to use to create variety, as well as characters' appearance [MLDSO08,MLHRC09]. However, we also demonstrated recently that introducing variety at the animation step by driving body motions based on local interactions with neighbours can improve the naturalness of crowd animations [HOKP16].

In this internship, we are interested in exploring how variety can be introduced at the simulation step. For interactive applications, crowd simulators usually compute the global displacement of hundreds of characters based on local interactions between simulated agents, and many models of varying complexity have been proposed in the literature: social forces [HM95], flocking rules [Reynolds87], velocity-obstacles [VLM08], synthetic vision

[OPOD10], power law [KSG14], etc. Each model differs in terms of strategies used to drive characters and avoid collisions, but also in relation to their internal parameters will affect these trajectories. In order to create variety at the simulation step, we therefore want to explore two complementary aspects: 1) how introducing variety in the parameters of simulation models will affect the visual quality of the crowd by creating variety in the global trajectories, and 2) how using different models in a single simulation will affect the overall visual quality by creating a range of distinct social behaviours. To assess these effects in terms of visual quality, this internship will draw from methodologies in Psychophysics to conduct perceptual experiments and user studies.

This internship therefore involves
• Integrating existing simulation models in a unified framework
• Exploring how the individual parameters of each simulation model affect variety in terms of global trajectories
• Exploring how using several different simulation models affect variety in terms of character behaviours
• Designing protocols to assess the effect of simulation models and parameters in terms of visual quality

Environment

The candidate will work in the joined Inria / IRISA research centre located in Rennes. Inria (www.inria.fr) and IRISA (http://www.irisa.fr/) are amongst the leading research centres in Computer Sciences in France. The work will be supervised by members of the MimeTIC team, internationally recognised in the fields of Computer Graphics and Virtual Human Simulation, as well as by members of the Lagadic team, internationally recognised in the fields of Robotics and Computer Vision.

Requirements for candidacy

- C/C++ recommended
- Strong background in mathematics
- Interest in User Evaluations

We are looking for motivated candidates, please send CV, motivation letter and any relevant material to: ludovic.hoyet@inria.fr and julien.pettre@inria.fr

Keywords and References

Crowd Simulation, Character Animation, Perception, User Experimentation

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Contacts

Advisors (please contact directly by email)

Ludovic Hoyet - ludovic.hoyet@inria.fr - http://people.rennes.inria.fr/Ludovic.Hoyet/

Julien Pettré - julien.pettre@inria.fr - http://people.rennes.inria.fr/Julien.Pettre/