Connectionist-Symbolic Integration

From Unified to Hybrid Approaches

Edited by
Ron Sun and Frederic Alexandre

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VM Jensen

Connectionist Symbolic Integration From Unified To Hybrid Approaches:

Connectionist-Symbolic Integration Ron Sun,Frederic Alexandre,2013-04-15 A variety of ideas approaches and techniques exist in terms of both architecture and learning and this abundance seems to lead to many exciting possibilities in terms of theoretical advances and application potentials Despite the apparent diversity there is clearly an underlying unifying theme architectures that bring together symbolic and connectionist models to achieve a synthesis and synergy of the two different paradigms and the learning and knowledge acquisition methods for developing such architectures More effort needs to be extended to exploit the possibilities and opportunities in this area This book is the outgrowth of The IJCAI Workshop on Connectionist Symbolic Integration From Unified to Hybrid Approaches held in conjunction with the fourteenth International Joint Conference on Artificial Intelligence IJCAI 95 Featuring various presentations and discussions this two day workshop brought to light many new ideas controversies and syntheses which lead to the present volume This book is concerned with the development analysis and application of hybrid connectionist symbolic models in artificial intelligence and cognitive science Drawing contributions from a large international group of experts it describes and compares a variety of models in this area The types of models discussed cover a wide range of the evolving spectrum of hybrid models thus serving as a well balanced progress report on the state of the art As such this volume provides an information clearinghouse for various proposed approaches and models that share the common belief that connectionist and symbolic models can be usefully combined and integrated and such integration may lead to significant advances in understanding intelligence

Connectionist-symbolic Integration : from Unified to Hybrid Approaches Frederic Alexandre,Ron Sun,1995 **A Geometric Approach to the Unification of Symbolic Structures and Neural Networks** Tiansi Dong,2020-08-24 The unification of symbolist and connectionist models is a major trend in AI The key is to keep the symbolic semantics unchanged Unfortunately present embedding approaches cannot The approach in this book makes the unification possible It is indeed a new and promising approach in AI Bo Zhang Director of AI Institute Tsinghua It is indeed wonderful to see the reviving of the important theme Nural Symbolic Model Given the popularity and prevalence of deep learning symbolic processing is often neglected or downplayed This book confronts this old issue head on with a historical look incorporating recent advances and new perspectives thus leading to promising new methods and approaches Ron Sun RPI on Governing Board of Cognitive Science Society Both for language and humor approaches like those described in this book are the way to snickerdoodle wombats Christian F Hempelmann Texas A M Commerce on Executive Board of International Society for Humor Studies

Hybrid Neural Systems Stefan Wermter,Ron Sun,2006-12-30 Hybrid neural systems are computational systems which are based mainly on artificial neural networks and allow for symbolic interpretation or interaction with symbolic components This book is derived from a workshop held during the NIPS 98 in Denver Colorado USA and competently reflects the state of the art of research and development in hybrid neural systems The 26 revised full papers presented together with an

introductory overview by the volume editors have been through a twofold process of careful reviewing and revision The papers are organized in the following topical sections structured connectionism and rule representation distributed neural architectures and language processing transformation and explanation robotics vision and cognitive approaches

Artificial Neural Networks - ICANN 2001 Georg Dorffner,Horst Bischof,Kurt Hornik,2003-05-15 This book is based on the papers presented at the International Conference on Arti cial Neural Networks ICANN 2001 from August 21 25 2001 at the enna University of Technology Austria The conference is organized by the A trian Research Institute for Arti cal Intelligence in cooperation with the Pattern Recognition and Image Processing Group and the Center for Computational telligence at the Vienna University of Technology The ICANN conferences were initiated in 1991 and have become the major European meeting in the eld of neural networks From about 300 submitted papers the program committee selected 171 for publication Each paper has been reviewed by three program committee m bers reviewers We would like to thank all the members of the program comm tee and the reviewers for their great e ort in the reviewing process and helping us to set up a scienti c program of high quality In addition we have invited eight speakers three of their papers are also included in the proceedings We would like to thank the European Neural Network Society ENNS for their support We acknowledge the nancial support of Austrian Airlines A trian Science Foundation FWF under the contract SFB 010 Austrian Society for Arti cial Intelligence OGAI Bank Austria and the Vienna Convention Bureau We would like to express our sincere thanks to A Flexer W Horn K Hraby F Leisch C Schittenkopf and A Weingessel The conference and the proceedings would not have been possible without their enormous contri tion   **Fuzzy Logic and Expert Systems Applications** Cornelius T. Leondes,1998-02-09 This volume covers the integration of fuzzy logic and expert systems A vital resource in the field it includes techniques for applying fuzzy systems to neural networks for modeling and control systematic design procedures for realizing fuzzy neural systems techniques for the design of rule based expert systems using the massively parallel processing capabilities of neural networks the transformation of neural systems into rule based expert systems the characteristics and relative merits of integrating fuzzy sets neural networks genetic algorithms and rough sets and applications to system identification and control as well as nonparametric nonlinear estimation Practitioners researchers and students in industrial manufacturing electrical and mechanical engineering as well as computer scientists and engineers will appreciate this reference source to diverse application methodologies Fuzzy system techniques applied to neural networks for modeling and control Systematic design procedures for realizing fuzzy neural systems Techniques for the design of rule based expert systems Characteristics and relative merits of integrating fuzzy sets neural networks genetic algorithms and rough sets System identification and control Nonparametric nonlinear estimation Practitioners researchers and students in industrial manufacturing electrical and mechanical engineering as well as computer scientists and engineers will find this volume a unique and comprehensive reference to these diverse application methodologies

<u>Natural Language Processing</u> Robert Dale,Hermann Moisl,Harold Somers,2000-07-25 This study explores the design and application of natural language text based processing systems based on generative linguistics empirical copus analysis and artificial neural networks It emphasizes the practical tools to accommodate the selected system **Advances in Intelligent Modelling and Simulation** Joanna Kołodziej,Samee Ullah Khan,Tadeusz Burczyński,2012-07-11 One of the most challenging issues in today s large scale computational modeling and design is to effectively manage the complex distributed environments such as computational clouds grids ad hoc and P2P networks operating under various types of users with evolving relationships fraught with uncertainties In this context the IT resources and services usually belong to different owners institutions enterprises or individuals and are managed by different administrators Moreover uncertainties are presented to the system at hand in various forms of information that are incomplete imprecise fragmentary or overloading which hinders in the full and precise resolve of the evaluation criteria subsequencing and selection and the assignment scores Intelligent scalable systems enable the flexible routing and charging advanced user interactions and the aggregation and sharing of geographically distributed resources in modern large scale systems This book presents new ideas theories models technologies system architectures and implementation of applications in intelligent scalable computing systems In 15 chapters several important Artificial Intelligence based techniques such as fuzzy logic neural networks evolutionary and memetic algorithms are studied and implemented All of those technologies have formed the foundation for the intelligent scalable computing that we know of today We believe that this book will serve as a reference for students researchers and industry practitioners working or interested in joining interdisciplinary research in the areas of intelligent decision systems using emergent distributed computing paradigms It will also allow newcomers students and researchers alike to grasp key issues and potential solutions on the selected topics This book presents new ideas theories models technologies system architectures and implementation of applications in intelligent scalable computing systems In 15 chapters several important Artificial Intelligence based techniques such as fuzzy logic neural networks evolutionary and memetic algorithms are studied and implemented All of those technologies have formed the foundation for the intelligent scalable computing that we know of today We believe that this book will serve as a reference for students researchers and industry practitioners working or interested in joining interdisciplinary research in the areas of intelligent decision systems using emergent distributed computing paradigms It will also allow newcomers students and researchers alike to grasp key issues and potential solutions on the selected topics **Foundations of Artificial Intelligence and Robotics** Wendell H. Chun,2024-12-24 Artificial intelligence AI is a complicated science that combines philosophy cognitive psychology neuroscience mathematics and logic logicism economics computer science computability and software Meanwhile robotics is an engineering field that compliments AI There can be situations where AI can function without a robot e g Turing Test and robotics without AI e g teleoperation but in many cases each technology requires each other to exhibit a complete system having smart robots and

AI being able to control its interactions i e effectors with its environment This book provides a complete history of computing AI and robotics from its early development to state of the art technology providing a roadmap of these complicated and constantly evolving subjects Divided into two volumes covering the progress of symbolic logic and the explosion in learning deep learning in natural language and perception this first volume investigates the coming together of AI the mind and robotics the body and discusses the state of AI today Key Features Provides a complete overview of the topic of AI starting with philosophy psychology neuroscience and logicism and extending to the action of the robots and AI needed for a futuristic society Provides a holistic view of AI and touches on all the misconceptions and tangents to the technologies through taking a systematic approach Provides a glossary of terms list of notable people and extensive references Provides the interconnections and history of the progress of technology for over 100 years as both the hardware Moore s Law GPUs and software i e generative AI have advanced Intended as a complete reference this book is useful to undergraduate and postgraduate students of computing as well as the general reader It can also be used as a textbook by course convenors If you only had one book on AI and robotics this set would be the first reference to acquire and learn about the theory and practice **Combinations of Intelligent Methods and Applications** Ioannis Hatzilygeroudis,Jim Prentzas,2011-03-29 The combination of different intelligent methods is a very active research area in Artificial Intelligence AI The aim is to create integrated or hybrid methods that benefit from each of their components Some of the existing efforts combine soft computing methods either among themselves or with more traditional AI methods such as logic and rules Another stream of efforts integrates machine learning with soft computing or traditional AI methods Yet another integrates agent based approaches with logic and also non symbolic approaches Some of the combinations have been quite important and more extensively used like neuro symbolic methods neuro fuzzy methods and methods combining rule based and case based reasoning However there are other combinations that are still under investigation such as those related to the Semantic Web The 2nd Workshop on Combinations of Intelligent Methods and Applications CIMA 2010 was intended to become a forum for exchanging experience and ideas among researchers and practitioners who are dealing with combining intelligent methods either based on first principles or in the context of specific applications CIMA 2010 was held in conjunction with the 22nd IEEE International Conference on Tools with Artificial Intelligence ICTAI 2010 Also a special track was organized in ICTAI 2010 under the same title This volume includes revised versions of the papers presented in CIMA 2010 and one of the short papers presented in the corresponding ICTAI 2010 special track It also includes a paper of the editors as invited *Principles of Brain Dynamics* Mikhail I. Rabinovich,Karl J. Friston,Pablo Varona,2023-12-05 Experimental and theoretical approaches to global brain dynamics that draw on the latest research in the field The consideration of time or dynamics is fundamental for all aspects of mental activity perception cognition and emotion because the main feature of brain activity is the continuous change of the underlying brain states even in a constant environment The application of nonlinear dynamics to the study of

brain activity began to flourish in the 1990s when combined with empirical observations from modern morphological and physiological observations This book offers perspectives on brain dynamics that draw on the latest advances in research in the field It includes contributions from both theoreticians and experimentalists offering an eclectic treatment of fundamental issues Topics addressed range from experimental and computational approaches to transient brain dynamics to the free energy principle as a global brain theory The book concludes with a short but rigorous guide to modern nonlinear dynamics and their application to neural dynamics *Engineering Intelligent Hybrid Multi-Agent Systems* Rajiv Khosla,2012-12-06 Engineering Intelligent Hybrid Multi Agent Systems is about building intelligent hybrid systems Included is coverage of applications and design concepts related to fusion systems transformation systems and combination systems These applications are in areas involving hybrid configurations of knowledge based systems case based reasoning fuzzy systems artificial neural networks genetic algorithms and in knowledge discovery and data mining Through examples and applications a synergy of these subjects is demonstrated The authors introduce a multi agent architectural theory for engineering intelligent associative hybrid systems The architectural theory is described at both the task structure level and the computational level This problem solving architecture is relevant for developing knowledge agents and information agents An enterprise wide system modeling framework is outlined to facilitate forward and backward integration of systems developed in the knowledge information and data engineering layers of an organization In the modeling process software engineering aspects like agent oriented analysis design and reuse are developed and described Engineering Intelligent Hybrid Multi Agent Systems is the first book in the field to provide details of a multi agent architecture for building intelligent hybrid systems *Neural-Symbolic Learning Systems* Artur S. d'Avila Garcez,Krysia B. Broda,Dov M. Gabbay,2012-12-06 Artificial Intelligence is concerned with producing devices that help or replace human beings in their daily activities Neural symbolic learning systems play a central role in this task by combining and trying to benefit from the advantages of both the neural and symbolic paradigms of artificial intelligence This book provides a comprehensive introduction to the field of neural symbolic learning systems and an invaluable overview of the latest research issues in this area It is divided into three sections covering the main topics of neural symbolic integration theoretical advances in knowledge representation and learning knowledge extraction from trained neural networks and inconsistency handling in neural symbolic systems Each section provides a balance of theory and practice giving the results of applications using real world problems in areas such as DNA sequence analysis power systems fault diagnosis and software requirements specifications Neural Symbolic Learning Systems will be invaluable reading for researchers and graduate students in Engineering Computing Science Artificial Intelligence Machine Learning and Neurocomputing It will also be of interest to Intelligent Systems practitioners and anyone interested in applications of hybrid artificial intelligence systems Computational Methods in Neural Modeling José Mira,2003-05-22 The two volume set LNCS 2686 and LNCS 2687 constitute the refereed proceedings of the 7th International

Work Conference on Artificial and Natural Neural Networks IWANN 2003 held in Ma Menorca Spain in June 2003 The 197 revised papers presented were carefully reviewed and selected for inclusion in the book and address the following topics mathematical and computational methods in neural modelling neurophysiological data analysis and modelling structural and functional models of neurons learning and other plasticity phenomena complex systems dynamics cognitive processes and artificial intelligence methodologies for net design bio inspired systems and engineering and applications in a broad variety of fields Cognitive Science Harald Maurer,2021-07-08 The Mind and Brain are usually considered as one and the same nonlinear complex dynamical system in which information processing can be described with vector and tensor transformations and with attractors in multidimensional state spaces Thus an internal neurocognitive representation concept consists of a dynamical process which filters out statistical prototypes from the sensorial information in terms of coherent and adaptive n dimensional vector fields These prototypes serve as a basis for dynamic probabilistic predictions or probabilistic hypotheses on prospective new data see the recently introduced approach of predictive coding in neurophilosophy Furthermore the phenomenon of sensory and language cognition would thus be based on a multitude of self regulatory complex dynamics of synchronous self organization mechanisms in other words an emergent flux equilibrium process steady state of the total collective and coherent neural activity resulting from the oscillatory actions of neuronal assemblies In perception it is shown how sensory object informations like the object color or the object form can be dynamically related together or can be integrated to a neurally based representation of this perceptual object by means of a synchronization mechanism feature binding In language processing it is shown how semantic concepts and syntactic roles can be dynamically related together or can be integrated to neurally based systematic and compositional connectionist representations by means of a synchronization mechanism variable binding solving the Fodor Pylyshyn Challenge Since the systemtheoretical connectionism has succeeded in modeling the sensory objects in perception as well as systematic and compositional representations in language processing with this vector and oscillation based representation format a new convincing theory of neurocognition has been developed which bridges the neuronal and the cognitive analysis level The book describes how elementary neuronal information is combined in perception and language so it becomes clear how the brain processes this information to enable basic cognitive performance of the humans **Artificial Neural Networks — ICANN 2002** Jose R. Dorronsoro,2003-08-03 The International Conferences on Arti cial Neural Networks ICANN have been held annually since 1991 and over the years have become the major European meeting in neural networks This proceedings volume contains all the papers presented at ICANN 2002 the 12th ICANN conference held in August 28 30 2002 at the Escuela T ecnica Superior de Inform atica of the Universidad Aut onoma de Madrid and organized by its Neural Networks group ICANN 2002 received a very high number of contributions more than 450 Almost all papers were revised by three independent reviewers selected among the more than 240 serving at this year s ICANN and 221 papers were nally selected

for publication in these proceedings due to space considerations quite a few good contributions had to be left out I would like to thank the Program Committee and all the reviewers for the great collective e ort and for helping us to have a high quality conference *Computer Aided Systems Theory - EUROCAST 2003* Robeto Moreno Diaz,2003-10-13 This book constitutes the thoroughly refereed post proceedings of the 9th International Workshop on Computer Aided Systems Theory EUROCAST 2003 held in Las Palmas de Gran Canaria Spain in February 2003 The 60 revised full papers presented were carefully selected during two rounds of reviewing and improvement The papers are organized in topical sections on complex systems tools and applications logic and formal tools social and intelligent systems distributed computing autonomous and control systems computational methods in bioinformatics natural and artificial neural networks neuroinformatics and neuroimaging and image processing **Soft Computing in Case Based Reasoning** Sankar Kumar Pal,Tharam S. Dillon,Daniel S. Yeung,2012-12-06 Soft Computing in Case Based Reasoning demonstrates how various soft computing tools can be applied to design and develop methodologies and systems with case based reasoning for real life decision making or recognition problems Comprising contributions from experts from all over the world it Provides an introduction to CBR and soft computing and the relevance of their integration Evaluates the strengths and weaknesses of CBR in its current form Presents recent developments and significant applications in domains such as data mining medical diagnosis knowledge based expert systems banking and forensic investigation Addresses new information on developing intelligent systems This book will be of particular interest to graduate students and researchers in computer science electrical engineering and information technology but it will also be of interest to researchers and practitioners in the fields of systems design pattern recognition and data mining **Technical Report** ,2004

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