

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, Lancaster, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Friedemann Mattern

ETH Zurich, Zurich, Switzerland

John C. Mitchell

Stanford University, Stanford, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

C. Pandu Rangan

Indian Institute of Technology, Madras, India

Bernhard Steffen

TU Dortmund University, Dortmund, Germany

Demetri Terzopoulos

University of California, Los Angeles, CA, USA

Doug Tygar

University of California, Berkeley, CA, USA

Gerhard Weikum

Max Planck Institute for Informatics, Saarbrücken, Germany

More information about this series at <http://www.springer.com/series/7409>

Andreas Holzinger · Peter Kieseberg
A Min Tjoa · Edgar Weippl (Eds.)

Machine Learning and Knowledge Extraction

First IFIP TC 5, WG 8.4, 8.9, 12.9
International Cross-Domain Conference, CD-MAKE 2017
Reggio, Italy, August 29 – September 1, 2017
Proceedings

Editors

Andreas Holzinger
Medical University Graz
Graz
Austria

Peter Kieseberg
SBA Research
Vienna
Austria

A Min Tjoa
Vienna University of Technology
Vienna
Austria

Edgar Weippl
SBA Research
Vienna
Austria

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-319-66807-9 ISBN 978-3-319-66808-6 (eBook)
DOI 10.1007/978-3-319-66808-6

Library of Congress Control Number: 2017951440

LNCS Sublibrary: SL3 – Information Systems and Applications, incl. Internet/Web, and HCI

© IFIP International Federation for Information Processing 2017

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

The International Cross Domain Conference for Machine Learning and Knowledge Extraction, CD-MAKE, is a joint effort of IFIP TC 5, IFIP WG 8.4, IFIP WG 8.9, and IFIP WG 12.9 and is held in conjunction with the International Conference on Availability, Reliability, and Security (ARES).

CD stands for Cross-Domain and means the integration and appraisal of different fields and application domains to provide an atmosphere to foster different perspectives and opinions. The conference is dedicated to offering an international platform for novel ideas and a fresh look at the methodologies for putting crazy ideas into business for the benefit of the human. Serendipity is a desired effect, cross-fertilizing methodologies and transferring algorithmic developments.

MAKE stands for MACHine Learning and Knowledge Extraction. Machine learning studies algorithms that can learn from data to gain knowledge from experience and to make decisions and predictions. A grand goal is to understand intelligence for the design and development of algorithms that work autonomously and can improve their learning behavior over time. The challenge is to discover relevant structural and/or temporal patterns (“knowledge”) in data, which is often hidden in arbitrarily high dimensional spaces, which is simply not accessible to humans. Machine learning as a branch of Artificial Intelligence is currently undergoing kind of Cambrian explosion and is the fastest growing field in computer science today. There are many application domains, e.g., smart health, smart factory, etc. with many use cases from our daily life, e.g., speech recognition, autonomous driving, etc. The grand challenges are in sense-making, in context understanding, and in decision making under uncertainty. Our real-world is full of uncertainties, and probabilistic inference has enormously influenced Artificial Intelligence generally and statistical learning specifically. The inverse probability allows us to infer unknowns, to learn from data, and to make predictions to support decision making. Whether in social networks, health, or Industry 4.0 applications, the increasingly complex data sets require efficient, useful, and useable solutions for knowledge discovery and knowledge extraction.

To acknowledge here all those who contributed to the organization and stimulating discussions would be impossible. Many people contributed to the development of this volume, either directly or indirectly, so it would be sheerly impossible to list all of them. We herewith thank all colleagues and friends for all their positive and supportive encouragement. Last but not least we thank the Springer management team and the Springer production team for their smooth support.

Thank you to all! Let’s make it!

August 2017

Andreas Holzinger
Peter Kieseberg
Edgar Weippl
A Min Tjoa

Organization

International Cross Domain Conference for Machine Learning and Knowledge Extraction (CD-MAKE 2017)

CD-MAKE Conference Organizers

Andreas Holzinger	Med. University and Graz University of Technology, Austria
Peter Kieseberg	SBA Research, Austria
Edgar Weippl	SBA Research, Austria (IFIP WG 8.4 Chair)
A Min Tjoa	TU Vienna, Austria (IFIP WG 8.9. Chair, Honorary Secretary IFIP)

Program Committee

Rakesh Agrawal	Microsoft Search Labs, USA
Amin Anjomshoaa	SENSEable City Laboratory, Massachusetts Institute of Technology, USA
Joel P. Arrais	Centre for Informatics and Systems, University of Coimbra, Portugal
John A. Atkinson Abutridy	Department of Computer Science, Universidad de Concepción, Chile
Chloe Agathe Azencott	Centre for Computational Biology (CBIO), Mines Paris Tech, France
Alexandra Balahur	European Commission Joint Research Centre, Italy
Smaranda Belciug	Department of Computer Science, Faculty of Mathematics & Computer Science, University of Craiova, Romania
Mounir Ben Ayed	Research Group Intelligent Machines, Ecole Nationale d'Ingenieurs de Sfax, Tunisia
Mattia G. Bergomi	Chamalimaud Centre for the Unknown, Portugal
Elisa Bertino	Department of Computer Science, Purdue University, USA
Michele Bezzi	Security Research, SAP Labs France, France
Jiang Bian	College of Medicine, Health Outcomes and Policy, University of Florida, USA
Chris Biemann	Language Technology Group, FB Informatik, Technische Universität Darmstadt, Germany
Mirosław Bober	Department of Electronic Engineering, University of Surrey, UK

Francesco Buccafurri	Security and Social Networks Group, Università Mediterranea di Reggio Calabria, Italy
Andre Calero-Valdez	RWTH Aachen University, Germany
Mirko Cesarini	Department of Statistics and Quantitative Methods, Università di Milano Bicocca, Italy
Polo Chau	School of Computational Science and Engineering, College of Computing, Georgia Tech, USA
Nitesh Chawla	University of Notre Dame, USA
Chaomei Chen	College of Information Science and Technology, Drexel University, USA
Veronika Cheplygina	Biomedical Imaging Group, Erasmus Medical Center, Netherlands
Krzysztof Cios	Data Mining and Biomedical Informatics Lab, Department of Computer Science, VCU, USA
Carlo Combi	Department of Computer Science, University of Verona, Italy
Tim Conrad	Institut für Mathematik, Medical Bioinformatics Group, Freie Universität Berlin, Germany
Pierluigi Crescenzi	Dipartimento di Matematica e Informatica ‘Ulisse Dini’, Università degli Studi di Firenze, Italy
Gloria Cerasela Crisan	Faculty of Sciences, Vasile Alecsandri University of Bacau, Romania
Alfredo Cuzzocrea	DIA Department, University of Trieste, Italy
Beatriz De La Iglesia	Knowledge Discovery & Data Mining Group, Computing Sciences, University of East Anglia, UK
Matthias Dehmer	University for Health and Medical Informatics Tyrol, Austria
Barbara Di Fabio	Università di Bologna, Italy
Alexiei Dingli	Intelligent Systems Technologies Research Group, University of Malta, Malta
Josep Domingo Ferrer	UNESCO Chair in Data Privacy, Universitat Rovira i Virgili, Tarragona, Spain
Isao Echizen	Digital Content and Media Sciences Research Division, National Institute of Informatics, Japan
Max Egenhofer	Center for Geographic Information and Analysis, University of Maine, USA
Kapetanios Epaminondas	Computer Science and Software Engineering Department, University of Westminster, UK
Aldo Faisal	Brain & Behaviour Lab and Machine Learning Group, Imperial College London, UK
Aasa Feragen	Department of Computer Science, University of Copenhagen, Denmark
Massimo Ferri	Department of Mathematics, University of Bologna, Italy
Ana Fred	Communication Theory and Pattern Recognition Group, IST – Technical University of Lisbon, Portugal

Aryya Gangopadhyay	UMBC Center of Cybersecurity, University of Maryland, USA
Panagiotis Germanakos	Department of Computer Science, University of Cyprus, Cyprus
Randy Goebel	Centre for Machine Learning, Department of Computer Science, University of Alberta, Canada
Michael Granitzer	Media Computer Science, University of Passau, Germany
Dimitrios Gunopulos	Knowledge Discovery in Databases Lab, Department of Informatics, University of Athens, Greece
Marie Gustafsson Friberger	Computer Science Department, Malmö University, Sweden
Siegfried Handschuh	Insight Centre for Data Analytics, NUI Galway, Ireland
Helwig Hauser	Visualization Group, University of Bergen, Norway
Julian Heinrich	Biodata Visualization Team, CSIRO, Australia
Kristina Hettne	BioSemantics Group, Department of Human Genetics, Leiden University Medical Center, Netherlands
Rainer Hofmann-Wellenhof	Division of General Dermatology, Graz University Hospital, Austria
Andreas Hotho	Data Mining and Information Retrieval Group, University of Würzburg, Germany
Jun Huan	Computational Knowledge Discovery Lab, University of Kansas, USA
Anthony Hunter	Intelligent Systems Group, Department of Computer Science, University College London, UK
Barna Laszlo Iantovics	Department of Mathematics and Informatics, Petru Maior University, Romania
Sara Johansson Fernstad	Computer Science and Digital Technologies, Northumbria University, UK
Igor Jurisica	IBM Life Sciences Discovery Centre, and Princess Margaret Cancer Centre, Canada
Andreas Kerren	ISOVIS Group, Department of Computer Science, Linnaeus University, Sweden
Negar Kiyavash	Department of Industrial and Enterprise Systems, University of Illinois at Urbana-Champaign, USA
Lubos Klucar	Bioinformatics Lab, Institute of Molecular Biology, Slovak Academy of Sciences, Slovakia
Natsuhiko Kumasaka	Center for Genomic Medicine (CGM), RIKEN, Japan
Robert S. Laramée	Data Visualization Group, Department of Computer Science, Swansea University, UK
Nada Lavrac	Department of Knowledge Technologies, Jozef Stefan Institute, Slovenia
Sangkyun Lee	Artificial Intelligence Unit, Dortmund University, Germany
Lenka Lhotska	Department of Cybernetics, Faculty of Electrical Engineering, Czech Technical University Prague, Czech Republic

Chunping Li	School of Software, Tsinghua University, China
Haibin Ling	Center for Data Analytics and Biomedical Informatics, Temple University, USA
Luca Longo	Knowledge & Data Engineering Group, Trinity College Dublin, Ireland
Andras Lukacs	Institute of Mathematics, Hungarian Academy of Sciences and Eoetvos University, Hungary
Ljiljana Majnarić Trtica	Department of Family Medicine, Medical School, University of Osijek, Croatia
Donato Malerba	Dipartimento di Informatica, Università degli Studi di Bari Aldo Moro, Italy
Vincenzo Manca	Dipartimento di Informatica, University of Verona, Italy
Ernestina Menasalvas	Data Mining Group, Polytechnic University of Madrid, Spain
Yoan Miche	Nokia Bell Labs, Helsinki, Finland
Silvia Miksch	Centre of Visual Analytics Science & Technology, Vienna University of Technology, Austria
Antonio Moreno-Ribas	Intelligent Technologies for Advanced Knowledge Acquisition, Univ. Rovira i Virgili, Spain
Marian Mrozek	Computational Mathematics, Institute of Computer Science, Jagiellonian University, Poland
Nysret Musliu	Database and Artificial Intelligence Group (DBAI), Vienna University of Technology, Austria
Zoran Obradovic	Data Analytics and Biomedical Informatics Center, Temple University, USA
Patricia Ordonez-Rozo	Department of Computer Science, University of Puerto Rico Rio Piedras, Puerto Rico
Daniel O’Leary	School of Business, University of Southern California, USA
Vasile Palade	School of Computing, Electronics and Mathematics, Coventry University, UK
Jan Paralic	Department of Cybernetics and Artificial Intelligence, Technical University of Kosice, Slovakia
Valerio Pascucci	Scientific Computing and Imaging Institute, University of Utah, USA
Gabriella Pasi	Laboratorio di Information Retrieval, Università di Milano Bicocca, Italy
Philip R.O. Payne	Institute for Informatics, School of Medicine, Washington University, USA
Roberto Perdisci	Institute for Artificial Intelligence, Computer Science Department, University of Georgia, USA
Armando J. Pinho	Departamento de Electrónica, Telecomunicações e Informática, University Aveiro, Portugal
Raul Rabadan	Biomedical Informatics, Columbia University, USA
Heri Ramampiaro	Data and Information Management Group, Norwegian University of Science and Technology, Norway

Fabrizio Riguzzi	Dipartimento di Matematica e Informatica, Università di Ferrara, Italy
Giuseppe Rizzo	Innovation Development, Istituto Superiore Mario Boella Turin, Italy
Lior Rokach	Department of Information Systems Engineering, Ben-Gurion University of the Negev, Israel
Timo Ropinski	Visual Computing Research Group, Ulm University, Germany
Jianhua Ruan	Computational Biology, Department of Computer Science, University of Texas, USA
Carsten Röcker	Fraunhofer IOSB-INA and Ostwestfalen-Lippe University of Applied Sciences, Germany
Pierangela Samarati	Dipartimento di Informatica, University of Milan, Italy
Giuseppe Santucci	Dipartimento di Informatica e Sistemistica, La Sapienza, University of Rome, Italy
Paola Sebastiani	Department of Biostatistics, School of Public Health, Boston University, USA
Christin Seifert	Media Computer Science, University of Passau, Germany
Bracha Shapira	Department of Information Systems Engineering, Ben-Gurion University of the Negev, Israel
Yongtang Shi	Center for Combinatorics, Nankai University, China
Neil R. Smalheiser	College of Medicine, Department of Psychiatry, University of Illinois at Chicago, USA
Axel J. Soto	National Centre for Text Mining (NaCTeM), Manchester Institute of Biotechnology, UK
Rainer Spang	Statistical Bioinformatics Department, Institute of Functional Genomics, University Regensburg, Germany
Irena Spasic	Health Informatics, School of Computer Science & Informatics, Cardiff University, UK
Jessica Staddon	Google Research and Computer Science Department, NC State University, USA
Jerzy Stefanowski	Institute of Computing Science, Poznan University of Technology, Poland
Ulrich Stelzl	Network Pharmacology Group, Institute of Pharmaceutical Sciences, Graz University, Austria
Gregor Stiglic	Stanford Center for Biomedical Informatics, Stanford School of Medicine, USA
Shiliang Sun	Pattern Recognition & Machine Learning Research Group, East China Normal University, China
Olof Torgersson	Applied Information Technology, Chalmers University of Technology, Sweden
Dimitar Trajanov	Department of Computer Science, Cyril and Methodius University, Macedonia
Shusaku Tsumoto	Department of Medical Informatics, Faculty of Medicine, Shimane University, Japan

Cagatay Turkey	Department of Computer Science, City University London, UK
Karin Verspoor	Health and Life Sciences, National Information and Communications Technology Australia, Australia
Jean Philippe Vert	Cancer Computational Genomics and Bioinformatics, Mines ParisTech, France
Dmitry Vetrov	Bayesian Methods Research Group, Higher School of Economics, Russia
Hubert Wagner	Institute for Science and Technology IST Austria, Austria
Byron Wallace	College of Computer and Information Science, Northeastern University, USA
Daniel Weiskopf	Visualization and Interactive Systems Institute, Universität Stuttgart, Germany
William B.L. Wong	HCI, Computing and Multimedia Department, Middlesex University London, UK
Kai Xu	Visual Analytics, Computing and Multimedia Department, Middlesex University London, UK
Jieping Ye	Center for Evolutionary Medicine and Informatics, Arizona State University, USA
Pinar Yildirim	Department of Computer Engineering, Okan University, Turkey
Ning Zhong	Knowledge Information Systems Laboratory, Maebashi Institute of Technology, Japan
Xuezhong Zhou	Beijing Jiaotong University, China
Martina Ziefle	e-Health Group, RWTH Aachen University, Germany

Contents

MAKE Topology

On Distance Mapping from non-Euclidean Spaces to Euclidean Spaces	3
<i>Wei Ren, Yoan Miche, Ian Oliver, Silke Holtmanns, Kaj-Mikael Bjork, and Amaury Lendasse</i>	
Some Remarks on the Algebraic Properties of Group Invariant Operators in Persistent Homology	14
<i>Patrizio Frosini and Nicola Quercioli</i>	
Decentralized Computation of Homology in Wireless Sensor Networks Using Spanning Trees	25
<i>Domen Šoberl, Neža Mramor Kosta, and Primož Škraba</i>	
Detecting and Ranking API Usage Pattern in Large Source Code Repository: A LFM Based Approach.	41
<i>Jitong Zhao and Yan Liu</i>	

MAKE Smart Factor

Towards a Framework for Assistance Systems to Support Work Processes in Smart Factories	59
<i>Michael Fellmann, Sebastian Robert, Sebastian Büttner, Henrik Mucha, and Carsten Röcker</i>	
Managing Complexity: Towards Intelligent Error-Handling Assistance Trough Interactive Alarm Flood Reduction.	69
<i>Sebastian Büttner, Paul Wunderlich, Mario Heinz, Oliver Niggemann, and Carsten Röcker</i>	
Online Self-disclosure: From Users' Regrets to Instructional Awareness.	83
<i>N.E. Díaz Ferreyra, Rene Meis, and Maritta Heisel</i>	

MAKE Privacy

Decision Tree Rule Induction for Detecting Covert Timing Channels in TCP/IP Traffic	105
<i>Félix Iglesias, Valentin Bernhardt, Robert Annessi, and Tanja Zseby</i>	
Practical Estimation of Mutual Information on Non-Euclidean Spaces	123
<i>Yoan Miche, Ian Oliver, Wei Ren, Silke Holtmanns, Anton Akusok, and Amaury Lendasse</i>	

IntelliAV: Toward the Feasibility of Building Intelligent Anti-malware
on Android Devices 137
Mansour Ahmadi, Angelo Sotgiu, and Giorgio Giacinto

DO NOT DISTURB? Classifier Behavior on Perturbed Datasets 155
Bernd Malle, Peter Kieseberg, and Andreas Holzinger

A Short-Term Forecast Approach of Public Buildings' Power Demands
upon Multi-source Data 174
Shubing Shan and Buyang Cao

MAKE VIS

On the Challenges and Opportunities in Visualization for Machine Learning
and Knowledge Extraction: A Research Agenda 191
Cagatay Turkay, Robert Laramée, and Andreas Holzinger

Quantitative Externalization of Visual Data Analysis Results Using Local
Regression Models 199
Krešimir Matković, Hrvoje Abraham, Mario Jelović, and Helwig Hauser

Analysis of Online User Behaviour for Art and Culture Events 219
Behnam Rahdari, Tahereh Arabghalizi, and Marco Brambilla

On Joint Representation Learning of Network Structure
and Document Content 237
Jörg Schlötterer, Christin Seifert, and Michael Granitzer

MAKE AAL

Ambient Assisted Living Technologies from the Perspectives of Older
People and Professionals 255
Deepika Singh, Johannes Kropf, Sten Hanke, and Andreas Holzinger

Human Activity Recognition Using Recurrent Neural Networks 267
*Deepika Singh, Erinc Merdivan, Ismini Psychoula, Johannes Kropf,
Sten Hanke, Matthieu Geist, and Andreas Holzinger*

Modeling Golf Player Skill Using Machine Learning 275
Rikard König, Ulf Johansson, Maria Riveiro, and Peter Brattberg

Predicting Chronic Heart Failure Using Diagnoses Graphs 295
*Saurabh Nagrecha, Pamela Bilo Thomas, Keith Feldman,
and Nitesh V. Chawla*

MAKE Semantics

A Declarative Semantics for P2P Systems 315
Luciano Caroprese and Ester Zumpano

Improving Language-Dependent Named Entity Detection 330
Gerald Petz, Werner Wetzlinger, and Dietmar Nedbal

Towards the Automatic Detection of Nutritional Incompatibilities Based
on Recipe Titles 346
Nadia Clairet and Mathieu Lafourcade

The More the Merrier - Federated Learning from Local
Sphere Recommendations. 367
Bernd Malle, Nicola Giuliani, Peter Kieseberg, and Andreas Holzinger

Author Index 375