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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.

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

Artificial Intelligence Applications and Innovations

AIAI 2020 IFIP WG 12.5
International Workshops

MHDW 2020 and 5G-PINE 2020
Neos Marmaras, Greece, June 5–7, 2020
Proceedings

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Preface

AIAI 2020 Workshops

Artificial Intelligence (AI) is already affordable through a large number of applications that offer good services to our post-modern societies. Image-face recognition and speech translation are already a reality. File sharing via Dropbox, Uber transportations, social interaction through Twitter, and shopping from eBay are employing Google's TensorFlow platform. AI has already developed high levels of reasoning. Respective applications like AlphaGo (released by Google DeepMind) have managed to defeat human experts in highly sophisticated demanding games, like *Go*. This is a great step forward, if we realize that in the *Go* game the number of potential moves is higher than the number of atoms in the entire Universe. *AlphaGo Zero* is a recent and impressive advance which is using Reinforcement Learning to teach itself. It started with no knowledge at all and in three days it bypassed the capabilities of *AlphaGo Lee*, which is the version that defeated one of the best *Go* human players in four out of five games in 2016. In 21 days, it evolved even further and it reached Master level. More specifically, it defeated 60 top professional *Go* players online and the world champion himself.

Deep Learning has significantly contributed to the progress made during the last decades. Meta-Learning and intuitive intelligence are on the way, and soon they will enable machines to understand what learning is all about. The concept of Generative Adversarial Neural Networks will try to fuse "imagination" to AI. However historic challenges for the future of mankind will be faced. Potential unethical use of AI may violate democratic human rights and may alter the character of western societies.

The 16th conference on Artificial Intelligence Applications and Innovations (AIAI 2020) offers an insight to all timely challenges related to technical, legal, and ethical aspects of AI systems and their applications. New algorithms and potential prototypes employed in diverse domains are introduced. AIAI is a mature international scientific conference held in Europe and 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 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. It contains the papers that were accepted to be presented orally at the following workshops, held as parallel events of the AIAI 2020 conference which was held during June 5–7, 2020, as a remote live event with presentations, a lot of interaction, and Q&A sessions. There was no potential for physical attendance due to the COVID-19 global pandemic.

The following scientific workshops on timely AI subjects were organized under the framework of AIAI 2020:

9th Mining Humanistic Data Workshop (MHDW 2020)

We would like to thank the Steering Committee of MHDW 2020, Professors Ioannis Karydis and Katia Lida Kermanidis from Ionian University, Greece, and Professor Spyros Sioutas from the University of Patras, Greece, for their important contribution towards the organization of this high-quality and mature event. Also, we would like to thank Professor Christos Makris and Dr. Andreas Kanavos from the University of Patras, Greece, and Professor Phivos Mylonas Ionian University, Greece, for doing an excellent job as Senior Members of the Program Committee. MHDW is an annual event that attracts an increasing amount of high-quality research papers, under the framework of the AIAI conference.

MHDW 2020 accepted 6 full papers (12-pages long) out of 16 submissions. Due to the high quality of the submissions, the Program Committee decided additionally to accept three more papers to be published as short papers (10-pages long).

5th Workshop on 5G-Putting Intelligence to the Network Edge (5G-PINE 2020)

We would like to thank Dr. Ioannis P. Chochliouros, Research Programs Section, Research and Development Department, Fixed & Mobile, Hellenic Telecommunications Organization (OTE). We really appreciate his great efforts in organizing this high-quality 5th 5G-PINE workshop, which is a well-established annual event. It presents timely and significant results from state-of-the-art research in the 4th industrial revolution area. This workshop connects the conference with the latest AI applications in the telecommunication industry.

5G-PINE 2020 accepted 11 Full papers out of 22 submissions. Due to the high quality of the submissions, the Program Committee decided additionally to accept one more paper to be published as a short paper (10-pages long).

June 2020

Ilias Maglogiannis
Plamen Angelov
John Macintyre
Lazaros Iliadis
Stefanos Kolias
Elias Pimenidis

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Preface

5G-PINE 2020

The 5th Workshop on 5G-Putting Intelligence to the Network Edge (5G-PINE 2020) followed the great success and wider impact of its predecessors, established to disseminate knowledge obtained from actual 5G EU-funded projects, as well as from any other action of research, in the wider thematic area of 5G innovative activities and with the main focus on Artificial Intelligence (AI) in modern 5G telecommunications infrastructures.

5G-PINE 2020 had a strong impact in the broader context of the AIAI 2020 conference. The preparatory work was mainly driven by the hard organizational effort and the dynamic coordination of Dr. Ioannis P. Chochliouros (Hellenic Telecommunications Organization - OTE, Greece) who is also the coordinator of the relevant EU-funded 5G-PPP project “5G-ESSENCE”, with the support of Dr. Latif Ladid (President of IPv6 Forum and Researcher of SnT and University of Luxembourg, Luxembourg); Professor Ramjee Prasad (University of Aarhus, Denmark) who is also the coordinator of the H2020-MCSA-ITN “MOTOR-5G” project; Professor Pavlos Lazaridis (University of Huddersfield, UK); Dr. Zaharias Zaharis (Aristotle University of Thessaloniki, Greece); Mr. Uwe Herzog (EURESCOM GmbH, Germany) who is also the coordinator of the 5G-PPP project “5G-DRIVE”; Professors Oriol Sallent and Jordi Pérez-Romero (Universitat Politècnica de Catalunya, Spain); Dr. Tao Chen (VTT Technical Research Center of Finland, Finland); Dr. Slawomir Kukliński and Dr. Lechosław Tomaszewski (Orange Polska, Poland); Mr. Athanassios Dardamanis (SmartNet S.A., Greece); Dr. Ioannis Neokosmidis (inCITES Consulting SARL, Luxembourg); Mr. Stelios Pantelopoulos (Singular Logic Systems Ltd., Greece); Professor Fidel Liberal (Universidad del País Vasco and Euskal Herriko Unibertsitatea, Spain); and Dr. Monique Calisti and Mrs. Kai Zhang (Martel Innovate GmbH, Switzerland).

Apart from the above members of the Workshop Organizing Committee, the entire process was also supported by more than 90 European experts, several of who came from the relevant EU-funded H2020/5G-PPP projects “5G-ESSENCE” and “5G-DRIVE” as well as from the H2020-MCSA-ITN “MOTOR-5G” project, that forms the core of the corresponding effort for realizing a joint 5G-PINE 2020 workshop, purely 5G-oriented. Among the originally submitted 23 proposed papers, 11 were accepted as full papers (acceptance ratio of 50%). The acceptance of papers was based on the high quality of the works and, most importantly, due to their strong relevance to ongoing EU-funded research activities, especially in the scope of the H2020/5G-PPP framework for promoting important innovations from current-and applied-5G research activities and incentives for growth. Due to the high quality of the submissions, the Program Committee decided additionally to accept one more paper to be published as a short paper (10-pages long).

5G-PINE promotes, *inter-alia*, 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 the network management. Furthermore, based upon the well-known Self-Organizing Network (SON) functionalities, the 5G-PINE promotes 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 for the gaining of in-depth and detailed knowledge about the whole underlying 5G ecosystem, understanding hidden patterns, data structures, and relationships, and using them for a more efficient network management.

5G-PINE supports delivery of intelligence directly to network's edge, by exploiting the emerging paradigms of Network Functions Virtualisation (NFV), Software Defined Networking (SDN), Network Slicing, and Edge Cloud Computing. Moreover, it supports the promotion of rich virtualization and multi-tenant capabilities, optimally deployed close to the user. 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 strong emphasis on vertical applications, based on well-defined scenarios and/or selective use cases as promoted by the detailed 5G ESSENCE context. Another one among the important areas of interest has been around the original scope of the "5G-DRIVE" project promoting cooperation between EU and China, especially by discussing the proposed context for trials according to the corresponding European policy for realizing tests and trials, as well as by promoting the context for enhanced Mobile Broadband (eMBB) applications and "Vehicle-to-Everything" (V2X) communications. Last but not least, among the pillars of the 5G-PINE workshop there has also been the framework promoted by the ongoing H2020-MCSA-ITN "MOTOR-5G" project focusing on embedding AI into 5G communication systems for the smarter use of network-generated data, the automated enabling of network operators and service providers to adapt to changes in traffic patterns, security risks, and user behavior, thus paving the way towards safe and reliable next-generation wireless ecosystems.

The accepted papers focus on several innovative findings coming directly from modern European research in the area, that is from the 5G-PPP projects "5G-ESSENCE", "5G-DRIVE", "5G-PHOS", "5G-City", and "5G-MEDIA"; the H2020 "DataPorts" and "YAKSHA" projects; as well as from the Spanish "SONAR 5G" Grant all covering a wide variety of technical and business aspects and promoting options for growth and development in the respective market(s). One additional work also comes from the H2020-MCSA-ITN "MOTOR-5G" project. The other accepted papers cover broader aspects of current research activities in the respective domains, as briefly outlined before. All works are fully aligned to the objectives of the 5G-PINE 2020 scope and introduce innovative aspects.

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Preface

MHDW 2020

The abundance of available data, which is retrieved from or is related to the areas of 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 to understand human behavior, creativity, way 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, as well as 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 considered a significant challenge on its own. New techniques, appropriate to deal with this type of data, need to be proposed whereas existing ones must be 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 as well as knowledge discovery and management techniques (like decision rules, decision trees, association rules, ontologies and alignments, clustering, filtering, learning, classifier systems, neural networks, support vector machines, preprocessing, post processing, feature selection and visualization techniques) to data derived from all areas of Humanistic Sciences (e.g. linguistic, historical, behavioral, psychological, artistic, musical, educational, social, etc.) Ubiquitous Computing, as well as Bioinformatics.

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 centers consists of managing, processing, and computationally analyzing biological and biomedical data. Hence, one of the main aims of this workshop was to 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.

Topics of interest include but are not limited to (please see):
<https://conferences.cwa.gr/mhdw2020/workshop-aim/>

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