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A Roadmap for Cognitive Development in Humanoid Robots

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A Roadmap For Cognitive Development In Humanoid Robots Cognitive Systems Monographs:

A Roadmap for Cognitive Development in Humanoid Robots David Vernon, Claes von Hofsten, Luciano Fadiga, 2011-12-28
This book addresses the central role played by development in cognition. The focus is on applying our knowledge of development in natural cognitive systems specifically human infants to the problem of creating artificial cognitive systems in the guise of humanoid robots. The approach is founded on the three fold premise that a cognition is the process by which an autonomous self governing agent acts effectively in the world in which it is embedded b the dual purpose of cognition is to increase the agent s repertoire of effective actions and its power to anticipate the need for future actions and their outcomes and c development plays an essential role in the realization of these cognitive capabilities. Our goal in this book is to identify the key design principles for cognitive development. We do this by bringing together insights from four areas: enactive cognitive science, developmental psychology, neurophysiology and computational modelling. This results in a roadmap comprising a set of forty three guidelines for the design of a cognitive architecture and its deployment in a humanoid robot. The book includes a case study based on the iCub, an open systems humanoid robot which has been designed specifically as a common platform for research on embodied cognitive systems.

Cognitive Robotics Angelo Cangelosi, Minoru Asada, 2022-05-17
The current state of the art in cognitive robotics covering the challenges of building AI powered intelligent robots inspired by natural cognitive systems. A novel approach to building AI powered intelligent robots takes inspiration from the way natural cognitive systems in humans, animals and biological systems develop intelligence by exploiting the full power of interactions between body and brain, the physical and social environment in which they live and phylogenetic developmental and learning dynamics. This volume reports on the current state of the art in cognitive robotics offering the first comprehensive coverage of building robots inspired by natural cognitive systems. Contributors first provide a systematic definition of cognitive robotics and a history of developments in the field. They describe in detail five main approaches: developmental, neuro evolutionary, swarm and soft robotics. They go on to consider methodologies and concepts treating topics that include commonly used cognitive robotics platforms and robot simulators, biomimetic skin as an example of a hardware based approach, machine learning methods and cognitive architecture. Finally they cover the behavioral and cognitive capabilities of a variety of models, experiments and applications looking at issues that range from intrinsic motivation and perception to robot consciousness. *Cognitive Robotics* is aimed at an interdisciplinary audience balancing technical details and examples for the computational reader with theoretical and experimental findings for the empirical scientist.

Artificial Cognitive Systems David Vernon, 2024-08-20
A concise introduction to a complex field bringing together recent work in cognitive science and cognitive robotics to offer a solid grounding on key issues. This book offers a concise and accessible introduction to the emerging field of artificial cognitive systems. Cognition, both natural and artificial, is about anticipating the need for action and developing the capacity to predict the outcome of those actions. Drawing on

artificial intelligence developmental psychology and cognitive neuroscience the field of artificial cognitive systems has as its ultimate goal the creation of computer based systems that can interact with humans and serve society in a variety of ways This primer brings together recent work in cognitive science and cognitive robotics to offer readers a solid grounding on key issues The book first develops a working definition of cognitive systems broad enough to encompass multiple views of the subject and deep enough to help in the formulation of theories and models It surveys the cognitivist emergent and hybrid paradigms of cognitive science and discusses cognitive architectures derived from them It then turns to the key issues with chapters devoted to autonomy embodiment learning and development memory and prospection knowledge and representation and social cognition Ideas are introduced in an intuitive natural order with an emphasis on the relationships among ideas and building to an overview of the field The main text is straightforward and succinct sidenotes drill deeper on specific topics and provide contextual links to further reading

Developmental Robotics Angelo Cangelosi, Matthew Schlesinger, 2015-01-23 A comprehensive overview of an interdisciplinary approach to robotics that takes direct inspiration from the developmental and learning phenomena observed in children s cognitive development Developmental robotics is a collaborative and interdisciplinary approach to robotics that is directly inspired by the developmental principles and mechanisms observed in children s cognitive development It builds on the idea that the robot using a set of intrinsic developmental principles regulating the real time interaction of its body brain and environment can autonomously acquire an increasingly complex set of sensorimotor and mental capabilities This volume drawing on insights from psychology computer science linguistics neuroscience and robotics offers the first comprehensive overview of a rapidly growing field After providing some essential background information on robotics and developmental psychology the book looks in detail at how developmental robotics models and experiments have attempted to realize a range of behavioral and cognitive capabilities The examples in these chapters were chosen because of their direct correspondence with specific issues in child psychology research each chapter begins with a concise and accessible overview of relevant empirical and theoretical findings in developmental psychology The chapters cover intrinsic motivation and curiosity motor development examining both manipulation and locomotion perceptual development including face recognition and perception of space social learning emphasizing such phenomena as joint attention and cooperation language from phonetic babbling to syntactic processing and abstract knowledge including models of number learning and reasoning strategies Boxed text offers technical and methodological details for both psychology and robotics experiments

Simulation, Modeling, and Programming for Autonomous Robots Itsuki Noda, Noriako Ando, Davide Brugali, James J. Kuffner, 2012-10-20 This book constitutes the refereed proceedings of the Third International Conference on Simulation Modeling and Programming for Autonomous Robots SIMPAR 2012 held in Tsukuba Japan in November 2012 The 33 revised full papers and presented together with 3 invited talks were carefully reviewed and selected from 46 submissions Ten papers describe design of complex behaviors of

autonomous robots 9 address software layers 8 papers refer to related modeling and learning The papers are organized in topical sections on mobile robots software modeling and architecture and humanoid and biped robots [An Introduction to Robophilosophy Cognition, Intelligence, Autonomy, Consciousness, Conscience, and Ethics](#) Spyros G. Tzafestas, 2022-09-01 Modern robots have arrived at a very matured state both in their mechanical control aspects and their mental aspects An Introduction to Robophilosophy explores the philosophical questions that arise in the development creation and use of mental anthropomorphic and zoomorphic robots that are capable of semiautonomous autonomous operation decision making and human like action being able to socially interact with humans and exhibit behavior similar to human beings or animals Coverage first presents fundamental concepts and an overview of philosophy philosophy of science and philosophy of technology The six principal mental capabilities of modern robots namely cognition intelligence autonomy conscience and ethics are then studied from a philosophical point of view They actually represent the product of technological embodiment of cognitive features to robots Overall readers are provided a consolidated thorough investigation of the philosophical aspects of these mental capabilities when embedded to robots This book will serve as an ideal educational source in engineering and robotics courses as well as an introductory reference for researchers in the field of robotics and it includes a rich bibliography

New Trends in Medical and Service Robots Hannes Bleuler, Mohamed Bouri, Francesco Mondada, Doina Pislă, Aleksandar Rodić, Patrick Helmer, 2015-11-12 Medical and Service Robotics integrate the most recent achievements in mechanics mechatronics computer science haptic and teleoperation devices together with adaptive control algorithms The book includes topics such as surgery robotics assist devices rehabilitation technology surgical instrumentation and Brain Machine Interface BMI as examples for medical robotics Autonomous cleaning tending logistics surveying and rescue robots and elderly and healthcare robots are typical examples of topics from service robotics This is the Proceedings of the Third International Workshop on Medical and Service Robots held in Lausanne Switzerland in 2014 It presents an overview of current research directions and fields of interest It is divided into three sections namely 1 assistive and rehabilitation devices 2 surgical robotics and 3 educational and service robotics Most contributions are strongly anchored on collaborations between technical and medical actors engineers surgeons and clinicians Biomedical robotics and the rapidly growing service automation fields have clearly overtaken the classical industrial robotics and automatic control centered activity familiar to the older generation of roboticists

Universal Access in Human-Computer Interaction. Interaction Techniques and Environments Margherita Antona, Constantine Stephanidis, 2016-07-04 The three volume set LNCS 9737 9739 constitutes the refereed proceedings of the 10th International Conference on Universal Access in Human Computer Interaction UAHCI 2016 held as part of the 10th International Conference on Human Computer Interaction HCII 2016 in Toronto ON Canada in July 2016 jointly with 15 other thematically similar conferences The total of 1287 papers presented at the HCII 2016 conferences were carefully reviewed and selected from 4354 submissions The papers included in

the three UAHCI 2016 volumes address the following major topics novel approaches to accessibility design for all and eInclusion best practices universal access in architecture and product design personal and collective informatics in universal access eye tracking in universal access multimodal and natural interaction for universal access universal access to mobile interaction virtual reality 3D and universal access intelligent and assistive environments universal access to education and learning technologies for ASD and cognitive disabilities design for healthy aging and rehabilitation universal access to media and games and universal access to mobility and automotive

Intrinsically Motivated Learning in Natural and Artificial Systems Gianluca Baldassarre, Marco Mirolli, 2013-03-29 It has become clear to researchers in robotics and adaptive behaviour that current approaches are yielding systems with limited autonomy and capacity for self improvement To learn autonomously and in a cumulative fashion is one of the hallmarks of intelligence and we know that higher mammals engage in exploratory activities that are not directed to pursue goals of immediate relevance for survival and reproduction but are instead driven by intrinsic motivations such as curiosity interest in novel stimuli or surprising events and interest in learning new behaviours The adaptive value of such intrinsically motivated activities lies in the fact that they allow the cumulative acquisition of knowledge and skills that can be used later to accomplish fitness enhancing goals Intrinsic motivations continue during adulthood and in humans they underlie lifelong learning artistic creativity and scientific discovery while they are also the basis for processes that strongly affect human well being such as the sense of competence self determination and self esteem This book has two aims to present the state of the art in research on intrinsically motivated learning and to identify the related scientific and technological open challenges and most promising research directions The book introduces the concept of intrinsic motivation in artificial systems reviews the relevant literature offers insights from the neural and behavioural sciences and presents novel tools for research The book is organized into six parts the chapters in Part I give general overviews on the concept of intrinsic motivations their function and possible mechanisms for implementing them Parts II III and IV focus on three classes of intrinsic motivation mechanisms those based on predictors on novelty and on competence Part V discusses mechanisms that are complementary to intrinsic motivations and Part VI introduces tools and experimental frameworks for investigating intrinsic motivations The contributing authors are among the pioneers carrying out fundamental work on this topic drawn from related disciplines such as artificial intelligence robotics artificial life evolution machine learning developmental psychology cognitive science and neuroscience The book will be of value to graduate students and academic researchers in these domains and to engineers engaged with the design of autonomous adaptive robots The contributing authors are among the pioneers carrying out fundamental work on this topic drawn from related disciplines such as artificial intelligence robotics artificial life evolution machine learning developmental psychology cognitive science and neuroscience The book will be of value to graduate students and academic researchers in these domains and to engineers engaged with the design of autonomous adaptive robots Toward Robotic Socially

Believable Behaving Systems - Volume I Anna Esposito, Lakhmi C. Jain, 2016-03-21 This volume is a collection of research studies on the modeling of emotions in complex autonomous systems. Several experts in the field are reporting their efforts and reviewing the literature in order to shed light on how the processes of coding and decoding emotional states took place in humans, which are the physiological, physical, and psychological variables involved. It invents new mathematical models and algorithms to describe them and motivates these investigations in the light of observable societal changes and needs such as the aging population and the cost of health care services. The consequences are the implementation of emotionally and socially believable machines acting as helpers in domestic spheres where emotions drive behaviors and actions. The contents of the book are highly multidisciplinary since the modeling of emotions in robotic socially believable systems requires a holistic perspective on topics coming from different research domains such as computer science, engineering, sociology, psychology, linguistics, and information communication. The book is of interest both to experts and students since last research works on a so complex multidisciplinary topic are described in a neat and didactical scientific language.

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