

Lecture Notes in Artificial Intelligence

13343

Subseries of Lecture Notes in Computer Science

Series Editors

Randy Goebel

University of Alberta, Edmonton, Canada

Wolfgang Wahlster

DFKI, Berlin, Germany

Zhi-Hua Zhou

Nanjing University, Nanjing, China

Founding Editor

Jörg Siekmann

DFKI and Saarland University, Saarbrücken, Germany

More information about this subseries at <https://link.springer.com/bookseries/1244>


Hamido Fujita · Philippe Fournier-Viger ·
Moonis Ali · Yinglin Wang (Eds.)

Advances and Trends in Artificial Intelligence


Theory and Practices in Artificial Intelligence

35th International Conference
on Industrial, Engineering and Other Applications
of Applied Intelligent Systems, IEA/AIE 2022
Kitakyushu, Japan, July 19–22, 2022
Proceedings

Editors

Hamido Fujita 
i-SOMET, Inc.
Morioka-shi, Iwate, Japan

Moonis Ali
Texas State University
San Marcos, TX, USA

Philippe Fournier-Viger 
College of Computer Science and Software
Engineering
Shenzhen University
Shenzhen, Guangdong, China

Yinglin Wang
Shanghai University of Finance
and Economics
Shanghai, China

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Artificial Intelligence
ISBN 978-3-031-08529-1 ISBN 978-3-031-08530-7 (eBook)
<https://doi.org/10.1007/978-3-031-08530-7>

LNCS Sublibrary: SL7 – Artificial Intelligence

© Springer Nature Switzerland AG 2022

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, expressed 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.

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

Preface

In the last few decades, there have been major societal transformations due to the ever-increasing usage of computing devices. Impacts can be observed in all fields including science, governance, healthcare, industry, and the lives of individuals. Computers can calculate faster, store more data, and are smaller, while also being cheaper. Improved and specialized computing architectures have also been developed such as GPUs and FPGAs. Besides, distributed computing and storage platforms have become common to process very large databases. Thanks to technological advances and also several theoretical breakthroughs, researchers and practitioners have pushed back the limits of artificial intelligence to build more effective intelligent systems to solve real-world complex problems. Moreover, innovative applications of artificial intelligence are continuously being proposed.

This volume contains the proceedings of the 35th edition of the International Conference on Industrial, Engineering, and other Applications of Applied Intelligent Systems (IEA AIE 2022), which was during July 19–22, 2022, in Kitakyushu, Japan. IEA AIE is a yearly conference that focuses on applications of applied intelligent systems to solve real-life problems in all areas including business and finance, science, engineering, industry, cyberspace, bioinformatics, automation, robotics, medicine and biomedicine, and human-machine interactions. IEA AIE 2022 was organized in cooperation with the ACM Special Interest Group on Artificial Intelligence (SIGAI). This year, 127 submissions were received. Each paper was evaluated using double-blind peer review by at least three reviewers from an international Program Committee consisting of 74 members from 23 countries. Based on the evaluation, a total of 67 papers were selected as full papers and 11 as short papers, which are presented in this book. We would like to thank all the reviewers for the time spent on writing detailed and constructive comments for the authors, and to the latter for the proposal of many high-quality papers.

In the program of IEA AIE 2022, five special sessions were organized: Collective Intelligence in Social Media (CISM 2022), Intelligent Knowledge Engineering in Decision Making Systems (IKEDS 2022), Intelligent Systems and e-Applications (ISeA 2022), Multi-Agent Systems and Metaheuristics for Complex Problems (MASMCP 2022), and Spatiotemporal Big Data Analytics (SBDA 2022). In addition, two keynote talks were given by two distinguished researchers, one by Sebastian Ventura from the University of Cordoba (Spain) and the other by Tao Wu from the Shanghai University of Medicine and Health Sciences (China). We would like to thank everyone who has

contributed to the success of this year's edition of IEA AIE, that is the authors, reviewers, keynote speakers, Program Committee members, and organizers.

May 2021

Hamido Fujita
Philippe Fournier-Viger
Moonis Ali
Yinglin Wang

Organization

Honorary Chair

Tao Wu
Shanghai University of Medicine and Health
Sciences, China

General Chairs

Hamido Fujita
Moonis Ali
Iwate Prefectural University, Japan
Texas State University, USA

Organizing Chair

Jun Sasaki
i-SOMET Inc., Japan

Program Committee Chairs

Philippe Fournier-Viger
Yinglin Wang
Shenzhen University, China
Shanghai University of Finance and Economics,
China

Special Session Chairs

Ali Selamat
Xing Wu
Jerry Chun-Wei Lin
Ngoc Thanh Nguyen
Universiti Teknologi Malaysia, Malaysia
Shanghai University, China
Western Norway University of Applied Sciences,
Norway
Wroclaw University of Technology, Poland

Program Committee

Moulay A. Akhloufi
Azri Azmi
Hafewa Bargaoui
Olfa Belkahla Driss
Ladjel Bellatreche
Zalan Bodo
Zaki Brahmi
Francisco J. Cabrerizo
Université de Moncton, Canada
Universiti Teknologi Malaysia, Malaysia
Institut Supérieur de Gestion de Tunis, Tunisia
Ecole Supérieure de Commerce de Tunis, Tunisia
LIAS/ISAE-ENSMA, France
Babes-Bolyai University, Romania
ISITCOM, Tunisia
University of Granada, Spain

Alberto Cano	Virginia Commonwealth University, USA
Andrew Tzer-Yeu Chen	University of Auckland, New Zealand
Chun-Hao Chen	National Taipei University of Technology, Taiwan
Shyi-Ming Chen	National Taiwan University of Science and Technology, Taiwan
Tai Dinh	JAIST, Japan
Youcef Djenouri	Southern Denmark University, Denmark
Alexander Ferrein	Aachen University of Applied Science, Germany
Philippe Fournier-Viger	Shenzhen University, China
Hamido Fujita	Iwate Prefectural University, Japan
Abdennaceur Ghandri	Higher Institute of Management of Gabes, Tunisia
Sergei Gorlatch	Muenster University, Germany
Deepak Gupta	NIT Arunachal Pradesh, India
Tzung-Pei Hong	National University of Kaohsiung, Taiwan
Ko-Wei Huang	National Kaohsiung University of Science and Technology, Taiwan
Miroslav Hudec	University of Economics in Bratislava, Slovakia
Dosam Hwang	Yeungnam University, South Korea
Marcin Jodłowiec	Wroclaw University of Science and Technology, Poland
Fadoua Khennou	Université de Moncton, Canada
Yun Sing Koh	University of Auckland, New Zealand
Adrianna Kozierekiewicz	Wroclaw University of Science and Technology, Poland
Marek Krótkiewicz	Wroclaw University of Science and Technology, Poland
Masaki Kurematsu	Iwate Prefectural University, Japan
Thomas Lacombe	University of Auckland, New Zealand
Shih Hsiung Lee	National Kaohsiung University of Applied Sciences, Taiwan
Arkadiusz Liber	Wroclaw University of Science and Technology, Poland
Jerry Chun-Wei Lin	Western Norway University of Applied Sciences, Norway
Wen-Yang Lin	National University of Kaohsiung, Taiwan
Yu-Chen Lin	Feng Chia University, Taiwan
Frederick Maier	University of Georgia, USA
Wolfgang Mayer	University of South Australia, Australia
Masurah Mohamad	Universiti Teknologi Malaysia, Malaysia
M. Rashedur Rahman	North South University, Bangladesh
Yasser Mohammed	Assiut University, Egypt
Tauheed Khan Mohd	Augustana College, USA
Anirban Mondal	Ashoka University, India

M. Saqib Nawaz	Harbin Institute of Technology, China
Du Nguyen	Nong Lam University, Vietnam
Duc Nguyen	Vietnam Maritime University, Vietnam
Hien Nguyen	University of Information Technology, Vietnam
Ngoc-Thanh Nguyen	Wroclaw University of Technology, Poland
Tat-Bao-Thien Nguyen	Thuyloi University, Vietnam
Thanh Binh Nguyen	Ho Chi Minh City University of Technology, Vietnam
Mourad Nouioua	Harbin Institute of Technology, China
Housseem Eddine Nouri	Institut Supérieur de Gestion de Gabes, Tunisia
Ammar Odeh	Princess Sumaya University for Technology, Jordan
Samir Ouchani	LINEACT, CESI, France
P. Krishna Reddy	IIIT Hyderabad, India
Hau Pham	Quang Binh University, Vietnam
Marcin Pietranik	Wroclaw University of Science and Technology, Poland
Uday Rage	University of Tokyo, Japan
Shafin Rahman	North South University, Bangladesh
Penugonda Ravikumar	University of Aizu, Japan
Andreas Speck	Kiel University, Germany
Gautam Srivastava	Brandon University, Canada
Feiyang Tang	Norwegian University of Science of Technology, Norway
Stefania Tomasiello	University of Tartu, Estonia
Hai Tran	Ho Chi Minh University of Pedagogy, Vietnam
Jianjia Wang	Shanghai University, China
Zhijin Wang	Jimei University, China
Yutaka Watanobe	University of Aizu, Japan
Cheng-Wei Wu	National Ilan University, Taiwan
Takeru Yokoi	Tokyo Metropolitan College of Industrial Technology, Japan
Nurulhuda Zainuddin	Universiti Teknologi Malaysia, Malaysia
Wei Zhang	Adobe, USA
Hiba Zuhair	Al-Nahrain University, Iraq

Contents

Industrial Applications

Comparative Study of Methods for the Real-Time Detection of Dynamic Bottlenecks in Serial Production Lines	3
<i>Nikolai West, Jörn Schwenken, and Jochen Deuse</i>	
Ultra-short-Term Load Forecasting Model Based on VMD and TGCN-GRU ...	15
<i>Meirong Ding, Hang Zhang, Biqing Zeng, Gaoyan Cai, Yuan Chai, and Wensheng Gan</i>	
Learning to Match Product Codes	29
<i>Ying Excell and Sebastian Link</i>	
ResUnet: A Fully Convolutional Network for Speech Enhancement in Industrial Robots	42
<i>Yangyi Pu and Hongyang Yu</i>	
Surface Defect Detection and Classification Based on Fusing Multiple Computer Vision Techniques	51
<i>Min Zhu, Bingqing Shen, Yan Sun, Chongyu Wang, Guoxin Hou, Zhijie Yan, and Hongming Cai</i>	
Development of a Multiagent Based Order Picking Simulator for Optimizing Operations in a Logistics Warehouse	63
<i>Takuto Sakuma, Minami Watanabe, Koya Ihara, and Shohei Kato</i>	

Health Informatics

Predicting Infection Area of Dengue Fever for Next Week Through Multiple Factors	77
<i>Cong-Han Zheng, Ping-Yu Hsu, Ming-Shien Cheng, Ni Xu, and Yu-Chun Chen</i>	
Hospital Readmission Prediction via Personalized Feature Learning and Embedding: A Novel Deep Learning Framework	89
<i>Yuxi Liu and Shaowen Qin</i>	
Intelligent Medical Interactive Educational System for Cardiovascular Disease	101
<i>Sheng-Shan Chen, Hou-Tsan Lee, Tun-Wen Pai, and Chao-Hung Wang</i>	

Evolutionary Optimization for CNN Compression Using Thoracic X-Ray Image Classification	112
<i>Hassen Louati, Slim Bechikh, Ali Louati, Abdulaziz Aldaej, and Lamjed Ben Said</i>	
An Oriented Attention Model for Infectious Disease Cases Prediction	124
<i>Peisong Zhang, Zhijin Wang, Guoqing Chao, Yaohui Huang, and Jingwen Yan</i>	
The Differential Gene Detecting Method for Identifying Leukemia Patients	137
<i>Mingzhao Wang, Weiliang Jiang, and Juanying Xie</i>	
Epidemic Modeling of the Spatiotemporal Spread of COVID-19 over an Intercity Population Mobility Network	147
<i>Yuxi Liu, Shaowen Qin, and Zhenhao Zhang</i>	
Skin Cancer Classification Using Different Backbones of Convolutional Neural Networks	160
<i>Anh T. Huynh, Van-Dung Hoang, Sang Vu, Trong T. Le, and Hien D. Nguyen</i>	
Cardiovascular Disease Detection on X-Ray Images with Transfer Learning ...	173
<i>Nguyen Van-Binh and Nguyen Thai-Nghe</i>	
Causal Reasoning Methods in Medical Domain: A Review	184
<i>Xing Wu, Jingwen Li, Quan Qian, Yue Liu, and Yike Guo</i>	
Optimization	
Enhancing a Multi-population Optimisation Approach with a Dynamic Transformation Scheme	199
<i>Shengqi Dai, Vincent W. L. Tam, Zhenglong Li, and L. K. Yeung</i>	
A Model Driven Approach to Transform Business Vision-Oriented Decision-Making Requirement into Solution-Oriented Optimization Model	211
<i>Liwen Zhang, Hervé Pingaud, Elyes Lamine, Franck Fontanili, Christophe Bortolaso, and Mustapha Derras</i>	
A Hybrid Approach Based on Genetic Algorithm with Ranking Aggregation for Feature Selection	226
<i>Bui Quoc Trung, Le Minh Duc, and Bui Thi Mai Anh</i>	
A Novel Type-Based Genetic Algorithm for Extractive Summarization	240
<i>Bui Thi Mai Anh, Nguyen Thi Thu Trang, and Tran Thi Dinh</i>	

Dragonfly Algorithm for Multi-target Search Problem in Swarm Robotic with Dynamic Environment Size	253
<i>Mohd Ghazali Mohd Hamami and Zool H. Ismail</i>	

Video and Image Processing

Improved Processing of Ultrasound Tongue Videos by Combining ConvLSTM and 3D Convolutional Networks	265
<i>Amin Honarmandi Shandiz and László Tóth</i>	

Improvement of Text Image Super-Resolution Benefiting Multi-task Learning	275
<i>Kosuke Honda, Hamido Fujita, and Masaki Kurematsu</i>	

Question Difficulty Estimation with Directional Modality Association in Video Question Answering	287
<i>Bong-Min Kim and Seong-Bae Park</i>	

Natural Language Processing

Improving Neural Machine Translation by Efficiently Incorporating Syntactic Templates	303
<i>Phuong Nguyen, Tung Le, Thanh-Le Ha, Thai Dang, Khanh Tran, Kim Anh Nguyen, and Nguyen Le Minh</i>	

Forensic Analysis of Text and Messages in Smartphones by a Unification Rosetta Stone Procedure	315
<i>Claudio Tomazzoli, Simone Scannapieco, and Matteo Cristani</i>	

Relation-Level Vector Representation for Relation Extraction and Classification on Specialized Data	327
<i>Camille Gosset, Mokhtar Boumedyen Billami, Mathieu Lafourcade, Christophe Bortolaso, and Mustapha Derras</i>	

SAKE: A Graph-Based Keyphrase Extraction Method Using Self-attention	339
<i>Ping Zhu, Chuanyang Gong, and Zhihua Wei</i>	

Synonym Prediction for Vietnamese Occupational Skills	351
<i>Hai-Nam Cao, Duc-Thai Do, Viet-Trung Tran, Tuan-Dung Cao, and Young-In Song</i>	

A Survey of Pretrained Embeddings for Japanese Legal Representation	363
<i>Ha-Thanh Nguyen, Le-Minh Nguyen, and Ken Satoh</i>	

Machine Reading Comprehension Model for Low-Resource Languages and Experimenting on Vietnamese	370
<i>Bach Hoang Tien Nguyen, Dung Manh Nguyen, and Trang Thi Thu Nguyen</i>	
Inducing a Malay Lexicon from an Unlabelled Dataset Using Word Embeddings	382
<i>Ian H. J. Ho, Hui-Ngo Goh, and Yi-Fei Tan</i>	
Agent and Group-Based Systems	
Agent-Based Intermodal Behavior for Urban Toll	397
<i>Azise Oumar Diallo, Guillaume Lozenguez, Arnaud Doniec, and René Mandiau</i>	
Entropy Based Approach to Measuring Consensus in Group Decision-Making Problems	409
<i>J. M. Tapia, F. Chiclana, M. J. del Moral, and E. Herrera–Viedma</i>	
Adaptation of HMIs According to Users’ Feelings Based on Multi-agent Systems	416
<i>Alia Maaloul, Housseem Eddine Nouri, Zied Trifa, and Olfa Belkahla Driss</i>	
Pattern Recognition	
A Generalized Inverted Dirichlet Predictive Model for Activity Recognition Using Small Training Data	431
<i>Jiaxun Guo, Manar Amayri, Wentao Fan, and Nizar Bouguila</i>	
Deepfake Detection Using CNN Trained on Eye Region	443
<i>David Johnson, Tony Gwyn, Letu Qingge, and Kaushik Roy</i>	
Face Authentication from Masked Face Images Using Deep Learning on Periocular Biometrics	452
<i>Jeffrey J. Hernandez V., Rodney Dejournett, Udayasri Nannuri, Tony Gwyn, Xiaohong Yuan, and Kaushik Roy</i>	
An Optimization Algorithm for Extractive Multi-document Summarization Based on Association of Sentences	460
<i>Chun-Hao Chen, Yi-Chen Yang, and Jerry Chun-Wei Lin</i>	
A Spatiotemporal Image Fusion Method for Predicting High-Resolution Satellite Images	470
<i>Vipul Chhabra, R. Uday Kiran, Juan Xiao, P. Krishna Reddy, and Ram Avtar</i>	

Security

- WHTE: Weighted Hoeffding Tree Ensemble for Network Attack Detection
at Fog-IoMT 485
*Shilan S. Hameed, Ali Selamat, Liza Abdul Latiff, Shukor A. Razak,
and Ondrej Krejcar*
- An Improved Ensemble Deep Learning Model Based on CNN
for Malicious Website Detection 497
Nguyet Quang Do, Ali Selamat, Kok Cheng Lim, and Ondrej Krejcar
- Intrusion-Based Attack Detection Using Machine Learning Techniques
for Connected Autonomous Vehicle 505
*Mansi Bhavsar, Kaushik Roy, Zhipeng Liu, John Kelly,
and Balakrishna Gokaraju*
- Detection of Anti-forensics and Malware Applications in Volatile Memory
Acquisition 516
*Chandlor Ratcliffe, Biodoumoye George Bokolo, Damilola Oladimeji,
and Bing Zhou*
- Malware Classification Based on Graph Convolutional Neural Networks
and Static Call Graph Features 528
Attila Mester and Zalán Bodó

Modelling and Diagnosis

- The Java2CSP Debugging Tool Utilizing Constraint Solving
and Model-Based Diagnosis Principles 543
Franz Wotawa and Vlad Andrei Dumitru
- Formal Modelling and Security Analysis of Inter-Operable Systems 555
Abdelhakim Baouya, Samir Ouchani, and Saddek Bensalem

Social Network Analysis

- Content-Context-Based Graph Convolutional Network for Fake News
Detection 571
Huyen Trang Phan, Ngoc Thanh Nguyen, and Dosam Hwang
- Multi-class Sentiment Classification for Customers' Reviews 583
*Cuong T. V. Nguyen, Anh M. Tran, Thao Nguyen, Trung T. Nguyen,
and Binh T. Nguyen*

Transportation and Urban Applications

MM-AQI: A Novel Framework to Understand the Associations Between Urban Traffic, Visual Pollution, and Air Pollution 597
Kazuki Tejima, Minh-Son Dao, and Koji Zettsu

Two-Stage Traffic Clustering Based on HNSW 609
Xu Zhang, Xinzheng Niu, Philippe Fournier-Viger, and Bing Wang

Explainable Online Lane Change Predictions on a Digital Twin with a Layer Normalized LSTM and Layer-wise Relevance Propagation 621
Christoph Wehner, Francis Powlesland, Bashar Altakrouri, and Ute Schmid

An Agenda on the Employment of AI Technologies in Port Areas: The TEBETS Project 633
Adorni Emanuele, Rozhok Anastasiia, Revetria Roberto, and Suhev Sergey

Modelling and Solving the Green Share-a-Ride Problem 648
Elhem Elkout and Olfa Belkahla Driss

Machine Learning Techniques to Predict Real Time Thermal Comfort, Preference, Acceptability, and Sensation for Automation of HVAC Temperature 659
Yaa T. Acquaaah, Balakrishna Gokaraju, Raymond C. Tesiero III, and Kaushik Roy

Neural Networks

Serially Disentangled Learning for Multi-Layered Neural Networks 669
Ryotaro Kamimura and Ryoza Kitajima

Detecting Use Case Scenarios in Requirements Artifacts: A Deep Learning Approach 682
Munima Jahan, Zahra Shakeri Hossein Abad, and Behrouz Far

Hybrid Deep Neural Networks for Industrial Text Scoring 695
Sidharrth Nagappan, Hui-Ngo Goh, and Amy Hui-Lan Lim

Benchmarking Training Methodologies for Dense Neural Networks 707
Isaac Tonkin, Geoff Harris, and Volodymyr Novykov

Proposing Novel High-Performance Compounds by Nested VAEs Trained Independently on Different Datasets	714
<i>Yoshihiro Osakabe and Akinori Asahara</i>	

Clustering

Monotonic Constrained Clustering: A First Approach	725
<i>Germán González-Almagro, Pablo Sánchez Bermejo, Juan Luis Suarez, José-Ramón Cano, and Salvador García</i>	

Extractive Text Summarization on Large-scale Dataset Using K-Means Clustering	737
<i>Ti-Hon Nguyen and Thanh-Nghi Do</i>	

Multi-Granular Large Scale Group Decision-Making Method with a New Consensus Measure Based on Clustering of Alternatives in Modifiable Scenarios	747
<i>José Ramón Trillo, Ignacio Javier Pérez, Enrique Herrera-Viedma, Juan Antonio Morente-Molinera, and Francisco Javier Cabrerizo</i>	

Optimal User Categorization from a Hierarchical Clustering Tree for Recommendation	759
<i>Wei Song and Siqi Liu</i>	

Classification

A Preliminary Approach for using Metric Learning in Monotonic Classification	773
<i>Juan Luis Suárez, Germán González-Almagro, Salvador García, and Francisco Herrera</i>	

Deep Learning Architectures Extended from Transfer Learning for Classification of Rice Leaf Diseases	785
<i>Hai Thanh Nguyen, Quyen Thuc Quach, Chi Le Hoang Tran, and Huong Hoang Luong</i>	

Height Estimation for Abrasive Grain of Synthetic Diamonds on Microscope Images by Conditional Adversarial Networks	797
<i>Joe Brinton, Shota Oki, Xin Yang, and Maiko Shigeno</i>	

Pattern Mining and Tsetlin Machines

Fast Weighted Sequential Pattern Mining	807
<i>Zhenqiang Ye, Ziyang Li, Weibin Guo, Wensheng Gan, Shicheng Wan, and Jiahui Chen</i>	

Parallel High Utility Itemset Mining	819
<i>Gaojuan Fan, Huaiyuan Xiao, Chongsheng Zhang, George Almpanidis, Philippe Fournier-Viger, and Hamido Fujita</i>	
Towards Efficient Discovery of Stable Periodic Patterns in Big Columnar Temporal Databases	831
<i>Hong N. Dao, Penugonda Ravikumar, P. Likitha, Bathala Venus Vikranth Raj, R. Uday Kiran, Yutaka Watanobe, and Incheon Paik</i>	
Cyclostationary Random Number Sequences for the Tsetlin Machine	844
<i>Svein Anders Tunheim, Rohan Kumar Yadav, Lei Jiao, Rishad Shafik, and Ole-Christoffer Granmo</i>	
Logics and Ontologies	
Evolution of Prioritized \mathcal{EL} Ontologies	859
<i>Rim Mohamed, Zied Loukil, Faiez Gargouri, and Zied Bouraoui</i>	
A Comparison of Resource Data Framework and Inductive Logic Programing for Ontology Development	871
<i>Durgesh Nandini</i>	
MDNCaching: A Strategy to Generate Quality Negatives for Knowledge Graph Embedding	877
<i>Tiroshan Madushanka and Ryutaro Ichise</i>	
Robotics, Games and Consumer Applications	
Application of a Limit Theorem to the Construction of Japanese Crossword Puzzles	891
<i>Volodymyr Novykov, Geoff Harris, and Isaac Tonkin</i>	
Non Immersive Virtual Laboratory Applied to Robotics Arms	898
<i>Daniela A. Bastidas, Luis F. Recalde, Patricia N. Constante, Victor H. Andaluz, Dayana E. Gallegos, and José Varela-Aldás</i>	
An Improved Subject-Independent Stress Detection Model Applied to Consumer-grade Wearable Devices	907
<i>Van-Tu Ninh, Manh-Duy Nguyen, Sinéad Smyth, Minh-Triet Tran, Graham Healy, Binh T. Nguyen, and Cathal Gurrin</i>	

WDTourism: A Personalized Tourism Recommendation System Based
on Semantic Web 920
Kaiyu Dai, Pengfei Ji, Xiaorui Zuo, and Daixin Dai

Author Index 935