



George A. Bekey



Autonomous Robots

From Biological
Inspiration
to Implementation
and Control



Autonomous Robots From Biological Inspiration To Implementation And Control Intelligent Robotics And Autonomous Agents Series

Ronald C. Arkin



Autonomous Robots From Biological Inspiration To Implementation And Control Intelligent Robotics And Autonomous Agents Series:

Autonomous Robots George A. Bekey, 2005 An introduction to the science and practice of autonomous robots that reviews over 300 current systems and examines the underlying technology

Autonomous Robots George A. Bekey, 2005-05-20 An introduction to the science and practice of autonomous robots that reviews over 300 current systems and examines the underlying technology Autonomous robots are intelligent machines capable of performing tasks in the world by themselves without explicit human control Examples range from autonomous helicopters to Roomba the robot vacuum cleaner In this book George Bekey offers an introduction to the science and practice of autonomous robots that can be used both in the classroom and as a reference for industry professionals He surveys the hardware implementations of more than 300 current systems reviews some of their application areas and examines the underlying technology including control architectures learning manipulation grasping navigation and mapping Living systems can be considered the prototypes of autonomous systems and Bekey explores the biological inspiration that forms the basis of many recent developments in robotics He also discusses robot control issues and the design of control architectures After an overview of the field that introduces some of its fundamental concepts the book presents background material on hardware control from both biological and engineering perspectives software architecture and robot intelligence It then examines a broad range of implementations and applications including locomotion wheeled legged flying swimming and crawling robots manipulation both arms and hands localization navigation and mapping The many case studies and specific applications include robots built for research industry and the military among them underwater robotic vehicles walking machines with four six and eight legs and the famous humanoid robots Cog Kismet ASIMO and QRIO The book concludes with reflections on the future of robotics the potential benefits as well as the possible dangers that may arise from large numbers of increasingly intelligent and autonomous robots

Proceedings of the 10th National Technical Seminar on Underwater System Technology 2018 Zainah Md Zain, Hamzah Ahmad, Dwi Pebrianti, Mahfuzah Mustafa, Nor Rul Hasma Abdullah, Rosdiyana Samad, Maziya Mat Noh, 2019-02-08 This book presents cutting edge research papers in the field of Underwater System Technology in Malaysia and Asia in general The topics covered include intelligent robotics novel sensor technologies control algorithms acoustic signal processing imaging techniques biomimetic robots green energy sources and underwater communication backbones and protocols The book showcases some of the latest technologies and applications developed to facilitate local marine exploration and exploitation It also addresses related topics concerning the Sustainable Development Goals SDG outlined by the United Nations

Autonomous Bidding Agents Michael P. Wellman, Amy Greenwald, Peter Stone, 2007 E commerce increasingly provides opportunities for autonomous bidding agents computer programs that bid in electronic markets without direct human intervention Automated bidding strategies for an auction of a single good with a known valuation are fairly

straightforward designing strategies for simultaneous auctions with interdependent valuations is a more complex undertaking This book presents algorithmic advances and strategy ideas within an integrated bidding agent architecture that have emerged from recent work in this fast growing area of research in academia and industry The authors analyze several novel bidding approaches that developed from the Trading Agent Competition TAC held annually since 2000 The benchmark challenge for competing agents to buy and sell multiple goods with interdependent valuations in simultaneous auctions of different types encourages competitors to apply innovative techniques to a common task The book traces the evolution of TAC and follows selected agents from conception through several competitions presenting and analyzing detailed algorithms developed for autonomous bidding Autonomous Bidding Agents provides the first integrated treatment of methods in this rapidly developing domain of AI The authors who introduced TAC and created some of its most successful agents offer both an overview of current research and new results Michael P Wellman is Professor of Computer Science and Engineering and member of the Artificial Intelligence Laboratory at the University of Michigan Ann Arbor Amy Greenwald is Assistant Professor of Computer Science at Brown University Peter Stone is Assistant Professor of Computer Sciences Alfred P Sloan Research Fellow and Director of the Learning Agents Group at the University of Texas Austin He is the recipient of the International Joint Conference on Artificial Intelligence IJCAI 2007 Computers and Thought Award

Machine Learning Techniques for Smart City Applications: Trends and Solutions D. Jude Hemanth, 2022-09-19 This book discusses the application of different machine learning techniques to the sub concepts of smart cities such as smart energy transportation waste management health infrastructure etc The focus of this book is to come up with innovative solutions in the above mentioned issues with the purpose of alleviating the pressing needs of human society This book includes content with practical examples which are easy to understand for readers It also covers a multi disciplinary field and consequently it benefits a wide readership including academics researchers and practitioners

Soft Robotics Cecilia Laschi, 2025-09-02 A comprehensive cutting edge treatment of soft robotics that brings conceptual structure to this fast moving field Soft robotics is quickly transforming corners of our world but as yet there has been no comprehensive treatment of the young field Filling this gap Soft Robotics offers a systematic approach to learning the subject s essential ideas methods and techniques Cecilia Laschi takes a holistic view that integrates interdisciplinary material and provides a conceptual structure that can withstand the discipline s fast paced evolution Laschi first presents robotics basics and the commonly used bioinspired methods before covering materials and technologies for actuation and sensing modeling internal and external interactions and soft robot control with model based and learning based approaches Written by a pioneer of the field and honed by classroom experience this timely textbook is an essential roadmap for anyone studying soft robotics Comprehensive structured coverage of soft robotics from fundamentals to advanced techniques Pragmatic modular structure adapts to different curricula Suitable for advanced undergraduates graduate students and professionals Instructor resources include slides

videos and exercises **Social Computing** Wanxiang Che, Qilong Han, Hongzhi Wang, Weipeng Jing, Shaoliang Peng, Junyu Lin, Guanglu Sun, Xianhua Song, Hongtao Song, Zeguang Lu, 2016-07-30 This two volume set CCIS 623 and 634 constitutes the refereed proceedings of the Second International Conference of Young Computer Scientists Engineers and Educators ICYCSEE 2016 held in Harbin China in August 2016 The 91 revised full papers presented were carefully reviewed and selected from 338 submissions The papers are organized in topical sections on Research Track Part I and Education Track Industry Track and Demo Track Part II and cover a wide range of topics related to social computing social media social network analysis social modeling social recommendation machine learning data mining **The New Laws of Outer Space** Ugo Pagallo, 2024-11-14 This book maps out the moral legal and societal issues brought forth by the use of autonomous systems such as AI and smart robots in outer space Humanity is on the brink of a new space era in which projects for permanent human colonies on the Moon and space missions with autonomous AI systems will soon become a reality Principles and provisions of international space law fall increasingly short in tackling this scenario Experts and institutions have recommended improvements to the legal framework such as new international agreements or policies that would not require any amendment to conventional law Most of the time such proposals and recommendations overlook the challenges posed by technology and how autonomous and intelligent systems in outer space require moral and legal standards of their own This book argues that the traditional focus on satellite communications space related services and the appropriability of celestial resources needs to be integrated by new laws of outer space regulating cybersecurity law and environmental law data governance and consumer protection The new laws of outer space will increasingly concern the development of new standards for the behaviour and decision making of AI systems and smart robots with and without humans aboard deep space missions and in next generation colonies What laws shall govern us out there in a new terra incognita This is the question that the book sets out to answer **The Routledge Handbook of Technology, Crime and Justice** M. R. McGuire, Thomas Holt, 2017-02-24 Technology has become increasingly important to both the function and our understanding of the justice process Many forms of criminal behaviour are highly dependent upon technology and crime control has become a predominantly technologically driven process one where traditional technological aids such as fingerprinting or blood sample analysis are supplemented by a dizzying array of tools and techniques including surveillance devices and DNA profiling This book offers the first comprehensive and holistic overview of global research on technology crime and justice It is divided into five parts each corresponding with the key stages of the offending and justice process Part I addresses the current conceptual understanding of technology within academia and the criminal justice system Part II gives a comprehensive overview of the current relations between technology and criminal behaviour Part III explores the current technologies within crime control and the ways in which technology underpins contemporary formal and informal social control Part IV sets out some of the fundamental impacts technology is now having upon the judicial process Part V reveals the emerging

technologies for crime control and justice and considers the extent to which new technology can be effectively regulated This landmark collection will be essential reading for academics students and theorists within criminology sociology law engineering and technology and computer science as well as practitioners and professionals working within and around the criminal justice system

Introduction to Autonomous Mobile Robots, second edition Roland Siegwart, Illah Reza Nourbakhsh, Davide Scaramuzza, 2011-02-18 The second edition of a comprehensive introduction to all aspects of mobile robotics from algorithms to mechanisms Mobile robots range from the Mars Pathfinder mission's teleoperated Sojourner to the cleaning robots in the Paris Metro This text offers students and other interested readers an introduction to the fundamentals of mobile robotics spanning the mechanical motor sensory perceptual and cognitive layers the field comprises The text focuses on mobility itself offering an overview of the mechanisms that allow a mobile robot to move through a real world environment to perform its tasks including locomotion sensing localization and motion planning It synthesizes material from such fields as kinematics control theory signal analysis computer vision information theory artificial intelligence and probability theory The book presents the techniques and technology that enable mobility in a series of interacting modules Each chapter treats a different aspect of mobility as the book moves from low level to high level details It covers all aspects of mobile robotics including software and hardware design considerations related technologies and algorithmic techniques This second edition has been revised and updated throughout with 130 pages of new material on such topics as locomotion perception localization and planning and navigation Problem sets have been added at the end of each chapter Bringing together all aspects of mobile robotics into one volume Introduction to Autonomous Mobile Robots can serve as a textbook or a working tool for beginning practitioners Curriculum developed by Dr Robert King Colorado School of Mines and Dr James Conrad University of North Carolina Charlotte to accompany the National Instruments LabVIEW Robotics Starter Kit are available Included are 13 6 by Dr King and 7 by Dr Conrad laboratory exercises for using the LabVIEW Robotics Starter Kit to teach mobile robotics concepts

Bio-Inspired Computing and Networking Yang Xiao, 2016-04-19 Seeking new methods to satisfy increasing communication demands researchers continue to find inspiration from the complex systems found in nature From ant inspired allocation to a swarm algorithm derived from honeybees Bio Inspired Computing and Networking explains how the study of biological systems can significantly improve computing networki [The Monkey in the Machine](#) Javier Reyes, 2025-03-10 This book explores the provocative hypothesis of whether it is ethical to grant legal personality to artificial general intelligence AGI It delves into the nature of AGI contrasting it with narrow AI and examining its capabilities and limitations The concept of legal personality is dissected drawing parallels with corporate entities and historical precedents Ethical theories are applied to assess the moral status and potential rights and responsibilities of AGI The book addresses the practical implications of such a paradigm shift including regulatory socio economic and technological challenges It incorporates case studies thought experiments and comparative analyses of international legal systems Public

perception cultural attitudes and media influence are also considered highlighting societal impacts and the importance of education Counterarguments and ethical dilemmas are explored presenting alternative viewpoints and solutions to potential controversies The concluding chapters look towards the future offering recommendations for policy and practice This comprehensive examination is supported by additional resources making it an essential read for anyone interested in the intersection of ethics law and advanced AI

Nature Inspired Cooperative Strategies for Optimization (NICSO 2010)

Carlos Cruz, Juan R. González, David Alejandro Pelta, Natalio Krasnogor, Germán Terrazas, 2010-04-07 Many aspects of Nature Biology or even from Society have become part of the techniques and algorithms used in computer science or they have been used to enhance or hybridize several techniques through the inclusion of advanced evolution cooperation or biologically based additions The previous NICSO workshops were held in Granada Spain 2006 Acireale Italy 2007 and in Tenerife Spain 2008 As in the previous editions NICSO 2010 held in Granada Spain was conceived as a forum for the latest ideas and the state of the art research related to nature inspired cooperative strategies The contributions collected in this book cover topics including nature inspired techniques like Genetic Algorithms Evolutionary Algorithms Ant and Bee Colonies Swarm Intelligence approaches Neural Networks several Cooperation Models Structures and Strategies Agents Models Social Interactions as well as new algorithms based on the behaviour of fireflies or bats

Sapient Circuits and Digitalized

Flesh Matthew E. Gladden, 2018-03-14 This book develops new insights into the evolving nature of organizations by applying the methodologies of posthumanist thought to the fields of organizational theory and management An emerging organizational posthumanism is described that makes sense of the ways in which forces of technological posthumanization are reshaping the members personnel structures information systems processes physical and virtual spaces and external environments available for use by organizations Conceptual frameworks and analytic tools are formulated that diagnose the convergence in the capacities of human and artificial actors generated by new technologies relating to human augmentation synthetic agency and digital physical ecosystems As the first systematic study of these topics this text will interest scholars and students of organizational management and management practitioners who grapple on a daily basis with the forces of technologization that are increasingly powerful drivers of organizational change

Neurorobotics Tiffany J. Hwu, Jeffrey L.

Krichmar, 2022-11-29 An introduction to neurorobotics that presents approaches and design principles for developing intelligent autonomous systems grounded in biology and neuroscience Neurorobotics is an interdisciplinary field that draws on artificial intelligence cognitive sciences computer science engineering psychology neuroscience and robotics Because the brain is closely coupled to the body and situated in the environment neurorobots autonomous systems modeled after some aspect of the brain offer a powerful tool for studying neural function and may also be a means for developing autonomous systems with intelligence that rivals that of biological organisms This textbook introduces approaches and design principles for developing intelligent autonomous systems grounded in biology and neuroscience It is written for anyone interested in

learning about this topic and can be used in cognitive robotics courses for students in psychology cognitive science and computer science

Neurorobotics covers the background and foundations of the field with information on early neurorobots relevant principles of neuroscience learning rules and mechanisms and reinforcement learning and prediction neurorobot design principles grounded in neuroscience and principles of neuroscience research and examples of neurorobots for navigation developmental robotics and social robots presented with the cognitive science and neuroscience background that inspired them A supplementary website offers videos robot simulations and links to software repositories with neurorobot examples

The Horizons of Evolutionary Robotics Patricia A. Vargas, Ezequiel A. Di Paolo, Inman Harvey, Phil Husbands, 2014-03-28 An authoritative overview of current research in this exciting interdisciplinary field Evolutionary robotics ER aims to apply evolutionary computation techniques to the design of both real and simulated autonomous robots The Horizons of Evolutionary Robotics offers an authoritative overview of this rapidly developing field presenting state of the art research by leading scholars The result is a lively expansive survey that will be of interest to computer scientists robotics engineers neuroscientists and philosophers The contributors discuss incorporating principles from neuroscience into ER dynamical analysis of evolved agents constructing appropriate evolutionary pathways spatial cognition the coevolution of robot brains and bodies group behavior the evolution of communication translating evolved behavior into design principles the development of an evolutionary robotics based methodology for shedding light on neural processes an incremental approach to complex tasks and the notion of mindless intelligence complex processes from immune systems to social networks as a way forward for artificial intelligence Contributors Christos Ampatzis Randall D Beer Josh Bongard Joachim de Greeff Ezequiel A Di Paolo Marco Dorigo Dario Floreano Inman Harvey Sabine Hauert Phil Husbands Laurent Keller Michail Maniadakis Orazio Miglino Sara Mitri Renan Moioli Stefano Nolfi Michael O Shea Rainer W Paine Andy Philippides Jordan B Pollack Michela Ponticorvo Yoon Sik Shim Jun Tani Vito Trianni Elio Tuci Patricia A Vargas Eric D Vaughan

Multiagent Systems, second edition Gerhard Weiss, 2016-10-28 The new edition of an introduction to multiagent systems that captures the state of the art in both theory and practice suitable as textbook or reference Multiagent systems are made up of multiple interacting intelligent agents computational entities to some degree autonomous and able to cooperate compete communicate act flexibly and exercise control over their behavior within the frame of their objectives They are the enabling technology for a wide range of advanced applications relying on distributed and parallel processing of data information and knowledge relevant in domains ranging from industrial manufacturing to e commerce to health care This book offers a state of the art introduction to multiagent systems covering the field in both breadth and depth and treating both theory and practice It is suitable for classroom use or independent study This second edition has been completely revised capturing the tremendous developments in multiagent systems since the first edition appeared in 1999 Sixteen of the book's seventeen chapters were written for this edition all chapters are by leaders in the field with each author contributing to the broad base

of knowledge and experience on which the book rests The book covers basic concepts of computational agency from the perspective of both individual agents and agent organizations communication among agents coordination among agents distributed cognition development and engineering of multiagent systems and background knowledge in logics and game theory Each chapter includes references many illustrations and examples and exercises of varying degrees of difficulty The chapters and the overall book are designed to be self contained and understandable without additional material

Supplemental resources are available on the book s Web site Contributors Rafael Bordini Felix Brandt Amit Chopra Vincent Conitzer Virginia Dignum J rgen Dix Ed Durfee Edith Elkind Ulle Endriss Alessandro Farinelli Shaheen Fatima Michael Fisher Nicholas R Jennings Kevin Leyton Brown Evangelos Markakis Lin Padgham Julian Padget Iyad Rahwan Talal Rahwan Alex Rogers Jordi Sabater Mir Yoav Shoham Munindar P Singh Kagan Tumer Karl Tuyls Wiebe van der Hoek Laurent Vercouter Meritxell Vinyals Michael Winikoff Michael Wooldridge Shlomo Zilberstein

AI Approaches to the Complexity of Legal Systems - Models and Ethical Challenges for Legal Systems, Legal Language and Legal Ontologies, Argumentation and Software Agents Monica Palmirani,Ugo Pagallo,Pompeu Casanovas,Giovanni Sartor,2012-11-28 The inspiring idea of this workshop series Artificial Intelligence Approaches to the Complexity of Legal Systems AICOL is to develop models of legal knowledge concerning organization structure and content in order to promote mutual understanding and communication between different systems and cultures Complexity and complex systems describe recent developments in AI and law legal theory argumentation the Semantic Web and multi agent systems Multisystem and multilingual ontologies provide an important opportunity to integrate different trends of research in AI and law including comparative legal studies Complexity theory graph theory game theory and any other contributions from the mathematical disciplines can help both to formalize the dynamics of legal systems and to capture relations among norms Cognitive science can help the modeling of legal ontology by taking into account not only the formal features of law but also social behaviour psychology and cultural factors This book is thus meant to support scholars in different areas of science in sharing knowledge and methodological approaches This volume collects the contributions to the workshop s third edition which took place as part of the 25th IVR congress of Philosophy of Law and Social Philosophy held in Frankfurt Germany in August 2011 This volume comprises six main parts devoted to the each of the six topics addressed in the workshop namely models for the legal system ethics and the regulation of ICT legal knowledge management legal information for open access software agent systems in the legal domain as well as legal language and legal ontology

The Art of Agent-oriented Modeling Leon Sterling,Kuldar Taveter,2009 The Art of Agent Oriented Modeling is an introduction to agent oriented software development for students and for software developers who are interested in learning about new software engineering techniques Foreword

Unmanned Systems of World Wars I and II H. R. Everett,2015-11-13 The first comprehensive technical history of air land sea and underwater unmanned systems by a distinguished U S Navy roboticist Military drones have recently been hailed as a revolutionary new

technology that will forever change the conduct of war And yet the United States and other countries have been deploying such unmanned military systems for more than a century Written by a renowned authority in the field this book documents the forgotten legacy of these pioneering efforts offering the first comprehensive historical and technical accounting of unmanned air land sea and underwater systems Focusing on examples introduced during the two world wars H R Everett meticulously traces their development from the mid nineteenth century to the early Cold War A pioneering Navy roboticist Everett not only describes these systems in detail but also reverse engineers the designs in order to explain how they operated in real world conditions of the time More than 500 illustrations photographs drawings and plans many of them never before published accompany the text Everett covers the evolution of early wire guided submersibles tracing the development of power propulsion communication and control radio controlled surface craft deployed by both Germany and Great Britain in World War I radio controlled submersibles radio controlled aircraft including the TDR 1 assault drone project in World War II which laid the groundwork for subsequent highly classified drone programs and remote controlled ground vehicles including the Wehrmacht s Goliath and Borgward demolition carriers

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