

# **Lecture Notes in Artificial Intelligence**

**9992**

Subseries of Lecture Notes in Computer Science

LNAI Series Editors

Randy Goebel

*University of Alberta, Edmonton, Canada*

Yuzuru Tanaka

*Hokkaido University, Sapporo, Japan*

Wolfgang Wahlster

*DFKI and Saarland University, Saarbrücken, Germany*

LNAI Founding Series Editor

Joerg Siekmann

*DFKI and Saarland University, Saarbrücken, Germany*

More information about this series at <http://www.springer.com/series/1244>

Byeong Ho Kang · Quan Bai (Eds.)

# AI 2016: Advances in Artificial Intelligence

29th Australasian Joint Conference  
Hobart, TAS, Australia, December 5–8, 2016  
Proceedings

*Editors*

Byeong Ho Kang  
University of Tasmania  
Hobart  
Australia

Quan Bai  
Auckland University of Technology  
Auckland  
New Zealand

ISSN 0302-9743                      ISSN 1611-3349 (electronic)  
Lecture Notes in Artificial Intelligence  
ISBN 978-3-319-50126-0              ISBN 978-3-319-50127-7 (eBook)  
DOI 10.1007/978-3-319-50127-7

Library of Congress Control Number: 2016958512

LNCS Sublibrary: SL7 – Artificial Intelligence

© Springer International Publishing AG 2016, corrected publication 2020

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.

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

# Preface

This volume contains the papers presented at the 29th Australasian Joint Conference on Artificial Intelligence 2016 (AI 2016), which was held in Hobart, Australia, December 5–8, 2016.

The conference is the premier event for artificial intelligence in Australasia and provides a forum for researchers and practitioners across all subfields of artificial intelligence to meet and discuss recent advances. This year, we were co-located with the 2016 International Conference on Smart Media and Applications (SMA 2016), with which we shared the keynote speech session, a joint session, and a social event.

The technical program of AI 2016 comprised a number of high-quality papers that were selected in a thorough, single-blind reviewing process with at least two expert reviews per paper. Out of 121 submissions, our senior Program Committee with the help of an experienced international Program Committee selected 40 long papers and 18 short papers for presentation at the conference and inclusion in these proceedings. In addition to the technical program, we also selected two papers from the doctoral consortium and six papers from SMA 2016 to be included in the proceedings as invited papers.

Papers were submitted by authors from 28 countries, demonstrating the broad international appeal of our conference. In addition to the 58 paper presentations, we had four keynote talks by high-profile speakers:

- Prof. Rayid Ghani, University of Chicago, USA
- Prof. Takayuki Ito, Nagoya Institute of Technology, Japan
- Prof. Maurice Pagnucco, UNSW, Australia
- Prof. Zhi-Hua Zhou, Nanjing University, China

AI 2016 was complemented by a doctoral consortium, and featured an exciting selection of four workshops and a tutorial that were free for all conference participants to attend. The four workshops were:

- The 8th International Workshop on Collaborative Agents Research and Development
- The Workshop on Time Series Analytics and Applications
- The Workshop on Experiential Knowledge Platform Development Research
- Korean Academy of Scientists and Engineers in Australasian Annual Workshop

The tutorial were on:

- Deep Learning and Applications in Non-Cognitive Domains by Truyen Tran (Deakin University)

A large number of people and organizations helped make AI 2016 a success. First and foremost, we would like to thank the authors for contributing and presenting their latest work at the conference. Without their contribution this conference would not

have been possible. The same is true for the members of the conference organization. We also thank our senior Program Committee members, the members of our Program Committee, as well as additional reviewers who were all very dedicated and timely in their contributions to selecting the best papers for presentation at AI 2016.

We are grateful for support and sponsorship from the Australian Computer Society for AI (ACS-AI) Meeting, the School of Engineering and ICT, the University of Tasmania (UTAS), and the Science and Engineering Research Support Society. In particular, we appreciate the ACS-AI Meeting for student scholarships and the School of Engineering and ICT of UTAS for the administration and technical supports for this conference. We also appreciate the free conference management system EasyChair, which was used for putting together this volume. Last but not the least, we thank Springer for their sponsorship and their support in preparing and publishing this volume in the *Lecture Notes in Computer Science* series.

October 2016

Quan Bai  
Byeong Ho Kang

# Organization

## General Chairs

Geoff Webb	Monash University, Australia
Craig Lindley	CSIRO, Australia

## Program Chairs

Byeong Ho Kang	University of Tasmania, Australia
Quan Bai	Auckland University of Technology, New Zealand

## Workshop Chair

Ashfaqur Rahman	CSIRO, Australia
-----------------	------------------

## Tutorial Chair

Charlotte Sennersten	CSIRO, Australia
----------------------	------------------

## Doctoral Consortium Chairs

Alan Blair	University of New South Wales, Australia
James Montgomery	University of Tasmania, Australia

## Publicity Chair

Soyeon Caren Han	University of Tasmania, Australia
------------------	-----------------------------------

## Senior Program Committee

Wray Lindsay Buntine	Monash University, Australia
Stephen Cranefield	University of Otago, New Zealand
Reinhard Klette	Auckland University of Technology, New Zealand
Jimmy Lee	The Chinese University of Hong Kong, Hong Kong, SAR China
Michael Maher	UNSW, Australia
Thomas Meyer	University of Cape Town and CAIR, South Africa
Abhaya Nayak	Macquarie University, Australia
Fatih Porikli	ANU, Australia
Mikhail Prokopenko	University of Sydney, Australia
Fabio Ramos	University of Sydney, Australia

Jussi Rintanen	Aalto University, Finland
Michael Thielscher	UNSW, Australia
Dianhui Wang	La Trobe University, Australia
Ian Watson	University of Auckland, New Zealand
Chengqi Zhang	University of Technology, Sydney, Australia
Dongmo Zhang	University of Western Sydney, Australia
Mengjie Zhang	Victoria University of Wellington, New Zealand

## Program Committee

Ayse A. Bilgin	Macquarie University, Australia
Ivan Bindoff	University of Tasmania, Australia
Rafael H. Bordini	PUCRS, Brazil
Xiongcai Cai	UNSW, Australia
Lawrence Cavedon	RMIT University, Australia
Jeffrey Chan	RMIT University, Australia
Songcan Chen	Nanjing University of Aeronautics and Astronautics, China
Winyu Chinthammit	University of Tasmania, Australia
Sung-Bae Cho	Yonsei University, Korea
Michael Cree	University of Waikato, New Zealand
Hepu Deng	RMIT University, Australia
Peter Eklund	IT University of Copenhagen, Denmark
Atilla Elci	Aksaray University, Turkey
Daryl Essam	UNSW Canberra, Australia
Cèsar Ferri	Universitat Politècnica de València, Spain
Marcus Gallagher	University of Queensland, Australia
Xiaoying Gao	Victoria University of Wellington, New Zealand
Edel Garcia	CENATAV, Cuba
Saurabh Kumar Garg	University of Tasmania, Australia
Manolis Gergatsoulis	Ionian University, Greece
Chi Keong Goh	Advanced Technology Centre, Rolls Royce, Singapore
Hans W. Guesgen	Massey University, New Zealand
Christian Guttman	UNSW, Australia
Nader Hanna	Macquarie University, Australia
Jose Hernandez-Orallo	Universitat Politècnica de València, Spain
Weidong Huang	University of Tasmania, Australia
Paul Kennedy	University of Technology, Sydney, Australia
Philip Kilby	Data61, CSIRO and ANU, Australia
Myunghee Kim	Defence Science Technology (DST), Department of Defence, Australia
Yang Sok Kim	Keimyung University, Korea
Kevin Korb	Monash University, Australia
Rudolf Kruse	University of Magdeburg, Germany
Jérôme Lang	LAMSADE, Université Paris-Dauphine, France
Nung Kion Lee	Universiti Malaysia Sarawak, Malaysia



Tristan Ling	University of Tasmania, Australia
Jing Liu	Chinese Academy Sciences, China
Wan Quan Liu	Curtin University of Technology, Australia
Omaru Oarabile Maruatona	Internet Commerce Security Laboratory, Australia
Michael Mayo	University of Waikato, New Zealand
Brendan Mccane	University of Otago, New Zealand
Kathryn Merrick	UNSW Canberra, Australia
Parma Nand	Auckland University of Technology, New Zealand
Nina Narodytska	Samsung Research America
Richi Nayak	QUT, Australia
Robert Ollington	University of Tasmania, Australia
Lionel Ott	University of Sydney, Australia
Maurice Pagnucco	UNSW, Australia
Laurence Park	Western Sydney University, Australia
Seong-Bae Park	Kyungpook National University, Korea
Adrian Pearce	The University of Melbourne, Australia
Laurent Perrussel	Université de Toulouse, France
Bernhard Pfahringer	University of Waikato, New Zealand
Duc-Nghia Pham	Griffith University, Australia
Fenghui Ren	University of Wollongong, Australia
Deborah Richards	Macquarie University, Australia
Ji Ruan	Auckland University of Technology, New Zealand
Seung Ryu	UNSW, Australia
Sebastian Sardina	RMIT University, Australia
Ruhul Sarker	UNSW, Australia
Daniel Schmidt	University of Melbourne, Australia
Rolf Schwitter	Macquarie University, Australia
Arcot Sowmya	UNSW, Australia
Hannes Strass	Leipzig University, Germany
Maolin Tang	Queensland University of Technology, Australia
Andrea Torsello	Università CA Foscari, Italy
Peter Vamplew	Federation University Australia
Ivan Varzinczak	University of Artois, France
Karin Verspoor	University of Melbourne, Australia
Toby Walsh	UNSW, Australia
Rainer Wasinger	University of Tasmania, Australia
Renata Wassermann	University of São Paulo, Brazil
Peter Whigham	University of Otago, New Zealand
Raymond Williams	University of Tasmania, Australia
Wayne Wobcke	UNSW, Australia
Brendon J. Woodford	University of Otago, New Zealand
Shuxiang Xu	University of Tasmania, Australia
Bing Xue	Victoria University of Wellington, New Zealand
Dayong Ye	Swinburne University of Technology, Australia
Yanchang Zhao	RDataMining.com, Australia
Xiang Zhao	National University of Defence Technology, China
Zhi-Hua Zhou	Nanjing University, China

## **Additional Reviewers**

Arun Anand  
Flaulles Bergamaschi  
Aidan Bindoff  
Zied Bouraoui  
Khalil Bouzekri  
Christian Braune  
Nathan Brewer  
Kinzang Chhogyal  
Maisa Daoud  
Dave De Jonge  
Alexander Dockhorn  
Christoph Doell  
Alex Feng

Matthew Gibson  
Vitor Guizilini  
Aaron Hunter  
Eleftherios Kalogeros  
Luke Lake  
Weihua Li  
Zhidong Li  
Rodrigo A. Lima  
Craig Lindley  
Qinxue Meng  
Stefano Moretti  
Doan Tung Nguyen  
Lei Niu

Diogo Patrão  
Rivindu Perera  
Gavin Rens  
Sobia Saleem  
Ransalu Senanayake  
Upul Senanayake  
Darren Shen  
Damiano Spina  
Xishun Wang  
Mohammad Yousef  
Jihang Zhang

# Contents

## Agents and Multiagent Systems

Lifted Backward Search for General Game Playing . . . . .	3
<i>Dave de Jonge and Dongmo Zhang</i>	
Corrupt Strategic Argumentation: The Ideal and the Naive . . . . .	17
<i>Michael J. Maher</i>	
Adaptive Multiagent Reinforcement Learning with Non-positive Regret. . . . .	29
<i>Duong D. Nguyen, Langford B. White, and Hung X. Nguyen</i>	
Composability in Cognitive Hierarchies . . . . .	42
<i>David Rajaratnam, Bernhard Hengst, Maurice Pagnucco, Claude Sammut, and Michael Thielscher</i>	
Enable Efficient Resource Deployment in Multiple Concurrent Emergency Events Through a Decentralised MAS . . . . .	56
<i>Jihang Zhang, Minjie Zhang, Fenghui Ren, and Jiakun Liu</i>	

## AI Applications and Innovations

Forecasting Monthly Rainfall in the Western Australian Wheat-Belt up to 18-Months in Advance Using Artificial Neural Networks. . . . .	71
<i>John Abbot and Jennifer Marohasy</i>	
Forecasting Monthly Rainfall in the Bowen Basin of Queensland, Australia, Using Neural Networks with Niño Indices . . . . .	88
<i>John Abbot and Jennifer Marohasy</i>	
A Cluster Analysis of Stock Market Data Using Hierarchical SOMs . . . . .	101
<i>César A. Astudillo, Jorge Poblete, Marina Resta, and B. John Oommen</i>	
A Generative Deep Learning for Generating Korean Abbreviations . . . . .	113
<i>Su Jeong Choi, A-Yeong Kim, Seong-Bae Park, and Se-Young Park</i>	
Medical Prognosis Generation from General Blood Test Results Using Knowledge-Based and Machine-Learning-Based Approaches. . . . .	125
<i>Youjin Kim, Jonghwan Hyeon, Kyo-Joong Oh, and Ho-Jin Choi</i>	
Deep Learning for Classification of Malware System Call Sequences . . . . .	137
<i>Bojan Kolosnjaji, Apostolis Zarras, George Webster, and Claudia Eckert</i>	

Similarity Matching of Computer Science Unit Outlines in Higher Education . . . . .	150
<i>Gaurav Langan, James Montgomery, and Saurabh Garg</i>	
Parallel Late Acceptance Hill-Climbing Algorithm for the Google Machine Reassignment Problem. . . . .	163
<i>Ayad Turky, Nasser R. Sabar, Abdul Sattar, and Andy Song</i>	
Concept Drift Detection Using <i>Online</i> Histogram-Based Bayesian Classifiers . . . . .	175
<i>César A. Astudillo, Javier I. González, B. John Oommen, and Anis Yazidi</i>	
Visual Odometry in Dynamic Environments with Geometric Multi-layer Optimisation. . . . .	183
<i>Haokun Geng, Hsiang-Jen Chien, Radu Nicolescu, and Reinhard Klette</i>	
High Resolution SOM Approach to Improving Anomaly Detection in Intrusion Detection Systems . . . . .	191
<i>Ayu Saraswati, Markus Hagenbuchner, and Zhi Quan Zhou</i>	
<b>Big Data</b>	
CPF: Concept Profiling Framework for Recurring Drifts in Data Streams. . . .	203
<i>Robert Anderson, Yun Sing Koh, and Gillian Dobbie</i>	
Meta-mining Evaluation Framework: A Large Scale Proof of Concept on Meta-learning. . . . .	215
<i>William Raynaut, Chantal Soule-Dupuy, and Nathalie Valles-Parlangeau</i>	
Bayesian Grouped Horseshoe Regression with Application to Additive Models . . . . .	229
<i>Zemei Xu, Daniel F. Schmidt, Enes Makalic, Guoqi Qian, and John L. Hopper</i>	
<b>Constraint Satisfaction, Search and Optimisation</b>	
Improving and Extending the HV4D Algorithm for Calculating Hypervolume Exactly . . . . .	243
<i>Wesley Cox and Lyndon While</i>	
Local Search for Maximum Vertex Weight Clique on Large Sparse Graphs with Efficient Data Structures. . . . .	255
<i>Yi Fan, Chengqian Li, Zongjie Ma, Lian Wen, Abdul Sattar, and Kaile Su</i>	

Cascade Bayesian Optimization . . . . .	268
<i>Thanh Dai Nguyen, Sunil Gupta, Santu Rana, Vu Nguyen, Svetha Venkatesh, Kyle J. Deane, and Paul G. Sanders</i>	

Assignment Precipitation in Fail First Search . . . . .	281
<i>Majid Namazi, Nina G. Ghoshchi, M.A. Hakim Newton, and Abdul Sattar</i>	

## Knowledge Representation and Reasoning

Update Policies. . . . .	291
<i>Abhijeet Mohapatra, Sudhir Agarwal, and Michael Genesereth</i>	

Utilization of DBpedia Mapping in Cross Lingual Wikipedia Infobox Completion . . . . .	303
<i>Megawati, Saemi Jang, and Mun Yong Yi</i>	

A Multi-linguistic-Valued Modal Logic . . . . .	317
<i>Jinsheng Chen and Xudong Luo</i>	

An Empirical Study of a Simple Naive Bayes Classifier Based on Ranking Functions . . . . .	324
<i>Kinzang Chhogyal and Abhaya Nayak</i>	

Cognitive-Task-Based Information Aid Design for Clinical Diagnosis . . . . .	332
<i>Dong-Gyun Ko, Youkyoung Park, Yoochan Kim, Juyoun Kim, and Wan Chul Yoon</i>	

Domain Ontology Construction Using Web Usage Data. . . . .	338
<i>Thi Thanh Sang Nguyen and Haiyan Lu</i>	

Learning Functional Argument Mappings for Hierarchical Tasks from Situation Specific Explanations. . . . .	345
<i>Gavin Suddrey, Markus Eich, Frederic Maire, and Jonathan Roberts</i>	

Ontology Based Data Access with Referring Expressions for Logics with the Tree Model Property: (Extended Abstract). . . . .	353
<i>David Toman and Grant Weddell</i>	

## Machine Learning and Data Mining

Artificial Prediction Markets for Clustering . . . . .	365
<i>Sina Famouri, Sattar Hashemi, and Mohammad Taheri</i>	

Transfer Learning in Probabilistic Logic Models . . . . .	378
<i>Pouya Ghiasnezhad Omran, Kewen Wang, and Zhe Wang</i>	

RETRACTED CHAPTER: Co-clustering for Dual Topic Models . . . . .	390
<i>Santosh Kumar, Xiaoying Gao, and Ian Welch</i>	
Optimization of Traffic Signals Using Deep Learning Neural Networks . . . . .	403
<i>Saman Lawe and Ruili Wang</i>	
An Online Competence-Based Concept Drift Detection Algorithm . . . . .	416
<i>Anjin Liu, Guangquan Zhang, Jie Lu, Ning Lu, and Chin-Teng Lin</i>	
Bayesian Robust Regression with the Horseshoe+ Estimator. . . . .	429
<i>Enes Makalic, Daniel F. Schmidt, and John L. Hopper</i>	
High Resolution Self-organizing Maps. . . . .	441
<i>Van Tuc Nguyen, Markus Hagenbuchner, and Ah Chung Tsoi</i>	
Exceptional Contrast Set Mining: Moving Beyond the Deluge of the Obvious . . . . .	455
<i>Dang Nguyen, Wei Luo, Dinh Phung, and Svetha Venkatesh</i>	
Smart Sampling: A Novel Unsupervised Boosting Approach for Outlier Detection . . . . .	469
<i>Mahsa Salehi, Xuyun Zhang, James C. Bezdek, and Christopher Leckie</i>	
Approximating Message Lengths of Hierarchical Bayesian Models Using Posterior Sampling. . . . .	482
<i>Daniel F. Schmidt, Enes Makalic, and John L. Hopper</i>	
Kernel Embeddings of Longitudinal Data. . . . .	495
<i>Darren Shen and Fabio Ramos</i>	
Visual Analytical Tool for Higher Order $k$ -Means Clustering for Trajectory Data Mining. . . . .	507
<i>Ye Wang, Kyungmi Lee, and Ickjai Lee</i>	
A Framework for Mining Semantic-Level Tourist Movement Behaviours from Geo-tagged Photos . . . . .	519
<i>Guochen Cai, Kyungmi Lee, and Ickjai Lee</i>	
Learning High-Level Navigation Strategies via Inverse Reinforcement Learning: A Comparative Analysis . . . . .	525
<i>Michael Herman, Tobias Gindele, Jörg Wagner, Felix Schmitt, Christophe Quignon, and Wolfram Burgard</i>	
Artificial Neural Network: Deep or Broad? An Empirical Study . . . . .	535
<i>Nian Liu and Nayyar A. Zaidi</i>	
An Empirically-Sourced Heuristic for Predetermining the Size of the Hidden Layer of a Multi-layer Perceptron for Large Datasets . . . . .	542
<i>Amanda Lunt and Shuxiang Xu</i>	

Distributed Genetic Algorithm on GraphX . . . . .	548
<i>Seemran Mishra, Young Choon Lee, and Abhaya Nayak</i>	
Restricted Echo State Networks . . . . .	555
<i>Aaron Stockdill and Kourosh Neshatian</i>	
Feature-Aware Factorised Collaborative Filtering. . . . .	561
<i>Farhad Zafari and Irene Moser</i>	

## **Social Intelligence**

Mining Context Specific Inter-personalised Trust for Recommendation Generation in Preference Networks . . . . .	573
<i>Quan Bai, Weihua Li, and Jing Jiang</i>	
Proactive Skill Posting in Referral Networks . . . . .	585
<i>Ashiqur R. KhudaBukhsh, Jaime G. Carbonell, and Peter J. Jansen</i>	
Comprehensive Influence Propagation Modelling for Hybrid Social Network. . . . .	597
<i>Weihua Li, Quan Bai, and Minjie Zhang</i>	
Multi-agent Planning with Collaborative Actions. . . . .	609
<i>Satyendra Singh Chouhan and Rajdeep Niyogi</i>	

## **Text mining and NLP**

Open-Domain Question Answering Framework Using Wikipedia . . . . .	623
<i>Saleem Ameen, Hyunsuk Chung, Soyeon Caren Han, and Byeong Ho Kang</i>	
Predicting the Rank of Trending Topics. . . . .	636
<i>Dohyeong Kim, Soyeon Caren Han, Sungyoung Lee, and Byeong Ho Kang</i>	
A Topic Transition Map for Query Expansion: A Semantic Analysis of Click-Through Data and Test Collections. . . . .	648
<i>Kyung-min Kim, Yuchul Jung, and Sung-Hyon Myaeng</i>	
Unsupervised Keyphrase Extraction: Introducing New Kinds of Words to Keyphrases. . . . .	665
<i>Tho Thi Ngoc Le, Minh Le Nguyen, and Akira Shimazu</i>	

**Selected Papers from AI 2016 Doctoral Consortium**

Shaping Interactive Marketing Communication (IMC) Through Social Media Analytics and Modelling . . . . .	675
<i>Pornpimon Kachamas</i>	
Ingenious Product Form Co-design System for the Industry 4.0 . . . . .	682
<i>Kittipong Sakornsathien</i>	

**Selected Papers from SMA 2016**

Data Lifecycle and Tagging for Internet of Things Applications . . . . .	691
<i>Sanghong Ahn, Hyeontaek Oh, Hwa Jong Kim, and Jun Kyun Choi</i>	
A Content-Based Routing Scheme for Mobile Data Offloading in Pocket Switched Networks . . . . .	696
<i>Regin Cabacas and In-Ho Ra</i>	
Exploring the Use of Big Data Analytics for Improving Support to Students in Higher Education . . . . .	702
<i>Si Fan, Saurabh Garg, and Soonja Yeom</i>	
DataCon: Easier Data Sharing, Exploration, and Fusion with Automatic Metadata Generation . . . . .	708
<i>Hwa Jong Kim</i>	
An Empirical Evaluation of Job Classification Using Online Job Advertisements . . . . .	714
<i>Yang Sok Kim and Choong Kwon Lee</i>	
Robust Text Detection in Natural Scene Images . . . . .	720
<i>Van Khien Pham and GueeSang Lee</i>	
Retraction Note to: Co-clustering for Dual Topic Models . . . . .	C1
<i>Santosh Kumar, Xiaoying Gao, and Ian Welch</i>	
<b>Author Index</b> . . . . .	727