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Engineering Applications of Neural Networks

18th International Conference, EANN 2017 Athens, Greece, August 25–27, 2017 Proceedings

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Preface

The impact of technology on all areas of science and industry in the first two decades of the 21st century has been enormous. The rise of deep learning has been a milestone for the evolution of artificial neural networks (ANN). Deep ANN using multiple hidden layers are employed offering high performance. In deep networks each layer categorizes some kind of information, then it refines it before passing it to the next one, achieving a hierarchical representation. This way computers can use this technology to teach themselves. "You essentially have software writing software" (Jen-Hsun-Huang, CEO of graphics processing leader Nvidia).

The consequences are enormous in the United States. Equity funding of AI-focused start-ups reached an all-time high of more than U.S. $1 billion [CB Insights research firm]. There were 121 funding rounds for this kind of start-up during the last 3 months of 2016, which is really impressive compared with the 21 for the corresponding quarter of 2011. Google is running several deep learning research projects.

EANN, a well-established event with a very long and successful history, is always following the evolution of AI and moreover it aims at spreading it. Twenty-two years have passed since the first event in Otaniemi, Finland, in 1995. For the following years, it has had a continuous and dynamic presence as a major European scientific event. An important milestone was reached in 2009, when its guidance by a Steering Committee of the INNS (EANN Special Interest Group) was initiated. Thus, from that moment the conference has been continuously supported technically by the International Neural Network Society (INNS).

This CCIS Springer volume contains papers that were accepted for oral presentation at the 18th EANN conference and its satellite workshops. The event was held (August 25–27) in the "ZAFOLIA Hotel," Athens, Greece, and was supported by the Aristotle University of Thessaloniki and the Democritus University of Thrace.

Two workshops on timely AI subjects were organized successfully in the 2017 event:

- The 6th Mining Humanistic Data Workshop (MHDW) supported by the Ionian University and the University of Patras. The 6th MHDW was organized by Professor Christos Makris (University of Patras, Greece), Dr. Andreas Kanavos (University of Patras, Greece), and Phivos Mylonas (Ionian University, Greece). The Steering Committee of the MHDW comprises Dr. Ioannis Karydis, (Ionian University, Greece), Professor Katia Lida Kermanidis (Ionian University, Greece), and Professor Spyros Sioutas (Ionian University, Greece). We wish to express our gratitude to all of these colleagues for their invaluable contribution.
- The second Workshop on 5G-Putting Intelligence to the Network Edge (5G-PINE), which was driven by Dr. Ioannis P. Chochliouros (Hellenic Telecommunications Organization, OTE, Greece), Dr. Leonardo Goratti (Fondazione Bruno Kessler FBK, Italy), 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 Pais Vasco/ Euskal Herriko Unibertsitatea EHU, Spain), Dr. Emmanouil Kafetzakis (ORION Innovations Company, Greece), and Mr. Athanassios Dardamanis (Smartnet S.A., Greece). We would like to thank all of these colleagues for their hard work.

The diverse nature of papers presented demonstrates the vitality of neural computing and related soft computing approaches and proves the very wide range of ANN applications as well.

The Organizing Committee was delighted by the overwhelming response to the call for papers. All papers have passed through a peer-review process by at least two independent academic referees. Where needed, a third referee was consulted to resolve any conflicts. In total, 83 papers were submitted to the main event and 40 of them, around 48% were accepted as full papers in contract to the 5 papers that were accepted as short papers each and to be included in the proceedings with 12 pages maximum. Owing to the high quality of the submissions, the Program Committee decided that it should accept additionally five short papers that will be given 15 minutes for oral presentation and 10 pages each for the proceedings. The workshops also followed the same rules. More specifically, 5G-PINE accepted seven full papers out of 14 submissions, whereas MHDW accepted seven full out of 16 submissions.

The accepted papers of the 18th EANN conference are related to the following thematic topics:

- Spiking ANN
- Ensemble ANN
- Neuro Fuzzy
- Deep ANN
- Theoretical Aspects of ANN
- Agents and Constraints
- Fuzzy Modeling
- Medical ANN
- Feature Selection
- Emotion Recognition
- Hybrid Intelligent models
- Filtering
- Robotics-Machine vision
- Classification-Pattern Recognition
- Cryptography Applications
- Optimization
- Games
- Unsupervised Machine Learning

The authors of submitted papers came from 30 different countries from all over the globe, namely: Europe (Bulgaria, Czech Republic, Denmark, France, Germany, Greece, Italy, Norway, Romania, Spain, Slovakia, Turkey, UK), America (Brazil, Canada, Chile, USA, Mexico), Asia (China, India, Japan, Kazakhstan, Pakistan, Thailand, Taiwan, United Arab Emirates, Vietnam), Africa (Tunisia, Algeria), and Oceania (New Zealand). The authors of the accepted papers came from 15 countries of Europe, Asia, Africa, and America.

Three keynote speakers were invited and they gave lectures on timely aspects of AI and ANN.

- Professor Plamen Angelov from Lancaster University, UK, delivered a talk on "Empirical Data Analytics: Learning Autonomously from Data Streams." He leads the Data Science groups at the School of Computing and Communications of

Lancaster University, which includes over 20 academics, researchers, and PhD students and is one of the eight groups of the school. He is a Fellow of IEEE for contributions to neuro-fuzzy and autonomous learning systems. He is also member of the Board of Governors of the International Neural Networks Society (INNS), and Chair of the Technical Committee on Evolving Intelligent Systems of the IEEE Systems, Man and Cybernetics Society. He has (co-)authored over 200 peer-reviewed publications in leading journals, peer-reviewed conference proceedings, five patents, two research monographs (by Wiley, 2012, and Springer, 2002) and over a dozen other books. These publications have been cited over 5,000 times (Google Scholar) with an h-index of 34. He received a number of IEEE best paper awards (2006, 2009, 2012, 2013) and one of his papers was nominated for outstanding IEEE Transactions paper (2010). He leads numerous projects (including several multimillion ones) funded by UK research councils, EU, industry, UK Ministry of Defense. His research was recognized by The Engineer Innovation and Technology 2008 Special Award and "For Outstanding Services" (2013) by IEEE and INNS. He is also the founding Co-Editor-in-Chief of Springer's journal on *Evolving Systems* and Associate Editor of the leading international scientific journals in this area, including *IEEE Transactions on Cybernetics, IEEE Transactions on Fuzzy Systems* and several other journals including *Applied Soft Computing, Fuzzy Sets and Systems, Soft Computing,* etc. He was general chair of prime conferences (IJCNN 2013; INNS inaugural Conference on Big Data) and PC Co-chair of prime conferences (FUZZ-IEEE 2014, IEEE Intelligent Systems 2014, IJCNN 2016). He has given over a dozen plenary and keynote talks at high-profile conferences. More information can be found on his website www.lancs.ac.uk/staff/angelov.

- Professor Stefanos Kollias from University of Lincoln, UK, delivered a talk on "Developing Performance-Aware Trustful Neural Architectures for Complex Data Analysis." Stefanos Kollias has been the founding professor of Machine Learning in the College of Science of the University of Lincoln since September 2016. He has been Professor with the School of Electrical and Computer Engineering of the National Technical University of Athens since 1997 and Director of the Intelligent Systems, Content and Interaction Laboratory. He is an IEEE Fellow (2015, as suggested by the IEEE Computational Intelligence Society). He has been member of the Executive Committee of the European Neural Network Society (2007–2016). He has world-leading research activity in the fields of machine learning, intelligent systems (with emphasis on artificial neural networks), semantic multimedia analysis, semantic metadata interoperability, and affective computing. He has published over 100 papers in international journals and 300 papers in proceedings of international conferences. His research has been highly referenced (about 8,000 citations with an h-index of 41 in Google Scholar). He has supervised more than 40 PhD students. He has led his group participation in more than 100 European R&D projects, in which his group funding has been more than 20 million euro. He has received the following awards: Fellow in Intelligent Systems by IEEE (2015), Best Learning Game Award for the SIREN system (Games and Learning Alliance Network of Excellence, 2013), Beta Sprint Award for the MINT system (Digital Public Library of America, 2011), as well as several best paper awards at international conferences.

- Professor Wlodzislaw Duch from the Nicolaus Copernicus University, Torun, Poland, delivered a talk on "From Understanding the Brain to Neurocognitive Technologies." He received his MSc degree in theoretical physics (1977), PhD in quantum chemistry (1980), postdoc at University of Southern California (1980–1982), DSc in applied mathematics (1987). He worked at the University of Florida, Max Planck Institute, Kyushu Institute of Technology, Meiji and Rikkyo University in Japan, and several other institutions. Currently, he heads the Neurocognitive Laboratory in the Center of Modern Interdisciplinary Technologies, and the Department of Informatics, both at Nicolaus Copernicus University. During 2014–2015 he served as a Deputy Minister for science and higher education in Poland, and during 2011–2014 as the Vice-President for Research and ICT Infrastructure at his university. Before that he worked as Visiting Professor (2010–2012) in the School of Computer Engineering, Nanyang Technological University, Singapore, where he also worked as a visiting professor during 2003–2007. He is/was on the editorial board of IEEE TNN, CPC, NIP-LR, *Journal of Mind and Behavior*, and 14 other journals. He was also co-founder and scientific editor of the *Polish Cognitive Science* journal. For two terms he served as the President of the European Neural Networks Society executive committee (2006–2011). The International Neural Network Society Board of Governors elected him to their most prestigious College of Fellows. He works as an expert of the European Union science programs; he published over 300 scientific and over 200 popular articles on diverse subjects; he has written or co-authored four books and co-edited 21 books, his DuchSoft company has made GhostMiner software package marketed by Fujitsu company. He is well known for development of computational intelligence (CI) methods that facilitate understanding of data, general CI theory based on similarity evaluation and composition of transformations, meta-learning schemes that automatically discover the best model for a given data.

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

August 2017

Giacomo Boracchi
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