

Article

Investigations of Symmetrical Incomplete Information Spreading in the Evidential Reasoning Algorithm and the Evidential Reasoning Rule via Partial Derivative Analysis

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Abstract: Incomplete information causes great uncertainty in decision making. It is a critical task to understand how incomplete information spreads symmetrically in order to make comprehensive and balanced decisions. A better understanding of the spreading of incomplete information can also be used for accurately locating limited resources to reduce incomplete information in the input for the final purpose of reducing incomplete information in the result. In this study, the way in which incomplete information spreads is studied via the evidential reasoning (ER) algorithm and the evidential reasoning rule (the ER rule), which are known for their transparent analytical procedures. Specifically, the partial derivative analysis is conducted using the steps of ER and the ER rule for calculating the contributions made by the beliefs, weights, and reliability to the incomplete information in the result. The major theoretical contribution of this study is the calculation of the contribution of the input to the incomplete information in the output based on partial derivative analysis. A numerical case is studied to demonstrate the proposed derivative analysis, the contribution calculation, and the consequential results.

Keywords: symmetrical incomplete information; information spreading; evidential reasoning algorithm; evidential reasoning rule; partial derivative analysis



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1. Introduction

Incomplete information brings uncertainty to traditional decision making, which however, is almost unavoidable under many conditions [1,2]. There are many causes for incomplete information, e.g., degraded sensors [3], inaccurate recording and transferring of data [4], or human knowledge ignorance [5]. Generally existent incomplete information produces challenges in complex systems modeling.

Many traditional machine learning approaches, e.g., the neural network (NN), the support vector machine (SVM), etc., are effective in complex systems modeling, yet they cannot effectively handle incomplete information [1,6,7]. There are several methods for handling incomplete information [8]. When there is a large quantity of data, the data with incomplete information would be deleted or omitted from the later modeling procedure. Alternatively, incomplete information could be imputed using prior information or according to statistical data. Furthermore, the imputed information could be used either in a single value or as a distribution to provide a holistic picture of the problem, if required. Recently, machine learning approaches have been used for inferring the missing information, leading to superior performance. However, those endeavors are all indirect means, i.e., the missing information is either deleted or filled in, becoming complete information which traditional machine learning approaches can handle.

Therefore, the presence of incomplete information remains a challenge in decision-making, leading to the requirement of eliminating or at least reducing it. [9]. For example, there may be ambiguity regarding a patient's assessment of pain, or the X-rays or CT scans may be blurred [10,11], all of which are sources of incomplete information in the input.

Reasoning With Incomplete Information

Manish Soni



Reasoning With Incomplete Information:

Reasoning with Incomplete Information David W. Etherington, 1988 **Intellectics and Computational Logic** Steffen Hölldobler, 2013-04-18 Intellectics seeks to understand the functions structure and operation of the human intellect and to test artificial systems to see the extent to which they can substitute or complement such functions The word itself was introduced in the early 1980s by Wolfgang Bibel to describe the united fields of artificial intelligence and cognitive science The book collects papers by distinguished researchers colleagues and former students of Bibel s all of whom have worked together with him and who present their work to him here to mark his 60th birthday The papers discuss significant issues in intellectics and computational logic ranging across automated deduction logic programming the logic based approach to intellectics cognitive robotics knowledge representation and reasoning Each paper contains new previously unpublished reviewed results The collection is a state of the art account of the current capabilities and limitations of a computational logic based approach to intellectics Readership Researchers who are convinced that the intelligent behaviour of machines should be based on a rigid formal treatment of knowledge representation and reasoning The Automation of Reasoning with Incomplete Information Torsten Schaub, 1997 Reasoning with incomplete information constitutes a major challenge for any intelligent system In fact we expect such systems not to become paralyzed by missing information but rather to arrive at plausible results by bridging the gaps in the information available A versatile way of reasoning in the absence of information is to reason by default This book aims at providing formal and practical means for automating reasoning with incomplete information by starting from the approach taken by the framework of default logic For this endeavor a bridge is spanned between formal semantics over systems for default reasoning to efficient implementation *Mathematical Foundations of Computer Science 1996* Wojciech Penczek, Andrzej Szalas, 1996-08-07 This book constitutes the refereed proceedings of the 21st International Symposium on Mathematical Foundations of Computer Science MFCS 96 held in Crakow Poland in September 1996 The volume presents 35 revised full papers selected from a total of 95 submissions together with 8 invited papers and 2 abstracts of invited talks The papers included cover issues from the whole area of theoretical computer science with a certain emphasis on mathematical and logical foundations The 10 invited presentations are of particular value

AALIANCE Ambient Assisted Living Roadmap Seventh Framework Programme (European Commission), 2010 Title page AALIANCE The European Ambient Assisted Living Innovation Platform Foreword Executive Summary Table of contents List of Roadmaps List of Scenarios List of Figures List of Tables Introduction Structure of the Roadmap Roadmapping Process Scope of AAL Technological trends and barriers in AAL Technological trends Technological barriers AAL for persons AAL for health rehabilitation and care Support for chronic disease management Biorobotics for neuro rehabilitation Support for multi disciplinary care teams Consolidated view Coping with impairments and disabilities Motor disabilities Personal activity management and monitoring Physical activity Mental activity Consolidated view Personal and home safety and

security Open issues Safety in the face of specific threats Activities of Daily Life oriented support Other common activities Shopping Eat and drink Social interaction and communication AAL in the community Social inclusion Participation in community activities Creativity hobbies and sports Cultural and experience exchanges Entertainment and leisure Training the brain Exercise and gaming Mobility Supporting individual physical mobility AA driving cars private vehicles Public transport AAL at work Background Work ability Employers attitudes to older workers Training in and for the workplace Issues of work life balance Needs of older workers in the workplace Access to working space Assuring environmental working conditions Support for working Prevention of diseases and injuries Safety and health regulations Enabling Technologies Sensing Sensors for safety and security in the environments Sensors for monitoring persons Sensor networks

COMADEM 89 International Raj B. K. N. Rao, A. D. Hope, 2012-12-06 Raj B. K. N. Rao Conference Director Birmingham Polytechnic Condition Monitoring and Diagnostic Engineering Management COMADEM is a relatively new field that has already made its mark in a wide range of industries But all the signs are that even more will be required of researchers in the field over the next decade for COMADEM directly addresses a whole range of issues that are likely to become increasingly important to companies as competitiveness increases along with the uncertainties resulting from rapid technological change Already for example businesses are having to scrutinize the economics of plant and machinery in greater detail than ever before reliability is becoming a crucial factor as the costs of unscheduled breakdowns rise and there is increasing pressure on companies to demonstrate and assure improved health and safety conditions especially in light of the growing number of catastrophic accidents that have occurred throughout the world Because it offers solutions to these and similar problems COMADEM is now gaining an international reputation as a problem solving user friendly and financially beneficial multi discipline with immense potential Many people at the senior management level are now convinced that COMADEM has much to offer and are wasting no time in reaping maximum benefit from the latest developments The fact that the first UK informal seminar on COMADEM COMADEM 88 proved to be a great success and had a truly international flavour reflected this growing interest in the new field

An Introduction to Default Logic Philippe Besnard, 2013-04-17 This book is written for those who are interested in a formalization of human reasoning especially in order to build intelligent computer systems Thus it is mainly designed for the Artificial Intelligence community both students and researchers although it can be useful for people working in related fields like cognitive psychology The major theme is not Artificial Intelligence applications although these are discussed throughout in sketch form Rather the book places a heavy emphasis on the formal development of default logic results and problems Default logic provides a formalism for an important part of human reasoning Default logic is specifically concerned with common sense reasoning which has recently been recognized in the Artificial Intelligence literature to be of fundamental importance for knowledge representation Previously formalized reasoning systems failed in real world environments though succeeding with an acceptable ratio in well defined environments This situation enabled

empirical explorations and the design of systems without theoretical justification. In particular, they could not be compared since there was no basis to judge their respective merits. Default logic turned out to be very fruitful by proving the correctness of some of them. We hope that this book will initiate other successful developments in default logic. **Dynamic Fuzzy Logic and Its Applications** Fanzhang Li, 2008. Dynamic fuzzy problems are problems that are universally focused by academics. Mathematicians and cybernetic experts have used fuzzy logic to develop theories and solve static problems in so-called subjective and objective worlds. This book includes 12 chapters. Chapter 1 is about basic conceptions of Dynamic Fuzzy Sets (DFS). Chapter 2 introduces Dynamic Fuzzy (DF) decomposition theorems. Chapter 3 is about the L-form of DFS module structure. Chapter 4 is about representation theorems of DFS. Chapter 5 introduces extension theorems of DFS. Chapter 6 is about DF measure theory. In chapter 7, it is Dynamic Fuzzy Logic (DFL). Chapter 8 is about reasoning methods of DFL. Chapter 9 is about bases of DFL programming language. Chapter 10 introduces a multi-agent learning model based on DFL. Chapter 11 is about an autonomous computing model based on DFL. The last chapter introduces the application of DFL in machine learning.

The Many Valued and Nonmonotonic Turn in Logic Dov M. Gabbay, John Woods, 2007-08-13. The present volume of the Handbook of the History of Logic brings together two of the most important developments in 20th-century non-classical logic. These are many-valuedness and non-monotonicity. On the one approach, in deference to vagueness, temporal or quantum indeterminacy, or reference failure, sentences that are classically non-bivalent are allowed as inputs and outputs to consequence relations. Many-valued dialethic, fuzzy, and quantum logics are among other things principled attempts to regulate the flow through of sentences that are neither true nor false. On the second or non-monotonic approach, constraints are placed on inputs and sometimes on outputs of a classical consequence relation with a view to producing a notion of consequence that serves in a more realistic way the requirements of real-life inference. Many-valued logics produce an interesting problem. Non-bivalent inputs produce classically valid consequence statements for any choice of outputs. A major task of many-valued logics of all stripes is to fashion an appropriately non-classical relation of consequence. The chief preoccupation of non-monotonic and default logicians is how to constrain inputs and outputs of the consequence relation. In what is called left non-monotonicity, it is forbidden to add new sentences to the inputs of true consequence statements. The restriction takes notice of the fact that new information will sometimes override an antecedently and reasonably derived consequence. In what is called right non-monotonicity, limitations are imposed on outputs of the consequence relation. Most notably, perhaps, is the requirement that the rule of introduction not be given free sway on outputs. Also prominent is the effort of paraconsistent logicians, both preservationist and dialethic, to limit the outputs of inconsistent inputs, which in classical contexts are wholly unconstrained. In some instances, our two themes coincide. Dialethic logics are a case in point. Dialethic logics allow certain selected sentences to have as a third truth value the classical values of truth and falsity together. So such logics also admit classically inconsistent inputs. A central task is to construct a right non-monotonic

consequence relation that allows for these many valued and inconsistent inputs The Many Valued and Non Monotonic Turn in Logic is an indispensable research tool for anyone interested in the development of logic including researchers graduate and senior undergraduate students in logic history of logic mathematics history of mathematics computer science AI linguistics cognitive science argumentation theory and the history of ideas Detailed and comprehensive chapters covering the entire range of modal logic Contains the latest scholarly discoveries and interpretative insights that answers many questions in the field of logic

A Defeasible Logic Programming-Based Framework to Support Argumentation in Semantic Web Applications Naeem Khalid Janjua, 2014-02-15 This book reports on the development and validation of a generic defeasible logic programming framework for carrying out argumentative reasoning in Semantic Web applications GF SWA The proposed methodology is unique in providing a solution for representing incomplete and or contradictory information coming from different sources and reasoning with it GF SWA is able to represent this type of information perform argumentation driven hybrid reasoning to resolve conflicts and generate graphical representations of the integrated information thus assisting decision makers in decision making processes GF SWA represents the first argumentative reasoning engine for carrying out automated reasoning in the Semantic Web context and is expected to have a significant impact on future business applications The book provides the readers with a detailed and clear exposition of different argumentation based reasoning techniques and of their importance and use in Semantic Web applications It addresses both academics and professionals and will be of primary interest to researchers students and practitioners in the area of Web based intelligent decision support systems and their application in various domains

Belief Functions: Theory and Applications Fabio Cuzzolin, 2014-09-05 This book constitutes the thoroughly refereed proceedings of the Third International Conference on Belief Functions BELIEF 2014 held in Oxford UK in September 2014 The 47 revised full papers presented in this book were carefully selected and reviewed from 56 submissions The papers are organized in topical sections on belief combination machine learning applications theory networks information fusion data association and geometry

Symbolic and Quantitative Approaches to Uncertainty Rudolf Kruse, Pierre Siegel, 1991-10 A variety of formalisms have been developed to address such aspects of handling imperfect knowledge as uncertainty vagueness imprecision incompleteness and partial inconsistency Some of the most familiar approaches in this research field are nonmonotonic logics modal logics probability theory Bayesian and non Bayesian belief function theory and fuzzy sets and possibility theory ESPRIT Basic Research Action 3085 entitled Defeasible Reasoning and Uncertainty Management Systems DRUMS aims to contribute to the elucidation of similarities and differences between these formalisms It consists of 11 active European research groups The European Conference on Symbolic and Quantitative Approaches to Uncertainty ESQAU provides a forum for these groups to meet and discuss their scientific results This volume contains 42 contributions accepted for the ESQAU meeting held in October 1991 in Marseille together with 12 articles presenting the activities of the DRUMS groups and two invited presentations

Logic

Programming Philippe Codognet, 2001-11-14 This book constitutes the refereed proceedings of the 17th International Conference on Logic Programming ICLP 2001 held in Paphos Cyprus in November December 2001 The 23 revised full papers presented were carefully reviewed and selected from 64 submissions All current aspects of logic programming and computational logics are addressed

ECAI 2014 T. Schaub, G. Friedrich, B. O'Sullivan, 2014-08 The role of artificial intelligence AI applications in fields as diverse as medicine economics linguistics logical analysis and industry continues to grow in scope and importance AI has become integral to the effective functioning of much of the technical infrastructure we all now take for granted as part of our daily lives This book presents the papers from the 21st biennial European Conference on Artificial Intelligence ECAI 2014 held in Prague Czech Republic in August 2014 The ECAI conference remains Europe's principal opportunity for researchers and practitioners of Artificial Intelligence to gather and to discuss the latest trends and challenges in all subfields of AI as well as to demonstrate innovative applications and uses of advanced AI technology Included here are the 158 long papers and 94 short papers selected for presentation at the conference Many of the papers cover the fields of knowledge representation reasoning and logic as well as agent based and multi agent systems machine learning and data mining The proceedings of PAIS 2014 and the PAIS System Demonstrations are also included in this volume which will be of interest to all those wishing to keep abreast of the latest developments in the field of AI

Rules and Rule Markup Languages for the Semantic Web Grigoris Antoniou, 2004-10-27 This book constitutes the refereed proceedings of the Third International Workshop on Rules and Rule Markup Languages for the Semantic Web RuleML 2004 held in Hiroshima Japan in November 2004 together with ISWC 2004 The 11 revised full papers presented together with 2 invited papers and 5 tool presentation abstracts were carefully reviewed and selected from 25 submissions Among the topics addressed are nonmonotonic rule systems rule learning for feature extraction logic reasoners for the Semantic Web deductive RDF rule languages description logic programs defeasible description logics conceptual logic programs OWL inferencing and Semantic Web reasoning

IGNOU Artificial Intelligence Previous 10 Years Solved Papers Manish Soni, 2024-11-13 Welcome to the world of comprehensive learning and academic excellence with 10 Years Solved IGNOU Papers Artificial Intelligence As we stand at the forefront of a technological revolution the field of Artificial Intelligence AI has emerged as a driving force transforming the way we live work and perceive the world around us The Indira Gandhi National Open University IGNOU has been at the forefront of providing quality education and this compilation of solved papers aims to facilitate your journey through the AI program Over the past decade AI has witnessed unprecedented growth becoming an integral part of various industries from healthcare to finance and from education to entertainment Keeping pace with this dynamic field requires a strong foundation and IGNOU's AI program is designed to provide just that This book featuring solved papers from the last 10 years serves as an invaluable resource for students offering a comprehensive overview of the examination patterns question types and the depth of knowledge required to excel in AI studies The selection

of solved papers in this book is meticulous covering a wide range of topics such as machine learning natural language processing robotics and neural networks Each solution is presented in a clear and concise manner offering not only the correct answers but also detailed explanations to enhance your understanding of the underlying concepts We believe that learning from past examinations is a powerful tool for success and this book is crafted with the intention of providing you with the necessary insights to tackle future challenges in the AI domain As you embark on this academic journey it is essential to acknowledge the dedication and hard work put in by the faculty authors and experts in compiling this collection Their commitment to academic excellence is reflected in the quality of solutions provided ensuring that you receive the best possible guidance for your AI studies Approach each solved paper with curiosity and diligence treating it not only as a test of your current understanding but also as an opportunity for growth and improvement In conclusion 10 Years Solved IGNOU Papers Key Features Include Extensive Analysis of Solved Papers Each chapter focuses on a specific year s exam providing detailed solutions and explanations that clarify the rationale behind each answer helping you understand the intricacies of question framing and answer selection Theoretical Insights and Practical Examples To supplement the solved papers we provide theoretical insights and practical examples that explain complex AI concepts ensuring a well rounded understanding Mock Tests and Self Assessment To mimic examination conditions and test your readiness we include mock tests crafted from unsolved questions and typical exam questions accompanied by self assessment tools that help you track your progress and identify areas needing improvement Expert Tips and Examination Strategies Gain from insights provided by experts who have a profound understanding of the IGNOU exams These tips are designed to enhance your examination tactics and time management skills Artificial Intelligence is more than just a compilation of solved papers it is a companion on your academic journey providing guidance insights and a roadmap to success Embrace the challenges enjoy the process of learning and let this book be your trusted ally in mastering the exciting and evolving field of Artificial Intelligence **Pluralism and Law A.**

Soeteman,2013-04-17 AREND SOETEMAN In the past we lived on one earth but in many different worlds Different civilisations in regions far apart knew about one another at least from about the 16th century they competed with one another or tried to dominate the other they influenced one another but in many important aspects they were independent from one another Somewhere in the 20th century however this changed There is no far apart anymore We have lived through two European wars which developed into world wars Modern aeroplanes allow us to travel in only a couple of hours around the world Instant communication between individuals who have the whole globe in between is a reality There still exist great differences between different civilisations But they can ignore one another only at their peril They deeply influence one another Today therefore we live in one world Conflicts in the Middle East in Rwanda and Uganda or in the former Yugoslavia have their impact all over the world Violations of human rights no matter where are increasingly considered to be the concern of all of us The whims and caprices of some dictator may influence the spending possibilities of the general public

far away Multisensor Fusion and Integration in the Wake of Big Data, Deep Learning and Cyber Physical System Sukhan Lee, Hanseok Ko, Songhwa Oh, 2018-07-04 This book includes selected papers from the 13th IEEE International Conference on Multisensor Integration and Fusion for Intelligent Systems MFI 2017 held in Daegu Korea November 16 22 2017 It covers various topics including sensor actuator networks distributed and cloud architectures bio inspired systems and evolutionary approaches methods of cognitive sensor fusion Bayesian approaches fuzzy systems and neural networks biomedical applications autonomous land sea and air vehicles localization tracking SLAM 3D perception manipulation with multifinger hands robotics micro nano systems information fusion and sensors and multimodal integration in HCI and HRI The book is intended for robotics scientists data and information fusion scientists researchers and professionals at universities research institutes and laboratories **ECAI 2016** G.A. Kaminka, M. Fox, P. Bouquet, 2016-08-24 Artificial Intelligence continues to be one of the most exciting and fast developing fields of computer science This book presents the 177 long papers and 123 short papers accepted for ECAI 2016 the latest edition of the biennial European Conference on Artificial Intelligence Europe's premier venue for presenting scientific results in AI The conference was held in The Hague the Netherlands from August 29 to September 2 2016 ECAI 2016 also incorporated the conference on Prestigious Applications of Intelligent Systems PAIS 2016 and the Starting AI Researcher Symposium STAIRS The papers from PAIS are included in this volume the papers from STAIRS are published in a separate volume in the Frontiers in Artificial Intelligence and Applications FAIA series Organized by the European Association for Artificial Intelligence EurAI and the Benelux Association for Artificial Intelligence BNVKI the ECAI conference provides an opportunity for researchers to present and hear about the very best research in contemporary AI This proceedings will be of interest to all those seeking an overview of the very latest innovations and developments in this field **Ingenious Fuzzy Systems** Pasquale De Marco, 2025-04-17 In a world increasingly characterized by uncertainty and complexity adaptive fuzzy systems have emerged as a beacon of hope offering a powerful approach to modeling control and decision making in the face of ambiguity This book takes readers on an enlightening journey into the realm of adaptive fuzzy systems unveiling their principles methodologies and applications in a comprehensive and engaging manner Written with clarity and precision this book provides a solid foundation in fuzzy logic the cornerstone of adaptive fuzzy systems Readers will gain a deep understanding of fuzzy sets fuzzy operations and fuzzy reasoning empowering them to effectively capture and process imprecise information Delving deeper into adaptive fuzzy systems the book explores various types of these systems highlighting their unique features and suitability for different applications From basic adaptive fuzzy systems to more advanced approaches like neuro fuzzy systems and evolutionary fuzzy systems readers will gain a comprehensive understanding of the available options Furthermore the book delves into the intricacies of stability analysis design methodologies and optimization techniques for adaptive fuzzy systems These concepts are presented in a clear and accessible manner enabling readers to develop a thorough understanding of the underlying principles and their practical

implications To illustrate the transformative impact of adaptive fuzzy systems the book showcases a diverse range of real world applications across multiple industries These case studies provide tangible evidence of the effectiveness of adaptive fuzzy systems in addressing complex problems in areas such as robotics manufacturing finance and healthcare As readers conclude their exploration of this book they will possess a profound understanding of adaptive fuzzy systems and their immense potential They will be equipped with the knowledge and skills necessary to harness the power of these systems to solve real world problems and contribute to the advancement of this rapidly evolving field If you like this book write a review on google books

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