

# Jorge Lobo

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## Education

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Ph.D., *Computer Science, The University of Maryland at College Park.* December 1990

M.S., *Computer Science, Universidad Simón Bolívar, Caracas, Venezuela.* June 1985

B.S., *Computer Engineering, Universidad Simón Bolívar, Caracas, Venezuela.* June 1982

## Professional experience

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ICREA Research Professor: 2012 – present  
Department of Info. & Comm. Technologies, Universitat Pompeu Fabra, Barcelona, Spain

Research Staff Member: 2004–2014  
IT and Wireless Convergence. IBM T. J. Watson Research Center, NY, USA

Principal Architect: 2001–03  
Teltier Technologies, NJ, USA– Start-up acquired by Dynamicsoft/Cisco Systems

Member of Technical Staff: 1998–2001  
Network Computing Research Department. Bell Labs, Lucent Technologies, NJ, USA

Associate Professor (*tenured*): 1997–99  
Department of Electrical Engineering and Computer Science. University of Illinois at Chicago, IL, USA

Assistant Professor: 1991–97  
Department of Electrical Engineering and Computer Science. University of Illinois at Chicago, IL, USA

Post-doctoral Associate: 1990–91  
The University of Maryland Institute for Advanced Computer Studies, University of Maryland, College Park, MD, USA

Research Assistant: 1986–1990  
Department of Computer Science, University of Maryland, College Park, MD, USA

Instructor: 1983–85  
Universidad Simón Bolívar, Caracas, Venezuela.

## Visiting Appointments

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Professor (*Honorary*): 2013–present  
Department of Computing, Imperial College London, UK

Associate Professor:  
Department of Computer Science, Bar Ilan University, Israel

Winter 2003–Fall 04

Associate Professor (*adjoin*):  
Computer Science Department, Columbia University

Winter 2003–Fall 04

Associate Professor:  
Laboratoire d'Informatique Fondamentale de Lille. Université Lille 1 : Sciences et Technologies

Summer 1998

## Research interests

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My research interests relate to several areas in computer science: Logic Programming and AI, Networks and Distributed Systems, Security and Privacy. Recent projects include symbolic learning of access control policies, symbolic computation in neural networks, access control in social networks, security resource allocation in IoT, resource allocation for virtualized network functions in Software Defined Networks, and logic-based distributed computing.

## Services

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### University services.....

*UPF Research Committee: (2013–2018).*

Appointed member, Universitat Pompeu Fabra, Barcelona, Spain.

*Faculty Research Evaluations – Allegation Reviews Ad-hoc sub-commission: (2018).*

Appointed member, Universitat Pompeu Fabra, Barcelona, Spain.

*Head of Research: (2013–2015).*

Department of Information Technologies and Communication, Universitat Pompeu Fabra, Barcelona, Spain: the main outcomes of this appointment were the creation of the department External Advisory Board and the preparation for the successful application for the department to become a Maria de Maeztu Center of Excellence.

*Judiciary Committee: (1997–99).*

Elected member, The University of Illinois at Chicago.

*College Minority Engineering Recruitment and Retention Program: (1992–1996)*

Appointed member, The University of Illinois at Chicago.

### Appointment Reviews – Full Professors.....

George Mason University, Shanghai Jiao Tong University, University of Pittsburgh

### Federal & State Agencies Proposal Reviews.....

National Science Foundation  
Defense Advanced Research Projects Agency  
Air Force Office of Scientific Research  
Louisiana Education Quality Support Fund

### Review Panels.....

Information and Intelligent Systems Division, National Science Foundation (NSF), USA, 1995.  
Ramon y Cajal Program, Spanish Ministry of Economy and Competitiveness, Spain, 2000.

## Science Policy Advice.....

*Invited participant:* US National Science Foundation (NSF) workshop on Knowledge Representation and Information Management for Financial Risk Management. The goal of the workshop was to bring together scholars in computer science, information science, finance and economics, to consider the theoretical challenges underlying the practical problems of data management for financial services. July 2010.

*Invited participant:* NSF Workshop on Assurable and Usable Security Configuration. The workshop brought together academic as well as industry researchers to exchange experiences, discuss the major challenges, present future solutions to offer manageable and usable security, and guide the NSF future funding in the area. August 2008.

## Educational Activities

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My student supervision can be split into three parts: as faculty at UIC from 1992 to 1998 (one PhD student), my time working at industry labs from 1998 to 2012 and the period at UPF from 2012 to today (two PhD students). Supervision of interns in industry usually involved collaborative projects with the university where the students were coming from. Typically, the internship started with me proposing a project to the student and talking to his/her adviser with the aim of making the project part of the student's PhD. With Post-doctoral researchers the project was only presented to them. Hence, all the students published at least one paper based on the work done under my supervision, and the mentoring lasted for several years.

### Post-doctoral researchers:.....

Carlos Uzategui, Universidad de Santander (Colombia)/U. de Los Andes (Venezuela), 2 publications

Gisela Mendez, Universidad Central de Venezuela, 3 publications

Robert Craven, Imperial College, 4 publications

Luke Dickens, UCL, 3 publications

Jiefei Ma, The Trade Desk, 9 publications

Ian Molloy, IBM TJ Watson Research, 9 publications

Li Pan, Shanghai Jiao Tong University, 1 publication

Carlos Buil, Universidad Técnica Federico Santa María (Chile)

Edelmira Pasarella, Universitat Politècnica de Catalunya, 3 publications

### PhD students:.....

Monica Barback, Northwestern University, (1995).

*Thesis:* Default Logic as a general nonmonotonic reasoning paradigm.

Windy Rankothge, Universitat Pompeu Fabra, (2017).

*Thesis:* Towards virtualized network functions as a service.

Yaniv Aspis, Daniel Cunnington, Imperial College (expected 2024).

### Master students:.....

G. Trajcevski, University of Illinois at Chicago

(Thesis: Logical view updates, best conference paper, journal publication)

C. Robles, University of Illinois at Chicago

(Thesis: Experimental parallel Deductive Database System, conference paper publication)

G. Oyos, Jr., University of Illinois at Chicago (Project option)

N. Grover, University of Illinois at Chicago (Project option)

E. Berg, University of Illinois at Chicago (Project option)

J. Trin, University of Illinois at Chicago (Project option)

S. Taylor, University of Illinois at Chicago

(Thesis: Knowledge and the action description language *A*, conference paper and journal publication)

M. Grossman, Bar Ilan University, (Project option)

S. Pujol, UPF

(Thesis: A novel output-layer architecture for the Boltzmann machine to improve its performance on ambiguous inputs)

S. Galella, UPF

(Thesis: Learning to Choose in the presence of noise using Probabilistic Competitive Recurrent Networks)

Y. Zhou, Imperial College

(Thesis: Access Control Policy Migrations: From Attributed-based Access Control to Role-based Access Control)

A. Gavel, Imperial College

(Thesis: Biologically Plausible Neural Network Architectures for Solving Optimization Problems).

### Industry interns:.....

Tran Cao Son, University of Texas at El Paso, 1 publication

Alberto Schaeffer, Imperial College London, 2 publications

Qun Ni, Purdue University, 10 publications

Qihua Wang, Purdue University,, 5 publications

Hang Zhao, Columbia University, 2 publications

Qiang Zeng, Penn State University, 1 publication

Mingyi Zhao, Penn State University, 2 publications

### Teaching at University of Illinois at Chicago:.....

Artificial Intelligence I (Graduate/Undergraduate)

Artificial Intelligence II (Graduate course)

Data Structures and Algorithms (Undergraduate)

Database Systems (Undergraduate/Graduate)

Foundations of Computer Science (Undergraduate)

Introduction to Programming (Undergraduate)

Languages and Automata (Undergraduate)

Logic and Databases (new Graduate Course)

Faculty Adviser, University student chapter, the Society of Hispanic Professional Engineers: 1992-1997.

### Curriculum development at University of Illinois at Chicago:.....

I was member of an ad-hoc committee formed in 1993 to prepare a revision of the Computer Science curriculum to get accreditation from the US Computing Sciences Accreditation Board (CSAB). I played a major role in the design of the core courses for the junior year: Foundations of CS/Data Structures. In the new curriculum, we combined discrete mathematics for computer scientists and the fundamentals of data structures and algorithms in two courses. Mathematical concepts were presented side by side with programming concepts. The aim was to show the students how the formal concepts are used during programming. We received CSAB accreditation in 1997.

### Teaching at Columbia University:.....

Knowledge Representation (Graduate/Undergraduate)

### Teaching at Univeritat Pompeu Fabra:.....

Artificial Intelligence (Undergraduate)

Autonomous Systems (Graduate)

Distributed Algorithms (Graduate/Undergraduate) - New module that covers with some level of formality correctness and complexity of basic asynchronous distributed algorithms.

Large Scale Distributed Systems (Undergraduate)

Systems Administration (Undergraduate)

### Curriculum development at Universitat Pompeu Fabra:.....

1. In 2015 the whole Computer Science curriculum was revamped from a program that was designed around an audiovisual and a telecommunication degrees. The previous degree, introduced in 2007, had an emphasis on the technical side computing with little room for foundations. The CS faculty has matured since then and we decided to have a more classical curriculum following ACM standards. As a senior faculty, I coordinated the systems area. The curriculum was reviewed and approved in 2016 and was available to students in 2017. Since then, the program has attracted students with significant higher high school point averages.

2. The Machine Learning and Artificial Intelligence group is coordinating a new Erasmus International Master in Artificial commencing in the academic year 2023-24. All students will start with a core set of courses at UPF, select one among four universities, Sapienza University of Rome in Rome (Italy), Radboud University in Nijmegen (The Netherlands), and University of Ljubljana in Ljubljana (Slovenia), for the second semester, and pick any of the 5 participants universities for the 2nd year to complete some courses and their master thesis. I will teach a newly developed course on Symbolic Reasoning as part of the core set at UPF.

Teaching at Imperial College London:.....  
Knowledge Representation (Graduate/Undergraduate)

## Esteem factors

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Awards.....

- *ACM Distinguished Scientist*, elected in 2009.
- *NSF Research Initiation CAREER Award*.
- *Gran Mariscal de Ayacucho Scholar*.

Associate Editor.....

- IEEE Transaction on Network and Service Management
- Frontiers – Big Data, Cybersecurity & Privacy section
- Cybersecurity – Springer
- International Journal of Network Management
- Journal Science of Computer Programming (until 2018)

Conference Organization.....

- *Inaugural member of the SIGSAC CACM Research Highlights (CACM-RH) Committee* :  
Communications of the ACM (CACM), as the leading print and online publication for computing and information technology, regularly seeks nominations for the Research Highlights (RH) section of the magazine. As an ACM chapter, the Special Interest Group on Security, Audit and Control (SIGSAC) has created a committee in 2022 to streamline the selection process for suggesting excellent security papers as candidates to CACM-RH .
- *Elected chair of the steering committee (2022)*:  
ACM Symposium on Access Control Models and Technologies (SACMAT).  
*Member of the steering committees*:  
ACM Symposium on Access Control Models and Technologies (SACMAT).  
IEEE International Symposium on Policies for Distributed Systems and Networks, 2009–12.
- *General chair*:  
25th and 26th ACM Symposium on Access Control Models and Technologies (SACMAT). June 2020 and June 2022.
- *Program co-chair*:  
23rd ACM Symposium on Access Control Models and Technologies (SACMAT). June 2017.  
8th International Conference on Network and Service Management (CNSM). October 2012.  
16th ACM Symposium on Access Control Models and Technologies (SACMAT). June 2011.  
IEEE International Workshop on Policies for Distributed Systems and Networks. July 2008.
- *Tutorial chair*:  
17th ACM Computer Communication Security Conference (CCS). October 2010.
- *Panel sessions Co-chair*:  
The 11th IFIP/IEEE International Symposium on Integrated Network Management (IM). June 2009.
- *Panel chair*:  
10th IFIP/IEEE Symposium on Integrated Management, Munich, Germany, May 2007.
- *Co-organizer*:  
7th International Workshop on Non-monotonic reasoning – logic programming track, 1998.
- *Coordinator for the Americas*:  
5th International Conference on the Deductive and Object Oriented Databases, (DOODs) 1997.

## Program committee membership participation (selected):.....

- AAAI, IJCAI, ECAI, KR, LPNMR, WWW, EDBT, SACMAT, CCS, INFOCOM, IM, CNMS, NOMS

## Keynotes.....

- *Declarative Distributed Computing*. XXXIX Conferencia Latinoamericana de Informatica (CLEI 2013), Venezuela.
- *Implementing Policy: Two Approaches*. 3rd IEEE International Conference on Information Privacy, Security, Risk and Trust (PASSAT 2011), MIT, Boston.
- *Policy-based computing: from systems and applications to theory*. 9th International Conference on Logic Programming and Nonmonotonic Reasoning, May 2007.

## Invited speaker.....

- *Access Control Under Uncertainty* 4th Cybersecurity Workshop, The Institute of Information Engineering, Chinese Academy of Sciences, Beijing, China, 2018.
- *Distributed Declarative Computing*. Department of Information Systems and Services, UPC, Barcelona, Spain, October 2012.
- *Risk-based Security Decisions under Uncertainty*. Department of Computer Science, Stony Brook University, September 2011.
- *Expressive Policy Analysis with Enhanced System Dynamicity*. Department of Computer Science and Engineering, University of California at San Diego, September 2008.
- *Policies, Presence and Availability Services* IBM Research Labs, Haifa, Israel (January 2004) and T. J. Watson, New York, April 2004.
- *Java Technologies for Location Presence and Availability*. JavaOne 2002 and 2003 technical sessions, San Francisco, CA. June 2002-03
- *Reasoning about Policies*. Research seminar, Institut de Recherche en Informatique de Toulouse (IRIT), Univeriste Paul Sabatier, Toulouse, France, June 2000.
- *A Workflow Language for Network Management*. Database Seminar, Department of Computer and Information Science. The University of Pennsylvania, May 1999.
- *From Action Theories to Active Databases*. Computer Science Department Colloquium. The University of Iowa, March 1998.
- *Qualified Answers That Reflect User Needs and Preferences*. Department of Computer Science, University of Koblenz, Koblenz, Germany, June 1994.
- *Qualified Answers That Reflect User Needs and Preferences*. IBM Almaden Research Center, August 1994.
- *Computing the Transitive Closure in Disjunctive Databases*. Symposium on Logic in Databases, Knowledge Representation and Reasoning. Institute for Advanced Computer Studies. University of Maryland at College Park, Maryland, November 1992.
- *A top-down procedure for stable logic programs*. Invited talk. Institute for Logic, Complexity and Deductive Systems. University of Karlsruhe, Karlsruhe, Germany, October 1992.
- *A theorem prover for stable theories*. Colloquium, Department of Computer Science, The University of Texas at El Paso, September 1992.

## Tutorials/Summer Schools.....

- Policy-based computing. 12th International Joint Conference on Artificial Intelligence (IJCAI), Hyderabad, India, January 2007.
- Lecturer in the 11th European Summer School in Logic, Language and Information, Utrecht, the Netherlands, August 1999.
- From Action Theories to Updates, Transactions, Triggers and Agents. 5th International Conference on Deductive and Object-Oriented Databases, Montreux, Switzerland, December 1997.
- A Tutorial on Deductive Databases. XIII International Conference of the Chilean Computer Science Society, La Serena, Chile, October 1993.
- Theoretical foundations of logic programming. The International Center of Scientific Cooperation Simon Bolivar. Caracas, Venezuela, February 1992.

## Standardization efforts.....

- *DMTF specification editor: CIM Simplified Policy Language (CIM-SPL)*, Document DSP0231. 2006-07.
- *Expert Lead: Java Specification Requirement 123, JAIN Presence and Availability Management API*, until November 2002-03.



## Funding

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*Note:* I had industry appointments from 1998 to 2012.

*Principal Investigator (2019–20):* Security Policy Migrants in Dynamic Collaborative IT Environments, USA Army Research Office . \$91,000.

*Principal Investigator (2017–20):* Distributed Computing in Artificial and Neural Systems. Ministerio de Economía y Competitividad, Program Estatal de Fomento de la Investigación Científica y Técnica de Excelencia. EUR65,098.

*Department-wide Grant (2016–19):* Unidades de excelencia «María de Maeztu». Ministerio de Economía y Competitividad, Programa Estatal de Fomento de la Investigación Científica y Técnica de Excelencia. EUR2,000,000.00. During my first two years at UPF (2013–2015), I was head of the Research Commission of my department. It was during my tenure that the department set the organizational foundations to become one of the few Spanish Maria de Maeztu Centres of Excellence. I was responsible for the coordination of professors in the department that contributed scientific content to the proposal, and worked with the administration of the department to collect the administrative and scientific data necessary to complete the proposal. This award, given by the Spanish Government, recognizes institutions from all areas of knowledge that perform cutting-edge research at global standards. The awarded centres and units that show outstanding international scientific leadership and are open to international collaborations. In that regard, with my international connections and collaborations I was able to secure the participation of Prof. Elisa Bertino, Prof. Shimon Ullman and Prof. Moshe Vardi to be three of the five members of the first Scientific Advisory Board of the department, a requirement the department needed to fulfill before the application.

*Principal Investigator (2013–16):* US ARL/UK MoD International Technology Alliance in Network and Information Science (<http://www.usukita.org>) BPP13. This is a competitive multi-institutional collaboration with bi-annual competition for funding. EUR116,000.

*Principal Investigator (2007–2013):* US ARL/UK MoD International Technology Alliance in Network and Information Science (<http://www.usukita.org>). This is a competitive multi-institutional collaboration with bi-annual competition for funding. My projects have consistently brought to IBM T.J. Watson Research Center over \$500,000 per year.

*Principal Investigator (early academic position, 1991–97):* funded by the National Science Foundation (NSF), including an NSF early CAREER Award (1991), the Department of Transportation, the Department of Energy and the Research Institute for Advanced Information Processing of Japan. Total funding during that period was over \$300,000.00.

### Technology transfer:.....

- The Operations, Administration, Maintenance and Provisioning (OAMP) system of Lucent of Lucent softswitch for telephone networks.
- Present and availability server of Teltier Technologies.
- IBM Policy Management for Autonomic Computing (<http://www.ibm.com/developerworks/tivoli/tutorials/ac-buspmac/>).
- IBM Storage Configuration Manager (<http://www-947.ibm.com/support/entry/portal/docdisplay?lnocid=TOOL-SCM>).
- Role mining module for IBM Tivoli Identity Manager (<http://www-01.ibm.com/software/tivoli/products/identity-mgr/>).

## Publications

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### Books.....

- [1] Dakshi Agrawal, Seraphin Calo, Kang-won Lee, Jorge Lobo, and Dinesh Verma. *Policy technologies for self-managing systems*. Pearson Education, 2008.
- [2] Jorge Lobo, Jack Minker, and Arcot Rajasekar. *Foundations of disjunctive logic programming*. Logic Programming. MIT Press, 1992.

## Journal articles.....

- [1] Daniel Cunningham, Mark Law, Jorge Lobo, and Alessandra Russo. Ffnsl: Feed-forward neural-symbolic learner. *Machine Learning*, In press, <https://arxiv.org/abs/2106.13103>, 2023.
- [2] Jorge Lobo. Relationship-based access control: More than a social network access control model. *WIREs Data Mining Knowl. Discov.*, 9(2), 2019.
- [3] Windhya Rankothge, Franck Le, Alessandra Russo, and Jorge Lobo. Optimizing resource allocation for virtualized network functions in a cloud center using genetic algorithms. *IEEE Trans. Netw. Serv. Manag.*, 14(2):343–356, 2017.
- [4] Jiefei Ma, Franck Le, Alessandra Russo, and Jorge Lobo. Declarative framework for specification, simulation and analysis of distributed applications. *IEEE Trans. Knowl. Data Eng.*, 28(6):1489–1502, 2016.
- [5] Qiang Zeng, Mingyi Zhao, Peng Liu, Poonam Yadav, Seraphin B. Calo, and Jorge Lobo. Enforcement of autonomous authorizations in collaborative distributed query evaluation. *IEEE Trans. Knowl. Data Eng.*, 27(4):979–992, 2015.
- [6] Philippe Owezarski, Jorge Lobo, and Deep Medhi. Network and service management for cloud computing and data centers: A report on CNSM 2012. *J. Netw. Syst. Manag.*, 21(4):707–712, 2013.
- [7] Dan Lin, Prathima Rao, Rodolfo Ferrini, Elisa Bertino, and Jorge Lobo. A similarity measure for comparing XACML policies. *IEEE Trans. Knowl. Data Eng.*, 25(9):1946–1959, 2013.
- [8] Jiefei Ma, Franck Le, David Wood, Alessandra Russo, and Jorge Lobo. A declarative approach to distributed computing: Specification, execution and analysis. *Theory Pract. Log. Program.*, 13(4-5):815–830, 2013.
- [9] Prathima Rao, Dan Lin, Elisa Bertino, Ninghui Li, and Jorge Lobo. Fine-grained integration of access control policies. *Comput. Secur.*, 30(2-3):91–107, 2011.
- [10] Dan Lin, Prathima Rao, Elisa Bertino, Ninghui Li, and Jorge Lobo. EXAM: a comprehensive environment for the analysis of access control policies. *Int. J. Inf. Sec.*, 9(4):253–273, 2010.
- [11] Ian M. Molloy, Hong Chen, Tiancheng Li, Qihua Wang, Ninghui Li, Elisa Bertino, Seraphin B. Calo, and Jorge Lobo. Mining roles with multiple objectives. *ACM Trans. Inf. Syst. Secur.*, 13(4):36:1–36:35, 2010.
- [12] Qun Ni, Elisa Bertino, Jorge Lobo, Carolyn Brodie, Clare-Marie Karat, John Karat, and Alberto Trombetta. Privacy-aware role-based access control. *ACM Trans. Inf. Syst. Secur.*, 13(3):24:1–24:31, 2010.
- [13] Elisa Bertino, Carolyn Brodie, Seraphin B. Calo, Lorrie Faith Cranor, Clare-Marie Karat, John Karat, Ninghui Li, Dan Lin, Jorge Lobo, Qun Ni, Prathima Rao, and Xiping Wang. Analysis of privacy and security policies. *IBM J. Res. Dev.*, 53(2):3, 2009.
- [14] John Karat, Clare-Marie Karat, Elisa Bertino, Ninghui Li, Qun Ni, Carolyn Brodie, Jorge Lobo, Seraphin B. Calo, Lorrie Faith Cranor, Ponnurangam Kumaraguru, and Robert W. Reeder. Policy framework for security and privacy management. *IBM J. Res. Dev.*, 53(2):4, 2009.
- [15] Qun Ni, Elisa Bertino, Jorge Lobo, and Seraphin B. Calo. Privacy-aware role-based access control. *IEEE Secur. Priv.*, 7(4):35–43, 2009.
- [16] Dakshi Agrawal, Kang-Won Lee, and Jorge Lobo. Policy-based management of networked computing systems. *IEEE Commun. Mag.*, 43(10):69–75, 2005.
- [17] Madhur Kohli and Jorge Lobo. Realizing network control policies using distributed action plans. *J. Netw. Syst. Manag.*, 11(3):305–327, 2003.
- [18] Jan Chomicki, Jorge Lobo, and Shamim A. Naqvi. Conflict resolution using logic programming. *IEEE Trans. Knowl. Data Eng.*, 15(1):244–249, 2003.



- [19] Goce Trajcevski, Chitta Baral, and Jorge Lobo. Formalizing and reasoning about the requirements specifications of workflow systems. *Int. J. Cooperative Inf. Syst.*, 10(4):483–507, 2001.
- [20] Jorge Lobo, Gisela Mendez, and Stuart R. Taylor. Knowledge and the action description language A. *Theory Pract. Log. Program.*, 1(2):129–184, 2001.
- [21] Jorge Lobo and Carlos Uzcátegui. Abductive consequence relations. *Artif. Intell.*, 89(1-2):149–171, 1997.
- [22] Terry Gaasterland and Jorge Lobo. Qualifying answers according to user needs and preferences. *Fundam. Informaticae*, 32(2):121–137, 1997.
- [23] Jorge Lobo and Goce Trajcevski. Minimal and consistent evolution of knowledge bases. *J. Appl. Non Class. Logics*, 7(1):117–146, 1997.
- [24] Chengjie Luo, Clement T. Yu, Jorge Lobo, Gaoming Wang, and Tracy Pham. Computation of best bounds of probabilities from uncertain data. *Comput. Intell.*, 12:541–566, 1996.
- [25] Jorge Lobo and Carlos Uzcátegui. Abductive change operators. *Fundam. Informaticae*, 27(4):385–411, 1996.
- [26] John Jeffrey, Jorge Lobo, and Tadao Murata. A high-level petri net for goal-directed semantics of horn clause logic. *IEEE Trans. Knowl. Data Eng.*, 8(2):241–259, 1996.
- [27] Louiqa Raschid and Jorge Lobo. Semantics for update rule programs and implementations in a relational database management system. *ACM Trans. Database Syst.*, 21(4):526–571, 1996.
- [28] Jorge Lobo, Qi Yang, and Clement T. Yu. Dynamic maintenance of the transitive closure in disjunctive graphs. *Ann. Math. Artif. Intell.*, 14(2-4):151–176, 1995.
- [29] Teruhiro Shimura, Jorge Lobo, and Tadao Murata. An extended petri net model for normal logic programs. *IEEE Trans. Knowl. Data Eng.*, 7(1):150–162, 1995.
- [30] Louiqa Raschid and Jorge Lobo. A semantics for a class of non-deterministic and causal production system programs. *J. Autom. Reason.*, 12(3):305–349, 1994.
- [31] José Alberto Fernández, Jorge Lobo, Jack Minker, and V. S. Subrahmanian. Disjunctive LP + integrity constraints = stable model semantics. *Ann. Math. Artif. Intell.*, 8(3-4):449–474, 1993.
- [32] John Grant, John F. Horty, Jorge Lobo, and Jack Minker. View updates in stratified disjunctive databases. *J. Autom. Reason.*, 11(2):249–267, 1993.
- [33] Terry Gaasterland and Jorge Lobo. Processing negation and disjunction in logic programs through integrity constraints. *J. Intell. Inf. Syst.*, 2(3):225–243, 1993.
- [34] Chitta Baral, Jorge Lobo, and Jack Minker. Generalized disjunctive well-founded semantics for logic programs. *Ann. Math. Artif. Intell.*, 5(2-4):89–131, 1992.
- [35] Jorge Lobo and V. S. Subrahmanian. Relating minimal models and pre-requisite-free normal defaults. *Inf. Process. Lett.*, 44(3):129–133, 1992.
- [36] Jorge Lobo, Arcot Rajasekar, and Jack Minker. Semantics of horn and disjunctive logic programs. *Theor. Comput. Sci.*, 86(1):93–106, 1991.
- [37] Arcot Rajasekar, Jorge Lobo, and Jack Minker. Weak generalized closed world assumption. *J. Autom. Reason.*, 5(3):293–307, 1989.

### Conference and workshop publications.....

- [1] Yaniv Aspis, Krysia Broda, Jorge Lobo, and Alessandra Russo. Embed2sym - scalable neuro-symbolic reasoning via clustered embeddings. In Gabriele Kern-Isberner, Gerhard Lakemeyer, and Thomas Meyer, editors, *Proceedings of the 19th International Conference on Principles of Knowledge Representation and Reasoning, KR 2022, Haifa, Israel. July 31 - August 5, 2022*, 2022.
- [2] Diego Calvanese, Francesco Di Cosmo, Jorge Lobo, and Marco Montali. Convergence verification of declarative distributed systems. In Stefania Monica and Federico Bergenti, editors, *Proceedings*

- of the 36th Italian Conference on Computational Logic, Parma, Italy, September 7-9, 2021, volume 3002 of CEUR Workshop Proceedings, pages 62–76. CEUR-WS.org, 2021.
- [3] Daniel Cunnington, Mark Law, Alessandra Russo, Jorge Lobo, and Lance M. Kaplan. Towards neural-symbolic learning to support human-agent operations. In *24th IEEE International Conference on Information Fusion, FUSION 2021, Sun City, South Africa, November 1-4, 2021*, pages 1–8. IEEE, 2021.
- [4] Anand Mudgerikar, Elisa Bertino, Jorge Lobo, and Dinesh C. Verma. A security-constrained reinforcement learning framework for software defined networks. In *ICC 2021 - IEEE International Conference on Communications, Montreal, QC, Canada, June 14-23, 2021*, pages 1–6. IEEE, 2021.
- [5] Arthur Drozdov, Mark Law, Jorge Lobo, Alessandra Russo, and Mercion Wilathgamuwege Don. Online symbolic learning of policies for explainable security. In *3rd IEEE International Conference on Trust, Privacy and Security in Intelligent Systems and Applications, TPS-ISA 2021, Atlanta, GA, USA, December 13-15, 2021*, pages 269–278. IEEE, 2021.
- [6] Mark Law, Alessandra Russo, Elisa Bertino, Krysia Broda, and Jorge Lobo. Fastlas: Scalable inductive logic programming incorporating domain-specific optimisation criteria. In *The Thirty-Fourth AAAI Conference on Artificial Intelligence, AAAI 2020, The Thirty-Second Innovative Applications of Artificial Intelligence Conference, IAAI 2020, The Tenth AAAI Symposium on Educational Advances in Artificial Intelligence, EAAI 2020, New York, NY, USA, February 7-12, 2020*, pages 2877–2885. AAAI Press, 2020.
- [7] Amani Abu Jabal, Elisa Bertino, Jorge Lobo, Mark Law, Alessandra Russo, Seraphin B. Calo, and Dinesh C. Verma. Polisma - A framework for learning attribute-based access control policies. In Liqun Chen, Ninghui Li, Kaitai Liang, and Steve A. Schneider, editors, *Computer Security - ESORICS 2020 - 25th European Symposium on Research in Computer Security, ESORICS 2020, Guildford, UK, September 14-18, 2020, Proceedings, Part I*, volume 12308 of *Lecture Notes in Computer Science*, pages 523–544. Springer, 2020.
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## Patents.....

- *Policy Management System*. U.S. PAT.NO. 7213068.
- *Mechanism to enforce availability preferences and needs of user resources hosted by telecommunication networks*. U.S. PAT.NO. 7680913.
- *Method and system for supporting differentiated network service for mobile customers and applications*. U.S. PAT.NO. 6687495.
- *Method and system for supporting non-intrusive and effective voice communication among mobile users*. U.S. PAT.NO. 7330721.
- *Method and system for supporting rendezvous based instant group conferencing among mobile users*. U.S. PAT.NO. 7602893.
- *System and method for ratification of policies*. U.S. PAT.NO. 8006290.
- *Method and System for determining Policy Similarities*. U.S.PAT.NO. 8020191.
- *Methods and apparatus for scoped role-based access control*. U.S.PAT.NO. 8458337.
- *Predictive Placement of Content through Network Analysis*. U.S.PAT.NO. 9037700.