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MetroNet: A metropolitan simulation model based on commuting processes.

Kuipers, Fernando A. (ed.) et al., Self-organizing systems. 6th IFIP TC 6 international workshop, IWSOS 2012, Delft, The Netherlands, March 15–16, 2012. Proceedings. Berlin: Springer (ISBN 978-3-642-28582-0/pbk). Lecture Notes in Computer Science 7166, 96-103 (2012).

Summary: The aim of this work is to identify a set of fundamental rules that govern the interactions within urban systems at the metropolitan scale. For that, we developed an USM (Urban Simulation Model) specifically designed to study the evolution and dynamics of systems of cities. Our model is innovative in its structure: it is a superposition of cellular automata and agent based modeling approaches (that are essentially spatial analyses) and a complex network approach (that is essentially a topological analysis). This implies that in our model, the local activities and interaction of agents give rise to the global urban structure and network that in turn affects the agents' cognition, behavior, movement and action in the city and so on in circular causality. The model simulates commuting patterns of agents within a metropolis. The agents in our model represent workers who look for working places, the nodes represent urban employment centers, and the links represent commuters. Our results address three issues: the first suggests that the perception of urban boundaries plays a significant role in the metropolitan evolution in terms of network topology. This means that the existence of business centers, located in proximity to each other (but belonging to different municipalities) may lead to the emergence of new centers at the metropolis scale. The second issue concerns urban segregation; our results suggest that the location preferences of the agents regarding proximity to similar/different agents have a major affect not only on the urban morphology but also on the topology of the urban network. The third and last issue concerns the size distributions of agents in our model; these distributions correspond to all types of homogenous distributions observed in real system of cities.

Keywords: urban complexity; urban networks; agent based models; urban simulation models
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