ALBERT ORRIOLS PUIG, Ph.D.

Grup de Recerca en Sistemes Intel·ligents

Business Engineering School La Salle (BES La Salle)

Universitat Ramon Llull

Quatre Camins 2, Barcelona, Catalonia (Spain)

Phone: +34 687 71 37 04 • Fax: +34 93 290 24 50

email: aorriols@albertorriols.net

www: http://www.albertorriols.net

Updated: August 2009

CURRENT POSITION

Research assistant professor at BES La Salle, Universitat Ramon Llull (qualified as lecturer by the "Agència Catalana d'Universitats" with expedient number U1443/9075811-81).

EDUCATION

PhD in Computer Engineering: 2004 – 2008.

PhD under the program: *Communication and Information Systems and its Management.* BES La Salle, Universitat Ramon Llull.

Dissertation Title: "New Challenges in Learning Classifier Systems: Mining Rarities and Evolving Fuzzy Models" (Excellent Cum Laude) [preprint] [slides preprint].

Thesis Supervisor: Ester Bernadó-Mansilla

Examining Committee: David E. Goldberg, Francisco Herrera, Martin V. Butz, Xavier Llorà, and Xavier Vilasís.

DEA in Computer Engineering: 2004 – 2006.

BES La Salle, Universitat Ramon Llull.

Dissertation Title: "Facetwise Analysis of Learning Classifier Systems for Mining Rarities"

DEA Supervisor: Ester Bernadó-Mansilla

MS in Computer Engineering: 2002 – 2004.

BES La Salle, Universitat Ramon Llull.

Thesis Title: "Development and Integration of the XCS Classifier System into KEEL and analysis of rule set reduction mechanisms" (A with Honors)

Thesis Supervisor: Ester Bernadó-Mansilla

Best student of the promotion

MSc in Computer Engineering: 1999 – 2002.

BES La Salle, Universitat Ramon Llull.

Thesis Title: "Comparative Platform among Genetic Algorithms, Evolution Strategies, and Simulated Annealing" (A with Honors)

Thesis Supervisor: Josep M. Garrell Guiu

Best student of the promotion

RESEARCH INTERESTS

Learning classifier systems and genetic-based machine learning.
Research conducted for a better understanding of the processes that guide learning classifier systems, i.e., evolutionary rule-based machine learning techniques that evolve rule sets online from streams of examples. Facetwise models have been derived to increase our understanding of different aspects of such complex systems. Besides, these models have been used as a tool for design, detecting the weaknesses of learning classifier systems and proposing new approaches to overcome them.

Learning from domains with rare cases and rare classes.
Analysis and improvement of different types of learners, including learning classifier systems, to extract models from domains where rare cases or rare classes exist. For traditional machine learning techniques, several pre-process methodologies have been developed to improve the detection of rarities. For learning classifier systems, the underlying processes of these types of machine learning techniques have been improved to increase the accuracy of the models extracted from rare classes, which are learned on the fly due to its online learning architecture.

Fuzzy logics and genetic fuzzy systems.
Design, implementation, and improvement of online rule-based fuzzy systems for supervised learning. Fuzzy logic provides a formal framework in which the reasoning mechanisms are similar to those of human experts. Thus, learning classifier systems have been extended by including fuzzy rules. This has enabled learning classifier systems to evolve much more interpretable rules, as linguistic fuzzy rules are, and to provide reasoning mechanisms that are similar to human ones. Moreover, they have also been prepared to deal with imprecise and incomplete data, which are really common in real-world domains.

Extraction of association rules from streams of examples.
Design and implementation of online methods—based on learning classifier systems architectures—to mine association rules from streams of examples. Appli-

cation of these methods to challenging real-world problems such as the characterization of the user's state of *flow* when browsing the Internet.

Substructural learning of decomposable problems.
Design and implementation of methodologies to (1) extract the structure of randomly decomposable problems, (2) learn which variables contribute together to define the output, and (3) evolve classification models that exploit the salient interactions among variables.

Data complexity and analysis of problem difficulty.
Designment and development of metrics to assess the intrinsic complexity of classification problems. These metrics are used to relate classifier behavior with the apparent problem difficulty and to identify the domain of competence of different learning systems. These complexity metrics have been used as an objective function of evolutionary algorithms to create boundedly-difficult problems, that is, problems with certain characteristics that may challenge learning techniques. These artificially generated problems have been used to test the behavior of several systems on problems with different complexities and establish comparisons of learners on certain types of problems, which has led to a better understanding of the sweet spot in which different learners are competitive.

Application of machine learning techniques to real-world problems.
Application of the designed techniques to challenging real-world problems that range in different fields such as marketing (client characterization) or transmission networks (to optimize the routing mechanisms in new generation networks).

RESEARCH EXPERIENCE

Member of the Research Group in Intelligent Systems (GRSI): 2001 – present. GRSI is a research group which has been recognized by the Catalan government, the *Generalitat de Catalunya*, under the reference *2005SGR-00302*. The group focuses its research on applications of evolutionary computation and soft-case-based reasoning.

Among others, the research group participates in the following projects:

- *Artificial intelligence telematic network: 2003 – present.* The aim of this project is to coordinate and enhance the collaboration among research groups in the field of artificial intelligence. This project is funded by the Spanish government under grant *2003XT00075*.
- *Spanish network on data mining and machine learning: 2003 – 2004.* This project is funded by the Spanish government under grant *TIC2002-11124-E*.

Member of the Illinois Genetic Algorithm Laboratory (IlliGAL): 2006-present. The IlliGAL, placed in the General Engineering Department (University of Illinois at Urbana champaign), is one of the most important research

groups in genetic algorithms and genetic-based machine learning. At the IlliGAL, researches study nature's search algorithm of choice, genetics, and evolution, as a practical approach to solving difficult problems on a computer. Theory and empirical results obtained in the lab demonstrate that well-designed genetic algorithms can be guaranteed to solve a broad class of provably hard problems quickly, reliably, and accurately. The quality of the research of the group is highlighted by the large number of publications of the director of the lab, Professor David E. Goldberg—one of the top 20 most cited authors in computer science according to Palsberg—who has published more than 400 scientific publications in international journals, referred conferences, and book chapters.

PARTICIPATION IN RESEARCH PROJECTS

KEEL III – Genetic-based machine learning, data complexity, unbalanced domains, data streams, and scalability: 2009 – present. KEEL III is a continuation of KEEL II, which aims at conducting research on some of the hot topics in data mining such as evaluate the complexity of classification domains, learn from unbalanced domains and data streams, and improve the scalability of existing algorithms—and build new scalable methods—in order to solve large problems. The project is sponsored by the Ministerio de Educacin y Ciencia under the national project with reference TIN2008-06681-C06-05.

The project is sponsored by the *Ministerio de Educación y Ciencia* under the national project with reference *TIN2008-06681-C06-05*.

KEEL II – Rule-based Evolutive Models: 2005 – 2008. KEEL II continues with the development of a machine learning tool initiated in the KEEL project. In KEEL II, we are introducing the following novelties to the prototype: (1) new machine learning techniques and (2) algorithm evaluation methodologies.

The project was sponsored by the *Ministerio de Educación y Ciencia* under the national project with reference *TIN2005-08386-C05-04*.

KEEL – Knowledge Extraction with Evolutionary Learning: 2002 – 2005. The KEEL project develops a software tool that integrates a large variety of genetic-based machine learning techniques for pattern classification, regression, and clustering; it includes the top-notch evolutionary learning methodologies. KEEL provides an intuitive visual tool that permits the user to run experiments, compare algorithms, and extract classification models for user's classification, regression, and unsupervised problems.

The following five universities participate in the project: Universidad de Granada (UGR), Universidad de Córdoba (UCO), Universitat Ramon Llull (URL), Universidad de Jaén (UJ), and Universidad de Oviedo (UO).

The project was sponsored by the *Ministerio de Ciencia y Tecnología* under the national project with reference *TIC2002-04036-C05-03*.

Since 2007 I am the technical coordinator of the KEEL project in the URL university.

TEACHING EXPERIENCE

Qualified as lecturer by the "Agència Catalana d'Universitats" with expedient number U1443/9075811-81.

Teaching *Machine Learning*: 2009 – present. Subject of the PhD program "Communication and Information Systems and its Management", BES La Salle, Universitat Ramon Llull. I give the classes in English.

Teaching *Artificial Intelligence*: 2008 – present. Subject of the 5th course of Computer Engineering, BES La Salle, Universitat Ramon Llull. I give the classes in English.

Teaching *Programming II*: 2008 – present. Subject of the 2nd course of Computer Engineering, BES La Salle, Universitat Ramon Llull.

Teaching *Data structures*: 2003 – 2008. Subject of the 2nd course of Computer Engineering, BES La Salle, Universitat Ramon Llull. Since 2007, I give the classes in English.

Supervisor of Master Thesis: 2003 – present. Supervisor of several master thesis of Computer Engineering students.

Seminars of optimization and learning with genetic algorithms: 2004 – 2006. Several seminars given in the subject *Artificial Intelligence*, 5th course of Computer Engineering, BES La Salle, Universitat Ramon Llull. These seminars introduce the students into genetic algorithms in the context of search, optimization, and machine learning.

Coordination of seminars of second-year students in the GRSI lab: 2005 – 2006. Coordination of the seminars given to second-year students in the Research Group of Intelligent Systems lab (GRSI). In these seminars, the students are introduced to several topics in the optimization and machine learning realms.

VISITS TO RESEARCH GROUPS

Illinois Genetic Algorithm Laboratory (IlliGAL): Jun. 2008 – Jul. 2008. In this visit, we continued on the investigation of the effect of class imbalances on learning classifier systems, as well as on how we can learn the sub-structure of non-trivial, hierarchical unbalanced problems.

Soft Computing and Intelligent Information Systems (SCI2s): Jan. 28 – Mar. 14, 2008. In this visit, I continued the collaboration with several SCI2s members to further improve genetic-based machine learners for evolving linguistic fuzzy rules. Moreover, in this visit we also collaborated in the emerging field of *data complexity* assessment for supervised learning.

Soft Computing and Intelligent Information Systems (SCI2s): Mar. 11 – Mar. 25, 2007. In this visit, I collaborated with Jorge Casillas and other members of the SCI2s group to develop different genetic-based machine learning systems. We designed a new online supervised learning process based on a Michigan-style learning fuzzy-classifier system. The algorithm, called Fuzzy-UCS, is inspired by UCS, an existing learning classifier system for classification tasks. Fuzzy-UCS introduces a linguistic fuzzy representation into the rules with the aim of evolving more readable rule sets and providing a reasoning methodology more similar to the human one, while maintaining similar performance and generalization capabilities to those presented by UCS.

Illinois Genetic Algorithm Laboratory (IlliGAL): Jul. 2006 – Dec. 2006. In this visit, we developed facetwise models of learning classifier systems for learning from environments with rare cases or classes. The research resulted in a better understanding of the process that guide learning classifier systems in domains with rarities. In addition, the models were used as a tool for designing new approaches that improved the accuracy of the models evolved by learning classifier systems in domain with rarities.

AWARDS & GRANTS

- **Best student paper award** in the 2008 ESTYLF conference for the paper *Albert Orriols-Puig, Jorge Casillas, and Francisco J. Martínez-López. Modelado Causal en Marketing Mediante Aprendizaje no Supervisado de Reglas de Asociación Difusas. XIV Congreso Español sobre Tecnologías y Lógica Fuzzy.*

- **Best paper award** in the Genetic and Evolving Fuzzy Systems Workshop in 2008 for the paper *Jorge Casillas, Albert Orriols-Puig, and Ester Bernadó-Mansilla. Toward Evolving Consistent, Compete, and Compact Fuzzy Rule Sets for Classification Problems. In Genetic and Evolving Fuzzy Systems, pages 89-94, IEEE.*

- **Best master thesis award** given to the master thesis *Analysis and improvement of the genetic discovery of XCS* by Sergio Morales-Ortigosa, which I supervised.

- **Beca BE (2008)**. Scholarship to visit foreign research groups. This scholarship is granted by the *Generalitat de Catalunya*. The scholarship funded my research visit to the IlliGAL from June to July 2008. Ref: 2007BE-200124.

- **GECCO'08 travel grant**. Grant given to the students that had, at least, one paper in the 2008 Genetic and Evolutionary Conference.
- **GECCO'07 travel grant**. Grant given to the students that had, at least, one paper in the 2007 Genetic and Evolutionary Conference.
- **Best paper nomination** in the Genetic and Evolutionary Computation Conference in 2006 for the paper *Albert Orriols-Puig and Ester Bernadó-Mansilla. Bounding XCS Parameters for Unbalanced Datasets. Proceedings of the 2006 Genetic and Evolutionary Computation Conference. Seattle, WA. 2006.*
- **GECCO'06 travel grant**. Grant given to the students that have, at least, one paper in the 2006 Genetic and Evolutionary Conference.
- **Beca BE (2006)**. Scholarship to visit foreign research groups. This scholarship is granted by the *Generalitat de Catalunya*. The scholarship funded my research visit to the *Illinois Genetic Algorithms Laboratory* (IlliGAL) from July 16, 2006 to December 16, 2006. Ref: 2006BE-00299.
- **Grant *fundación Rafael Escolá a la Excelencia Universitaria* (2005)**. Grant given to the three best engineers of the year (including the disciplines of general engineering, telecomunications engineering, and computer engineering).
- **Beca FI (2004 – 2008)**. Scholarship for formation of researchers. Ref: 2005FI-00252.
- **Becas líder de inmersión a la realidad social española (July 2004)**. Fellowship granted to the 8 best Spanish students. Sponsors: Grupo Santander, Hoteles NH, and Fundación Carolina.
- **Beca colaboración (2003)**. Scholarship to fund the collaboration of a last-year student with a research group of the University. Funded by *Ministerio de Ciencia, Cultura y Deporte*.
- **Beca universitaria de la Caixa de Manresa (2000)**. Scholarship given to the best students of the year in Catalonia.
- **Beca universitaria de la Caixa de Manresa (1999)**. Scholarship given to the best students of the year in Catalonia.

PROFESSIONAL ACTIVITIES

- Co-organizer of the special session Knowledge Extraction based on Evolutionary Learning in the 4th International Conference on Hybrid Artificial Intelligent Systems, 2009.
- Reviewer, IEEE Transactions on Evolutionary Computation

- Reviewer, Information Sciences
- Reviewer, Pattern Recognition Letters
- Reviewer, International Journal of Hybrid Intelligent Systems
- Reviewer, Memetic Computing Journal
- Reviewer, Neural Computing and Applications
- Reviewer, Genetic and Evolutionary Computation Conference
- Reviewer, International Workshop on Learning Classifier Systems
- Reviewer, Bio-Inspired Computing: Theory and Applications
- Reviewer, World Multi-Conference on Systemics, Cybernetics and Informatics
- Reviewer, Hybrid Intelligent Systems Conference

INVITED TALKS

- Learning Classifier Systems: New Trends, in I Workshop on Knowledge Extraction based on Evolutionary Learning, May 2008.
- Some results on the use of UCS for imbalanced data sets, in I Workshop on Knowledge Extraction based on Evolutionary Learning, May 2008.
- Can LCSs learn from Rare Classes? University of Granada, March 2007.

COAUTHORS

David E. Goldberg (University of Illinois, USA, h-index = 59) • Tin Kam Ho (Bell Labs, USA, h-index = 18) • Pier Luca Lanzi (Politecnico di Milano, Italy, h-index = 18) • Kumara Sastry (University of Illinois, USA, h-index = 16) • Jorge Casillas (Universidad de Granada, Spain, h-index = 15) • Ester Bernadó-Mansilla (Universitat Ramon Llull, Spain, h-index=7) • Francisco J. Martínez-López (University of Granada, Spain) • Jordi Dalmau (Abertis, Spain) • Alex Vallejo (Universitat Ramon Llull, Spain) • Agustn Zaballos (Universitat Ramon Llull, Spain) • David Vernet (Universitat Ramon Llull, Spain) • Núria Macià (Universitat Ramon Llull, Spain) • Joaquim Rios-Boutin (Universitat Ramon Llull, Spain) • Francesc Teixidó-Navarro (Universitat Ramon Llull, Spain) • Sergio Morales-Ortigosa (Universitat Ramon Llull, Spain)

PUBLICATIONS

Books

Elisabet Golobardes-Ribé and **Albert Orriols-Puig**. *Intel·ligència Artificial*. Creative Commons Deed, ISBN 978-84-935665-6-2 2008 [preprint].

Journal Papers

Albert Orriols-Puig, Ester Bernadó-Mansilla, David E. Goldberg, Kumara Sastry, Pier Luca Lanzi. *Facetwise Analysis of XCS for Problems with Class Imbalances*. IEEE Transactions on Evolutionary Computation, online first, 2009, doi=10.1109/TEVC.2009.2019829 (ISI index = 3.77), ISSN 1089-778X [preprint].

Albert Orriols-Puig, Jorge Casillas and Ester Bernadó-Mansilla. *Fuzzy-UCS: A Michigan-style Fuzzy-Learning Classifier System for Supervised Learning*. IEEE Transactions on Evolutionary Computation, volume 13, number 2, pages 260–283, 2009, doi=10.1109/TEVC.2008.925144 (ISI index = 3.77), ISSN 1089-778X [preprint].

Albert Orriols-Puig, Jorge Casillas, and Francisco J. Martínez-López. *Unsupervised Learning of Fuzzy Association Rules for Consumer Behavior Modeling*. Mathware and Soft Computing, volume 16, pages 29–43, 2009, ISSN 1134-5632 [preprint].

Alex Vallejo, Agustin Zaballos, David Vernet, **Albert Orriols-Puig**, and Jordi Dalmau. *A Traffic Engineering Proposal for ITU-T NGNs using Hybrid Genetic Algorithms*. International Journal on Advances in Networks and Services, in press, 2009 [preprint].

Sergio Morales-Ortigosa, **Albert Orriols-Puig**, and Ester Bernadó-Mansilla. *Analysis and Improvement of the Genetic Discovery Component of XCS*. International Journal of Hybrid and Intelligent Systems, volume 6, pages 1–15, 2009, doi 10.3233/HIS-2009-0088, ISSN 1134-5869 [preprint].

Albert Orriols-Puig, Jorge Casillas, and Ester Bernadó-Mansilla. *Genetic-Based Machine Learning Systems Are Competitive for Pattern Recognition*. Evolutionary Intelligence, volume 1, number 3, pages 209–232, 2008, doi=10.1007/s12065-008-0013-9, ISSN 1864-5909 [preprint].

Albert Orriols-Puig and Ester Bernadó-Mansilla. *Evolutionary Rule-Based Systems for Imbalanced Datasets*. Soft Computing Journal. Special Issue on Evolutionary and Metaheuristic-based Data Mining (EMBDM), pages 213–225, volume 13, number 3, 2008, doi=10.1007/s00500-008-0319-7 (ISI index=0.516), ISSN 1432-7643 [preprint].

LNCS/LNAI volumes

Núria Macià, **Albert Orriols-Puig**, and Ester Bernadó-Mansilla. *Beyond Homemade Artificial Data Sets*. In Proceedings of the 2009 International Workshop on

Hybrid Artificial Intelligence Systems (HAIS'09), LNAI series, in press, Springer, 2009 [preprint].

Guiomar Corral, Alvaro Garcia-Piquer, **Albert Orriols-Puig**, Albert Fornells, and Elisabet Golobardes. *Multiobjective Evolutionary Clustering Approach to Security Vulnerability Assesments*. In Proceedings of the 2009 International Workshop on Hybrid Artificial Intelligence Systems (HAIS'09), LNAI series, in press, Springer, 2009 [preprint].

Albert Orriols-Puig, Jorge Casillas, and Ester Bernadó-Mansilla. *Approximate versus Linguistic Representation in Fuzzy-UCS*. In Proceedings of the 2008 International Workshop on Hybrid Artificial Intelligence Systems (HAIS'08), LNAI series, volume 5271/2008, pages 722–729, Springer, ISSN 0302-9743, 2008 [preprint].

Albert Orriols-Puig, Kumara Sastry, David E. Goldberg, and Ester Bernadó-Mansilla. *Substructural Surrogates for Learning Decomposable Classification Problems*. In Advances at the frontier of LCS, LNCS series, volume 4998, pages 235–254, Springer, ISSN 0302-9743, 2008 [preprint].

Albert Orriols-Puig, Jorge Casillas Ester Bernadó-Mansilla. *Evolving Fuzzy Rules with UCS: Preliminary Results*. In Advances at the frontier of LCS, LNCS series, volume 4998, pages 57–76, Springer, ISSN 0302-9743, 2008 [preprint].

Albert Orriols-Puig and Ester Bernadó-Mansilla. *Revisiting UCS: Description, Fitness Sharing, and Comparison with XCS*. In Advances at the frontier of LCS, LNCS series, volume 4998, pages 96–116, Springer, ISSN 0302-9743, 2008 [preprint].

Albert Orriols-Puig and Ester Bernadó-Mansilla. *The Class Imbalance Problem in UCS Classifier System: A Preliminary Study*. In Advances at the frontier of LCS, LNCS series, pages 164-183, Springer, ISSN 0302-9743, 2007 [preprint].

Book Chapters

Albert Orriols-Puig, Jorge Casillas, and Francisco J. Martínez-López. *Automatic Discovery of Potential Causal Structures in Marketing Databases by Unsupervised Genetic Fuzzy Systems*. Marketing Intelligent Systems using Soft Computing, Studies of Fuzziness and Soft Computing series, in press, 2009. [preprint].

Albert Orriols-Puig, Jorge Casillas, and Ester Bernadó-Mansilla. *A Comparative Study of Several Classifiers in Supervised Learning*. Learning Classifier Systems in Datamining, Studies of Fuzziness and Soft Computing series, volume 125/2008, pages 205-230, Springer, ISSN 1860-949X, 2008 [preprint].

Albert Orriols-Puig and Ester Bernadó-Mansilla. *Mining Imbalanced Data with Learning Classifier Systems*. Learning Classifier Systems in Datamining, Studies of Fuzziness and Soft Computing series, volume 125/2008, pages 123-145, Springer, ISSN 1860-949X, 2008 [preprint].

Sergio Morales-Ortigosa, **Albert Orriols-Puig**, and Ester Bernadó-Mansilla. *Can*

Evolution Strategies Improve Learning Guidance in XCS? Design and Comparison with Genetic Algorithms based XCS. In Artificial Intelligence Research and Development, number 184, pages 253–261, IOS Press, ISBN 978-1-58603-925-7, 2008 [preprint].

Núria Macià, Ester Bernadó-Mansilla, and **Albert Orriols-Puig**. *On the Dimensions of Data Complexity through Synthetic Data Sets*. In Recent Advances in Artificial Intelligence Research and Development, number 184, pages 244–252, IOS Press, ISBN 978-1-58603-925-7, 2008 [preprint].

Ester Bernadó-Mansilla, Tin K. Ho and **Albert Orriols-Puig**. *Data Complexity and Evolutionary Learning: Classifier's Behavior and Domain of Competence*. Data Complexity, pages 115-124. Springer, ISBN 978-1-84628-171-6, 2006 [preprint].

Albert Orriols-Puig and Ester Bernadó-Mansilla. *Analysis of Reduction Algorithms for XCS Classifier System*. In Recent Advances in Artificial Intelligence Research and Development, number 113, pages 383-390, IOS Press, 2004, ISBN 978-1-58603-466-5, 2004 [preprint].

Referred Conference Papers

Núria Macià, **Albert Orriols-Puig**, and Ester Bernadó-Mansilla. *EMO Shines a Light on the Holes of Complexity Space*. In 2009 Genetic and Evolutionary Computation Conference, ACM Press, in press, 2009 [preprint].

Albert Orriols-Puig, Jorge Casillas, and Ester Bernadó-Mansilla. *First Approach toward On-line Evolution of Association Rules with Learning Classifier Systems*. In 2008 Genetic and Evolutionary Computation Conference workshop program, ACM Press, pages 2031–2038, ISBN 978-1-60558-131-6, 2008 [preprint].

Sergio Morales-Ortigosa, **Albert Orriols-Puig**, and Ester Bernadó-Mansilla. *New Crossover Operator for Evolutionary Rule Discovery in XCS*. HIS'08: Proceedings of the 2008 Hybrid Intelligent Systems Conference, pages 867-872, ISBN 978-0-7695-3326-1, 2008 [preprint].

Joaquim Rios-Boutin, **Albert Orriols-Puig**, and Josep M. Garrell-Guiu. *Artificial Data Sets based on Knowledge Generators: Analysis of Learning Algorithms Efficiency*. HIS'08: Proceedings of the 2008 Hybrid Intelligent Systems Conference, pages 873–878, ISBN 978-0-7695-3326-1, 2008 [preprint].

Núria Macià, **Albert Orriols-Puig**, and Ester Bernadó-Mansilla. *Genetic-based synthetic data sets for the analysis of classifiers' behavior*. HIS'08: Proceedings of the 2008 Hybrid Intelligent Systems Conference, pages 507–512 , ISBN 978-0-7695-3326-1, 2008 [preprint].

Núria Macià, Ester Bernadó-Mansilla, and **Albert Orriols-Puig**. *Preliminary Approach on Synthetic Datasets Generation for Classification*. In 2008 International Conference on Pattern Recognition, pages 986–995, ISBN 978-1-4244-2175-6, 2008 [preprint].

Francesc Teixidó-Navarro, **Albert Orriols-Puig**, and Ester Bernadó-Mansilla. *Hierarchical Evolution of Linear Regressors*. In Genetic and Evolutionary Computation Conference (GECCO'08), ACM Press, 1413–1420, ISBN 978-1-60558-130-9, 2008 [preprint].

Jorge Casillas, **Albert Orriols-Puig**, and Ester Bernadó-Mansilla. *Toward Evolving Consistent, Complete, and Compact Fuzzy Rule Sets for Classification Problems*. In Genetic and Evolving Fuzzy Systems, pages 89-94, IEEE, ISBN 978-1-4244-1613-4, 2008. *Best paper award* [preprint].

Albert Orriols-Puig, David. E. Goldberg, Kumara Sastry, and Ester Bernadó-Mansilla. *Modeling XCS in Class Imbalances: Population Size and Parameter Settings*. In Genetic and Evolutionary Computation Conference (GECCO'07), pages 1838-1845, ACM Press, ISBN 978-1-59593-697-4, 2007 [preprint].

Albert Orriols-Puig, Kumara Sastry, Pier Luca Lanzi, David E. Goldberg, and Ester Bernadó-Mansilla. *Modeling Selection Pressure in XCS for Proportionate and Tournament Selection*. In Genetic and Evolutionary Computation Conference (GECCO'07), pages 1846-1853, ACM Press, ISBN 978-1-59593-697-4, 2007 [preprint].

Albert Orriols-Puig, Kumara Sastry, David E. Goldberg, and Ester Bernadó-Mansilla. *Substructural Surrogates for Learning Decomposable Classification Problems: Implementation and First Results*. In 2007 Genetic and Evolutionary Computation Conference workshop program, pages 2875-2882, ACM Press, ISBN 978-1-59593-698-1, 2007 [preprint].

Albert Orriols-Puig, Jorge Casillas, and Ester Bernadó-Mansilla. *Fuzzy-UCS: Preliminary Results*. In 2007 Genetic and Evolutionary Computation Conference workshop program, pages 2871-2874, ACM Press, ISBN 978-1-59593-698-1, 2007 [preprint].

Albert Orriols-Puig and Ester Bernadó-Mansilla. *Bounding XCS's Parameters for Unbalanced Datasets*. Best paper nomination. In Genetic and Evolutionary Computation Conference (GECCO'06), pages 1561-1568. ACM Press, ISBN 1-59593-186-4, 2006 [preprint].

Albert Orriols-Puig and Ester Bernadó-Mansilla. *A Further Look at UCS Classifier System*. In Genetic and Evolutionary Computation Conference (GECCO'06) workshop program, pages 1-4. ACM Press, ISBN 1-59593-186-4, 2006 [preprint].

Albert Orriols-Puig and Ester Bernadó-Mansilla. *The Class Imbalance Problem in UCS Classifier System: Fitness Adaptation*. In Congress on Evolutionary Computation, volume 1, pages 604-611. IEEE, 2005 [preprint].

Albert Orriols-Puig and Ester Bernadó-Mansilla. *The Class Imbalance Problem in Learning Classifier Systems: A Preliminary Study*. In Genetic and Evolutionary Computation Conference (GECCO'05) workshop program, pages 74-78, ACM Press, 2005 [preprint].

National Conferences

Albert Orriols-Puig, Jorge Casillas, and Francisco J. Martínez-López. *Modelado Causal en Marketing Mediante Aprendizaje no Supervisado de Reglas de Asociación Difusas*. XIV Congreso Español sobre Tecnologías y Lógica Fuzzy (ESTYLF'08). *Best paper award*, pages 529-536, 2008 [preprint].

Albert Orriols-Puig, Jorge Casillas, and Ester Bernadó-Mansilla. *Aprendizaje Supervisado de Reglas Difusas mediante un Sistema Clasificador Evolutivo Estilo Michigan*. Proceedings of the II Congreso Español de Informática (CEDI 2007), pages 171-178. I Jornadas sobre Algoritmos Evolutivos y Metaheurísticas (JAEM07). Zaragoza (Spain), 2007 [preprint].

Technical Reports

Kumara Sastry and **Albert Orriols-Puig**. *Extended Compact Genetic Algorithm in Matlab*. Technical report number 2007010, Illinois Genetic Algorithms Laboratory - University of Illinois at Urbana Champaign, 2007 [preprint].

Albert Orriols-Puig, David. E. Goldberg, Kumara Sastry, and Ester Bernadó-Mansilla. *Modeling XCS in Class Imbalances: Population Size and Parameters' Settings*. Technical report number 2007001, Illinois Genetic Algorithms Laboratory - University of Illinois at Urbana Champaign, 2007 [preprint].

Albert Orriols-Puig, Kumara Sastry, Pier Luca Lanzi, David E. Goldberg, and Ester Bernadó-Mansilla. *Modeling Selection Pressure in XCS for Proportionate and Tournament Selection*. Technical report number 2007004, Illinois Genetic Algorithms Laboratory - University of Illinois at Urbana Champaign, 2007 [preprint].

Albert Orriols-Puig. Facetwise *Analysis of Learning Classifier Systems in Imbalanced Domains (Catalan version only)*. Diploma de Estudios Avanzados. BES La Salle - Universidad Ramon Llull, 2006 [preprint].

SOURCE CODE

Extended compact genetic algorithm in Matlab
Kumara Sastry, **Albert Orriols-Puig**
Documentation: http://www.illigal.uiuc.edu/pub/papers/IlliGALs/2007009.pdf
Source: http://www.illigal.uiuc.edu/pub/src/ECGA/eCGAmatlab.zip

Data complexity library in C++
Albert Orriols-Puig
Documentation: http://dcol.sourceforge.net
Source: http://dcol.sourceforge.net

The extended classifier system (XCS)
Albert Orriols-Puig
Documentation: http://www.keel.es
Source: http://www.keel.es

The supervised classifier system (UCS)
Albert Orriols-Puig
Documentation: http://www.keel.es
Source: http://www.keel.es

LANGUAGES

Catalan (native), Spanish, English: Reading, speaking, and writing very well.

- English proficiency course. Institut d'Estudis Nord-Americans (IEN), 2007.
- Advanced Certificate in English. Institut d'Estudis Nord-Americans (IEN), 2006.
- Course of English Language at Advanced Level in Oxford Brookes University. Nord Anglia International. Oxford, UK (1999).
- Certificate of Competence in English. The University of Michigan - English Language Institute. Ann Arbor, Michigan, United States of America (1998).

SOFTWARE AND OPERATING SYSTEMS

Operating Systems: Ms. Windows and Linux

Programming languages: bash, perl, python, javascript, jsp, php, corba, Matlab, C/C++, java, J2EE, and EJB among others.

REFERENCES

Prof. David E. Goldberg

Jerry S. Dobrovolny Distinguished Professor

Department of Industrial and Enterprise Systems Engineering

University of Illinois at Urbana-Champaign

117 Transportation Building

104 S. Mathews Ave, Urbana, IL 61801, USA

Phone: +1-217-333 0897 • FAX: +1-217-244-5705

email: deg@uiuc.edu

Prof. Francisco Herrera

Head of the Soft Computing and Intelligent Information Systems group

Department of Computer Science and Artificial Intelligence

ETS de Ingenierias Informática y de Telecomunicación

University of Granada, E-18071 Granada, Spain

Phone: +34-958-240598 • Fax: +34-958-243317

email: herrera@decsai.ugr.es

Prof. Miquel Bertran

Codirector of the Research Group on Distributed Systems and Director of General Systems Development

Department of Computer Science

BES La Salle - Ramon Llull University,

C/ Quatre Camins 2, 08022 Barcelona, Spain

Phone: +34-93-2902410 • Fax: +34-93-2902450

email: miqbe@salle.url.edu

Dr. M. Antonia Mozota

Comercial Director of TRIPLEI and Associate Professor at BES La Salle

Ingenieria Informática Industrial

Cases Pairals, Fills de Gil, Corbera de Llobregat, Barcelona, Spain

Phone: +34-93-650-25-56 • Fax: +34-93-688-13-36

email: tona@salle.url.edu