



# CATALA: Moving towards the future of legal expert systems

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## Abstract

Around the world, private and public organizations use software called legal expert systems to compute taxes. This software must comply with the laws they are designed to implement. As such, a bug or an error in a program that leads to tax miscalculations can have heavy legal and democratic consequences. However, increasing evidence suggests that some legal expert systems may not comply with the law. Moreover, traditional software development processes mean that legal expert systems are difficult to adapt to the continuous flow of new legislation. To prevent further software decay and to reconcile these systems with the growing demand for algorithmic transparency, we argue that there is a need for a new development process for legal expert systems. This new system must be built to comply with the law, in particular the GDPR. It must also respect democratic transparency. For these reasons, we present a solution built by lawyers and computer scientists: CATALA, a new programming language coupled with a pair programming development process.

**Keywords** Legal expert systems · Formal methods · Literate programming · Algorithmic transparency · Tax law · Social benefits

## 1 Introduction

How do governments compute taxes and social benefits for their citizens? Many have chosen to solve this complicated task by using computer programs. They have created software, modeled on the law, which computes the amount of tax due and the social benefits to be paid to each citizen.

These programs, called “legal expert systems”, are based on the law. In other words, the program and its reference statute ought to be functionally equivalent.

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# Moving Towards Expert Systems Globally I

**Lech Polkowski, Shusaku  
Tsumoto, Tsau Y. Lin**



## **Moving Towards Expert Systems Globally I:**

*The Handbook of Applied Expert Systems* Jay Liebowitz, 2019-07-23 The Handbook of Applied Expert Systems is a landmark work dedicated solely to this rapidly advancing area of study Edited by Jay Liebowitz a professor author and consultant known around the world for his work in the field this authoritative source covers the latest expert system technologies applications methodologies and practices The book features contributions from more than 40 of the world's foremost expert systems authorities in industry government and academia The Handbook is organized into two major sections The first section explains expert systems technologies while the second section focuses on applied examples in a wide variety of industries Key topics covered include fuzzy systems genetic algorithm development machine learning knowledge representation and much more Expertmedia--expert Systems and Hypermedia Roy Rada, Klaus

Tochtermann, 1995 ExpertMedia is growing in popularity and brings together the well established disciplines of Human Computer Interaction and Artificial Intelligence ExpertMedia is a neologism from expert systems and hypermedia systems and is intended to synergistically combine the advantages of each of these components Expert System HyperMedia System ExpertMediaKey practitioners in the field have been meeting at the past two World Congresses on Expert Systems 1991 in Orlando and 1994 in Lisbon Their experience in the field is brought together in this book which disseminates information about this innovative area to a large audience The book consists of three different parts The first part introduces ExpertMedia in general the second part focuses on case studies of ExpertMedia and Medical Applications and the last part deals with ExpertMedia and Knowledge based Systems Encyclopedia of Library and Information Science Allen Kent, 2000-09-21 This is the 68th volume supplement 31 in a series which examines library and information science

**Knowledge Acquisition: Approaches, Algorithms and Applications** Debbie Richards, Byeong-Ho Kang, 2009-05-25 This book constitutes the thoroughly refereed post workshop proceedings of the 2008 Pacific Rim Knowledge Acquisition Workshop PKAW 2008 held in Hanoi Vietnam in December 2008 as part of 10th Pacific Rim International Conference on Artificial Intelligence PRICAI 2008 The 20 revised papers presented were carefully reviewed and selected from 57 submissions and went through two rounds of reviewing and improvement The papers are organized in topical sections on machine learning and data mining incremental knowledge acquisition web based techniques and applications as well as domain specific knowledge acquisition methods and applications **Knowledge-Based Software Engineering** M. Virvou, T. Nakamura, 2008-08-15 The papers in this publication address many topics in the context of knowledge based software engineering including new challenges that have arisen in this demanding area of research Topics in this book are knowledge based requirements engineering domain analysis and modeling development processes for knowledge based applications knowledge acquisition software tools assisting the development architectures for knowledge based systems and shells including intelligent agents intelligent user interfaces and human machine interaction development of multi modal

interfaces knowledge technologies for semantic web internet based interactive applications knowledge engineering for process management and project management methodology and tools for knowledge discovery and data mining knowledge based methods and tools for testing verification and validation maintenance and evolution decision support methods for software engineering and cognitive systems knowledge management for business processes workflows and enterprise modeling program understanding programming knowledge modeling programs and programmers and software engineering methods for intelligent tutoring systems

**Advanced IT Tools** Nobuyoshi Terashima, Edward Altman, 1996-08-31 This book provides a state of the art review of information technology tools for multimedia and its applications It explores specifically the integration of multimedia applications and the information superhighway The book is divided into three main parts Part one discusses innovative applications in the public sector Multimedia and intelligent systems will have a significant influence in many aspects of the public sector in the future Part two is entitled Innovative Applications on the Horizon and is concerned with turning current technological opportunities into real benefits in the future Part three Intelligent Systems deals with systems used for application development platforms for these systems and intelligent applications

**Negotiation Processes: Modeling Frameworks and Information Technology** Melvin Shakun, 2012-12-06 This book focuses on negotiation processes and how negotiation modeling frameworks and information technology can support these A modeling framework for negotiation as a purposeful complex adaptive process is presented and computer implemented in the first three chapters Two game theoretic contributions use non cooperative games in extensive form and a computer implemented graph model for conflict resolution respectively Two chapters use the negotiators joint utility distribution to provide problem structure and computer support A chapter on cognitive support uses restructurable modeling as a framework One chapter matches information technologies with negotiation tasks Another develops computer support based on preference programming Two final chapters develop a stakeholder approach to support system evaluation and a research framework for them respectively Negotiation Processes Modeling Frameworks and Information Technology will be of interest to researchers and students in the areas of negotiation group decision negotiation support systems and management science as well as to practising negotiators interested in this technology

**Rough Set Methods and Applications** Lech Polkowski, Shusaku Tsumoto, Tsau Y. Lin, 2012-10-07 Rough set approach to reasoning under uncertainty is based on inducing knowledge representation from data under constraints expressed by discernibility or more generally similarity of objects Knowledge derived by this approach consists of reducts decision or association rules dependencies templates or classifiers This monograph presents the state of the art of this area The reader will find here a deep theoretical discussion of relevant notions and ideas as well as rich inventory of algorithmic and heuristic tools for knowledge discovery by rough set methods An extensive bibliography will help the reader to get an acquaintance with this rapidly growing area of research

**New Industry 4.0 Advances in Industrial IoT and Visual Computing for Manufacturing Processes** Luis Norberto López de

Lacalle, Jorge Posada, 2020-03-18 Modern factories are experiencing rapid digital transformation supported by emerging technologies such as the Industrial Internet of things IIOT industrial big data and cloud technologies deep learning and deep analytics AI intelligent robotics cyber physical systems and digital twins complemented by visual computing including new forms of artificial vision with machine learning novel HMI simulation and visualization This is evident in the global trend of Industry 4.0 The impact of these technologies is clear in the context of high performance manufacturing Important improvements can be achieved in productivity systems reliability quality verification etc Manufacturing processes based on advanced mechanical principles are enhanced by big data analytics on industrial sensor data In current machine tools and systems complex sensors gather useful data which is captured stored and processed with edge fog or cloud computing These processes improve with digital monitoring visual data analytics AI and computer vision to achieve a more productive and reliable smart factory New value chains are also emerging from these technological changes This book addresses these topics including contributions deployed in production as well as general aspects of Industry 4.0 Knowledge Engineering and Management

Guus Schreiber, 2000 Prologue The Value of Knowledge 2 Knowledge Engineering Basics 3 The Task and Its Organizational Context 4 Knowledge Management 5 Knowledge Model Components 6 Template Knowledge Models 7 Knowledge Model Construction 8 Knowledge Elicitation Techniques 9 Modelling Communication Aspects 10 Case Study The Housing Application 11 Designing Knowledge Systems 12 Knowledge System Implementation 13 Advanced Knowledge Modelling 14 UML Notations Used in Common KADS 15 Project Management *Anti-GenetiX* Derrick A. Purdue, 2017-11-01

This title was first published in 2000 The development of genetically modified foods has given rise to much widespread and heated debate on the possible consequences both positive and negative of this new technology This book not only addresses the broad issues involved outlining the connections between gene patenting and biotechnology and their impact on international relations but also for the first time examines the social movement emerging against GM food Anti GenetiX traces this movement from its emergence and shows how and why it expanded from a small expert concern to the current huge political uproar It explores the contribution this movement makes to shaping global civil society and argues that such global social movements will become increasingly common in the global age **Database and Expert Systems**

**Applications** A Min Tjoa, Isidro Ramos, 2012-12-06 The Database and Expert Systems Application DEXA conferences are mainly oriented to establish a state of the art forum on Database and Expert System applications But Practice without Theory has no sense as Leonardo said five centuries ago In this Conference we try a compromise between these two complementary aspects A total of 5 sessions are application oriented ranging from classical applications to more unusual ones in Software Engineering Recent research aspects in Databases such as activity deductivity and or Object Orientation are also present in DEXA 92 as well as the implication of the new data models such as OO Model Deductive Model etc included in the Modelling sessions Other areas of interest such as Hyper Text and Multimedia application together with the classical field of

Information Retrieval are also considered Finally Implementation Aspects are reflected in very concrete fields A total of of nearly 200 papers submitted from all over the world were sent to DEXA 92 Only 90 could be accepted A Poster session has also been established DEXA 90 was held in Vienna Austria DEXA 91 in Berlin Germany and DEXA 92 will take place in Valencia Spain where we are celebrating the discovery of the New World just five centuries ago in Leonardo's age Both the quality of the Conference and the compromise between Practice and Theory are due to the credit of all the DEXA 92 authors

**Managing Information Technology in a Global Society** Mehdi Khosrowpour, 1991-01-01 Technological advances in information technology have created many new ways and structures in our lives Organizations now are mastering services of this technology in their business strategies productivity customer services and other managerial functions to stay competitive With a focus on the global issues of IT and its implications on organization this proceedings includes all the presentations of this international conference Managing Information and Communications in a Changing Global Environment Information Resources Management Association. International Conference, 1995-01-01 Advances of information and communications technologies have created new forces in managing organizations These forces are leading modern organizations to reassess their current structures to become more effective in the growing global economy This Proceedings is aimed at the challenges involved in effective utilization and management of technologies in contemporary organizations Expert System Fouad Sabry, 2023-07-06 What Is Expert System In the field of artificial intelligence an expert system is a type of computer program that simulates the abilities of a human expert to make judgment calls Instead of using typical procedural code expert systems reason through bodies of knowledge which are primarily represented as if then rules This is in contrast to traditional computer programs which tackle complicated issues by writing procedural code In the 1970s the first expert systems were developed and later in the 1980s their use became more widespread Expert systems were one of the earliest forms of artificial intelligence AI software that was actually successful An expert system can be broken down into its two component subsystems which are the knowledge base and the inference engine The knowledge base is a collection of facts and guidelines The inference engine takes the rules and applies them to the known data in order to derive new information The capabilities of explanation and debugging are also sometimes included in inference engines How You Will Benefit I Insights and validations about the following topics Chapter 1 Expert system Chapter 2 Learning classifier system Chapter 3 AI winter Chapter 4 Constraint logic programming Chapter 5 Constraint satisfaction Chapter 6 CLIPS Chapter 7 Mycin Chapter 8 Knowledge engineering Chapter 9 Rule based machine learning Chapter 10 CADUCEUS expert system II Answering the public top questions about expert system III Real world examples for the usage of expert system in many fields Who This Book Is For Professionals undergraduate and graduate students enthusiasts hobbyists and those who want to go beyond basic knowledge or information for any kind of expert system What Is Artificial Intelligence Series The Artificial Intelligence eBook series provides comprehensive coverage in over 200 topics Each ebook covers a specific Artificial Intelligence topic in

depth written by experts in the field The series aims to give readers a thorough understanding of the concepts techniques history and applications of artificial intelligence Topics covered include machine learning deep learning neural networks computer vision natural language processing robotics ethics and more The ebooks are written for professionals students and anyone interested in learning about the latest developments in this rapidly advancing field The Artificial Intelligence eBook series provides an in depth yet accessible exploration from the fundamental concepts to the state of the art research With over 200 volumes readers gain a thorough grounding in all aspects of Artificial Intelligence The ebooks are designed to build knowledge systematically with later volumes building on the foundations laid by earlier ones This comprehensive series is an indispensable resource for anyone seeking to develop expertise in artificial intelligence *Computerworld* , For more than 40 years Computerworld has been the leading source of technology news and information for IT influencers worldwide Computerworld s award winning Web site Computerworld com twice monthly publication focused conference series and custom research form the hub of the world s largest global IT media network Global Business Expansion: Concepts, Methodologies, Tools, and Applications Management Association, Information Resources,2018-04-06 As businesses seek to compete on a global stage they must be constantly aware of pressures from all levels regional local and worldwide The organizations that can best build advantages in diverse environments achieve the greatest success Global Business Expansion Concepts Methodologies Tools and Applications is a comprehensive reference source for the latest scholarly material on the emergence of new ideas and opportunities in various markets and provides organizational leaders with the tools they need to be successful Highlighting a range of pertinent topics such as market entry strategies transnational organizations and competitive advantage this multi volume book is ideally designed for researchers scholars business executives and professionals and graduate level business students **Policing and Intelligence in the Global Big Data Era, Volume I** Tereza Østbø Kuldova,Helene Oppen Ingebrigtsen Gundhus,Christin Thea Wathne,2024-10-17 Policing and Intelligence in the Global Big Data Era Volume I the first of a two volume set presents a rich and unique collection of global perspectives on data driven predictive technologies and the expansion and use of surveillance apparatuses in policing and intelligence both public and private Centered around the notion of algorithmic governance this volume explores various practices of abstract and intelligence led policing within the context of surveillance and regulatory capitalism Each chapter interrogates these concepts as much as realities on the ground as they play out across the globe from Russia USA India Brazil to Denmark Germany and Norway The volume offers a unique insight into the ways in which technologies and data driven practices from facial recognition predictive algorithms to generative AI are reshaping cultures of policing both within and beyond police proper Particular attention is paid to the simultaneous privatization and pluralization policing and intelligence and to the proliferation of new intelligence actors Academics students and readers interested in the fields of criminology social anthropology critical algorithm **Database and Expert Systems Applications** A. Hameurlain,A. Min

Tjoa,1997-08-20 This book contains the refereed proceedings of the 8th International Conference on Database and Expert Systems Applications DEXA 97 held in Toulouse France September 1997 The 62 revised full papers presented in the book together with three invited contributions were selected from a total of 159 submissions The papers are organized in sections on modeling object oriented databases active and temporal aspects images integrity constraints multimedia databases deductive databases and knowledge based systems allocation concepts data interchange digital libraries transaction concepts learning issues optimization and performance query languages maintenance federated databases uncertainty handling and qualitative reasoning and software engineering and reusable software      Nematode Identification and Expert System Technology

R. Fortuner,2013-06-29 The need to identify and name organisms is fundamental to any area of biological science basic or applied In order to study or conduct research on an organism or to convey information on this organism to others we must be able to attribute to it a consistent label Attribution of an incorrect label may have dire consequences if dangerous plant parasites are wrongly identified as members of an innocuous genus Traditional aids to nematode identification dichotomous keys use systematic criteria not always well adapted to practical identification Their reliance on dichotomous principles does not allow for intra taxon variability or for missing characters They are difficult to update and they cannot keep pace with rapidly changing classifications As experts in everyday life we recognize a horse or a dog without referring to the taxonomic descriptions of the genera Equus or Canis and their respective species Problems in identification arise when we are not experts in the recognition of a particular organism or group of organisms Then frequently in considerable frustration we reflect on the usefulness of having the advice of an expert in this group Traditional identification aids are useful tools for the expert identifiers and for teaching Their use is often difficult for general practitioners in nematology and they may lead to incorrect identification even at the genus level



## **Moving Towards Expert Systems Globally I** Book Review: Unveiling the Power of Words

In some sort of driven by information and connectivity, the energy of words has become more evident than ever. They have the ability to inspire, provoke, and ignite change. Such is the essence of the book **Moving Towards Expert Systems Globally I**, a literary masterpiece that delves deep to the significance of words and their affect our lives. Published by a renowned author, this captivating work takes readers on a transformative journey, unraveling the secrets and potential behind every word. In this review, we will explore the book is key themes, examine its writing style, and analyze its overall affect readers.

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