

Preface

Artificial Intelligence (AI) is a rapidly evolving and growing research area. During the last few decades it has expanded from a field of promise to one of actual delivery, with good practical application in almost every scientific domain. More specifically, during the last 5 years, AI algorithms have been applied more and more by Google in Facebook, by Microsoft (e.g., the CNTK that is an open source deep learning toolkit on GitHub) by Amazon, and by Baidu in China. The common core of all these recent research efforts is deep learning. Joaquin Candela, head of Facebook's Applied Machine Learning group, stated: "We're trying to build more than 1.5 billion AI agents, one for every person who uses Facebook or any of its products." Facebook is using a machine-learning platform known as the FBLeamer Flow. In fact, Facebook is already building AI that builds AI! Deep learning, deep neural networks, multi-agent systems and autonomous agents, image processing, biologically inspired neural networks (spiking ANN) are already a reality. Deep neural networks are changing the Internet.

The International Federation for Information Processing (IFIP) was founded in 1960 under the auspices of UNESCO, following the first historical World Computer Congress held in Paris in 1959. The First AIAI conference (Artificial Intelligence Applications and Innovations) was organized in Toulouse, France in 2004 by the IFIP. Since then, it has always been technically supported by the Working Group 12.5 "Artificial Intelligence Applications." After 12 years of continuous presence, it has become a well-known and recognized mature event, offering AI scientists from all over the globe the chance to present their research achievements and to cope with the AI research explosion that is taking place at a meteoric speed. The 12th AIAI was held in Thessaloniki, Greece, during September 16–18, 2016.

Following a long-standing tradition, this Springer volume belongs to the IFIP AICT series and it contains the accepted papers that were presented orally at the AIAI 2016 main conference and in the workshops that were held as parallel events. Three workshops were organized, by invitation to prominent and distinguished colleagues, namely:

- The Third MT4BD2016 (Workshop on New Methods and Tools for Big Data),
- The Fifth MHDW 2016 (Mining Humanistic Data Workshop), and
- The First 5G-PINE (Workshop on 5G-Putting Intelligence to the Network Edge).

It is interesting that two of these workshops have a continuous presence in the AIAI events, which means that they are well established in the AI community.

All papers went through a peer-review process by at least two independent academic referees. Where needed, a third and a fourth referee were consulted to resolve any potential conflicts. For the 12th AIAI conference, 65 papers were submitted. Out of these submissions, 30 papers (46.15 %) were accepted for oral presentation as full

ones, whereas another eight papers (12.3 %) were accepted as short ones. The authors of the accepted papers of the main event come from 12 different countries around the globe, namely: Brazil, Canada, China, Cyprus, Denmark, UK, Greece, India, Italy, Norway, Portugal, and USA.

As the title of the conference denotes, there are two core orientations of interest, basic research AI approaches and also applications in real-world cases. The diverse nature of the papers presented demonstrates the vitality of AI computing methods and proves the wide range of AI applications as well. The accepted papers of the 12th AIAI conference are related to the following thematic topics:

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| – Artificial Neural Networks | – Genetic Algorithms |
| – Classification | – Hybrid Systems |
| – Clustering | – Image and Video Processing |
| – Control Systems – Robotics | – Medical AI Applications |
| – Data Mining | – Multi-Agent Systems |
| – Engineering Applications of AI | – Ontology |
| – Environmental Applications of AI | – Optimization |
| – Feature Reduction | – Pattern Recognition |
| – Filtering | – Support Vector Machines |
| – Financial-Economics Modeling | – Text Mining |
| – Fuzzy Logic | – Web-Social Media Data AI Modeling |

Three distinguished keynote speakers were invited to deliver lectures at the 12th AIAI conference.

Professor Barbara Hammer (Bielefeld University, Germany) gave a talk entitled “Discriminative Dimensionality Reduction for Data Inspection and Classifier Visualization.” Barbara Hammer received her PhD in computer science in 1995 and her *venia legendi* in computer science in 2003, both from the University of Osnabrück, Germany. From 2000 to 2004, she was chair of the junior research group Learning with Neural Methods on Structured Data at University of Osnabrück before accepting the position of professor of theoretical computer science at Clausthal University of Technology, Germany, in 2004. Since 2010, she has held a professorship for theoretical computer science for cognitive systems at the CITEC cluster of excellence at Bielefeld University, Germany. Several research stays have taken her to Italy, UK, India, France, The Netherlands, and the USA. Her areas of expertise include hybrid systems, self-organizing maps, clustering, and recurrent networks as well as applications in bioinformatics, industrial process monitoring, or cognitive science. She chaired the IEEE CIS Technical Committee on Data Mining in 2013 and 2014, and she is chair of the Fachgruppe Neural Networks of the GI and vice-chair of the GNNS. She has been elected as IEEE CIS AdCom member for 2016–2018. Barbara has published more than 200 contributions to international conferences/journals, and she is coauthor/editor of four books.

Professor Aristidis Likas (University of Ioannina, Greece) delivered a talk entitled “Number of Clusters Estimation, Multi-view Clustering and Their Use for Video Summarization.” Aristidis Likas is a professor in the Department of Computer Science and Engineering of the University of Ioannina, Greece. He received his diploma in

electrical engineering from the National Technical University of Athens, Greece, in 1990 and his PhD degree in electrical and computer engineering from the same university in 1994. Since 1996, he has been with the Department of Computer Science and Engineering, University of Ioannina, Greece. He is interested in developing methods for machine learning/data mining problems (mainly classification, clustering, statistical and Bayesian learning) and in the application of these methods to video analysis, computer vision, medical diagnosis, bioinformatics, and text mining. His recent research focuses on techniques for estimating the number of clusters, kernel-based clustering, and multi-view clustering. He has published more than 80 journal papers and more than 80 conference papers attracting over 5,000 citations. Recently, he received a Best Paper Award at the ICPR 2014 conference. He has participated in several national and European research and development projects. He is a senior member of the IEEE. He served as an associate editor of the *IEEE Transactions on Neural Networks* journal and as general co-chair of the ECML PKDD 2011 and the SETN 2014 conferences.

Professor Jan Peters (Max Planck Institute for Intelligent Systems, TU Darmstadt, Germany) gave a talk on “Machine Learning of Motor Skills for Robots: From Simple Skills to Table Tennis and Manipulation.” Jan Peters is a full professor (W3) for intelligent autonomous systems at the Computer Science Department of the Technische Universität Darmstadt and at the same time a senior research scientist and group leader at the Max Planck Institute for Intelligent Systems, where he heads the interdepartmental Robot Learning Group. Jan Peters has received the Dick Volz Best 2007 US PhD Thesis Runner-Up Award, the Robotics: Science & Systems – Early Career Spotlight, the INNS Young Investigator Award, and the IEEE Robotics & Automation Society’s Early Career Award. Jan Peters has been honored for the development of new approaches to robot learning, robot architecture, and robotic methods and their applications for humanoid robots. In 2015, he was awarded an ERC Starting Grant. Jan Peters has studied computer science, electrical, mechanical, and control engineering at TU Munich and FernUni Hagen in Germany, and at the National University of Singapore (NUS) and the University of Southern California (USC). He has received four master’s degrees in these disciplines as well as a PhD in computer science from USC.

We are grateful to Professors Spyros Sioutas, Katia Lida Kermanidis (Ionian University, Greece), Christos Makris (University of Patras Greece), and Phivos Mylonas (Ionian University, Greece). Thanks to their invaluable contribution and hard work, the 5th MHDW workshop was held successfully once more and it has already become a well-accepted event running in parallel with AIAI.

It was a great pleasure to host the Third MT4BD in the framework of the AIAI conference. We wish to sincerely thank its organizers for their great efforts and for their invaluable contribution. More specifically we wish to thank Spiros Likothanassis (University of Patras, Greece) and Dimitris Tzovaras (CERTH/ITI, Thessaloniki, Greece) for this well-established event.

The First 5G-PINE (Putting Intelligence to the Network Edge) workshop was an important part of the AIAI 2016 conference and it was driven by the hard work of Ioannis P. Chochliouros (Hellenic Telecommunications Organization - OTE, Greece), Leonardo Goratti (CREATE-NET, Italy), Oriol Sallent (UPC Spain), Haris Mouratidis

(University of Brighton, UK), Ioannis Neokosmidis (INCITES, Luxembourg), and Athanasios Dardamanis (SmartNet, Greece).

All workshops had a high attendance from scientists from all parts of Europe and some from Asia (e.g., UK, Greece, India, Italy, Spain, and Turkey) and we would like to thank all participants for this. The workshops received 33 submissions of which 17 were accepted as full papers, while seven were selected to be presented as short ones.

The 12th organization of AIAI is a real proof of the brand name that the conference has gained among the circles of the international scientific community. After so many years of hard effort, it is recorded as a mature event with loyal followers and it has plenty of new and qualitative research results to offer to the international scientific community. We hope that the readers of these proceedings will be highly motivated and stimulated for further research in the domain of AI in general.

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