

Integrating Geographic Information Systems and Agent-based Modeling Techniques for Simulating Social and Ecological Processes

Edited by
H. Randy Gimblett



A VOLUME IN THE
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Integrating Geographic Information Systems And Agent Based Modeling Techniques For Simulating Social And Ecological Processes

Leopold M. Stoneham



Integrating Geographic Information Systems And Agent Based Modeling Techniques For Simulating Social And Ecological Processes:

Integrating Geographic Information Systems and Agent-based Modeling Techniques for Simulating Social and Ecological Processes H. Randy Gimblett, 2002 For those addressing ecological and natural resource management problems this volume presents a set of coherent cross referenced perspectives on incorporating the spatial representation and analytical power of GIS with agent based modeling of evolutionary and non linear processes and phenomena Many recent advances in software algorithms for incorporating geographic data in modeling social and ecological behaviors and also the success in applying such algorithms have not been adequately represented in the present literature This book fills that gap and provides much needed information on applications for the research community as well as those in the management of natural resources

Agent-Based Modelling and Geographical Information Systems Andrew Crooks, Nicolas Malleon, Ed Manley, Alison Heppenstall, 2018-12-13 This is the era of Big Data and computational social science It is an era that requires tools which can do more than visualise data but also model the complex relation between data and human action and interaction Agent Based Models ABM computational models which simulate human action and interaction do just that This textbook explains how to design and build ABM and how to link the models to Geographical Information Systems It guides you from the basics through to constructing more complex models which work with data and human behaviour in a spatial context All of the fundamental concepts are explained and related to practical examples to facilitate learning with models developed in NetLogo with all code examples available on the accompanying website You will be able to use these models to develop your own applications and link where appropriate to Geographical Information Systems All of the key ideas and methods are explained in detail geographical modelling an introduction to ABM the fundamentals of Geographical Information Science why ABM and GIS using QGIS designing and building an ABM calibration and validation modelling human behavior An applied primer that provides fundamental knowledge and practical skills it will provide you with the skills to build and run your own models and to begin your own research projects

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 **GeoDynamics** Peter Atkinson, Giles M. Foody, Steven E. Darby, Fulong Wu, 2004-12-16 While remote sensing gives a surface depiction of the world its recent convergence with GIS enables richer depictions that can be used to simulate physical processes identify trends and make more accurate predictions GeoDynamics is based on specialized lectures from an international field of experts addressing remote sensing spatially **Advances in Sociology Research** Leopold M. Stoneham, 2004 Presents original research results on the leading edge of sociology Each chapter has been carefully selected in an attempt to present substantial advances across a broad spectrum **Conserving Biodiversity in Agricultural Landscapes** Robert K. Swihart, Jeffrey E. Moore, 2004 Habitat loss and fragmentation arguably pose the greatest threats to biological diversity Agriculture is a dominant land use that along with urban sprawl and residential development can reduce the amount and connectedness of natural areas required by many native species Unfortunately progress has been slow in integrating nature and biodiversity protection into community planning in intensively farmed regions especially in America's heartland Seldom do issues related to species conservation receive consideration during local planning activities Lack of progress stems partly from scientific inadequacies in understanding the dynamics of complex landscapes and from a lack of engagement of non scientific stakeholders by scientists and modelers The result of these shortcomings is a critical disconnect of conservation issues from the planning infrastructure This book provides a blueprint for advancing conceptual understanding of conservation in agricultural regions It accomplishes this with a two pronged approach first by developing spatially structured models that acknowledge the link between socio economic drivers of land use change and the dynamics of species occupying agricultural landscapes with abrupt changes in land cover i.e sharp edges and second by providing guidelines and examples to enable scientists to effectively engage stakeholders in participatory learning and planning activities that integrate biodiversity with other more traditional considerations The structure of the book is truly interdisciplinary linking the efforts of ecologists economists statisticians mathematicians and land use specialists **Complex Artificial Environments** Juval Portugali, 2006-01-09 This book explores the possibilities of applying the theories of complexity and self organization developed to account for various phenomena in the natural science to artifacts traditionally the realm of humanities and social sciences The emphasis of this volume is on the development of cities and the impact of these methods on urban simulation methods **Companion Modeling and Multi-agent Systems for Integrated Natural Resource Management in Asia** François Bousquet, 2005 **Advances in Fuzzy Object-oriented Databases** Zongmin Ma, 2005-01-01 Collecting the latest results from leading researchers in the field this volume provides a single source on major aspects of fuzzy object oriented database modeling conceptual logical and physical as well as details of implementations and applications **Frontiers of Engineering** National Academy of Engineering, 2007-03-08 This volume includes 15 papers from the National Academy of Engineering's 2006 U S Frontiers of Engineering USFOE Symposium held

in September 2006 USFOE meetings bring together 100 outstanding engineers ages 30 to 45 to exchange information about leading edge technologies in a range of engineering fields The 2006 symposium covered four topic areas intelligent software systems and machines the nano bio interface engineering personal mobility for the 21st century and supply chain management A paper by dinner speaker Dr W Dale Compton Lillian M Gilbreth Distinguished Professor of Industrial Engineering Emeritus is also included The papers describe leading edge research on commercializing auditory neuroscience future developments in bionanotechnology sustainable urban transportation and managing disruptions to supply chains among other topics Appendixes include information about contributors the symposium program and a list of meeting participants This is the twelfth volume in the USFOE series

Agent-Based Computational Economics Shu-Heng Chen, 2017-09-19 This book aims to answer two questions that are fundamental to the study of agent based economic models what is agent based computational economics and why do we need agent based economic modelling of economy This book provides a review of the development of agent based computational economics ACE from a perspective on how artificial economic agents are designed under the influences of complex sciences experimental economics artificial intelligence evolutionary biology psychology anthropology and neuroscience This book begins with a historical review of ACE by tracing its origins From a modelling viewpoint ACE brings truly decentralized procedures into market analysis from a single market to the whole economy This book also reviews how experimental economics and artificial intelligence have shaped the development of ACE For the former the book discusses how ACE models can be used to analyse the economic consequences of cognitive capacity personality and cultural inheritance For the latter the book covers the various tools used to construct artificial adaptive agents including reinforcement learning fuzzy decision rules neural networks and evolutionary computation This book will be of interest to graduate students researching computational economics experimental economics behavioural economics and research methodology

Simulating Social Complexity Bruce Edmonds, Ruth Meyer, 2017-11-24 This volume examines all aspects of using agent or individual based simulation This approach represents systems as individual elements having their own set of differing states and internal processes The interactions between elements in the simulation represent interactions in the target systems What makes this social is that it can represent an observed society Social systems include all those systems where the components have individual agency but also interact with each other This includes human societies and groups but also increasingly socio technical systems where the internet based devices form the substrate for interaction These systems are central to our lives but are among the most complex known This poses particular problems for those who wish to understand them The complexity often makes analytic approaches infeasible but on the other hand natural language approaches are also inadequate for relating intricate cause and effect This is why individual and agent based computational approaches hold out the possibility of new and deeper understanding of such systems This handbook marks the maturation of this new field It brings together summaries of the best thinking and practices in this area from

leading researchers in the field and constitutes a reference point for standards against which future methodological advances can be judged This second edition adds new chapters on different modelling purposes and applying software engineering methods to simulation development Revised existing content will keep the book up to date with recent developments This volume will help those new to the field avoid reinventing the wheel each time and give them a solid and wide grounding in the essential issues It will also help those already in the field by providing accessible overviews of current thought The material is divided into four sections Introduction Methodology Mechanisms and Applications Each chapter starts with a very brief section called Why read this chapter followed by an abstract which summarizes the content of the chapter Each chapter also ends with a section on Further Reading Whilst sometimes covering technical aspects this second edition of Simulating Social Complexity is designed to be accessible to a wide range of researchers including both those from the social sciences as well as those with a more formal background It will be of use as a standard reference text in the field and also be suitable for graduate level courses

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 **Environmental Modelling, Software and Decision Support** Anthony J. Jakeman, Alexey A. Voinov, Andrea E. Rizzoli, Serena H. Chen, 2008-09-11 The complex and multidisciplinary nature of environmental problems requires that they are dealt with in an integrated manner Modeling and software have become key instruments used to promote sustainability and improve environmental decision processes especially through systematic integration of various knowledge and data and their ability to foster learning and help make predictions This book presents the current state of the art in environmental modeling and software and identifies the future challenges in the field State of the art in environmental modeling and software theory and practice for integrated assessment and management serves as a starting point for researchers Identifies the areas of research and practice required for advancing the requisite knowledge base and tools and their wider usage Best practices of environmental modeling enables the reader to select appropriate software and gives the reader tools to integrate natural system dynamics with human dimensions

Spatial Decision Support Systems Ramanathan Sugumaran, John Degroote, 2010-11-15 Although interest in Spatial Decision Support Systems SDSS continues to grow rapidly in a wide range of disciplines students planners managers and the research community have lacked a book that covers the fundamentals of SDSS along with the advanced design concepts required for building SDSS Filling this need Spatial Decision Support System

The Oxford Handbook of Land Economics Joshua M. Duke, JunJie Wu, 2014-05 Land use change is one of the most pervasive socioeconomic forces affecting ecological systems economic systems and human wellbeing This Oxford Handbook draws on recent advances in several economic fields that investigate land use behavior making this a must read for those who want to understand the frontier of land economics

Epistemological Aspects of Computer Simulation in the Social Sciences Flaminio Squazzoni, 2009-04-21 This volume collects the revised versions of the invited and selected papers that were presented at the Second EPOS Epistemological Perspectives on Simulation Workshop held in Brescia Italy in October 2006 EPOS is a bi annual cross disciplinary workshop on simulation originally established by Ulrich Frank and Klaus G Troitzsch with a first edition held in Koblenz in July 2004 EPOS aims to provide a forum for scholars from various disciplines such as the social sciences computer sciences engineering and natural sciences who are interested in discussing epistemological aspects of computer simulation across disciplinary boundaries The common belief behind the workshop is the recognition that the time has come to seriously reflect on epistemological and methodological preconditions processes and consequences of simulation as a research tool During the first edition in Koblenz 2004 a number of interesting topics were carefully addressed the link between theory and simulation models the empirical validation of agent based models in the natural and the social sciences the relation between models and truth as well as the role of stylized facts in evidence based models A good cross disciplinary atmosphere permeated the workshop making possible the exchange of knowledge and ideas beyond any disciplinary boundary The first EPOS proceedings were edited by Ulrich Frank and Klaus G Troitzsch and published in the Journal of Artificial Societies and Social Simulation Vol 8 No 4 2005

The Modeling Process in Geography Yves Guermond, 2013-03-01 This title focuses on the evolution of the modeling process and on new research perspectives in theoretical and applied geography as well as spatial planning In the last 50 years the achievements of spatial analysis models opened the way to a new understanding of the relationship between society and geographical space In this book these models are confronted by the real conditions of territorial prospect regional dynamism cultural policy HMO and spatial segregation This confrontation takes into account the instability of social behavior and the permanence of partial determinist trajectories

Geospatial Analysis Dr Michael J de Smith, Professor Michael F Goodchild, Professor Paul A Longley, 2018 Geospatial Analysis A Comprehensive Guide to Principles Techniques and Software Tools originated as material to accompany the spatial analysis module of MSc programmes at University College London delivered by the principal author Dr Mike de Smith The project was discussed with Professors Longley and Goodchild They kindly agreed to contribute to the contents of the Guide itself As such this Guide may be seen as a companion to the pioneering book on Geographic Information Systems and Science now changed to Science and Systems by Longley Goodchild Maguire and Rhind particularly the chapters that deal with spatial analysis and modeling Their participation has also facilitated links with broader spatial literacy and spatial analysis programmes Notable amongst these are the GIS T Body of Knowledge materials provided by the

Association of American Geographers together with the spatial educational programmes provided through UCL and UCSB. The formats in which this Guide has been published have proved to be extremely popular, encouraging us to seek to improve and extend the material and associated resources further. Many academics and industry professionals have provided helpful comments on previous editions and universities in several parts of the world have now developed courses which make use of the Guide and the accompanying resources. Workshops based on these materials have been run in Ireland, the USA, East Africa, Italy and Japan, and a Chinese version of the Guide 2nd ed. has been published by the Publishing House of Electronics Industry, Beijing, PRC (www.phei.com.cn) in 2009. A Chinese version of this 6th edition is due to be published in 2021 by Science Press.

Handbook of Applied System Science Zachary P. Neal, 2016-11-25. The Handbook of Applied System Science is organized around both methodological approaches in systems science and the substantive topic to which these approaches have been applied. The volume begins with an essay that introduces three system science methods: agent-based modeling, system dynamics, and network analysis. The remainder of the volume is organized around three broad topics: 1. health and human development, 2. environment and sustainability, and 3. communities and social change. Each part begins with a brief introductory essay and includes nine chapters that demonstrate the application of system science methods to address research questions in these areas. This handbook will be useful for work in Public Health, Sociology, Criminal Justice, Social Work, Political Science, Environmental Studies, Urban Studies, and Psychology.

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