Johannes F. Knabe

Computational Genetic Regulatory Networks: Evolvable, Self-organizing Systems



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Devendra Prasad, Suresh Chand Gupta, Anju Bhandari Gandhi, Stuti Mehla, Upasana Lakhina

Computational Genetic Regulatory Networks: Evolvable, Self-organizing Systems Johannes F. Knabe, 2012-08-14 Genetic Regulatory Networks GRNs in biological organisms are primary engines for cells to enact their engagements with environments via incessant continually active coupling In differentiated multicellular organisms tremendous complexity has arisen in the course of evolution of life on earth Engineering and science have so far achieved no working system that can compare with this complexity depth and scope of organization Abstracting the dynamics of genetic regulatory control to a computational framework in which artificial GRNs in artificial simulated cells differentiate while connected in a changing topology it is possible to apply Darwinian evolution in silico to study the capacity of such developmental differentiated GRNs to evolve In this volume an evolutionary GRN paradigm is investigated for its evolvability and robustness in models of biological clocks in simple differentiated multicellularity and in evolving artificial developing organisms which grow and express an ontogeny starting from a single cell interacting with its environment eventually including a changing local neighbourhood of other cells These methods may help us understand the genesis organization adaptive plasticity and evolvability of differentiated biological systems and may also provide a paradigm for transferring these principles of biology s success to computational and engineering challenges at a scale not previously conceivable **Evolutionary Computation** in Gene Regulatory Network Research Hitoshi Iba, Nasimul Noman, 2016-02-23 Introducing a handbook for gene regulatory network research using evolutionary computation with applications for computer scientists computational and system biologists This book is a step by step guideline for research in gene regulatory networks GRN using evolutionary computation EC The book is organized into four parts that deliver materials in a way equally attractive for a reader with training in computation or biology Each of these sections authored by well known researchers and experienced practitioners provides the relevant materials for the interested readers The first part of this book contains an introductory background to the field The second part presents the EC approaches for analysis and reconstruction of GRN from gene expression data The third part of this book covers the contemporary advancements in the automatic construction of gene regulatory and reaction networks and gives direction and guidelines for future research Finally the last part of this book focuses on applications of GRNs with EC in other fields such as design engineering and robotics Provides a reference for current and future research in gene regulatory networks GRN using evolutionary computation EC Covers sub domains of GRN research using EC such as expression profile analysis reverse engineering GRN evolution applications Contains useful contents for courses in gene regulatory networks systems biology computational biology and synthetic biology Delivers state of the art research in genetic algorithms genetic programming and swarm intelligence Evolutionary Computation in Gene Regulatory Network Research is a reference for researchers and professionals in computer science systems biology and bioinformatics as well as upper

undergraduate graduate and postgraduate students Hitoshi Iba is a Professor in the Department of Information and Communication Engineering Graduate School of Information Science and Technology at the University of Tokyo Toyko Japan He is an Associate Editor of the IEEE Transactions on Evolutionary Computation and the journal of Genetic Programming and Evolvable Machines Nasimul Noman is a lecturer in the School of Electrical Engineering and Computer Science at the University of Newcastle NSW Australia From 2002 to 2012 he was a faculty member at the University of Dhaka Bangladesh Noman is an Editor of the BioMed Research International journal His research interests include computational biology synthetic biology and bioinformatics Advances in Computational Intelligence Wen Yu, Edgar N. Sanchez, 2009-08-18 This book constitutes the proceedings of the second International Workshop on Advanced Computational Intelligence IWACI 2009 with a seguel of IWACI 2008 successfully held in Macao China IWACI 2009 provided a high level international forum for scientists engineers and educators to present state of the art research in computational intelligence and related fields Over the past decades computational intelligence community has witnessed t mendous efforts and developments in all aspects of theoretical foundations archit tures and network organizations modelling and simulation empirical study as well as a wide range of applications across different domains IWACI 2009 provided a great platform for the community to share their latest research results discuss critical future research directions stimulate innovative research ideas as well as facilitate inter tional multidisciplinary collaborations IWACI 2009 received 146 submissions from about 373 authors in 26 countries and regions Australia Brazil Canada China Chile Hong Kong India Islamic Republic of Iran Japan Jordan Macao Malaysia Mexico Pakistan Philippines Qatar Republic of Korea Singapore South Africa Sri Lanka Spain Taiwan Thailand UK USA Ve zuela Vietnam and Yemen across six continents Asia Europe North America South America Africa and Oceania Based on the rigorous peer reviews by the Program Committee members 52 high quality papers were selected for publication in this book with an acceptance rate of 36 3% These papers cover major topics of the theoretical research empirical study and applications of computational intelligence Computational Intelligence in Bioinformatics Gary B. Fogel, David W. Corne, Yi Pan, 2007-11-26 Combining biology computer science mathematics and statistics the field of bioinformatics has become a hot new discipline with profound impacts on all aspects of biology and industrial application Now Computational Intelligence in Bioinformatics offers an introduction to the topic covering the most relevant and popular CI methods while also encouraging the implementation of these methods to readers research Computational Evolution of Neural and Morphological <u>Development</u> Yaochu Jin, 2023-07-14 This book provides a basic yet unified overview of theory and methodologies for evolutionary developmental systems Based on the author's extensive research into the synergies between various approaches to artificial intelligence including evolutionary computation artificial neural networks and systems biology it also examines the inherent links between biological intelligence and artificial intelligence The book begins with an introduction to computational algorithms used to understand and simulate biological evolution and development including evolutionary

algorithms gene regulatory network models multi cellular models for neural and morphological development and computational models of neural plasticity Chap 2 discusses important properties of biological gene regulatory systems including network motifs network connectivity robustness and evolvability Going a step further Chap 3 presents methods for synthesizing regulatory motifs from scratch and creating more complex regulatory dynamics by combining basic regulatory motifs using evolutionary algorithms Multi cellular growth models which can be used to simulate either neural or morphological development are presented in Chapters 4 and 5 Chap 6 examines the synergies and coupling between neural and morphological evolution and development In turn Chap 7 provides preliminary yet promising examples of how evolutionary developmental systems can help in self organized pattern generation referred to as morphogenetic self organization highlighting the great potentials of evolutionary developmental systems Finally Chap 8 rounds out the book stressing the importance and promise of the evolutionary developmental approach to artificial intelligence Featuring a wealth of diagrams graphs and charts to aid in comprehension this book offers a valuable asset for graduate students researchers and practitioners who are interested in pursuing a different approach to artificial intelligence Self-Organizing Robotic Systems Yan Meng, Yaochu Jin, 2011-05-11 Self organizing approaches inspired from biological systems such as social insects genetic molecular and cellular systems under morphogenesis and human mental development has enjoyed great success in advanced robotic systems that need to work in dynamic and changing environments Compared with classical control methods for robotic systems the major advantages of bio inspired self organizing robotic systems include robustness self repair and self healing in the presence of system failures and or malfunctions high adaptability to environmental changes and autonomous self organization and self reconfiguration without a centralized control Bio inspired Self organizing Robotic Systems provides a valuable reference for scientists practitioners and research students working on developing control algorithms for self organizing engineered collective systems such as swarm robotic systems self reconfigurable modular robots smart material based robotic devices unmanned aerial vehicles and satellite constellations

Genetic and Evolutionary Computing Jeng-Shyang Pan, Pavel Krömer, Václav Snášel, 2013-08-04 Genetic and Evolutionary Computing This volume of Advances in Intelligent Systems and Computing contains accepted papers presented at ICGEC 2013 the 7th International Conference on Genetic and Evolutionary Computing The conference this year was technically co sponsored by The Waseda University in Japan Kaohsiung University of Applied Science in Taiwan and VSB Technical University of Ostrava ICGEC 2013 was held in Prague Czech Republic Prague is one of the most beautiful cities in the world whose magical atmosphere has been shaped over ten centuries Places of the greatest tourist interest are on the Royal Route running from the Powder Tower through Celetna Street to Old Town Square then across Charles Bridge through the Lesser Town up to the Hradcany Castle One should not miss the Jewish Town and the National Gallery with its fine collection of Czech Gothic art collection of old European art and a beautiful collection of French art The conference was intended as an

international forum for the researchers and professionals in all areas of genetic and evolutionary computing The main topics of ICGEC 2013 included Intelligent Computing Evolutionary Computing Genetic Computing and Grid Computing

Transactions on Computational Systems Biology X Corrado Priami, Falko Dressler, Ozgur B. Akan, Alioune Ngom, 2010-06-27 Technology is taking us to a world where myriads of heavily networked devices interact with the physical world in multiple ways and at many levels from the globalInternetdowntomicroandnanodevices Manyofthesedevicesarehighly mobile and autonomous and must adapt to the surrounding environment in a totally unsupervised way A fundamental research challenge is the design of robust decentralized c puting systemsthat are capable of operating in changing environments and with noisy input and yet exhibit the desired behavior and response time under c straints such as energy consumption size and processing power These systems should be able to adapt and learn how to react to unforeseen scenarios as well as to display properties comparable to social entities The observation of nature has brought us many great and unforeseen concepts Biological systems are able to handle many of these challenges with an elegance and e ciency far beyond currenthumanartifacts Basedonthisobservation bio inspired approaches have been proposed as a means of handling the complexity of such systems. The goal is to obtain methods to engineer technical systems which are of a stability and e ciency comparable to those found in biological entities This Special Issue on Biological and Biologically inspired Communication contains the best papers from the Second International Conference on Bio Inspired Models of Network Information and Computing Systems BIONET ICS 2007 The BIONETICS conference aims to bring together researchers and scientistsfromseveraldisciplines incomputerscienceandengineeringwhereb inspired methods are investigated as well as from bioinformatics to deepen the information exchange and collaboration among the di erent communities **Computational** Knowledge Discovery for Bioinformatics Research Li, Xiao-Li, Ng, See-Kiong, 2012-06-30 This book discusses the most significant research and latest practices in computational knowledge discovery approaches to bioinformatics in a cross disciplinary manner that is useful for researchers practitioners academicians mathematicians statisticians and computer Devendra Prasad, Suresh Chand Gupta, Anju Bhandari Gandhi, Stuti Mehla, Upasana Lakhina, 2024-08-29 It is with great pleasure to present the proceedings of the International Conference on Computational Intelligence and Mathematical Applications ICCIMA 2023 held on 21 22 December 2023 at Panipat Institute of Engineering and Technology Panipat This conference brought scholars researchers professionals and intellectuals together from diverse fields to exchange ideas share insights and foster collaborations in Optimization Computational Intelligence and Mathematical Applications The ICCIMA 2023 served as a platform for contributors to demonstrate their latest findings discuss emerging trends and explore innovations to the problems that different disciplines are currently experiencing. The conference is scope and depth of themes reflect our community s rich diversity of interests and levels of competence

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