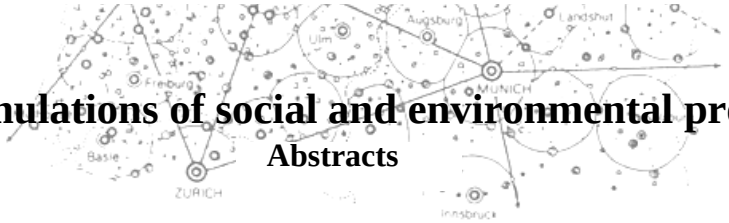
European Modeling Tour – 4th Session – Aix-en-Provence

Spatial Simulation for Social Sciences (S4)



Spatial simulations of social and environmental processes

Abstracts

Université de Provence / Centre Schuman
UFR des Sciences géographiques et de l'Aménagement
29 Avenue Robert Schuman
13621 Aix-en-Provence Cedex 1

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RESEARCH TOPIC: SETTLEMENT SYSTEMS and TRANSPORT

GENETIC ALGORITHMS APPLIED ZONING SYSTEM

FREDERIC AUDARD (UMR 6012 ESPACE)

Abstract:

We consider here a specific stage often neglected in geographical transport approaches to the subject. This stage called traffic generation consists in modelling the process of choice at the point origin of an individual journey. So far, the way that these questions have been treated using transport economy methods has obscured an important stage in the conception of traffic generation, the geographical stage. This stage relates to the zoning of the study area which constrains trip generation. We propose here to develop a specific method around genetic algorithms to answer this question.

SIMULATING MULTI-SCALE URBAN DYNAMICS WITH MULTI-SCALE MULTI-AGENTS MODEL

THOMAS LOUAIL (UMR 8504 GEOGRAPHIE-CITES)

Abstract:

The existing Simpop2 model is a simulation tool for exploring the future of cities and reconstructing their past dynamics. It allows the end-user to configure and launch simulations on various real cities systems (Europe, United States, South Africa). The model is multi-agent designed, which means the whole system behaviour and properties result from the multiple

interactions occurring among cities-agents, which constitute the core entity of the model. With the simpopNano model, we inject an intra-urban extension and a level of representation of urban systems to Simpop2. SimpopNano is itself a multi-agent model which simulates the evolution of localisation of urban functions in a particular type of city through time. Coupling the two models means that the inner-city activity causes a modification in the inputs of the inter-urban model which, in feedback, constrains by its outputs the dynamics occurring at the lower scale of the system. The result of this new development is a 3-scale-levels multi-agent simulation model dedicated to the study of urban systems. By integrating multi-scale dynamics in a single object, we have a well bounded frame to study questions like : "To what extent are the dynamics at a particular level independent from the influence of the others ?", "What look like the dynamics taking place at the frontier between levels ?", etc. Eventually, we shall discuss the relevance of the underlying generic market model used at both scales, by explaining why it's interesting for the computer scientist to build a somewhat "recursive" multi-scale simulation model.

MODELLING INTRA-REGIONAL DYNAMICS THROUGH BAYESIAN NETWORKS

GIOVANNI FUSCO (UMR 6012 ESPACE)

Abstract:

Producing explicative models for spatial dynamics at a regional level from real world data is a key issue in geography. This seminar illustrates how such a model can be produced using Bayesian Networks technique. Bayesian Networks are a relatively new and powerful tool of knowledge representation, manipulation and discovery, whose capabilities are just beginning to be applied in regional studies.
The study area is the coastal region of South-Eastern France, which has recently been marked by the emergence of two metropolitan systems around the main urban areas.
The Bayesian Network model is produced using a series of quantitative spatial indicators calculated at the municipal level. The indicators describe the sociodemographic dynamics within the last censuses. They also include geographical parameters produced through GIS applications and through modelling on transportation graphs. The information thus produced makes up a geographic database used to learn both the structure and the parameters of a Bayesian Network. The latter constitutes a model of the interaction between variables, capable of describing the process of metropolisation in the study area.
Opportunities for developing dynamic Bayesian Networks for regional modelling will be further discussed in the seminar.

A GEOCOMPUTED METHOD TO FIND THE MOST ROBUST CENTRAL LOCATION FOR A SET OF POINTS
Toward the concept of 'spatial robustness'

DIDIER JOSSELIN (UMR 6012 ESPACE)

Abstract:

Where is *the* central location representing a set of points? It depends, at least, on the several following parameters: (i) whether or not, and how the points are weighted (ii) if the center belongs or not to the set of points (iii) which parameter(s) the method aims to minimize, (iv) which norm is considered (v) what process is used to estimate the centre(vi) and, the most important question, related to all the others, what is the definition of a 'good' estimate of location? We propose in this paper to tackle these questions and we design a method to search the most robust central location for a set of points scattered in geographical space. A set of towns located in South of France is used to illustrate our research. The different towns are represented by geocoded points, weighted by their respective population.

Key words: centre, robustness, location, spatial robustness, bootstrap, L_p-norms, meAdian, geocomputation.

Friday, January 25, 2008

RESEARCH TOPIC: ENVIRONMENT

SPATIAL SIMULATION AND SATELLITE MONITORING IN RELATION WITH PUBLIC HEALTH (WEST NILE VIRUS, SOUTH OF FRANCE)

ALAIN SANDOZ*, ALAIN LEBLOND**

* Centre de recherche pour la conservation des zones humides méditerranéennes, Tour du Valat.
** Ecole Vétérinaire de Lyon.

Abstract:

Environment plays a major role in certain pandemics development. Studying some virus, as West Nile, allows us to measure how linked are environment and public health. The study we carried, has been done in South of France, area were West Nile virus occurred. This virus affects horse and sometimes man, to which it can also be lethal. In the USA, this virus caused death of several hundreds of people during the past years. Following its transmission chain, the West Nile is hosted by mosquitoes and birds. Abundance of mosquitoes and birds species, is heavily conditioned by flooded areas extent and their variations. The West Nile therefore seems to show a dynamic linked to environmental conditions and more specifically to submersion duration variations.
In this context, surface hydrology is a determinant variable. The knowledge of flooded areas and of their spatiotemporal dynamic could be formalised using an important cover of Spot 4 and 5 images acquired during one hydrological year (between 6 to 12 images per year). A spatial knowledge of surface hydrology dynamics could be generated. This knowledge, leash together with ecological models, allowed to better understand the virus dynamic and to derive risk zones maps.

DOWNSCALING AND EXTREME SEA LEVEL SIMULATION IN THE GULF OF LIONS

ALBIN ULLMANN, VINCENT MORON (UMR 6635 CEREGE)

Abstract:

The aim of this study is to present a methodology of statistical modelisation used in climatology. Sea surges in the Gulf of Lions are associated with atmopsheric forcings acting at different spatial and temporal scales: from local winds to barometric synoptic patterns. Global circulation models can't reproduce local atmospheric variability (i.e wind conditions). In the perspective of sea-surges frequency and intensity approximation in the 21st century, the idea of downscalling is to build a robust statistical model that relates sea surges in the Gulf of Lion with large-scale atmospheric forcings.

USING MULTI-AGENT PROGRAMMABLE ENVIRONMENT FOR MODELING BEACH BEHAVIOUR

CEDRIC BRUNEL**, JEAN-LUC BONNEFOY**, SAMUEL MEULE*
(* UMR 6635 CEREGE, **UMR 6012 ESPACE)

Abstract:

Shore and shoreline evolution both due to natural and human-induced causes or factors can be variable over a wide range of different temporal and/or spatial scales. Our capability to understand and especially predict this variability is still limited.
The mathematical models used to predict the behavior of beaches are usualy deterministic and fail to account for the uncertainty of storms or for the chaotic nature of the near-shore environment. The objective of this work is to test a new way of beach behaviour modeling by multi-agent programmable environment.

Key words: Shore and shoreline evolution, multi-agent programmable environment.

RESEARCH TOPIC: MICRO AND MACRO INTERACTIONS THROUGH ACTION

LEARNING AND BELIEF DISSEMINATION FOR AGENTS ACTING TOGETHER ON A COMMON RESOURCE

JULIETTE ROUCHIER (UMR 6579 GREQAM)

Abstract:

The paper presents results of simulations on belief dissemination in an universe where agents are situated on an environment. Contrary to most papers on belief dissemination, this environment has an impact on the interaction of agents and on their learning. In this society, one attribute of agents is their ability to be influenced: the way they follow others in their actions and copy their beliefs. This attribute is heterogeneous. We compare, tow global learning: when agents can perceive their environment or when they only see the result of their actions, which implies a different learning dynamics. Agents are paired randomly. If agents can perceive their environment to change their beliefs, the presence of a small group of agents

who are easy to influence can lead to very homogeneous beliefs, rather accurate regarding the reality of the environment.
When agents cannot perceive the environment but copy others' beliefs when they get influenced, then the reality of the environment is not so well perceived and a small group of agents who do not follow others can block the convergence of beliefs.
This result is interesting when one try to interpret collective action as interactions on a resource, with more or less ability to learn thanks to actions.

MODELING PANIC'S DYNAMIC: EXPLORING THE RELATIONSHIP BETWEEN AN AGENT-BASED MODEL AND A SYSTEM DYNAMICS MODEL

ERIC DAUDE (UMR 6228 IDEES)

Abstract:

This presentation explores two different models of panic's dynamic, one based on the micro level and one based on a macro level. These two models derive from the SIR's epidemic model (Susceptible --> Infected --> Removal). The system dynamics model is an aggregate model of the relationship between different group of population, diffusion of the panic depending both on the global interactions and on a transmission rate of the panic. In the agent model, interactions between individuals are mainly local and panic transmission is based on the intensity of panic in the neighbourhood.

CRASSOU: AN EDUCATIONAL MULTI-AGENT MODEL TO SIMULATE CLEANLINESS DYNAMICS IN A STREET OF MARSEILLE (FRANCE)

JEAN-LUC BONNEFOY (UMR 6012 ESPACE)

Abstract:

The CRASSOU model is an educational model to evaluate the reciprocal influences of various agents behaviours and representations on the cleanliness of the "Saint Féréol" street in Marseille (France). It's a well known street in the centre of the city, with much of stores and very animated during the week-end. The main idea of that model is to show a way for putting in interaction: pedestrians, fast food dealers, fatty papers and other garbage (receipts and packing, leaflets, cigarette ends, tin cans or plastic bottles,…), dustbins, street sweepers and police officers.
If the form of the street and position of dustbins are very important in the model, perceptions and representations of the different agents are acting a lot on the dynamics, just because actions of some agents (or kind of) can modify collective representation little by little. And so, perceptions of the agents modify themselves to be in keeping with new representations.