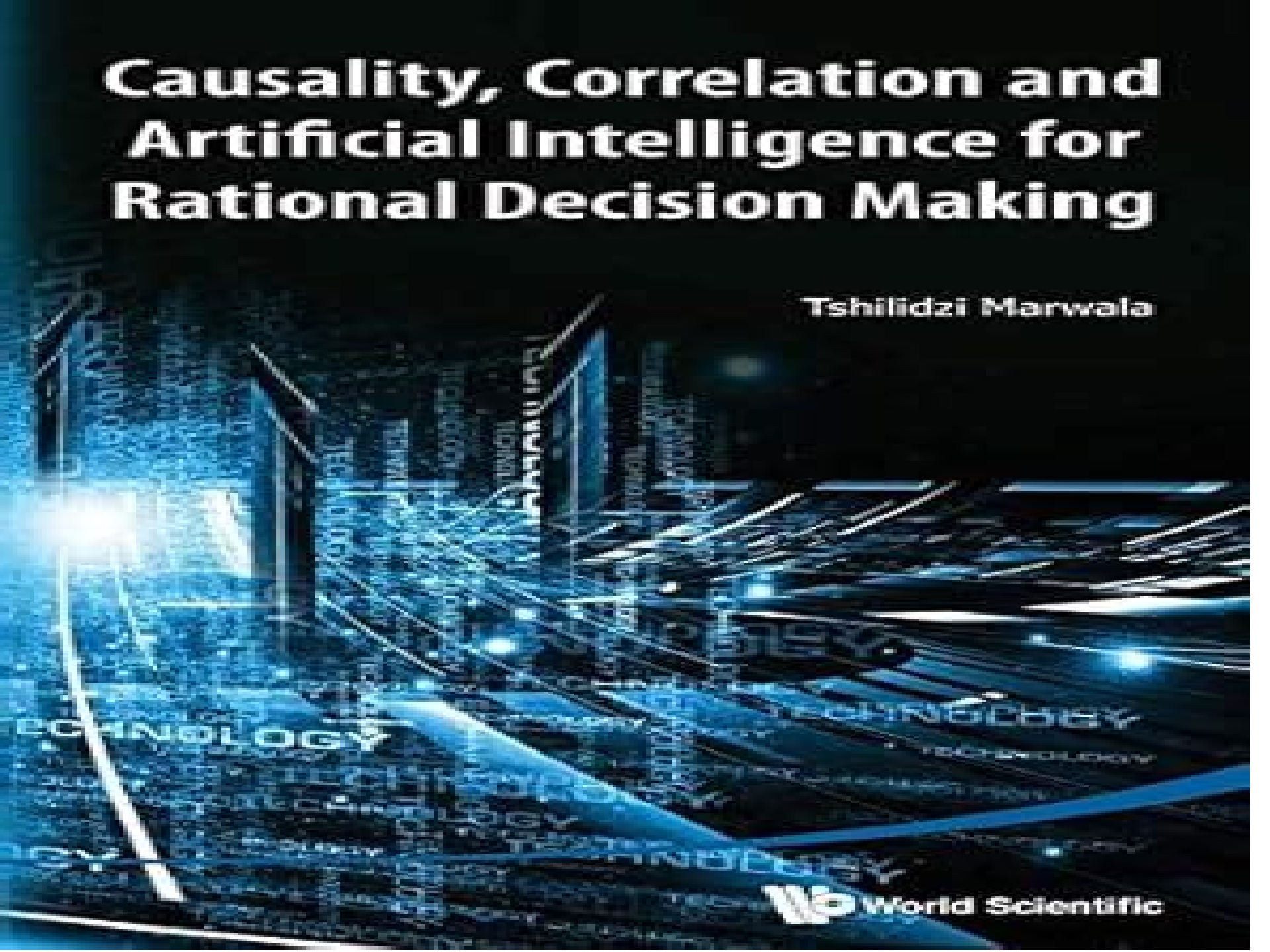
Causality, Correlation and Artificial Intelligence for Rational Decision Making

Tshilidzi Marwala



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Causality Correlation And Artificial Intelligence For Rational Decision Making

Tshilidzi Marwala,Letlhokwa George Mpedi

Causality Correlation And Artificial Intelligence For Rational Decision Making:

Causality, Correlation And Artificial Intelligence For Rational Decision Making Tshilidzi Marwala,2015-01-02 Causality has been a subject of study for a long time Often causality is confused with correlation Human intuition has evolved such that it has learned to identify causality through correlation In this book four main themes are considered and these are causality correlation artificial intelligence and decision making A correlation machine is defined and built using multi layer perceptron network principal component analysis Gaussian Mixture models genetic algorithms expectation maximization technique simulated annealing and particle swarm optimization Furthermore a causal machine is defined and built using multi layer perceptron radial basis function Bayesian statistics and Hybrid Monte Carlo methods Both these machines are used to build a Granger non linear causality model In addition the Neyman Rubin Pearl and Granger causal models are studied and are unified The automatic relevance determination is also applied to extend Granger causality framework to the non linear domain The concept of rational decision making is studied and the theory of flexibly bounded rationality is used to extend the theory of bounded rationality within the principle of the indivisibility of rationality The theory of the marginalization of irrationality for decision making is also introduced to deal with satisficing within irrational conditions The methods proposed are applied in biomedical engineering condition monitoring and for modelling interstate conflict

Artificial Intelligence Techniques for Rational Decision Making Tshilidzi Marwala,2014-10-20 Develops insights into solving complex problems in engineering biomedical sciences social science and economics based on artificial intelligence Some of the problems studied are in interstate conflict credit scoring breast cancer diagnosis condition monitoring wine testing image processing and optical character recognition The author discusses and applies the concept of flexibly bounded rationality which prescribes that the bounds in Nobel Laureate Herbert Simon s bounded rationality theory are flexible due to advanced signal processing techniques Moore s Law and artificial intelligence Artificial Intelligence Techniques for Rational Decision Making examines and defines the concepts of causal and correlation machines and applies the transmission theory of causality as a defining factor that distinguishes causality from correlation It develops the theory of rational counterfactuals which are defined as counterfactuals that are intended to maximize the attainment of a particular goal within the context of a bounded rational decision making process Furthermore it studies four methods for dealing with irrelevant information in decision making Theory of the marginalization of irrelevant information Principal component analysis Independent component analysis Automatic relevance determination method In addition it studies the concept of group decision making and various ways of effecting group decision making within the context of artificial intelligence Rich in methods of artificial intelligence including rough sets neural networks support vector machines genetic algorithms particle swarm optimization simulated annealing incremental learning and fuzzy networks this book will be welcomed by researchers and students working in these areas **Smart Computing Applications in Crowdfunding** Bo Xing,Tshilidzi

Marwala,2018-12-07 The book focuses on smart computing for crowdfunding usage looking at the crowdfunding landscape e g reward donation equity P2P based and the crowdfunding ecosystem e g regulator asker backer investor and operator The increased complexity of fund raising scenario driven by the broad economic environment as well as the need for using alternative funding sources has sparked research in smart computing techniques Covering a wide range of detailed topics the authors of this book offer an outstanding overview of the current state of the art providing deep insights into smart computing methods tools and their applications in crowdfunding exploring the importance of smart analysis prediction and decision making within the fintech industry This book is intended to be an authoritative and valuable resource for professional practitioners and researchers alike as well as finance engineering and computer science students who are interested in crowdfunding and other emerging fintech topics **Handbook Of Machine Learning - Volume 2: Optimization And Decision Making** Tshilidzi Marwala,Collins Achepsah Leke,2019-11-21 Building on this volume on Optimization and Decision Making covers a range of algorithms and their applications Like the first volume it provides a starting point for machine learning enthusiasts as a comprehensive guide on classical optimization methods It also provides an in depth overview on how artificial intelligence can be used to define disprove or validate economic modeling and decision making concepts Rational Machines and Artificial Intelligence Tshilidzi Marwala,2021-03-31 Intelligent machines are populating our social economic and political spaces These intelligent machines are powered by Artificial Intelligence technologies such as deep learning They are used in decision making One element of decision making is the issue of rationality Regulations such as the General Data Protection Regulation GDPR require that decisions that are made by these intelligent machines are explainable Rational Machines and Artificial Intelligence proposes that explainable decisions are good but the explanation must be rational to prevent these decisions from being challenged Noted author Tshilidzi Marwala studies the concept of machine rationality and compares this to the rationality bounds prescribed by Nobel Laureate Herbert Simon and rationality bounds derived from the work of Nobel Laureates Richard Thaler and Daniel Kahneman Rational Machines and Artificial Intelligence describes why machine rationality is flexibly bounded due to advances in technology This effectively means that optimally designed machines are more rational than human beings Readers will also learn whether machine rationality can be quantified and identify how this can be achieved Furthermore the author discusses whether machine rationality is subjective Finally the author examines whether a population of intelligent machines collectively make more rational decisions than individual machines Examples in biomedical engineering social sciences and the financial sectors are used to illustrate these concepts Provides an introduction to the key questions and challenges surrounding Rational Machines including When do we rely on decisions made by intelligent machines What do decisions made by intelligent machines mean Are these decisions rational or fair Can we quantify these decisions and Is rationality subjective Introduces for the first time the concept of rational opportunity costs and the concept of flexibly bounded rationality as a

rationality of intelligent machines and the implications of these issues on the reliability of machine decisions Includes coverage of Rational Counterfactuals group versus individual rationality and rational markets Discusses the application of Moore s Law and advancements in Artificial Intelligence as well as developments in the area of data acquisition and analysis technologies and how they affect the boundaries of intelligent machine rationality **Artificial Intelligence and Economic Theory: Skynet in the Market** Tshilidzi Marwala,Evan Hurwitz,2017-09-18 This book theoretically and practically updates major economic ideas such as demand and supply rational choice and expectations bounded rationality behavioral economics information asymmetry pricing efficient market hypothesis game theory mechanism design portfolio theory causality and financial engineering in the age of significant advances in man machine systems The advent of artificial intelligence has changed many disciplines such as engineering social science and economics Artificial intelligence is a computational technique which is inspired by natural intelligence concepts such as the swarming of birds the working of the brain and the pathfinding of the ants Artificial Intelligence and Economic Theory Skynet in the Market analyses the impact of artificial intelligence on economic theories a subject that has not been studied It also introduces new economic theories and these are rational counterfactuals and rational opportunity costs These ideas are applied to diverse areas such as modelling of the stock market credit scoring HIV and interstate conflict Artificial intelligence ideas used in this book include neural networks particle swarm optimization simulated annealing fuzzy logic and genetic algorithms It furthermore explores ideas in causality including Granger as well as the Pearl causality models **Mechanism Design, Behavioral Science and Artificial Intelligence in International Relations** Tshilidzi Marwala,2024-07-23 Recent advances in AI and Mechanism Design provide a vital tool for solving collective action problems common in international relations By using AI to optimize mechanisms for cooperation and coordination we can better address issues such as climate change trade and security Mechanism Design Behavioral Science and Artificial Intelligence in International Relations shows readers how the intersection of Mechanism Design and Artificial Intelligence is revolutionizing the way we approach international relations By using AI to optimize mechanisms we can design better institutions policies and agreements that are more effective and efficient Dr Tshilidzi Marwala United Nations University Rector and UN Under Secretary General presents the essential technologies used in Game Theory Mechanism Design and AI and applies these to significant global issues such as interstate conflict cybersecurity and energy International relations are a complex field with many different actors and interests in play By incorporating AI into our analysis and decision making processes we can better understand and predict the behavior of multiple actors and design mechanisms that take these behaviors into account thereby producing more desirable and creative interdisciplinary approaches The book presents real world applications of these rapidly evolving technologies in crucial research fields such as Interstate Conflict International Trade Climate Change Water management Energy cybersecurity and global finance Provides insights for computer scientists researchers practitioners and policymakers on how

to develop practical tools to solve many complex problems in international relations such as climate change cybersecurity and interstate conflict Presents the necessary computer science mathematical methods and techniques in AI game theory mechanism design and algorithm development Includes real world applications of AI and mechanism design in a wide variety of research topics such as international conflict international trade climate change water management energy management cybersecurity and global finance **Artificial Intelligence in Economics and Finance Theories** Tankiso Moloi,Tshilidzi Marwala,2020-05-07 As Artificial Intelligence AI seizes all aspects of human life there is a fundamental shift in the way in which humans are thinking of and doing things Ordinarily humans have relied on economics and finance theories to make sense of and predict concepts such as comparative advantage long run economic growth lack or distortion of information and failures role of labour as a factor of production and the decision making process for the purpose of allocating resources among other theories Of interest though is that literature has not attempted to utilize these advances in technology in order to modernize economic and finance theories that are fundamental in the decision making process for the purpose of allocating scarce resources among other things With the simulated intelligence in machines which allows machines to act like humans and to some extent even anticipate events better than humans thanks to their ability to handle massive data sets this book will use artificial intelligence to explain what these economic and finance theories mean in the context of the agent wanting to make a decision The main feature of finance and economic theories is that they try to eliminate the effects of uncertainties by attempting to bring the future to the present The fundamentals of this statement is deeply rooted in risk and risk management In behavioural sciences economics as a discipline has always provided a well established foundation for understanding uncertainties and what this means for decision making Finance and economics have done this through different models which attempt to predict the future On its part risk management attempts to hedge or mitigate these uncertainties in order for the planner to reach the favourable outcome This book focuses on how AI is to redefine certain important economic and financial theories that are specifically used for the purpose of eliminating uncertainties so as to allow agents to make informed decisions In effect certain aspects of finance and economic theories cannot be understood in their entirety without the incorporation of AI **The Balancing Problem in the Governance of Artificial Intelligence** Tshilidzi Marwala,2024-11-12 This book examines the balancing problems in the governance of artificial intelligence AI AI is transforming the world at an unprecedented pace which is revolutionary and presents significant challenges Nevertheless AI s complex balance dilemma necessitates careful governance as it transforms businesses economies and society Fundamental issues discussed in this book include the complexities of AI s dual nature the challenges of aligning memorizing with thinking and the trade offs between opportunity seeking and risk aversion This book explores the complex interplay between AI security and transparency the technical decision between CPUs and GPUs and the expanding potential of quantum computing Nevertheless the challenge of maintaining balance is not resolved by technological advancements It encompasses

the global arena where the forces of globalization and localization must be reconciled and the governance sphere where self regulation must coexist with government control Comprising cutting edge research real world examples and futuristic perspectives this book guides researchers practitioners politicians entrepreneurs and leaders in navigating AI s future The reader will learn how to capitalize on the potential of AI while avoiding its weaknesses ensuring that this disruptive technology benefits society **Handbook Of Machine Learning - Volume 1: Foundation Of Artificial Intelligence** Tshilidzi Marwala,2018-10-22 This is a comprehensive book on the theories of artificial intelligence with an emphasis on their applications It combines fuzzy logic and neural networks as well as hidden Markov models and genetic algorithm describes advancements and applications of these machine learning techniques and describes the problem of causality This book should serves as a useful reference for practitioners in artificial intelligence *Artificial Intelligence, Game Theory and Mechanism Design in Politics* Tshilidzi Marwala,2023-08-04 This book explores how AI and mechanism design can provide a new framework for international politics The international political system is all manners in which countries governments and people relate Mechanism design in international politics relates to identifying rules that define relationships between people and countries that achieve a particular outcome e g peace or more trade or democracy or economic development Artificial intelligence is technique of making machines intelligent This book explores mechanism design and artificial intelligence in international politics and applies these technologies to politics economy and society This book will be of interest to scholars of international relations politics sustainable development and artificial intelligence **Artificial Intelligence and the Law** Tshilidzi Marwala,Letlhokwa George Mpedi,2024-05-17 This textbook offers a starting point for the education of attorneys and other legal professionals about the potential impact of artificial intelligence AI on the law as well as a forum for discussing artificial intelligence s legal and ethical concerns Intended for classroom use this book will help students legal professionals and policymakers alike AI is swiftly transforming the world including the legal system Legal applications to areas such as ethics human rights climate change labor law health social protection inequality lethal autonomous weapons the criminal justice system and autonomous vehicles contract drafting legal investigation criminal analysis and evidence investigation utilize AI As AI becomes more sophisticated its impact on the law will likely increase Artificial Intelligence And Emerging Technologies In International Relations Bhaso Ndzendze,Tshilidzi Marwala,2021-06-03 Artificial Intelligence and Emerging Technologies in International Relations explores the geopolitics between technology and international relations Through a focus on war trade investment flows diplomacy regional integration and development cooperation this book takes a holistic perspective to examine the origins of technology analysing its current manifestations in the contemporary world The authors present the possible future roles of artificial intelligence AI and other emerging technologies including blockchain 3D printing 5G connectivity and the Internet of Things in the context of global arena This book is essential reading to all who seek to understand the reality of the inequitable

distribution of these game changing technologies that are shaping the world Research questions as well as some policy options for the developing world are explored and the authors make the case for cooperation by the international community as we enter the fourth industrial revolution **Higher Education in the Era of the Fourth Industrial Revolution** Nancy W. Gleason,2018-06-21 This open access collection examines how higher education responds to the demands of the automation economy and the fourth industrial revolution Considering significant trends in how people are learning coupled with the ways in which different higher education institutions and education stakeholders are implementing adaptations it looks at new programs and technological advances that are changing how and why we teach and learn The book addresses trends in liberal arts integration of STEM innovations the changing role of libraries in the digital age global trends in youth mobility and the development of lifelong learning programs This is coupled with case study assessments of the various ways China Singapore South Africa and Costa Rica are preparing their populations for significant shifts in labour market demands shifts that are already underway Offering examples of new frameworks in which collaboration between government industry and higher education institutions can prevent lagging behind in this fast changing environment this book is a key read for anyone wanting to understand how the world should respond to the radical technological shifts underway on the frontline of higher education Smart Maintenance for Human–Robot Interaction Bo Xing,Tshilidzi Marwala,2017-09-08 This self contained book written by active researchers presents up to date information on smart maintenance strategies for human robot interaction HRI and the associated applications of novel search algorithms in a single volume eliminating the need to consult scattered resources Unlike other books it addresses maintaining a smart HRI from three dimensions namely hardware cyberware and hybrid asset management covering problems encountered in each through a wide variety of representative examples and elaborated illustrations Further the diverse mathematical models and intelligent systems constructions make the book highly practical It enables readers interested in maintenance robotics and intelligent systems but perplexed by myriads of interrelated issues to grasp basic methodologies At the same time the referenced literature can be used as a roadmap for conducting deeper researches **Managing Knowledge in Organizations** W. David Holford,2020-04-28 This book explores organizational knowledge and how it can be pragmatically exploited within many of today s socio technical economic contexts It provides both conceptual and empirical findings across different organizational contexts addressing areas which have either been under developed such as power in relationship to knowledge or require further examination such as the role a more holistic action oriented view can contribute towards identifying and retaining expert knowledge within an organization especially within digital environments Further it looks at how different perceptions mental models beliefs and emotions or lack of as well as differing actions and behaviors affect our abilities to detect hidden risks This book will guide researchers in rendering the relationship between the managing of knowledge and the presence of risk more visible *Knowledge Science, Engineering and Management* Christos Douligeris,Dimitris Karagiannis,Dimitris

Apostolou,2019-08-21 This two volume set of LNAI 11775 and LNAI 11776 constitutes the refereed proceedings of the 12th International Conference on Knowledge Science Engineering and Management KSEM 2019 held in Athens Greece in August 2019 The 77 revised full papers and 23 short papers presented together with 10 poster papers were carefully reviewed and selected from 240 submissions The papers of the first volume are organized in the following topical sections Formal Reasoning and Ontologies Recommendation Algorithms and Systems Social Knowledge Analysis and Management Data Processing and Data Mining Image and Video Data Analysis Deep Learning Knowledge Graph and Knowledge Management Machine Learning and Knowledge Engineering Applications The papers of the second volume are organized in the following topical sections Probabilistic Models and Applications Text Mining and Document Analysis Knowledge Theories and Models and Network Knowledge Representation and Learning *Human Enactment Of Intelligent Technologies: Towards Metis And Mindfulness* W David Holford,2021-08-05 This book demystifies what artificial intelligence is examines its strength and limitations in comparison to what humans are capable of and investigates the nature of human adaptive expertise across the concept of m tis It also examines a particular family of mindsets that we as humans have adopted over the ages namely epistemologies of representational knowledge These representational perspectives have followed us into numerous fields including how we perceive and comprehend human cognition leading to with a hammer everything looks like a nail syndrome As such this book presents the alternative phenomenological viewpoint of embodied direct reality within the cognitive sciences in the form of radical embodied cognition and more importantly how it allows us to better highlight and comprehend human m tis and its adaptive expertise We then examine why we collectively continue to enact and perpetuate predominant mindsets of representations across the phenomena of mindlessness To counter this we re visit the practice of individual and collective mindfulness providing a potential beachhead in our re appropriation of technology artificial intelligence towards achieving the best of both worlds that is allowing human creativity and ingenuity to be expressed with artificial intelligence as a tool to help us do just that across meaningful human control Finally we conclude by examining current top of the horizon activities and debates regarding quantum physics in relation to the human mind and artificial intelligence and how once again representational mindsets need not be the only tool in town *Probabilistic Finite Element Model Updating Using Bayesian Statistics* Tshilidzi Marwala,Ilyes Boulkaibet,Sondipon Adhikari,2016-09-23 Probabilistic Finite Element Model Updating Using Bayesian Statistics Applications to Aeronautical and Mechanical Engineering Tshilidzi Marwala and Ilyes Boulkaibet University of Johannesburg South Africa Sondipon Adhikari Swansea University UK Covers the probabilistic finite element model based on Bayesian statistics with applications to aeronautical and mechanical engineering Finite element models are used widely to model the dynamic behaviour of many systems including in electrical aerospace and mechanical engineering The book covers probabilistic finite element model updating achieved using Bayesian statistics The Bayesian framework is employed to estimate the probabilistic finite element models which take into account of the uncertainties in the

measurements and the modelling procedure The Bayesian formulation achieves this by formulating the finite element model as the posterior distribution of the model given the measured data within the context of computational statistics and applies these in aeronautical and mechanical engineering Probabilistic Finite Element Model Updating Using Bayesian Statistics contains simple explanations of computational statistical techniques such as Metropolis Hastings Algorithm Slice sampling Markov Chain Monte Carlo method hybrid Monte Carlo as well as Shadow Hybrid Monte Carlo and their relevance in engineering Key features Contains several contributions in the area of model updating using Bayesian techniques which are useful for graduate students Explains in detail the use of Bayesian techniques to quantify uncertainties in mechanical structures as well as the use of Markov Chain Monte Carlo techniques to evaluate the Bayesian formulations The book is essential reading for researchers practitioners and students in mechanical and aerospace engineering Precision Medicine in Cancer Therapy Daniel D. Von Hoff,Haiyong Han,2019-06-17 This book presents the latest advances in precision medicine in some of the most common cancer types including hematological lung and breast malignancies It also discusses emerging technologies that are making a significant impact on precision medicine in cancer therapy In addition to describing specific approaches that have already entered clinical practice the book explores new concepts and tools that are being developed Precision medicine aims to deliver personalized healthcare tailored to a patient s genetics lifestyle and environment and cancer therapy is one of the areas in which it has flourished in recent years Documenting the latest advances this book is of interest to physicians and clinical fellows in the front line of the war on cancer as well as to basic scientists working in the fields of cancer biology drug development biomarker discovery and biomedical engineering The contributing authors include translational physicians withfirst hand experience in precision patient care

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