

# Lecture Notes in Artificial Intelligence

10089

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>

Rajendra Prasath · Alexander Gelbukh (Eds.)

# Mining Intelligence and Knowledge Exploration

4th International Conference, MIKE 2016  
Mexico City, Mexico, November 13–19, 2016  
Revised Selected Papers

*Editors*

Rajendra Prasath  
Norwegian University of Science  
and Technology  
Trondheim  
Norway

Alexander Gelbukh  
Center for Computing Research, CIC  
National Polytechnic Institute, IPN  
Mexico City, Distrito Federal  
Mexico

ISSN 0302-9743                      ISSN 1611-3349 (electronic)  
Lecture Notes in Artificial Intelligence  
ISBN 978-3-319-58129-3              ISBN 978-3-319-58130-9 (eBook)  
DOI 10.1007/978-3-319-58130-9

Library of Congress Control Number: 2017938635

LNCS Sublibrary: SL7 – Artificial Intelligence

© Springer International Publishing AG 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

This volume contains the papers presented at MIKE 2016: the 4th International Conference on Mining Intelligence and Knowledge Exploration held during November 13–19, 2016, at the Center for Computing Research (CIC) of the National Polytechnic Institute (IPN), Mexico City (<http://www.mike.org.in/2016/>). There were 56 submissions from 13 countries and each qualified submission was reviewed by a minimum of two Program Committee members using the criteria of relevance, originality, technical quality, and presentation. The committee accepted 17 full papers for oral presentation at the conference. The overall acceptance rate is 30.36%.

The International Conference on Mining Intelligence and Knowledge Exploration (MIKE) is an initiative focusing on research and applications on various topics of human intelligence mining and knowledge discovery. Human intelligence has evolved steadily over several generations, and today human expertise is excelling in multiple domains and in knowledge-acquiring artifacts. The primary goal was to focus on the frontiers of human intelligence mining toward building a body of knowledge in this key domain. The focus was also to present state-of-art scientific results, to disseminate modern technologies, and to promote collaborative research in mining intelligence and knowledge exploration. At MIKE 2016, specific focus was placed on the “learning to explore knowledge discovery” theme.

The accepted papers were chosen on the basis of their research excellence, which provides a body of literature for researchers involved in exploring, developing, and validating learning algorithms and knowledge-discovery techniques. Accepted papers were grouped into various subtopics including information retrieval, machine learning, pattern recognition, knowledge discovery, classification, clustering, image processing, network security, speech processing, natural language processing, language, cognition and computation, fuzzy sets, and business intelligence. Researchers presented their work and had an excellent opportunity to interact with eminent professors and scholars in their area of research. All participants benefitted from discussions that facilitated the emergence of new ideas and approaches. The authors of short papers presented their work during a special session and obtained feedback from thought leaders in the discipline.

A large number of eminent professors, well-known scholars, industry leaders, and young researchers participated in making MIKE 2016 a great success. We express our sincere thanks to the National Polytechnic Institute (IPN), Mexico City, Mexico, for allowing us to host MIKE 2016. We were pleased to have the following serving as advisory members for MIKE 2016: Prof. Ramon Lopez de Mantaras, Artificial Intelligence Research Institute, Spain; Prof. Mandar Mitra, Indian Statistical Institute (ISI), Kolkata, India; Prof. Pinar Ozturk and Prof. Bjorn Gambäck, Norwegian University of Science and Technology, Norway; Prof. Sudeshna Sarkar and Prof. Niloy Ganguly, Indian Institute of Technology, Kharagpur, India, Prof. Philip O’Reilly (University College Cork, Ireland); Prof. Nirmalie Wiratunga (Robert Gordon University, UK);

Prof. Paolo Rosso (Universitat Politecnica de Valencia, Spain); Prof. Chaman L. Sabharwal, Missouri University of Science and Technology, USA; and Dr. Rajarshi Pal (IRDBT, Hyderabad).

Several eminent scholars, including Prof. Ildar Batyrshin, National Polytechnic Institute, Mexico, Prof. Genoveva Vargas-Solar, CNRS, France, and Prof. Grigori Sidorov, Natural Language and Text Processing Laboratory, CIC - IPN, Mexico City, Mexico, delivered invited talks on learning and knowledge exploration topics in various interdisciplinary areas of artificial intelligence and machine learning.

We thank the Technical Program Committee members and all reviewers/subreviewers for their timely and thorough participation in the reviewing process.

We express our sincere gratitude to Prof. Marco Antonio Ramirez Salinas, Director of CIC-IPN, Mexico City, for his support in organizing MIKE 2016 in IPN, Mexico City. We also thank SMIA, the Mexican Society of Artificial Intelligence, for their support. We appreciate the time and effort put in by the members of the local organizing team at CIC-IPN, Mexico City. We are very grateful to all our sponsors, especially the Government of Mexico and many other local supporters, for their generous support to MIKE 2016.

Finally, we acknowledge the support of EasyChair in the submission, review, and proceedings creation processes. We are very pleased to express our sincere thanks to Springer, especially Alfred Hofmann, Anna Kramer, and the editorial staff, for their faith and support in publishing the proceedings of MIKE 2016.

November 2016

Rajendra Prasath  
Alexander Gelbukh

# Organization

## Program Committee

Agnar Aamodt	Norwegian University of Science and Technology, Norway
Ibrahim Adeyanju	Federal University Oye-Ekiti, Nigeria
Rajendra Akerkar	Western Norway Research Institute, Norway
Gethsiyal Augasta	Sarah Tucker College (Autonomous), India
Zeyar Aung	Masdar Institute of Science and Technology, UAE
Rakesh Balabantaray	International Institute of Information Technology, Bhubaneswar, India
Lavanya Balaraja	University of Madras, Chennai, India
Anupam Basu	Indian Institute of Technology, Kharagpur, India
Pinaki Bhaskar	Samsung R&D Institute India Bangalore, India
Vasudha Bhatnagar	University of Delhi, New Delhi, India
Plaban Kumar Bhowmik	Indian Institute of Technology, Kharagpur, India
Isis Bonet	Universidad EIA, Envigado, Colombia
Erik Cambria	Nanyang Technological University, Singapore
Tanmoy Chakraborty	University of Maryland, College Park, USA
Joydeep Chandra	Indian Institute of Technology, Patna, India
Sanjay Chatterji	Samsung R&D Institute India, Bangalore, India
Manoj Chinnakotla	Microsoft R&D India Pvt. Ltd, India
Kamal Kumar Choudhary	Indian Institute of Technology, Ropar, India
Gladis Christopher	Presidency College, Chennai, India
Amélie Cordier	LIRIS, Université Claude Bernard Lyon 1, France
Amitava Das	Indian Institute of Information Technology, Sri City, India
Dipankar Das	Jadavpur University, India
Tirthankar Dasgupta	TCS Innovation Lab, New Delhi, India
Ramon Lopez De Mantaras	IIIA - CSIC, Barcelona, Spain
Maunendra Sankar Desarkar	Indian Institute of Technology, Hyderabad, India
Lipika Dey	TCS Innovation Labs, New Delhi, India
Aidan Duane	Waterford Institute of Technology (WIT), Ireland
Björn Gambäck	Norwegian University of Science and Technology, Norway
Vineet Gandhi	International Institute of Information Technology, Hyderabad, India
Debasis Ganguly	Dublin City University, Ireland
Niloy Ganguly	Indian Institute of Technology Kharagpur, India
Alexander Gelbukh	Instituto Politécnico Nacional

Saptarshi Ghosh	Indian Institute of Engineering Science and Technology, Shibpur, India
Rob Gleasure	University College Cork, Ireland
Sumit Goswami	Defence Research and Development Organization, New Delhi, India
Devanur Guru	University of Mysore, India
Wu Huayu	Institute for Infocomm Research, Singapore
Gloria Ines Alvarez Vargas	Pontificia Universidad Javeriana Cali, Colombia
Abdeldjalil Khelassi	Abou bekr Belkaied University of Tlemcen, Algeria
Byung-Gyu Kim	Sookmyung Women's University, South Korea
P.V.V. Kishore	K.L. University, India
Vamsi Krishna	Indian Space Research Organisation, Bengaluru, India
Uttama Lahiri	Indian Institute of Technology, Gandhinagar, India
Jaiprakash Lallchandani	International Institute of Information Technology Bangalore, India
Sornam M.	University of Madras, India
Rajib Ranjan Maiti	Indian Institute of Technology, Kharagpur, India
Prasenjit Majumder	Indian Statistical Institute, India
Radhika Mamidi	International Institute of Information Technology, Hyderabad, India
Roshan Martis	Vivekananda College of Engineering and Technology, Puttur, India
Mandar Mitra	Indian Statistical Institute, Kolkata, India
Pabitra Mitra	Indian Institute of Technology, Kharagpur, India
Vinay Kumar Mittal	Indian Institute of Information Technology Chittoor, Sri City, India
Muthu Rama Krishnan	Singapore University of Technology and Design, Singapore
Mookiah	
A. Murugan	Dr. Ambedkar Govt Arts College, India
Jian-Yun Nie	Université de Montréal, Canada
Sylvester Olubolu Orimaye	Monash University, Melbourne, Australia
Inah Omoronyia	University of Glasgow, UK
Pinar Ozturk	Norwegian University of Science and Technology, Norway
Rajkumar P.V.	University of Texas at San Antonio
Jiaul Paik	Indian Institute of Technology, Kharagpur, India
Partha Pakray	National Institute of Technology Mizoram, India
Rajarshi Pal	IDRBT, Hyderabad, India
Shyamosree Pal	National Institute of Technology, Silchar, India
Sukomal Pal	Indian Institute of Technology, Varanasi, India
Marco Palomino	Plymouth University, UK
Chhabi Rani Panigrahi	Central University of Rajasthan, India
Ranjani Parthasarathi	Anna University
Praveen Paruchuri	International Institute of Information Technology, Hyderabad, India



Bibudhendu Pati	C.V. Raman College of Engineering, Bhubaneswar, India
Soma Paul	International Institute of Information Technology, Hyderabad, India
Carla Pires	IFSUL, Brazil
Rajendra Prasath	Norwegian University of Science and Technology, Norway
Shantha Selvakumari R.	Mepco Schlenk Engg. College, Sivakasi, India
K. Sreenivasa Rao	Indian Institute of Technology, Kharagpur, India
Pattabhi Rk Rao	AU-KBC Research Centre, MIT Campus of Anna University, Chennai, India
Juan Recio-Garcia	University Complutense of Madrid, Spain
N. Subba Reddy	Gyeongsang National University, Jinju, South Korea
Paolo Rosso	Technical University of Valencia, Spain
Sudip Roy	Indian Institute of Technology Roorkee, India
Udayabaskaran S.	Vel Tech Technical University, Chennai, India
Chaman Lal Sabharwal	Missouri University of Science and Technology, USA
Moumita Saha	Indian Institute of Science, Bengaluru, India
Sudipta Saha	Indian Institute of Technology, Bhubaneswar, India
Sujan Kumar Saha	Birla Institute of Technology, Mesra, India
Saurav Sahay	Intel Labs, Santa Clara, CA, USA
Debasis Samanta	Indian Institute of Technology, Kharagpur, India
A.K. Sao	Indian Institute of Technology, Mandi, India
Sudeshna Sarkar	Indian Institute of Technology, Kharagpur, India
P. Shanmugavadivu	Gandhigram Rural Institute, Deemed University, India
Avinash Sharma	International Institute of Information Technology, Hyderabad, India
Dipti Misra Sharma	International Institute of Information Technology, Hyderabad, India
Manish Shrivastava	International Institute of Information Technology, Hyderabad, India
Manjira Sinha	Xerox Research Center India, India
Tripti Swarnkar	Indian Institute of Technology, Kharagpur, India
Jaisingh T.	Indian School of Mines, Dhanbad, India
Kathirvalavakumar T.	VHNSN College (Autonomous), Virudhunagar, India
Geetha T.V.	Anna University, College of Engineering, Chennai, India
Venu Thangaraj	Ramanujan Institute for Advanced Study in Mathematics, India
Diana Trandabat	University Al. I. Cuza of Iasi, Romania
Vasudeva Varma	International Institute of Information Technology, Hyderabad, India
Anil Kumar Vuppala	International Institute of Information Technology, Hyderabad, India
Nirmalae Wiratunga	Robert Gordon University, Aberdeen, UK
Wei Lee Woon	Masdar Institute, UAE

## **Additional Reviewers**

Aggarwal, Apeksha  
Alluri, Knrk Raju  
Balaraja, Lavanya  
Christopher, Gladis  
Krishna, Hari  
Lai, Mirko  
Mondal, Anupam

Patra, Braja Gopal  
Sarkar, Sandip  
T. Kathirvalavakumar  
T. Kumaran  
Thirumuru, Ramakrishna  
Vegesna, Vishnu Vidyadhara Raju

# Contents

An Efficient Incremental Mining Algorithm for Dynamic Databases . . . . .	1
<i>Lydia Nahla Driff and Habiba Drias</i>	
Multi-objective Bat Algorithm for Mining Interesting Association Rules . . . .	13
<i>Kamel Eddine Heraguemi, Nadjat Kamel, and Habiba Drias</i>	
Dynamics of Self-replicating DNA-Tile Patterns . . . . .	24
<i>Vinay Kumar Gautam and Rajendra Prasath</i>	
Retweet Influence on User Popularity Over Time: An Empirical Study . . . . .	38
<i>Yecely Aridaí Díaz-Beristain, Guillermo-de-Jesús Hoyos-Rivera, and Nicandro Cruz-Ramírez</i>	
Privacy Preserving Interceptor for Online Social Media Applications. . . . .	49
<i>T. Shanmughapria and S. Swamynathan</i>	
Multimodal Sentiment Analysis Using Deep Neural Networks . . . . .	58
<i>Harika Abburi, Rajendra Prasath, Manish Shrivastava, and Suryakanth V. Gangashetty</i>	
A Study on Text-Independent Speaker Recognition Systems in Emotional Conditions Using Different Pattern Recognition Models. . . . .	66
<i>K.N.R.K. Raju Alluri, Sivanand Achanta, Rajendra Prasath, Suryakanth V. Gangashetty, and Anil Kumar Vuppala</i>	
A Study on Vowel Region Detection from a Continuous Speech. . . . .	74
<i>Ramakrishna Thirumuru, Harikrishna Vydana, Suryakanth V. Gangashetty, and Anil Kumar Vuppala</i>	
MiW: An MCC-WMSNs Integration Approach for Performing Multimedia Applications . . . . .	83
<i>Joy Lal Sarkar, Chhabi Rani Panigrahi, Bibudhendu Pati, and Rajendra Prasath</i>	
An Allocation Technique of MMH/FH for an Aircraft. . . . .	93
<i>Antony Gratas V. and Prakash R.</i>	
Determining the Balance Scorecard in Sheet Metal Industry Using the Intuitionistic Fuzzy Analytical Hierarchy Process with Fuzzy Delphi Method. . . . .	105
<i>S. Rajaprakash and R. Ponnusamy</i>	

Identifying and Pruning Features for Classifying Translated and Post-edited Gaze Durations . . . . . 119  
*Tanik Saikh, Dipankar Das, and Sivaji Bandyopadhyay*

Unsupervised Domain Ontology Learning from Text . . . . . 132  
*Sree Harish Venu, Vignesh Mohan, Kodaikkaavirinaadan Urkalan, and Geetha T.V.*

Regression Based Approaches for Detecting and Measuring Textual Similarity . . . . . 144  
*Sandip Sarkar, Partha Pakray, Dipankar Das, and Alexander Gelbukh*

Text Mining Models to Predict Brain Deaths Using X-Rays Clinical Notes . . . . 153  
*António Silva, Filipe Portela, Manuel Filipe Santos, José Machado, and António Abelha*

Inferring the Repetitive Behaviour from Event Logs for Process Mining Discovery . . . . . 164  
*Tonatiuh Tapia-Flores and Ernesto López-Mellado*

Automated Prediction of Demographic Information from Medical User Reviews . . . . . 174  
*Elena Tutubalina and Sergey Nikolenko*

**Author Index** . . . . . 185