Robot Learning

Judy A. Franklin,Tom M. Mitchell,Sebastian Thrun

Robot Learning:

Robot Learning J. H. Connell,Sridhar Mahadevan,2012-12-06 Building a robot that learns to perform a task has been acknowledged as one of the major challenges facing artificial intelligence Self improving robots would relieve humans from much of the drudgery of programming and would potentially allow operation in environments that were changeable or only partially known Progress towards this goal would also make fundamental contributions to artificial intelligence by furthering our understanding of how to successfully integrate disparate abilities such as perception planning learning and action Although its roots can be traced back to the late fifties the area of robot learning has lately seen a resurgence of interest The flurry of interest in robot learning has partly been fueled by exciting new work in the areas of reinforcement earning behavior based architectures genetic algorithms neural networks and the study of artificial life Robot Learning gives an overview of some of the current research projects in robot learning being carried out at leading universities and research laboratories in the United States The main research directions in robot learning covered in this book include reinforcement learning behavior based architectures neural networks map learning action models navigation and guided exploration

Recent Advances in Robot Learning Judy A. Franklin,Tom M. Mitchell,Sebastian Thrun,1996-06-30 Recent Advances in Robot Learning contains seven papers on robot learning written by leading researchers in the field As the selection of papers illustrates the field of robot learning is both active and diverse A variety of machine learning methods ranging from inductive logic programming to reinforcement learning is being applied to many subproblems in robot perception and control often with objectives as diverse as parameter calibration and concept formulation While no unified robot learning framework has yet emerged to cover the variety of problems and approaches described in these papers and other publications a clear set of shared issues underlies many robot learning problems Machine learning when applied to robotics is situated it is embedded into a real world system that tightly integrates perception decision making and execution Since robot learning involves decision making there is an inherent active learning issue Robotic domains are usually complex yet the expense of using actual robotic hardware often prohibits the collection of large amounts of training data Most robotic systems are real time systems Decisions must be made within critical or practical time constraints These characteristics present challenges and constraints to the learning system Since these characteristics are shared by other important real world application domains robotics is a highly attractive area for research on machine learning On the other hand machine learning is also highly attractive to robotics There is a great variety of open problems in robotics that defy a static hand coded solution Recent Advances in Robot Learning is an edited volume of peer reviewed original research comprising seven invited contributions by leading researchers This research work has also been published as a special issue of Machine Learning Volume 23 Numbers 2 and 3 **Robot Learning** Suraiya Jabin,2010-08-12 Robot Learning is intended for one term advanced Machine Learning courses taken by students from different computer science research disciplines This text has all the features of a renowned

best selling text It gives a focused introduction to the primary themes in a Robot learning course and demonstrates the relevance and practicality of various Machine Learning algorithms to a wide variety of real world applications from evolutionary techniques to reinforcement learning classification control uncertainty and many other important fields Salient features Comprehensive coverage of Evolutionary Techniques Reinforcement Learning and Uncertainty Precise mathematical language used without excessive formalism and abstraction Included applications demonstrate the utility of the subject in terms of real world problems A separate chapter on Anticipatory mechanisms of human sensory motor coordination and biped locomotion Collection of most recent research on Robot Learning *Robot Learning from Human Teachers* Sonia Chernova,Andrea L. Thomaz,2014-04-01 Learning from Demonstration LfD explores techniques for learning a task policy from examples provided by a human teacher The field of LfD has grown into an extensive body of literature over the past 30 years with a wide variety of approaches for encoding human demonstrations and modeling skills and tasks Additionally we have recently seen a focus on gathering data from non expert human teachers i e domain experts but not robotics experts In this book we provide an introduction to the field with a focus on the unique technical challenges associated with designing robots that learn from naive human teachers We begin in the introduction with a unification of the various terminology seen in the literature as well as an outline of the design choices one has in designing an LfD system Chapter 2 gives a brief survey of the psychology literature that provides insights from human social learning that are relevant to designing robotic social learners Chapter 3 walks through an LfD interaction surveying the design choices one makes and state of the art approaches in prior work First is the choice of input how the human teacher interacts with the robot to provide demonstrations Next is the choice of modeling technique Currently there is a dichotomy in the field between approaches that model low level motor skills and those that model high level tasks composed of primitive actions We devote a chapter to each of these Chapter 7 is devoted to interactive and active learning approaches that allow the robot to refine an existing task model And finally Chapter 8 provides best practices for evaluation of LfD systems with a focus on how to approach experiments with human subjects in this domain **Interdisciplinary Approaches To Robot Learning** Andreas Birk,Yiannis Demiris,2000-06-12 Robots are being used in increasingly complicated and demanding tasks often in environments that are complex or even hostile Underwater space and volcano exploration are just some of the activities that robots are taking part in mainly because the environments that are being explored are dangerous for humans Robots can also inhabit dynamic environments for example to operate among humans not just in factories but also taking on more active roles Recently for instance they have made their way into the home entertainment market Given the variety of situations that robots will be placed in learning becomes increasingly important Robot learning is essentially about equipping robots with the capacity to improve their behaviour over time based on their incoming experiences The papers in this volume present a variety of techniques Each paper provides a mini introduction to a subfield of robot learning Some also give a fine introduction to the field of robot

learning as a whole There is one unifying aspect to the work reported in the book namely its interdisciplinary nature especially in the combination of robotics computer science and biology This approach has two important benefits first the study of learning in biological systems can provide robot learning scientists and engineers with valuable insights into learning mechanisms of proven functionality and versatility second computational models of learning in biological systems and their implementation in simulated agents and robots can provide researchers of biological systems with a powerful platform for the development and testing of learning theories   Recent Advances in Robot Learning Judy A. Franklin,Tom M. Mitchell,Sebastian Thrun,2012-12-06 Recent Advances in Robot Learning contains seven papers on robot learning written by leading researchers in the field As the selection of papers illustrates the field of robot learning is both active and diverse A variety of machine learning methods ranging from inductive logic programming to reinforcement learning is being applied to many subproblems in robot perception and control often with objectives as diverse as parameter calibration and concept formulation While no unified robot learning framework has yet emerged to cover the variety of problems and approaches described in these papers and other publications a clear set of shared issues underlies many robot learning problems Machine learning when applied to robotics is situated it is embedded into a real world system that tightly integrates perception decision making and execution Since robot learning involves decision making there is an inherent active learning issue Robotic domains are usually complex yet the expense of using actual robotic hardware often prohibits the collection of large amounts of training data Most robotic systems are real time systems Decisions must be made within critical or practical time constraints These characteristics present challenges and constraints to the learning system Since these characteristics are shared by other important real world application domains robotics is a highly attractive area for research on machine learning On the other hand machine learning is also highly attractive to robotics There is a great variety of open problems in robotics that defy a static hand coded solution Recent Advances in Robot Learning is an edited volume of peer reviewed original research comprising seven invited contributions by leading researchers This research work has also been published as a special issue of Machine Learning Volume 23 Numbers 2 and 3   **Recent Advances in Robot Learning** Judy A. Franklin,Tom M. Mitchell,Sebastian Thrun,2014-01-15   **Interdisciplinary Approaches to Robot Learning** John Demiris,Andreas Birk,2000 Annotation Robots are being used in increasingly complicated and demanding tasks often in environments that are complex or even hostile Underwater space and volcano exploration are just some of the activities that robots are taking part in mainly because the environments that are being explored are dangerous for humans Robots can also inhabit dynamic environments for example to operate among humans not just in factories but also taking on more active roles Recently for instance they have made their way into the home entertainment market Given the variety of situations that robots will be placed in learning becomes increasingly important Robot learning is essentially about equipping robots with the capacity to improve their behaviour over time based on their incoming experiences The papers in this volume present a

variety of techniques Each paper provides a mini introduction to a subfield of robot learning Some also give a fine introduction to the field of robot learning as a whole Thereis one unifying aspect to the work reported in the book namely its interdisciplinary nature especially in the combination of robotics computer science and biology This approach has two important benefits first the study of learning in biological systems can provide robot learning scientists and engineers with valuable insights into learning mechanisms of proven functionality and versatility second computational models of learning in biological systems and their implementation in simulated agents and robots can provide researchers of biological systems with a powerful platform for the development and testing of learning theories **Robot Learning by Visual Observation** Aleksandar Vakanski,Farrokh Janabi-Sharifi,2017-01-13 This book presents programming by demonstration for robot learning from observations with a focus on the trajectory level of task abstraction Discusses methods for optimization of task reproduction such as reformulation of task planning as a constrained optimization problem Focuses on regression approaches such as Gaussian mixture regression spline regression and locally weighted regression Concentrates on the use of vision sensors for capturing motions and actions during task demonstration by a human task expert *Robot Learning from Human Teachers* Sonia Chernova,Andrea L. Thomaz,2022-06-01 Learning from Demonstration LfD explores techniques for learning a task policy from examples provided by a human teacher The field of LfD has grown into an extensive body of literature over the past 30 years with a wide variety of approaches for encoding human demonstrations and modeling skills and tasks Additionally we have recently seen a focus on gathering data from non expert human teachers i e domain experts but not robotics experts In this book we provide an introduction to the field with a focus on the unique technical challenges associated with designing robots that learn from naive human teachers We begin in the introduction with a unification of the various terminology seen in the literature as well as an outline of the design choices one has in designing an LfD system Chapter 2 gives a brief survey of the psychology literature that provides insights from human social learning that are relevant to designing robotic social learners Chapter 3 walks through an LfD interaction surveying the design choices one makes and state of the art approaches in prior work First is the choice of input how the human teacher interacts with the robot to provide demonstrations Next is the choice of modeling technique Currently there is a dichotomy in the field between approaches that model low level motor skills and those that model high level tasks composed of primitive actions We devote a chapter to each of these Chapter 7 is devoted to interactive and active learning approaches that allow the robot to refine an existing task model And finally Chapter 8 provides best practices for evaluation of LfD systems with a focus on how to approach experiments with human subjects in this domain **Advanced Teleoperation and Robot Learning for Dexterous Manipulation** Chenguang Yang,Zhenyu Lu,Ning Wang,2025-04-11 This book offers an in depth exploration of the interdisciplinary field of dexterous robotic manipulation focusing on advanced methods that enable robots to autonomously learn adapt and perform a variety of tasks It covers key topics such as teleoperation systems advanced control

frameworks and bio inspired autonomous learning The book stands out by providing a comprehensive examination of both the technical and theoretical aspects of dexterous manipulation with a particular emphasis on integrating advanced control and autonomous learning The book is primarily aimed at researchers engineers and graduate students in the fields of robotics artificial intelligence and control systems It is particularly useful for those interested in robotic manipulation autonomous learning and bio inspired systems The detailed technical explanations and cutting edge research make it an essential resource for professionals seeking to push the boundaries of robotic dexterous manipulation The book s practical applications make it relevant for many real world manipulation scenarios including healthcare and manufacturing *Robot Learning Human Skills and Intelligent Control Design* Chenguang Yang,Chao Zeng,Jianwei Zhang,2021-06-21 In the last decades robots are expected to be of increasing intelligence to deal with a large range of tasks Especially robots are supposed to be able to learn manipulation skills from humans To this end a number of learning algorithms and techniques have been developed and successfully implemented for various robotic tasks Among these methods learning from demonstrations LfD enables robots to effectively and efficiently acquire skills by learning from human demonstrators such that a robot can be quickly programmed to perform a new task This book introduces recent results on the development of advanced LfD based learning and control approaches to improve the robot dexterous manipulation First there s an introduction to the simulation tools and robot platforms used in the authors research In order to enable a robot learning of human like adaptive skills the book explains how to transfer a human user s arm variable stiffness to the robot based on the online estimation from the muscle electromyography EMG Next the motion and impedance profiles can be both modelled by dynamical movement primitives such that both of them can be planned and generalized for new tasks Furthermore the book introduces how to learn the correlation between signals collected from demonstration i e motion trajectory stiffness profile estimated from EMG and interaction force using statistical models such as hidden semi Markov model and Gaussian Mixture Regression Several widely used human robot interaction interfaces such as motion capture based teleoperation are presented which allow a human user to interact with a robot and transfer movements to it in both simulation and real word environments Finally improved performance of robot manipulation resulted from neural network enhanced control strategies is presented A large number of examples of simulation and experiments of daily life tasks are included in this book to facilitate better understanding of the readers *Advances in Robot Learning* Jeremy Wyatt,John Demiris,2003-06-29 This book constitutes the thoroughly refereed post workshop proceedings of the 8th European Workshop on Learning Robots EWLR 99 held in Lausanne Switzerland in September 1999 The seven revised full workshop papers presented were carefully reviewed and selected for inclusion in the book Also included are two invited full papers Among the topics addressed are map building for robot navigation multi task reinforcement learning neural network approaches example based learning situated agents planning maps for mobile robots path finding autonomous robots and biologically inspired approaches **Advances**

in Robot Learning Jeremy Wyatt,John Demiris,2000-10-11 This book constitutes the thoroughly refereed post workshop proceedings of the 8th European Workshop on Learning Robots EWLR 99 held in Lausanne Switzerland in September 1999 The seven revised full workshop papers presented were carefully reviewed and selected for inclusion in the book Also included are two invited full papers Among the topics addressed are map building for robot navigation multi task reinforcement learning neural network approaches example based learning situated agents planning maps for mobile robots path finding autonomous robots and biologically inspired approaches *Using Educational Robots to Enhance Learning* Dejian Liu,Ronghuai Huang,Ying Chen,Michael Agyemang Adarkwah,Xiangling Zhang,Xin Li,Junjie Zhang,Ting Da,2024-09-28 This book presents advances in the research of educational robotics and showcases how they can be used to facilitate learning It summarizes popular and relevant terms and theories in educational robotics via analyzing one hundred influential journal articles in this field to provide readers background knowledge on the subject matter This book also guides readers in understanding how different types of robotics are utilized to promote learning among different types of students in different contexts and in different disciplines of study **Encyclopedia of the Sciences of Learning** Norbert M. Seel,2011-10-05 Over the past century educational psychologists and researchers have posited many theories to explain how individuals learn i e how they acquire organize and deploy knowledge and skills The 20th century can be considered the century of psychology on learning and related fields of interest such as motivation cognition metacognition etc and it is fascinating to see the various mainstreams of learning remembered and forgotten over the 20th century and note that basic assumptions of early theories survived several paradigm shifts of psychology and epistemology Beyond folk psychology and its na ve theories of learning psychological learning theories can be grouped into some basic categories such as behaviorist learning theories connectionist learning theories cognitive learning theories constructivist learning theories and social learning theories Learning theories are not limited to psychology and related fields of interest but rather we can find the topic of learning in various disciplines such as philosophy and epistemology education information science biology and as a result of the emergence of computer technologies especially also in the field of computer sciences and artificial intelligence As a consequence machine learning struck a chord in the 1980s and became an important field of the learning sciences in general As the learning sciences became more specialized and complex the various fields of interest were widely spread and separated from each other as a consequence even presently there is no comprehensive overview of the sciences of learning or the central theoretical concepts and vocabulary on which researchers rely The Encyclopedia of the Sciences of Learning provides an up to date broad and authoritative coverage of the specific terms mostly used in the sciences of learning and its related fields including relevant areas of instruction pedagogy cognitive sciences and especially machine learning and knowledge engineering This modern compendium will be an indispensable source of information for scientists educators engineers and technical staff active in all fields of learning More specifically the Encyclopedia provides fast access to the

most relevant theoretical terms provides up to date broad and authoritative coverage of the most important theories within the various fields of the learning sciences and adjacent sciences and communication technologies supplies clear and precise explanations of the theoretical terms cross references to related entries and up to date references to important research and publications The Encyclopedia also contains biographical entries of individuals who have substantially contributed to the sciences of learning the entries are written by a distinguished panel of researchers in the various fields of the learning sciences   **From Motor Learning to Interaction Learning in Robots** Olivier Sigaud,Jan Peters,2010-02-04 From an engineering standpoint the increasing complexity of robotic systems and the increasing demand for more autonomously learning robots has become essential This book is largely based on the successful workshop From motor to interaction learning in robots held at the IEEE RSJ International Conference on Intelligent Robot Systems The major aim of the book is to give students interested the topics described above a chance to get started faster and researchers a helpful compandium Springer Handbook of Robotics Bruno Siciliano,Oussama Khatib,2016-07-27 The second edition of this handbook provides a state of the art overview on the various aspects in the rapidly developing field of robotics Reaching for the human frontier robotics is vigorously engaged in the growing challenges of new emerging domains Interacting exploring and working with humans the new generation of robots will increasingly touch people and their lives The credible prospect of practical robots among humans is the result of the scientific endeavour of a half a century of robotic developments that established robotics as a modern scientific discipline The ongoing vibrant expansion and strong growth of the field during the last decade has fueled this second edition of the Springer Handbook of Robotics The first edition of the handbook soon became a landmark in robotics publishing and won the American Association of Publishers PROSE Award for Excellence in Physical Sciences Mathematics as well as the organization s Award for Engineering Technology The second edition of the handbook edited by two internationally renowned scientists with the support of an outstanding team of seven part editors and more than 200 authors continues to be an authoritative reference for robotics researchers newcomers to the field and scholars from related disciplines The contents have been restructured to achieve four main objectives the enlargement of foundational topics for robotics the enlightenment of design of various types of robotic systems the extension of the treatment on robots moving in the environment and the enrichment of advanced robotics applications Further to an extensive update fifteen new chapters have been introduced on emerging topics and a new generation of authors have joined the handbook s team A novel addition to the second edition is a comprehensive collection of multimedia references to more than 700 videos which bring valuable insight into the contents The videos can be viewed directly augmented into the text with a smartphone or tablet using a unique and specially designed app Springer Handbook of Robotics Multimedia Extension Portal http handbookofrobotics org   Advances in Reinforcement Learning Abdelhamid Mellouk,2011-01-14 Reinforcement Learning RL is a very dynamic area in terms of theory and application This book brings together many different aspects of

the current research on several fields associated to RL which has been growing rapidly producing a wide variety of learning algorithms for different applications Based on 24 Chapters it covers a very broad variety of topics in RL and their application in autonomous systems A set of chapters in this book provide a general overview of RL while other chapters focus mostly on the applications of RL paradigms Game Theory Multi Agent Theory Robotic Networking Technologies Vehicular Navigation Medicine and Industrial Logistic   Intelligent Robotics and Applications Chun-Yi Su,Subhash Rakheja,Liu Honghai,2012-09-28 The three volume set LNAI 7506 LNAI 7507 and LNAI 7508 constitutes the refereed proceedings of the 5th International Conference on Intelligent Robotics and Applications ICIRA 2012 held in Montreal Canada in October 2012 The 197 revised full papers presented were thoroughly reviewed and selected from 271 submissions They present the state of the art developments in robotics automation and mechatronics This volume covers the topics of robot actuators and sensors robot design development and control robot intelligence learning and linguistics robot mechanism and design robot motion analysis and planning robotic vision recognition and reconstruction and planning and navigation

Robot Learning Book Review: Unveiling the Power of Words

In a global driven by information and connectivity, the energy of words has become more evident than ever. They have the ability to inspire, provoke, and ignite change. Such may be the essence of the book **Robot Learning**, a literary masterpiece that delves deep in to the significance of words and their affect our lives. Compiled by a renowned author, this captivating work takes readers on a transformative journey, unraveling the secrets and potential behind every word. In this review, we shall explore the book is key themes, examine its writing style, and analyze its overall effect on readers.

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