A learning approach to example-based animation of virtual crowds

Stage Master Recherche

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Description:

The goal of this project is to enable the intuitive design of virtual crowd animations for the entertainment industry (3D films and games) or illustrative purposes (architecture design, project presentation). Virtual crowds are needed to populate the background of scenes in movies, or to create sequences with massive crowds such as sport or war scenes, as well as to create more lively content for video-games. All these applications require being able to design crowd animations which are both plausible and correspond to a controlled scenario: crowds can be dense or sparse, globally or locally moving or still, uniform or made of characters with very different individual behaviors, etc.

Controlling the visual aspect of a crowd animation is a difficult task. Traditionally, a crowd scene is generated by using a crowd simulator and tuning the simulation parameters. These parameters do not directly play on the visual aspect of the crowd, but on motion and local interactions between individuals. The generation process is an indirect one, since the global crowd animation emerges from all these local interactions.

The goal of this project is to explore methods that can generate a crowd animations while providing direct control on their visual aspect. The key idea is to start from a few crowd examples (e.g. tracking data), and to apply learning techniques in order to measure and reproduce the distribution of the spatiotemporal and kinematic variables which make a crowd visually specific. These variables are, for example:

- Global variables such as the spatial distribution of the crowd, local densities, and their fluctuations, main directions of motion, etc;
- Individual kinematic properties, such as speed profiles, path curvatures, etc:
- Interaction variables (interpersonal distances, relative positions and motions, etc);
- Social variables such as the proportion of groups among the crowd;
- And finally, their spatial relationship with the environment.

The learned distributions will then serve as targets at the crowd generation stage. This way, we give the designer the ability to synthesize crowds animations which visually resemble examples, or interpolate two of them, without the need to manually tune some simulation parameters. This avoids the time-consuming trial-error process designers usually have to go through in order to find a right set of parameters.

Note that thanks to the learning approach, enabling to learn not only speed distributions for characters but also their correlation with the spatial layout, the generated crowd animations will be able to adapt to new environments, with a different geometry and layout for obstacles.

This project is a joint project of the Inria research groups Lagadic and Imagine, respectively located in Rennes and in Grenoble. Lagadic has a very strong background in crowd animation techniques, while Imagine is focused on the design of intuitive tools for the creation of 3D content, such as 3D shapes and animations. The localization of the work will be in Rennes, in the Lagadic team.

Bibliography

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