

# Lecture Notes in Artificial Intelligence

1810

Subseries of Lecture Notes in Computer Science

Edited by J. G. Carbonell and J. Siekmann

Lecture Notes in Computer Science

Edited by G. Goos, J. Hartmanis and J. van Leeuwen

**Springer**

*Berlin*

*Heidelberg*

*New York*

*Barcelona*

*Hong Kong*

*London*

*Milan*

*Paris*

*Singapore*

*Tokyo*

Ramon López de Mántaras    Enric Plaza (Eds.)

# Machine Learning: ECML 2000

11th European Conference on Machine Learning  
Barcelona, Catalonia, Spain, May 31 – June 2, 2000  
Proceedings



Springer

## Series Editors

Jaime G. Carbonell, Carnegie Mellon University, Pittsburgh, PA, USA  
Jörg Siekmann, University of Saarland, Saarbrücken, Germany

## Volume Editors

Ramon López de Mántaras  
Enric Plaza  
Institut d'Investigació en Intelligència Artificial, IIIA  
Spanish Council for Scientific Research, CSIC  
Campus, U.A.B.  
08193 Bellaterra, Catalonia, Spain  
E-mail: {mantaras/enric}@iia.csic.es

Cataloging-in-Publication Data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Machine learning : proceedings / ECML 2000, 11th European Conference  
on Machine Learning, Barcelona, Catalonia, Spain, May 31 - June 2,  
2000. Ramón López de Mántaras ; Enric Plaza (ed.). - Berlin ;  
Heidelberg ; New York ; Barcelona ; Hong Kong ; London ; Milan ; Paris  
; Singapore ; Tokyo : Springer, 2000  
(Lecture notes in computer science ; Vol. 1810 : Lecture notes in  
artificial intelligence)  
ISBN 3-540-67602-3

CR Subject Classification (1998): I.2, F.2.2

ISSN 0302-9743

ISBN 3-540-67602-3 Springer-Verlag Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law.

Springer-Verlag is a company in the BertelsmannSpringer publishing group.  
© Springer-Verlag Berlin Heidelberg 2000  
Printed in Germany

Typesetting: Camera-ready by author, data conversion by DA-Tex Gerd Blumenstein  
Printed on acid-free paper SPIN 10720254 06/3142 5 4 3 2 1 0

# Foreword

The biennial European Conference on Machine Learning (ECML) series is intended to provide an international forum for the discussion of the latest high quality research results in machine learning and is the major European scientific event in the field. The eleventh conference (ECML 2000) held in Barcelona, Catalonia, Spain from May 31 to June 2, 2000, has continued this tradition by attracting high quality papers from around the world.

Scientists from 21 countries submitted 100 papers to ECML 2000, from which 20 were selected for long oral presentations and 23 for short oral presentations. This selection was based on the recommendations of at least two reviewers for each submitted paper. It is worth noticing that the number of papers reporting applications of machine learning has increased in comparison to past ECML conferences. We believe this fact shows the growing maturity of the field.

This volume contains the 43 accepted papers as well as the invited talks by Katharina Morik from the University of Dortmund and Pedro Domingos from the University of Washington at Seattle. In addition, three workshops were jointly organized by ECML 2000 and the European Network of Excellence MLnet: “Dealing with Structured Data in Machine Learning and Statistics Web-sites”, “Machine Learning in the New Information Age” , and “Meta-Learning: Building Automatic Advice Strategies for Model Selection and Method Combination”. Finally, a special workshop on “Learning Agents” was jointly organized by ECML 2000 and the co-located International Conference on Autonomous Agents. Information on the workshops can be found on the ECML 2000 web page: <http://www.iia.csic.es/ecml2000/>.

We gratefully acknowledge the work of the invited speakers and the authors of the submitted papers that made this conference possible. We also thank the program committee and the additional reviewers for their effort during the paper selection process. Our gratitude also goes to the ECML 2000 sponsors: MLnet, CSIC, CICYT, and ACIA, as well as to Gemma Sales for her assistance in the organization of the conference.

March 2000

Ramon López de Mántaras  
Enric Plaza

# Organization

The 11th European Conference on Machine Learning took place on May 30th to June 2nd 2000 in Barcelona, Catalonia (Spain).

## Program Chairs

Ramon López de Mántaras (mantaras@iia.csic.es), Enric Plaza (enric@iia.csic.es), Institut d'Investigació en Intel·ligència Artificial (IIIA-CSIC), Bellaterra, Catalonia (Spain)

## Conference Support

ECML 2000 was organized by the Institut d'Investigació en Intel·ligència Artificial (IIIA), Consejo Superior de Investigaciones Científicas (CSIC), Bellaterra, Catalonia (Spain). Institutions that provided support for ECML 2000 are ACIA (Catalan Association for Artificial Intelligence), CICYT (Spanish Science and Technology Council), CSIC (Spanish Council for Scientific Research), and ML-net (European Network of Excellence on Machine Learning IST-29288)

## Program Committee

A. Aamodt (Norway)	Y. Kodratoff (France)
D. Aha (USA)	I. Kononenko (Slovenia)
K. D. Althoff (Germany)	N. Lavrac (Slovenia)
F. Bergadano (Italy)	R. López de Mántaras (Spain)
D. Borrajo (Spain)	S. Matwin (Canada)
I. Bratko (Slovenia)	K. Morik (Germany)
P. Brazdil (Portugal)	V. Moustakis (Greece)
E. Costa (Portugal)	S. Muggleton (UK)
K. DeJong (USA)	G. Nakhaeizadeh (Germany)
L. De Raedt (Germany)	C. Nedellec (France)
T. G. Dietterich (USA)	E. Plaza (Spain)
P. Domingos (USA)	C. Rouveirol (France)
M. Dorigo (Belgium)	S. Russell
S. Dzeroski (Slovenia)	L. Saitta (Italy)
F. Esposito (Italy)	M. van Someren (Netherlands)
D. H. Fisher (USA)	D. Sleeman (UK)
P. Flach (UK)	S. Thrun (USA)
J. Fuerkranz (Austria)	C. Torras (Spain)
J. G. Ganascia (France)	S. Weiss (Germany)
O. Gascuel (France)	G. Widmer (Austria)
M. Goldszmidt (USA)	S. Wrobel (Germany)

## Additional Reviewers

J. Aguilar Martin (France)	M. Liquiere (France)
K. Barker (Canada)	P. Machado (Portugal)
K. Bartlmae (Germany)	D. Malerba (Italy)
M. Birattari (Italy)	J. M. Molina (Spain)
M. Borth (Germany)	F. B. Pereira (Portugal)
O. A. Brevik (Norway)	F. A. Rauscher (Germany)
P. Brockhausen (Germany)	I. Renz (Germany)
T. Brychcy (Germany)	M. Robnik-Sikonja (Slovenia)
A. Cornuejols (France)	G. Ruffo (Italy)
D. Faure (France)	V. Ruiz de Angulo (Spain)
R. Gavalda (Spain)	M. Saerens (Belgium)
M. Grobelnik (Slovenia)	T. Scheffer (Germany)
D. Gunetti (Italy)	R. Schneider (Germany)
T. Hrycej (Germany)	G. Semeraro (Italy)
P. Isasi (Spain)	L. Todorovski (Slovenia)
A. Jorge (Portugal)	L. Torgo (Portugal)
T. Joachims (Germany)	F. Torre (France)
H. Kauderer (Germany)	C. Ungerer (Germany)
R. Klinkenberg (Germany)	M. Wiering (Italy)
M. Kukar (Slovenia)	D. Zupanic (Slovenia)
C. Lanquillon (Germany)	

# Table of Contents

## Invited Papers

Beyond Occam's Razor: Process-Oriented Evaluation .....	3
<i>Pedro Domingos</i>	
The Representation Race – Preprocessing for Handling Time Phenomena ....	4
<i>Katharina Morik</i>	

## Contributed Papers

Short-Term Profiling for a Case-Based Reasoning Recommendation System .....	23
<i>Esma Aimeur and Mathieu Vézeau</i>	
K-SVCR. A Multi-class Support Vector Machine .....	31
<i>Cecilio Angulo and Andreu Català</i>	
Learning Trading Rules with Inductive Logic Programming .....	39
<i>Liviu Badea</i>	
Improving Knowledge Discovery Using Domain Knowledge in Unsupervised Learning .....	47
<i>Javier Béjar</i>	
Exploiting Classifier Combination for Early Melanoma Diagnosis Support ..	55
<i>E. Blanzieri, C. Eccher, S. Forti and A. Sboner</i>	
A Comparison of Ranking Methods for Classification Algorithm Selection ..	63
<i>Pavel B. Brazdil and Carlos Soares</i>	
Hidden Markov Models with Patterns and Their Application to Integrated Circuit Testing .....	75
<i>Laurent Bréhélin, Olivier Gascuel and Gilles Caraux</i>	
Comparing Complete and Partial Classification for Identifying Latently Dissatisfied Customers .....	88
<i>Tom Brijs, Gilbert Swinnen, Koen Vanhoof and Geert Wets</i>	
Wrapper Generation via Grammar Induction .....	96
<i>Boris Chidloukii, Jon Ragethi and Maarten de Rijke</i>	
Diversity versus Quality in Classification Ensembles Based on Feature Selection .....	109
<i>Pádraig Cunningham and John Carney</i>	



Minimax TD-Learning with Neural Nets in a Markov Game .....	117
<i>Fredrik A. Dahl and Ole Martin Halck</i>	
Boosting Applied to Word Sense Disambiguation .....	129
<i>Gerard Escudero, Lluís Màrquez and German Rigau</i>	
A Multiple Model Cost-Sensitive Approach for Intrusion Detection .....	142
<i>Wei Fan, Wenke Lee, Salvatore J. Stolfo and Matthew Miller</i>	
Value Miner: A Data Mining Environment for the Calculation of the Customer Lifetime Value with Application to the Automotive Industry .....	154
<i>Katja Gelbrich and Reza Nakhaeizadeh</i>	
Investigation and Reduction of Discretization Variance in Decision Tree Induction .....	162
<i>Pierre Geurts and Louis Wehenkel</i>	
Asymmetric Co-evolution for Imperfect-Information Zero-Sum Games .....	171
<i>Ole Martin Halck and Fredrik A. Dahl</i>	
A Machine Learning Approach to Workflow Management .....	183
<i>Joachim Herbst</i>	
The Utilization of Context Signals in the Analysis of ABR Potentials by Application of Neural Networks .....	195
<i>Andrzej Izvorski, Ryszard Tadeusiewicz and Andrzej Paslawski</i>	
Complexity Approximation Principle and Rissanen's Approach to Real-Valued Parameters .....	203
<i>Yuri Kalnishkan</i>	
Handling Continuous-Valued Attributes in Decision Tree with Neural Network Modeling .....	211
<i>DaeEun Kim and Jaeho Lee</i>	
Learning Context-Free Grammars with a Simplicity Bias .....	220
<i>Pat Langley and Sean Stromsten</i>	
Partially Supervised Text Classification: Combining Labeled and Unlabeled Documents Using an EM-like Scheme .....	229
<i>Carsten Lanquillon</i>	
Toward an Explanatory Similarity Measure for Nearest-Neighbor Classification .....	238
<i>Mathieu Latourrette</i>	
Relative Unsupervised Discretization for Regression Problems .....	246
<i>Marcus-Christopher Ludl and Gerhard Widmer</i>	
Metric-Based Inductive Learning Using Semantic Height Functions .....	254
<i>Zdravko Markov and Ivo Marinchev</i>	

Error Analysis of Automatic Speech Recognition Using Principal Direction Divisive Partitioning .....	263
<i>David McKoskey and Daniel Boley</i>	
A Study on the Performance of Large Bayes Classifier .....	271
<i>Dimitris Meretakís, Hongjun Lu and Beat Wüthrich</i>	
Dynamic Discretization of Continuous Values from Time Series .....	280
<i>Llanos Mora López, Inmaculada Fortes Ruiz, Rafael Morales Bueno and Francisco Triguero Ruiz</i>	
Using a Symbolic Machine Learning Tool to Refine Lexico-syntactic Patterns .....	292
<i>Emmanuel Morin and Emmanuelle Martienne</i>	
Measuring Performance when Positives Are Rare: Relative Advantage versus Predictive Accuracy – A Biological Case-Study .....	300
<i>Stephen H. Muggleton, Christopher H. Bryant and Ashwin Srinivasan</i>	
Mining TCP/IP Traffic for Network Intrusion Detection by Using a Distributed Genetic Algorithm .....	313
<i>Filippo Neri</i>	
Learning Patterns of Behavior by Observing System Events .....	323
<i>Marlon Núñez</i>	
Dimensionality Reduction through Sub-space Mapping for Nearest Neighbour Algorithms .....	331
<i>Terry R. Payne and Peter Edwards</i>	
Nonparametric Regularization of Decision Trees .....	344
<i>Tobias Scheffer</i>	
An Efficient and Effective Procedure for Updating a Competence Model for Case-Based Reasoners .....	357
<i>Barry Smyth and Elizabeth McKenna</i>	
Layered Learning .....	369
<i>Peter Stone and Manuela Veloso</i>	
Problem Decomposition for Behavioural Cloning .....	382
<i>Dorian Šuc and Ivan Bratko</i>	
Dynamic Feature Selection in Incremental Hierarchical Clustering .....	392
<i>Luis Talavera</i>	
On the Boosting Pruning Problem .....	404
<i>Christino Tamon and Jie Xiang</i>	
An Empirical Study of MetaCost Using Boosting Algorithms .....	413
<i>Kai Ming Ting</i>	
Clustered Partial Linear Regression .....	426
<i>Luís Torgo and Joaquim Pinto da Costa</i>	

Knowledge Discovery from Very Large Databases Using  
Frequent Concept Lattices .....437  
*Kitsana Waiyamai and Lotfi Lakhal*

Some Improvements on Event-Sequence Temporal Region Methods .....446  
*Wei Zhang*

Author Index .....459