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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.

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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.

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Lazaros Iliadis · Ilias Maglogiannis
Vassilis Plagianakos (Eds.)

Artificial Intelligence Applications and Innovations

AIAI 2018 IFIP WG 12.5 International Workshops
SEDSEAL, 5G-PINE, MHDW, and HEALTHIOT
Rhodes, Greece, May 25–27, 2018
Proceedings

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ISSN 1868-4238 ISSN 1868-422X (electronic)
IFIP Advances in Information and Communication Technology
ISBN 978-3-319-92015-3 ISBN 978-3-319-92016-0 (eBook)
<https://doi.org/10.1007/978-3-319-92016-0>

Library of Congress Control Number: 2018944373

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Printed on acid-free paper

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

Preface

It is a fact that the world is changing extremely fast. Technological advances in artificial intelligence (AI) are leading this change. We have already passed from theory and algorithmic approaches, to actual delivery with several real-life practical applications. We have entered the fourth “industrial revolution” era. AI will definitely rupture the human-centric status of our civilization. Many philosophical and ethical issues will arise mainly due to the challenge and fear that the machines might take over. However, the contribution of AI so far to the improvement of our quality of life is profound. The AIAI conference offers insight into all timely challenges related to intelligent systems-algorithms and their applications.

AIAI is a mature European conference, well established in the scientific area of AI. It has a very long and successful history, following and spreading the evolution of AI. The first event was organized in Toulouse, France, in 2004. Since then, it has had a continuous and dynamic presence as a major European scientific event. More specifically, it has been organized in China, Greece, Cyprus, and France.

Through the years it has always been technically supported by the International Federation for Information Processing (IFIP) and more specifically by the WG12.5.

Following a long-standing tradition, this Springer volume belongs to the IFIP AICT Springer series and it contains the papers that were accepted for oral presentation at the workshops held as parallel events of the 14th AIAI conference. An additional volume comprises the papers that were accepted and presented at the 14th AIAI main conference.

The event was held May 25–27, 2018, in the Aldemar Amilia Mare five-star Hotel in Rhodes, Greece.

Four scientific workshops on timely AI subjects were organized successfully during the 2018 event:

- The 7th Mining Humanistic Data Workshop (MHDW) supported by the Ionian University and the University of Patras, Greece. The 7th MHDW was organized by Professor Christos Makris, Department of Computer Engineering and Informatics, University of Patras, Professor Phivos Mylonas Department of Informatics, Ionian University, Dr. Andreas Kanavos, Department of Computer Engineering and Informatics, University of Patras, and Georgios Drakopoulos, Department of Informatics, Ionian University Greece. The Steering Committee of MHDW 2018 comprised Dr. Ioannis Karydis, Department of Informatics, Ionian University, Professor Katia Lida Kermanidis Department of Informatics, Ionian University, and Professor Spyros Sioutas, Department of Informatics, Ionian University. We express our sincere appreciation to the committees of MHDW 2018 for organizing this important event for the seventh consecutive time.
- The Third Workshop on 5G-Putting Intelligence to the Network Edge (5G-PINE 2018). The Third 5G-PINE was driven by the hard work of Dr. Ioannis P. Chochliouros (Hellenic Telecommunications Organization, OTE,

Greece) Dr. Alexandros Kostopoulos (OTE, Greece), Professors Oriol Sallent and Jordi Pérez-Romero (Universitat Politècnica de Catalunya UPC, Spain), Dr. Ioannis Neokosmidis (INCITES Consulting S.A.R.L, Luxembourg), Professor Fidel Liberal (Universidad del País Vasco/Euskal Herriko Unibertsitatea EHU, Spain), Dr. Emmanouil Kafetzakis (ORION Innovations Company, Greece), and Dr. Ioannis Giannoulakis (National Center for Scientific Research, Demokritos, Greece). We would like to thank all of these colleagues for their hard work.

- The Workshop on Semantics in the Deep: Semantic Analytics for Big Data (SEDSEAL 2018) supported by the University of Patras, Greece. The workshop was organized by Professor Spiridon D. Likothanasis, Department of Computer Engineering and Informatics, University of Patras, and Dr. Dimitrios Koutsomitropoulos, University of Patras, Greece. We wish to express our gratitude to these colleagues for their invaluable contribution.
- The Intelligent Cloud and IOT Paradigms in EHealth (HEALTHIOT). This scientific event was organized by Professor Ilias Maglogiannis, Department of Digital Systems, University of Piraeus, Greece, Dimosthenis Kyriazis, Department of Digital Systems, University of Piraeus, Greece, and Vassilios Plagianakos, Department of Computer Science and Biomedical Informatics, University of Thessaly, Greece. We are very happy for the important contribution of this workshop to the success of AIAI 2018.

The diverse nature of papers presented at the AIAI 2018 workshops demonstrates the vitality of neural computing and related soft computing approaches.

The Organizing Committee was delighted by the overwhelming response to the call for papers. All workshops papers went through a peer review process by at least two independent academic referees. Where needed, a third reviewer was consulted to resolve any conflicts.

Full accepted papers were presented orally for 20 minutes each and were included in the AIAI 2018 workshops proceedings with 12 pages maximum. Owing to the high quality of the submissions, the Program Committees of the workshops decided to additionally accept short papers that were given 15 minutes for oral presentation and 10 pages each in the proceedings. The workshops followed the same rules as the main event. More specifically, 5G-PINE accepted six full papers (42.85%) and one short one out of 14 submissions, whereas MHDW accepted seven full (46.6%) and four short papers out of 15 submissions. HealthIOT accepted four full papers (44.5%) out of nine contributions, and SEDSEAL accepted two full papers out of five submissions (40%).

The accepted papers of the AIAI 2018 workshops are related to the following thematic topics:

- AI in 5G and telecommunications
- AI and e-health services
- AI in 5G networks
- Incremental learning
- Clustering
- AI in text mining
- Visual data analytics
- AI in molecular biology, DNA, RNA, proteins

- Big data analytics
- Internet of Things and recommender systems
- AI in biomedical applications

The authors of the 14th AIAI workshops came from 13 different countries from all over the globe, namely: Europe (Austria, France, Germany, Greece, Ireland, Italy, Luxembourg, Poland, Spain, UK), America (Brazil, USA), and Asia (India).

We hope that these proceedings will help researchers worldwide to understand and to be aware of novel AI aspects. We do believe that they will be of major interest for scientists over the globe and that they will stimulate further research in the domain of AI in general.

May 2018

Lazaros Iliadis
Ilias Maglogiannis
Vassilis Plagianakos

Preface to SEDSEAL 2018

During the past decade, the field of artificial intelligence (AI) has been experiencing an outburst of applications and innovations, having many facets: on the one hand, there are strong symbolic representations to underpin the next generation of the Web, and the advent of the Semantic Web has a major role in giving everyday browsing tasks a blend of intelligence; and on the other hand, deep learning techniques and achievements have been proven to tackle problems that would seem intractable some time ago. The wide availability of information on the Internet, storage space, and Web-generated content add more impetus to devising applications that would take advantage of such unprecedented resources but would also stand up to the challenges posed by processing and value extraction out of big data.

The SEDSEAL 2018 workshop's particular aim was exactly to put emphasis on big data analysis and more specifically on how semantics-aware applications can contribute in this field. Still, there are often issues that need to be dealt with. These range from efficient ontological processing of big data ontologies to knowledge graph maintenance to ontology evolution with machine-learning techniques.

Semantic interoperability inside data lakes composed of vast IoT networks is addressed by Kalamaras et al. The authors propose an architecture for big data analytics in the context of large-scale IoT systems consisting of multiple IoT platforms. The efficient management of the spectrum crunch in the field of wireless communication necessitates processing of a large volume of information and requires knowledge-based decision-making upon ever-changing circumstances. Nagpure et al. explain how semantic models can be employed to analyze complex spectrum data. Semantic ambiguity in natural language has been a problem that traditionally hampers Semantic Web applications. To resolve this ambiguity, Gadag and Sagar describe a deep learning architecture, trained to compute semantic similarity between words.

Indeed, the interplay between the logical formalisms of the Semantic Web and machine- and deep-learning techniques is currently a hot research topic for both technologies to reach their next step and forms the state of the art in this area. We believe that the overall outcome of the SEDSEAL 2018 workshop can offer a valuable and timely snapshot, bringing together a multidisciplinary audience under the general AI and data science framework, of current advances, practices, and lessons learned.

We were honored to have Prof. Panos Kalnis as the SEDSEAL keynote speaker, to whom we express our gratitude for kindly accepting our invitation. There could be no better way than his motivating lecture on scalable querying of big RDF data to open this workshop. We are grateful to the number of people who served in the SEDSEAL 2018 Program Committee. Their eager participation and thoughtful remarks have been

invaluable. We would also like to thank the AIAI 2018 chair, Prof. Lazaros Iliadis, and the workshop co-chairs, Profs. Christos Makris and Spiros Sioutas, for their help and support for a successful SEDSEAL 2018.

Dimitrios A. Koutsomitropoulos
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Preface to 5G-PINE 2018

The Third 5G-PINE Workshop has been established to disseminate knowledge obtained from actual EU projects as well as from any other action of EU-funded research, in the wider thematic area of “5G Innovative Activities – Putting Intelligence to the Network Edge” and with the aim of focusing upon artificial intelligence (AI) in modern 5G telecommunications infrastructures.

The Third 5G-PINE Workshop had a strong impact in the broader context of the AIAI 2018 Conference. The preparatory work was mainly driven by the hard effort of Dr. Ioannis P. Chochliouros (Hellenic Telecommunications Organization, OTE, Greece) also coordinator of the relevant EU-funded 5G-PPP projects “SESAME” and “5G-ESSENCE,” with the support of Dr. Alexandros Kostopoulos (Hellenic Telecommunications Organization, OTE, Greece), Profs. Oriol Sallent and Jordi Pérez-Romero (Universitat Politècnica de Catalunya, UPC, Spain), Dr. Ioannis Giannoulakis (National Center for Scientific Research Demokritos, NCSR, Greece), Prof. Fidel Liberal (Universidad del País Vasco/Euskal Herriko Unibertsitatea, EHU, Spain), Dr. Emmanouil Kafetzakis (ORION Innovations Private Company, Greece), and Dr. Ioannis Neokosmidis (INCITES Consulting S.A.R.L., Luxembourg). Apart from these members of the Workshop Organizing Committee, the entire effort was also supported by more than 30 European experts (mainly from the relevant EU-funded 5G-PPP projects “SESAME” and “5G-ESSENCE”). Among the originally submitted 14 proposals, six were finally accepted as full papers (acceptance ratio of 42.85%) and one as a short paper.

The Third 5G-PINE Workshop promoted the context of modern 5G network infrastructures and of related innovative services in a complex and highly heterogeneous underlying radio access network (RAN) ecosystem, strongly enhanced by the inclusion of cognitive capabilities and intelligence features with the aim of improving network management. Based upon the well-known self-organizing network (SON) functionalities, the Third 5G-PINE Workshop promoted network planning and optimization processes through AI-based tools, able to smartly process input data from the environment and come up with knowledge that can be formalized in terms of models and/or structured metrics, able to “represent” the network behavior. This allows us to gain in-depth and detailed knowledge about the whole 5G ecosystem, understanding hidden patterns, data structures, and relationships, and using them for a more efficient network management.

The 5G-PINE Workshop supports delivery of intelligence directly to the network’s edge, by exploiting the emerging paradigms of network functions virtualization (NFV) and edge cloud computing. Moreover, it supports promotion of rich virtualization and multi-tenant capabilities, optimally deployed close to the user. Interalia, it emphasizes the small cell (SC) concept, so as to support improved cellular coverage, capacity, and applications in a fully dynamic and flexible manner with vertical applications.

The accepted papers focus on several innovative findings coming directly from modern European research in the area, mainly from the 5G-PPP projects 5G-ESSENCE and 5GCity as well as from the Spanish RAMSES and SONAR 5G Grants, covering a wide variety of technical and business aspects and promoting options for growth and development. One additional work focusing on vertical markets and within cloud environments comes from the H2020 VICINITY European project.

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Preface to MHD 2018

The abundance of available data retrieved from or related to the area of the humanities and the human condition challenges the research community in processing and analyzing it. The aim is two fold: on the one hand, to extract knowledge that will help us understand human behavior, creativity, ways of thinking, reasoning, learning, decision-making, socializing, and even biological processes; on the other hand, to exploit the extracted knowledge by incorporating it into intelligent systems that will support humans in their everyday activities.

The nature of humanistic data can be multimodal, semantically heterogeneous, dynamic, time and space-dependent, and highly complicated. Translating humanistic information, e.g., behavior, state of mind, artistic creation, linguistic utterance, learning, and genomic information into numerical or categorical low-level data is a significant challenge on its own. New techniques, appropriate for dealing with this type of data, need to be proposed and existing ones adapted to its special characteristics.

The workshop aims to bring together interdisciplinary approaches that focus on the application of innovative as well as existing data matching, fusion, and mining and knowledge discovery and management techniques (e.g., decision rules, decision trees, association rules, ontologies and alignments, clustering, filtering, learning, classifier systems, neural networks, support vector machines, preprocessing, postprocessing, feature selection, visualization techniques) to data derived from all areas of the humanities, e.g., linguistic, historical, behavioral, psychological, artistic, musical, educational, social etc.

Ubiquitous computing applications (aka pervasive computing, mobile computing, ambient intelligence, etc.) collect large volumes of usually heterogeneous data in order to effect adaptation, learning, and in general context awareness. Data matching, fusion, and mining techniques are necessary to ensure human-centered application functionality.

An important aspect of humanistic studies centers around managing, processing, and computationally analyzing biological and biomedical data. Hence, one of the aims of this workshop was to also attract researchers interested in designing, developing, and applying efficient data and text mining techniques for discovering the underlying knowledge existing in biomedical data, such as sequences, gene expressions, and pathways.

The topics of interest can be found at <https://conferences.cwa.gr/mhdw2018/workshop-aim/>.

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Preface to HealthIoT 2018

It is our pleasure to welcome you to the proceedings of the Intelligent Cloud and IoT Paradigms in eHealth (HealthIoT) Workshop held as part of the AIAI 2018 conference during May 25–27, 2018, in Rhodes, Greece. Evolving from a network of interconnected computers and networking devices, the Internet is increasingly being approached as the Internet of Everything capturing the interconnections of devices with diverse characteristics, service offerings, and data flows (e.g., smart phones and tablets, wearable devices, sensor networks, cameras, vehicles, etc.). In this context, the Internet of Things (IoT) is evolving into a platform of platforms, consisting of a plethora of networked devices, infrastructures, and supporting systems of systems, addressing various application domains, with electronic health care being one of them. This workshop offers the opportunity to present recent results concerning the design, development, implementation, and deployment of big data analytics and cloud infrastructures and IoT in different areas relating to electronic health care. The workshop aims to support research and innovation on IoT-based eHealth systems and especially in: wearable systems, medical and sensor data processing, machine learning in eHealth, emerging eHealth IoT applications, network communications for health care applications, quantified self technologies and applications, intelligent data processing and predictive algorithms in eHealth, smart homes and assistive environments, data mining of health data on the cloud, security, safety and privacy in eHealth and IoT, interoperability and standardization issues in IoT and eHealth. The workshop received nine submissions of which were accepted (44% acceptance ratio). We express our special thanks to all who contributed to the organization and scientific contents of this workshop — first to the authors of the papers, to the AIAI 2018 conference organizers, and finally to the reviewers and members of the Program and Organizing Committees.

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