A model of hierarchical cognitive map and human-like memory designed for reactive and planned navigation

72

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Abstract
In the behavioural animation field of research, the simulation of populated virtual cities requires that agents are able to navigate autonomously through their environment. It is of interest to tend to the most realistic human-like planning and navigation. In order to do so, we have designed a navigation system for autonomous agents, which implements theoretical views from the field of human behaviour in urban environments.

We started from the assumptions that it would be interesting to merge a spatial cognitive map model with a model of human memory, and that the representation of space in the cognitive map would be hierarchical. An interest of our approach is that the agent navigation can be seen as a planned and reactive navigation loop generated in real time. We use a semantically and geometrically informed hierarchical topological graph as a representation of a large environment to be navigated in. Our model of the cognitive map has a topological and hierarchical graph structure which partially maps the regions of the environment the agent has explored during the simulation. This map can be seen as a filter on the environment. It does not contain geometrical or semantic information about the urban objects encountered, but only controls the partial access to the database while the agent recalls or perceives the urban objects. As a simplified model of human memory, we use the recall and recognition attributes, and their respective thresholds of activation to parameterize the cognitive map in two different ways.

Keywords
cognitive maps, human memory, topological graphs

72.1

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