

Agent-Based Modelling And Simulation For The Geospatial Network Model Of The Roman World

Wednesday, March 16, 2016 4:00 PM (20 minutes)

Computational models have large potential for enhancing our understanding of human-environment interaction as a factor in various social and historical phenomena [1]. One such an approach are agent-based models that provide useful model paradigm for human behavior [3]. When coupled with geospatial data, such models can be spatially explicit, and have variety of applications in computational social science [2].

The ORBIS project [4, 5] provides a geospatial network model of travel in the Roman Empire. It combines the road network with maritime transport model derived from historical data, and provides cost and time expense prediction for given routes. The time and cost prediction take into account various influential factors, such as seasonal changes, distinguishes coastal and open sea routes, and onshore means of transport. Currently the online interface enables the researchers to examine routes between given locations, analyze distance from one location to all others, and visualize the importance of paths connecting a given location to the rest of the network.

In our case, we use agents traveling between the cities of the Roman Empire on routes defined by the ORBIS transportation model. As the preferred routes can change depending on season and other external factors, advancing the model from current average estimates to probabilistic distributions derived from the simulation will provide with better understanding and robustness to subsequent analysis. The agent-based approach allows for such probabilistic simulations, and it is a direct extension of the current model.

In this paper we present a computational environment for agent-based modelling on the ORBIS geospatial transport model. We provide web-based interface to specify the agent-based model and visualize the results of the simulation. We also enable the user to specify the parameters of the transportation model to create and visualize a static network, with the possibility to download the network for further analysis. The functionality of the environment is demonstrated on a model of diffusion process on the transport network.

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Primary author: Mr FOUSEK, Jan (Faculty of Informatics, Masaryk University, Brno, Czech Republic)

Co-authors: MERTEL, Adam (Department of Geography, Faculty of Science, Masaryk University, Brno, Czech Republic); CHALUPA, Aleš (Department for Study of Religions, Faculty of Arts, Masaryk University, Brno, Czech Republic); Dr HLADKÁ, Eva (Faculty of Informatics, Masaryk University, Brno, Czech Republic); VÝTVAROVÁ, Eva (Faculty of Informatics, Masaryk University, Brno, Czech Republic)

Presenters: Dr HLADKÁ, Eva (Faculty of Informatics, Masaryk University, Brno, Czech Republic); VÝT-
VAROVÁ, Eva (Faculty of Informatics, Masaryk University, Brno, Czech Republic); Mr FOUSEK, Jan (Faculty of
Informatics, Masaryk University, Brno, Czech Republic)

Session Classification: Humanities, Arts, and Social Sciences Session II

Track Classification: Humanities, Arts, and Social Sciences (HASS) Applications