

Geosimulation

Automata-based modeling of urban phenomena

Itzhak Benenson

Paul M. Torrens



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Geosimulation Automata Based Modeling Of Urban Phenomena

Zoran Vojinovic, Michael B. Abbott



Geosimulation Automata Based Modeling Of Urban Phenomena:

Geosimulation Paul Torrens,2004 Geosimulation is hailed as the next big thing in geographic modelling for urban studies This book presents readers with an overview of this new and innovative field by introducing the spatial modelling environment and describing the latest research and development using cellular automata and multi agent systems Extensive case studies and working code is available from an associated website which demonstrate the technicalities of geosimulation and provide readers with the tools to carry out their own modelling and testing

Geosimulation Itzhak Benenson,Paul Torrens,2004-08-20 Geosimulation is hailed as the next big thing in geographic modelling for urban studies This book presents readers with an overview of this new and innovative field by introducing the spatial modelling environment and describing the latest research and development using cellular automata and multi agent systems Extensive case studies and working code is available from an associated website which demonstrate the technicalities of geosimulation and provide readers with the tools to carry out their own modelling and testing The first book to treat urban geosimulation explicitly integrating socio economic and environmental modelling approaches Provides the reader with a sound theoretical base in the science of geosimulation as well as applied material on the construction of geosimulation models Cross references to an author maintained associated website with downloadable working code for readers to apply the models presented in the book Visit the Author s Website for further information on Geosimulation Geographic Automata Systems and Geographic Automata Software <http://www.geosimulationbook.com>

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Geospatial Analysis and Modelling of Urban Structure and Dynamics Bin Jiang,Xiaobai Yao,2010-06-16 A Coming of Age Geospatial Analysis and Modelling in the Early Twenty First Century Forty years ago when spatial analysis first emerged as a distinct theme within geography s quantitative revolution the focus was largely on consistent methods for measuring spatial correlation The concept of spatial au correlation took pride of place mirroring concerns in time series analysis about similar kinds of dependence known to distort the standard probability theory used to derive appropriate statistics Early applications of spatial correlation tended to reflect geographical patterns expressed as points The perspective taken on such analytical thinking was founded on induction the search for pattern in data with a view to suggesting appropriate hypotheses which could subsequently be tested In parallel but using very different techniques came the development of a more deductive style of analysis based on modelling and thence simulation Here the focus was on translating prior theory into forms for generating testable predictions whose outcomes could be compared with observations about some system or phenomenon of interest In the intervening years spatial analysis has broadened to embrace both inductive and deductive approaches often combining both in different mixes for the variety of problems to which it is now applied

Urban Simulation Modeling Jakub Vorel,2015-01-01 This book Urban Simulation Modeling An Introduction and Experimental Applications in the Czech Republic provides readers with a review of basic urban simulation modeling methodology and discusses the constraints and

potentials of its application in the Czech Republic The first part of the book elaborates on eleven distinct urban simulation models with the aim of illustrating the basic theoretical and methodological approaches to urban simulation modeling The analysis of the models focuses on the way the models represent essential urban entities and processes with the primary objective to make the assumptions on which the models are based more explicit Special emphasis is placed on the behavioral content of the models The first part concludes with a discussion of the potential use of the models for policy analysis In the second part of the book several experimental simulation models illustrate the potentials and limits of the micro simulation modeling of the most essential urban processes and provide methodological and technical guidance for their development and implementation in the Czech Republic

Agent-Based Models of Geographical Systems Alison J. Heppenstall, Andrew T. Crooks, Linda M. See, Michael Batty, 2011-11-24 This unique book brings together a comprehensive set of papers on the background theory technical issues and applications of agent based modelling ABM within geographical systems This collection of papers is an invaluable reference point for the experienced agent based modeller as well those new to the area Specific geographical issues such as handling scale and space are dealt with as well as practical advice from leading experts about designing and creating ABMs handling complexity visualising and validating model outputs With contributions from many of the world s leading research institutions the latest applied research micro and macro applications from around the globe exemplify what can be achieved in geographical context This book is relevant to researchers postgraduate and advanced undergraduate students and professionals in the areas of quantitative geography spatial analysis spatial modelling social simulation modelling and geographical information sciences

Complexity and Planning Gert de Roo, Jean Hillier, 2016-05-23 Complexity complex systems and complexity theories are becoming increasingly important within a variety disciplines While these issues are less well known within the discipline of spatial planning there has been a recent growing awareness and interest As planners grapple with how to consider the vagaries of the real world when putting together proposals for future development they question how complexity complex systems and complexity theories might prove useful with regard to spatial planning and the physical environment This book provides a readable overview presenting and relating a range of understandings and characteristics of complexity and complex systems as they are relevant to planning It recognizes multiple relational approaches of dynamic complexity which enhance understandings of and facilitate working with contingencies of place time and the various participants behaviours In doing so it should contribute to a better understanding of processes with regard to our physical and social worlds

Spatial Information Theory Anthony G. Cohn, 2005-09 This book constitutes the refereed proceedings of the International Conference on Spatial Information Theory COSIT 2005 held in Elliottville NY USA in September 2005 The 30 revised full papers presented were carefully reviewed and selected from 82 submissions The papers are organized in topical sections on vagueness uncertainty and gradation paths and routes ontologies and semantics ontologies and spatial relations spatial reasoning cognitive maps and spatial reasoning time

change and dynamics landmarks and navigation geographic information and spatial behaviour Agent-based Modeling and Simulation in Archaeology Gabriel Wurzer, Kerstin Kowarik, Hans Reschreiter, 2014-11-08 Archaeology has been historically reluctant to embrace the subject of agent based simulation since it was seen as being used to re enact and visualize possible scenarios for a wider generally non scientific audience based on scarce and fuzzy data Furthermore modeling in exact terms and programming as a means for producing agent based simulations were simply beyond the field of the social sciences This situation has changed quite drastically with the advent of the internet age Data it seems is now ubiquitous Researchers have switched from simply collecting data to filtering selecting and deriving insights in a cybernetic manner Agent based simulation is one of the tools used to glean information from highly complex excavation sites according to formalized models capturing essential properties in a highly abstract and yet spatial manner As such the goal of this book is to present an overview of techniques used and work conducted in that field drawing on the experience of practitioners *Monitoring, Simulation, and Management of Visitor Landscapes* Howard Randal Gimblett, Hans Skov-Peterson, 2008 Conventional methods used in the planning and management of human landscape interactions fall far short of the needs of today s land management professionals *Monitoring Simulation and Management of Visitor Landscapes* presents a growing body of applied research that provides decision makers with tools to maintain the ecological integrity of public places by evaluating the impacts of humans in various landscapes across space and time This will help land managers and policy makers construct strategies for evaluating interactions between humans and the environment and expand the model of land management to include social and geographic as well as environmental factors Jacket **GeoComputation, Second Edition** Robert J. Abrahart, Linda M. See, 2014-06-23 A revision of Openshaw and Abrahart s seminal work *GeoComputation Second Edition* retains influences of its originators while also providing updated state of the art information on changes in the computational environment In keeping with the field s development this new edition takes a broader view and provides comprehensive coverage across the field of GeoComputation See What s New in the Second Edition Coverage of ubiquitous computing the GeoWeb reproducible research open access and agent based modelling Expanded chapter on Genetic Programming and a separate chapter developed on Evolutionary Algorithms Ten chapters updated by the same or new authors and eight new chapters added to reflect state of the art Each chapter is a stand alone entity that covers a particular topic You can simply dip in and out or read it from cover to cover The opening chapter by Stan Openshaw has been preserved with only a limited number of minor essential modifications having been enacted This is not just a matter of respect Openshaw s work is eloquent prophetic and his overall message remains largely unchanged In contrast to other books on this subject *GeoComputation Second Edition* supplies a state of the art review of all major areas in GeoComputation with chapters written especially for this book by invited specialists This approach helps develop and expand a computational culture one that can exploit the ever increasing richness of modern geographical and geospatial datasets It also supplies an instructional

guide to be kept within easy reach for regular access and when need arises

Innovations in Urban and Regional Systems Jean-Claude Thill, 2020-05-11 This book presents cutting edge research on urban and regional systems applying modern spatial analytical techniques of Geographic Information Science Technologies GIS T spatial statistics and location modeling The contributions written by leading scholars from around the globe adopt a spatially explicit analytical perspective and highlight methodological innovations and substantive breakthroughs on many facets of the socioeconomic and environmental reality of urban and regional contexts The book is divided into three parts The first part offers an introduction to the research field while the second part discusses critical issues in urban growth and urban management presenting case studies on city and urban environments their growth data infrastructures and spatial and management issues The third part then broadens the analysis to the regional scale addressing growth convergence and adaptation to new economic and information based realities This book appeals to scholars of spatial and regional sciences as well as to policy decision makers interested in advanced methods of spatial analysis location modeling and GIS T

Flood Risk and Social Justice Zoran Vojinovic, Michael B. Abbott, 2012-03-05 Flood Risk and Social Justice is a response to the rising significance of floods and flood related disasters worldwide as an initiative to promote a socially just approach to the problems of flood risk It integrates the human social and the technological components to provide a holistic view This book treats flooding as a multi dimensional human and natural world tragedy that must be accommodated using all the social and technological means that can be mobilised before during and after the flooding event It covers socially just flood risk mitigation practices which necessitate a wide range of multidisciplinary approaches starting from social and wider environmental needs including feedback cycles between human needs and technological means Flood Risk and Social Justice looks at how to judge whether a risk is acceptable or not by addressing an understanding of social and phenomenological considerations rather than simple calculations of probabilities multiplied by unwanted outcomes and their balancing between costs and benefits It is argued that the present flood management practice should be largely replaced by the social justice approach where particular attention is given to deciding what is the right thing to do within a much wider context Thus it insists upon the validity of modes of human understanding which cannot be addressed within the limited context of modern science Flood Risk and Social Justice is written to support a wide range of audiences and seeks to improve the dialogue between researchers and practitioners from different disciplines including post graduate engineering environmental and social science students industry practitioners academics planners environmental advocacy groups and environmental law professionals who have a strong interest in a new kind of social justice work that can act as a continuous counter balance to the various mechanisms that unceasingly give rise to profound injustices More information about this book can be found in this article written for the WaterWiki by the author <http://www.iwawaterwiki.org/xwiki/bin/view/Articles/FloodRiskandSocialJustice> Authors Zoran Vojinovic is Associate Professor at the UNESCO IHE Institute for Water Education Delft the Netherlands with almost 20

years of consulting and research experience in various aspects of water industry in New Zealand Australia Asia Europe Central South America and the Caribbean Michael B Abbott is Emeritus Professor at the UNESCO IHE Institute for Water Education Delft the Netherlands and a Director of the European Institute for Industrial Leadership in Brussels He founded and developed the disciplines of Computational Hydraulics and Hydroinformatics and co founded the Journal of

Hydroinformatics with Professor Roger Falconer **Planning within Complex Urban Systems** Shih-Kung Lai, 2020-12-17

Imagine living in a city where people could move freely and buildings could be replaced at minimal cost Reality cannot be further from such Despite this imperfect world in which we live urban planning has become integral and critical especially in the face of rapid urbanization in many developing and developed countries This book introduces the axiomatic experimental approach to urban planning and addresses the criticism of the lack of a theoretical foundation in urban planning With the rise of the complexity movement the book is timely in its depiction of cities as complex systems and explains why planning from within is useful in the face of urban complexity It also includes policy implications for the Chinese cities in the context of axiomatic experimental planning theory Complexity Theories of Cities Have Come of Age Juval Portugali, Han

Meyer, Egbert Stolk, Ekim Tan, 2012-02-04 Today our cities are an embodiment of the complex historical evolution of knowledge desires and technology Our planned and designed activities co evolve with our aspirations mediated by the existing technologies and social structures The city represents the accretion and accumulation of successive layers of collective activity structuring and being structured by other increasingly distant cities reaching now right around the globe This historical and structural development cannot therefore be understood or captured by any set of fixed quantitative relations Structural changes imply that the patterns of growth and their underlying reasons change over time and therefore that any attempt to control the morphology of cities and their patterns of flow by means of planning and design must be dynamical based on the mechanisms that drive the changes occurring at a given moment This carefully edited post proceedings volume gathers a snapshot view by leading researchers in field of current complexity theories of cities In it the achievements criticisms and potentials yet to be realized are reviewed and the implications to planning and urban design are assessed

Self-Organizing Systems Fernando A. Kuipers, Poul E. Heegaard, 2012-03-12 This book constitutes the refereed proceedings of the 6th IFIP TC 6 International Workshop on Self Organizing Systems IWSOS 2012 held in Delft The Netherlands in March 2012 The 5 revised full papers and 5 short papers presented together with 2 invited papers were carefully selected from 25 full paper and 8 short paper submissions The papers address the following key topics design and analysis of self organizing and self managing systems inspiring models of self organization in nature and society structure characteristics and dynamics of self organizing networks techniques and tools for modeling self organizing systems robustness and adaptation in self organizing systems self organization in complex networks like peer to peer sensor ad hoc vehicular and social networks control of self organizing systems decentralized power management in the smart grid self

organizing group and pattern formation self organizing mechanisms for task allocation coordination and resource allocation self organizing information dissemination and content search and risks and limits of self organization

Theories and Models of Urbanization Denise Pumain, 2020-01-02 This book provides a thorough discussion about fundamental questions regarding urban theories and modeling It is a curated collection of contributions to a workshop held in Paris on October 12th and 13th 2017 at the Institute of Complex Systems by the team of ERC GeoDiverCity There are several chapters conveying the answers given by single authors to problems of conceptualization and modeling and others in which scholars reply to their conception and question them Even the chapters transcribing keynote presentations were rewritten according to contributions from the respective discussions The result is a complete state of the art of what is our knowledge about urban processes and their possible formalization

Modelling Environmental Dynamics Martin Paegelow, María Teresa Camacho Olmedo, 2008-07-16 Modelling environmental dynamics is critical to understanding and predicting the evolution of the environment in response to the large number of influences including urbanisation climate change and deforestation Simulation and modelling provide support for decision making in environmental management The first chapter introduces terminology and provides an overview of methodological modelling approaches which may be applied to environmental and complex dynamics Based on this introduction this book illustrates various models applied to a large variety of themes deforestation in tropical regions fire risk natural reforestation in European mountains agriculture biodiversity urbanism climate change and land management for decision support etc These case studies provided by a large international spectrum of researchers and presented in a uniform structure focus particularly on methods and model validation so that this book is not only aimed at researchers and graduates but also at professionals

Flood Risk Zoran Vojinovic, 2015-03-15 According to the International Disaster Database EM DAT over the last seventy years floods have shown the fastest rate of increase relative to any other type of disasters Devastation due to these events occurs almost daily Even though our technological capabilities for dealing with floods have advanced rapidly over the same period and while global economic growth per capita has doubled flood events have become ever more disastrous Does this mean that our technological developments have advanced independently from the social and wider ecological needs Flood Risk The Holistic Perspective is a direct response to this question and it argues that this paradoxical situation is a result from our narrow and fragmented perception of reality which has been characteristic of our academic disciplines and government agencies It suggests that the way forward can be found only if we broaden our view and learn how the natural or social phenomena can provoke a response in a society or a social group which in turn can trigger the technical developments and so on again and again in what has the potential to become a network of interactions and relationships through positive feedback or coevolving cycles The holistic perspective however may raise the following question If everything is connected to everything else how can we ever hope to understand anything Our response draws from the understandings brought by complexity theory where individual elements coevolve

together both in development and application This recognition opens a new analysis which goes beyond the direct objects or actors of concern risk forecasting early warning land use planning technology and systems for example and into the relationships between them The book suggests that our initial response to this and many other challenges is to change our perception from a disciplinary and defensive one to a progressive or transcendental and transdisciplinary i e the one that turns challenges into the possibilities that can re shape our future The book is structured in eight chapters Chapter 1 provides exposure to the complexity of flood related issues and illustrates diversity of multiple points of view Chapter 2 elaborates on the history of holistic thinking with connection to the flood resilience process Chapter 3 discusses the holistic risk governance approach which progresses beyond the integrated urban flood management Chapter 4 describes the Green Cities Initiative an initiative which is essentially holistic in its nature as it aims to improve transport energy efficiency industrial metabolism including water supply and distribution as well as drainage and sewerage services through the holistic lens of interactions between different sectors Chapter 5 discusses various risk assessment practices and it concludes that any practice that omits social ethical and wider ecological points of view will be severely restricted in its scope and its reach Chapter 6 describes the root causes of floods in the Pasig Marikina River Basin in Metro Manila Philippines Chapter 7 reflects upon the key issues and challenges from 2011 Thailand floods Finally Chapter 8 presents some of the key aspects concerning urban stormwater management practice in Beijing China

Artificial Crime Analysis Systems: Using Computer Simulations and Geographic Information Systems Liu, Lin, Eck, John, 2008-01-31 In the last decade there has been a phenomenal growth in interest in crime pattern analysis Geographic information systems are now widely used in urban police agencies throughout industrial nations With this scholarly interest in understanding crime patterns has grown considerably Artificial Crime Analysis Systems Using Computer Simulations and Geographic Information Systems discusses leading research on the use of computer simulation of crime patterns to reveal hidden processes of urban crimes taking an interdisciplinary approach by combining criminology computer simulation and geographic information systems into one comprehensive resource

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