Track A: Research

Agent-based crowd simulation with the MASSIS framework

Rafael Pax, Jorge Gómez Sánz, Juan Pavón

UCM-GRASIA

A relevant issue when implementing agent-based models for crowd simulation is scalability, due to the large number of agents that are moving in a common environment. Most of the approaches try to make simplifications, mainly by considering homogeneous agent behaviours, which are characterized by a rather limited number of parameters. In reality, although most of the people react in a similar way under certain situations, there are different types of behaviours, and it is important to consider several roles as well as what happens when some agents exhibit irregular behaviours. Also, some behaviours can be adapted by learning (e.g., with fire drills) or during the action by some driving actors (e.g., security officers). Modelling these scenarios can be done with agents but this usually implies a loss in performance because of the computation that complex behaviours models demand.

In our case we focus on indoor scenarios, where the number of agents may be large (thousands) but not very large as in a city (millions). The scale and structure of the indoor environments open the possibility to consider some algorithmic solutions that can cope with performance constraints, while keeping the ability to modelling of individual agents with heterogeneous behaviours. Taking these assumptions into account, an agent-based framework, MASSIS (Multi-agent System Simulation of Indoor Scenarios), has been developed to facilitate the simulation of crowds in indoor scenarios, looking for a tradeoff between performance and flexibility in the behaviour of the agents.

Agents are specified and managed individually, but the effects of the crowd are taken into account by several methods that take advantage of characteristics of the indoor domain in order to cope with the efficiency and scalability issues in the processing of their movements and their visualization. At the same time, some alternative reasoning mechanisms are provided for each agent in order to allow modelling of rich and heterogeneous behaviours. This is achieved by structuring agents in low level components (which take care of the perception of the agent and actions in the environment) and a high level controller. Low level behaviour comprises typical actions such as finding a path to some place, avoiding collisions, following other agents, etc. These require usually time consuming calculations and are very common in the simulation, so main effort has been dedicated to their optimization. High level behaviour is more open and allows to simulate a diversity of scenarios. Usually crowd modelling focus on emergency situations or others where all agents have the same goal (e.g., to safely exit the place), but we are looking for more diverse scenarios such as modelling visitors on a museum or in a mall, where agents have a variety of goals, so how to adapt an smart environment to avoid concentrations and maximazing the benefits for individual agents in satisfying their goals.

The presentation will show MASSIS in action with some scenarios, in order to explain how to model the agents and the environment. There is a tutorial on the framework at http://www.massisframework.com/.

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