

## Editor-in-Chief

*Kai Rannenberg, Goethe University Frankfurt, Germany*

## Editorial Board Members

TC 1 – Foundations of Computer Science

*Jacques Sakarovitch, Télécom ParisTech, France*

TC 2 – Software: Theory and Practice

*Michael Goedicke, University of Duisburg-Essen, Germany*

TC 3 – Education

*Arthur Tatnall, Victoria University, Melbourne, Australia*

TC 5 – Information Technology Applications

*Erich J. Neuhold, University of Vienna, Austria*

TC 6 – Communication Systems

*Aiko Pras, University of Twente, Enschede, The Netherlands*

TC 7 – System Modeling and Optimization

*Fredi Tröltzsch, TU Berlin, Germany*

TC 8 – Information Systems

*Jan Pries-Heje, Roskilde University, Denmark*

TC 9 – ICT and Society

*David Kreps, University of Salford, Greater Manchester, UK*

TC 10 – Computer Systems Technology

*Ricardo Reis, Federal University of Rio Grande do Sul, Porto Alegre, Brazil*

TC 11 – Security and Privacy Protection in Information Processing Systems

*Steven Furnell, Plymouth University, UK*

TC 12 – Artificial Intelligence

*Ulrich Furbach, University of Koblenz-Landau, Germany*

TC 13 – Human-Computer Interaction

*Marco Winckler, University of Nice Sophia Antipolis, France*

TC 14 – Entertainment Computing

*Rainer Malaka, University of Bremen, Germany*

## **IFIP – The International Federation for Information Processing**

IFIP was founded in 1960 under the auspices of UNESCO, following the first World Computer Congress held in Paris the previous year. A federation for societies working in information processing, IFIP's aim is two-fold: to support information processing in the countries of its members and to encourage technology transfer to developing nations. As its mission statement clearly states:

*IFIP is the global non-profit federation of societies of ICT professionals that aims at achieving a worldwide professional and socially responsible development and application of information and communication technologies.*

IFIP is a non-profit-making organization, run almost solely by 2500 volunteers. It operates through a number of technical committees and working groups, which organize events and publications. IFIP's events range from large international open conferences to working conferences and local seminars.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is generally smaller and occasionally by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is also rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

IFIP distinguishes three types of institutional membership: Country Representative Members, Members at Large, and Associate Members. The type of organization that can apply for membership is a wide variety and includes national or international societies of individual computer scientists/ICT professionals, associations or federations of such societies, government institutions/government related organizations, national or international research institutes or consortia, universities, academies of sciences, companies, national or international associations or federations of companies.

More information about this series at <http://www.springer.com/series/6102>

John MacIntyre · Ilias Maglogiannis ·  
Lazaros Iliadis · Elias Pimenidis (Eds.)

# Artificial Intelligence Applications and Innovations

AIAI 2019 IFIP WG 12.5 International Workshops:  
MHDW and 5G-PINE 2019  
Hersonissos, Crete, Greece, May 24–26, 2019  
Proceedings

*Editors*

John MacIntyre  
University of Sunderland  
Sunderland, UK

Lazaros Iliadis  
Democritus University of Thrace  
Xanthi, Greece

Ilias Maglogiannis  
University of Piraeus  
Piraeus, Greece

Elias Pimenidis  
University of West England  
Bristol, UK

ISSN 1868-4238

ISSN 1868-422X (electronic)

IFIP Advances in Information and Communication Technology

ISBN 978-3-030-19908-1

ISBN 978-3-030-19909-8 (eBook)

<https://doi.org/10.1007/978-3-030-19909-8>

© IFIP International Federation for Information Processing 2019

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

## AIAI 2019 Workshops

According to Professor Klaus Schwab (founder and executive chairman of the World Economic Forum), we are living in the era of a great revolution that is rapidly bringing huge changes and challenges in our daily lives. This is the Fourth Industrial Revolution, which has a big impact on all disciplines, even in the way that we communicate and interact with each other. Artificial intelligence (AI) is a major and significant part of the Fourth Industrial Revolution. Its rapid technical breakthroughs are enabling superhuman performance by machines in a real-time mode. Machine vision (e.g., face recognition) or language translators and assistants like Siri and Alexa are characteristic examples. AI is promising a brave new world where business and economies will expand their productivity and innovation. Machine learning and deep learning are part of our usual common interactions on our mobile phones and on social media. Numerous applications of AI are used in almost all domains from cybersecurity to financial and medical cases. However, historic challenges for the future of mankind are being faced. Potential unethical use of AI may violate democratic human rights and may alter the character of Western societies.

The 15th Artificial Intelligence Applications and Innovations (AIAI) conference offered insight into all timely challenges related to technical, legal, and ethical aspects of intelligent systems and their applications. New algorithms and potential prototypes employed in diverse domains were introduced.

AIAI is a mature international scientific conference held in Europe and is well established in the scientific area of AI. Its history is long and very successful, following and spreading the evolution of intelligent systems.

The first event was organized in Toulouse France in 2004. Since then, it has had a continuous and dynamic presence as a major global, but mainly European scientific event. More specifically, it has been organized in China, Greece, Cyprus, Australia, and France. It has always been technically supported by the International Federation for Information Processing (IFIP) and more specifically by the Working Group 12.5, which is interested in AI applications.

Following a long-standing tradition, this Springer volume belongs to the IFIP AICT Springer Series and it contains the papers that were accepted to be presented orally at the following workshops held as parallel events of the 15th AIAI conference, which took place during May 24–26, 2019 in the Aldemar Knossos Royal five-star Hotel in Crete, Greece:

- **8th Mining Humanistic Data Workshop (MHDW 2019)**
- **The 4th Workshop on 5G-Putting Intelligence to the Network Edge (5G-PINE 2019)**

All workshops had Program Committees and all submissions were peer reviewed by at least two independent academic referees. Where needed, a third referee was consulted to resolve any potential conflicts.

The workshops also followed the same review and acceptance ratio rules. More specifically, the 4th 5G-PINE accepted eight full papers out of 17 submissions (47%) and two short papers. In total, 15 manuscripts were submitted to the 8th MHDW workshop. The Program Committee accepted seven papers to be published as full papers (12 pages long) in the proceedings (46.6%). Moreover, four submissions were accepted as short papers (10 pages long) to be included in the proceedings.

The third workshop organized in the framework of AIAI 2019 was:

- **The First Workshop on Emerging Trends in AI (ETAI 2019)**

This workshop, sponsored by the Springer journal *Neural Computing and Applications*, was an open workshop without submission of papers.

Artificial intelligence is going through a new boom period, with exponential growth in the commercialization of research and development, products being introduced into the market with embedded AI as well as “intelligent systems” of various types. Projections for commercial revenue from AI also show exponential growth; such is the ubiquitous nature of AI in the modern world that members of the public are interacting with intelligent systems or agents every day – even though they often are not aware of it! This workshop, led by Professor John MacIntyre, considered emerging themes in AI, covering not only the technical aspects of where AI is going, but the wider question of ethics, and the potential for future regulatory frameworks for the development, implementation, and operation of intelligent systems and their role in our society.

The workshop format included three short presentations by the keynote speakers, followed by an interactive panel Q&A session where the panel members and audience engaged in a lively debate on the topics discussed.

The subjects of their presentations were the following:

- John MacIntyre: “The Future of AI – Existential Threat or New Revolution?”
- Andrew Starr: “Practical AI for Practical Problems”

We are grateful to Professor John MacIntyre from the University of Sunderland, UK, for organizing this workshop and, moreover, for his continuous support of the AIAI and EANN conferences. We wish to thank Professor Andrew Starr for his contribution to this very interesting workshop.

John MacIntyre  
Ilias Maglogiannis  
Lazaros Iliadis  
Elias Pimenidis

# Organization

## AIAI 2019

### Executive Committee

#### General Chairs

John MacIntyre	University of Sunderland, UK (Dean of the Faculty of Applied Sciences and Pro Vice Chancellor of the University of Sunderland)
Ilias Maglogiannis (President of the IFIP WG12.5)	University of Piraeus, Greece
Plamen Angelov	University of Lancaster, UK

#### Program Chairs

Lazaros Iliadis	Democritus University of Thrace, Greece
Elias Pimenidis	University of the West of England, Bristol, UK

#### Advisory Chairs

Stefanos Kolias	University of Lincoln, UK
Spyros Likothanasis	University of Patras, Greece
Georgios Vouros	University of Piraeus, Greece

#### Honorary Chair

Barbara Hammer	Bielefeld University, Germany
----------------	-------------------------------

#### Workshop Chairs

Christos Makris	University of Patras, Greece
Phivos Mylonas	Ionian University, Greece
Spyros Sioutas	University of Patras, Greece

#### Publication and Publicity Chair

Antonis Papaleonidas	Democritus University of Thrace, Greece
----------------------	---

#### Program Committee

Michel Aldanondo	IMT Mines Albi, France
Athanasios Alexiou	NGCEF, Australia
Mohammed Alghwell	Freelancer, Libya

Ioannis Anagnostopoulos	University of Central Greece, Greece
George Anastassopoulos	Democritus University of Thrace, Greece
Vardis-Dimitris Anezakis	Democritus University of Thrace, Greece
Costin Badica	University of Craiova, Romania
Kostas Berberidis	University of Patras, Greece
Nik Bessis	Edge Hill University, UK
Varun Bhatt	Indian Institute of Technology, Bombay, India
Giacomo Boracchi	Politecnico di Milano, Italy
Farah Bouakrif	University of Jijel, Algeria
Antonio Braga	Federal University of Minas Gerais, Brazil
Peter Brida	University of Zilina, Slovakia
Ivo Bukovsky	Tohoku University, Japan
Paulo Vitor Campos Souza	CEFET-MG, Brazil
George Caridakis	National Technical University of Athens, Greece
Jhymesson Cavalcanti	UPE, Brazil
Ioannis Chamodrakas	National and Kapodistrian University of Athens, Greece
Ioannis Chochliouros	Hellenic Telecommunications Organization S.A. (OTE), Greece
Adriana Mihaela Coroiu	Babes Bolyai University, Romania
Dawei Dai	Fudan University, China
Vilson Luiz Dalle Mole	UTFPR, Brazil
Debasmit Das	Purdue University, USA
Bodhisattva Dash	IIIT Bhubaneswar, India
Konstantinos Demertzis	Democritus University of Thrace, Greece
Antreas Dionysiou	University of Cyprus, Cyprus
Ioannis Dokas	DUTH, Greece
Sergey Dolenko	D.V. Skobeltsyn Institute of Nuclear Physics, M.V. Lomonosov Moscow State University, Russia
Xiao Dong	Institute of Computing Technology, China
Shirin Dora	University Van Amsterdam, The Netherlands
Rodrigo Exterkoetter	LTrace Geophysical Solutions, Brazil
Mauro Gaggero	National Research Council, Italy
Claudio Gallicchio	University of Pisa, Italy
Ignazio Gallo	University of Insubria, Italy
Spiros Georgakopoulos	University of Thessaly, Greece
Eleonora Giunchiglia	Università di Genova, Italy
Giorgio Gnecco	IMT School for Advanced Studies, Italy
Ioannis Gkoutzounis	University of Northampton, Greece
Foteini Grivokostopoulou	University of Patras, Greece
Hakan Haberdar	University of Houston, USA
Petr Hajek	University of Pardubice, Czech Republic
Xue Han	China University of Geosciences, China
Ioannis Hatzilygeroudis	University of Patras, Greece
Jian Hou	Bohai University, China
Lazaros Iliadis	Democritus University of Thrace, Greece



Jacek Kabziński	Lodz University of Technology, Poland
Antonios Kalampakas	AUM, Kuwait
Andreas Kanavos	University of Patras, Greece
Savvas Karatsiolis	University of Cyprus, Cyprus
Kostas Karatzas	Aristotle University of Thessaloniki, Greece
Antonios Karatzoglou	Karlsruhe Institute of Technology, Germany
Ioannis Karydis	Ionian University, Greece
Petros Kefalas	University of Sheffield International Faculty, Greece
Katia Lida Kermanidis	Ionian University, Greece
Nadia Masood Khan	University of Engineering and Technology Peshawar, Pakistan
Sophie Klecker	University of Luxembourg, Luxembourg
Yiannis Kokkinos	University of Macedonia, Greece
Petia Koprinkova-Hristova	Bulgarian Academy of Sciences, Bulgaria
Athanasios Koutras	TEI of Western Greece, Greece
Ondrej Krejcar	University of Hradec Kralove, Czech Republic
Efthymoulos Kyriacou	Frederick University, Cyprus
Guangli Li	Institute of Computing Technology, Chinese Academy of Sciences, China
Annika Lindh	Dublin Institute of Technology, Ireland
Ilias Maglogiannis	University of Piraeus, Greece
George Magoulas	University of London, Birkbeck College, UK
Christos Makris	University of Patras, Greece
Mario Malcangi	Università degli Studi di Milano, Italy
Boudjelal Meftah	University Mustapha Stambouli, Mascara, Algeria
Nikolaos Mitianoudis	Democritus University of Thrace, Greece
Haralambos Mouratidis	University of Brighton, UK
Phivos Mylonas	National Technical University of Athens, Greece
Shigang Yue	University of Lincoln, UK
Yancho Todorov	Aalto University, Espoo, Finland
George Tsekouras	University of the Aegean, Greece
Mihaela Oprea	Petroleum-Gas University of Ploiesti, Romania
Paul Krause	University of Surrey, UK
Rafet Sifa	Fraunhofer IAIS, Germany
Alexander Ryjov	Lomonosov Moscow State University, Russia
Giannis Nikolentzos	Ecole Polytechnique, France
Duc-Hong Pham	VNU, Vietnam
Elias Pimenidis	University of the West of England, UK
Hongyu Li	Zhongan Tech, China
Marcello Sanguineti	University of Genoa, Italy
Zhongnan Zhang	Xiamen University, China
Doina Logofatu	Frankfurt University of Applied Sciences, Germany
Ruggero Labati	Università degli Studi di Milano, Italy
Florin Leon	Technical University of Iasi, Romania
Aristidis Likas	University of Ioannina, Greece
Spiros Likothanassis	University of Patras, Greece

Francesco Marcelloni	University of Pisa, Italy
Giorgio Morales	INICTEL-UNI, Peru
Stavros Ntalampiras	University of Milan, Italy
Basil Papadopoulos	Democritus University of Thrace, Greece
Antonios Papaleonidas	DUTH, Greece
Isidoros Perikos	University of Patras, Greece
Nicolai Petkov	University of Groningen, The Netherlands
Miltos Petridis	Middlesex University, UK
Jielin Qiu	Shanghai Jiao Tong University, China
Juan Qiu	Tongji University, China
Bernardete Ribeiro	University of Coimbra, Portugal
Simone Scardapane	Sapienza University of Rome, Italy
Andreas Stafylopatis	National Technical University of Athens, Greece
Antonino Staiano	Parthenope University of Naples, Italy
Ioannis Stephanakis	Hellenic Telecommunications Organisation SA, Greece
Ricardo Tanscheit	PUC-Rio, Brazil
Francesco Trovò	Politecnico di Milano, Italy
Nicolas Tsapatsoulis	Cyprus University of Technology, Cyprus
Nikolaos Vassilas	TEI of Athens, Greece
Petra Vidnerová	The Czech Academy of Sciences, Czech Republic
Panagiotis Vlamos	Ionian University, Greece
George Vouros	University of Piraeus, Greece
Xin-She Yang	Middlesex University, UK
Drago Žagar	University of Osijek, Croatia
Rabiah Zitouni	University Tunis el Manar, Tunisia

# Contents

## 4th Workshop on “5G-Putting Intelligence to the Network Edge” (5G-PINE 2019)

A Cloud-Based Architecture for Video Services in Crowd Events . . . . .	7
<i>Alexandros Kostopoulos, Ioannis Chochliouros, Evangelos Sfakianakis, Daniele Munaretto, and Claus Keuker</i>	
A New Self-planning Methodology Based on Signal Quality and User Traffic in Wi-Fi Networks . . . . .	19
<i>Juan Sánchez-González, Jordi Pérez-Romero, and Oriol Sallent</i>	
Enhanced Mobile Broadband as Enabler for 5G: Actions from the Framework of the 5G-DRIVE Project . . . . .	31
<i>Ioannis P. Chochliouros, Na Yi, Anastasia S. Spiliopoulou, Alexandros Kostopoulos, Nathan Gomes, Uwe Herzog, Tao Chen, Athanasios Dardamanis, Olga Segou, Philippos Assimakopoulos, Klaus Moessner, Juha Jidbeck, Rahim Tafazolli, and Latif Ladid</i>	
Inclusion of Telemetry and Data Analytics in the Context of the 5G ESSENCE Architectural Approach . . . . .	46
<i>Ioannis P. Chochliouros, Anastasia S. Spiliopoulou, Alexandros Kostopoulos, George Agapiou, Maria Belesioti, Evangelos Sfakianakis, Michail-Alexandros Kourtis, Mike Iosifidis, Marinos Agapiou, and Pavlos Lazaridis</i>	
A Framework to Support the Role of Telecommunication Service Providers in Evolving 5G Business Models . . . . .	60
<i>Ioanna Mesogiti, Eleni Theodoropoulou, George Lyberopoulos, Fotini Setaki, Aurora Ramos, Panagiotis Gouvas, Anastasios Zafeiropoulos, and Roberto Bruschi</i>	
Orchestration of Mission-Critical Services over an NFV Architecture. . . . .	70
<i>Aitor Sanchoyerto, Ruben Solozabal, Bego Blanco, Elisa Jimeno, Endika Aldecoa, Estrella Basurto, and Fidel Liberal</i>	
Testbeds for the Implementation of 5G in the European Union: The Innovative Case of the 5G-DRIVE Project . . . . .	78
<i>Ioannis P. Chochliouros, Anastasia S. Spiliopoulou, Alexandros Kostopoulos, Eirini Vasilaki, Uwe Herzog, Athanasios Dardamanis, Tao Chen, Latif Ladid, and Marinos Agapiou</i>	

<b>A Techno-Economic Analysis of Employing a Central Coordinator Entity in 5G Networks. . . . .</b>	<b>93</b>
<i>Christos Tsirakis, Mariana Goldhamer, Panagiotis Matzoros, George Agapiou, Dimitris Varoutas, and Marinós Agapiou</i>	
<b>Trustworthy AI for 5G: Telco Experience and Impact in the 5G ESSENCE . . .</b>	<b>103</b>
<i>Maria Rita Spada and Alessandro Vincentini</i>	
<b>Regulatory Considerations in the 5G Era: The 5GCity Neutral Host Case . . .</b>	<b>111</b>
<i>Ioannis Neokosmidis, Theodoros Rokkas, Dimitrios Xydias, and Maria Rita Spada</i>	
<b>8th Mining Humanistic Data Workshop (MHDW 2019)</b>	
<b>An Approach for Domain-Specific Design Pattern Identification Based on Domain Ontology. . . . .</b>	<b>125</b>
<i>Vassiliki Gkantouna, Vaios Papaioannou, Giannis Tzimas, and Zlatan Sabic</i>	
<b>Pre-processing Framework for Twitter Sentiment Classification. . . . .</b>	<b>138</b>
<i>Elias Dritsas, Gerasimos Vonitsanos, Ioannis E. Livieris, Andreas Kanavos, Aristidis Ilias, Christos Makris, and Athanasios Tsakalidis</i>	
<b>Computing Long Sequences of Consecutive Fibonacci Integers with TensorFlow. . . . .</b>	<b>150</b>
<i>Georgios Drakopoulos, Xenophon Liapakis, Evaggelos Spyrou, Giannis Tzimas, Phivos Mylonas, and Spyros Sioutas</i>	
<b>Employing Constrained Neural Networks for Forecasting New Product's Sales Increase. . . . .</b>	<b>161</b>
<i>Ioannis E. Livieris, Niki Kiriakidou, Andreas Kanavos, Gerasimos Vonitsanos, and Vassilis Tampakas</i>	
<b>Language Processing for Predicting Suicidal Tendencies: A Case Study in Greek Poetry . . . . .</b>	<b>173</b>
<i>Alexandros Dimitrios Zervopoulos, Evangelos Geramanis, Alexandros Toulakis, Asterios Papamichail, Dimitrios Triantafylloy, Theofanis Tasoulas, and Katia Kermanidis</i>	
<b>Recognition of Urban Sound Events Using Deep Context-Aware Feature Extractors and Handcrafted Features. . . . .</b>	<b>184</b>
<i>Theodore Giannakopoulos, Evaggelos Spyrou, and Stavros J. Perantonis</i>	
<b>Studying the Spatialities of Short-Term Rentals' Sprawl in the Urban Fabric: The Case of Airbnb in Athens, Greece . . . . .</b>	<b>196</b>
<i>Konstantinos Gourzis, Georgios Alexandridis, Stelios Gialis, and George Caridakis</i>	

**A Brief Overview of Dead-Zone Pattern Matching Algorithms . . . . . 208**  
*Miznah Alshammary, Mai Alzamel, Costas Iliopoulos,  
Richard E. Watson, and Bruce W. Watson*

**On the Cyclic Regularities of Strings. . . . . 219**  
*Oluwole Ajala, Miznah Alshammary, Mai Alzamel, Jia Gao,  
Costas Iliopoulos, Jakub Radoszewski, Wojciech Rytter,  
and Bruce Watson*

**Paid Crowdsourcing, Low Income Contributors, and Subjectivity . . . . . 225**  
*Giannis Haralabopoulos, Christian Wagner, Derek McAuley,  
and Ioannis Anagnostopoulos*

**Predicting Secondary Structure for Human Proteins Based  
on Chou-Fasman Method . . . . . 232**  
*Fotios Kounelis, Andreas Kanavos, Ioannis E. Livieris,  
Gerasimos Vonitsanos, and Panagiotis Pintelas*

**Author Index . . . . . 243**