Ilias Maglogiannis
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Artificial Intelligence Applications and Innovations

18th IFIP WG 12.5 International Conference, AIAI 2022
Hersonissos, Crete, Greece, June 17–20, 2022
Proceedings, Part I

Part I

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Proceedings, Part I

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Preface

Artificial intelligence (AI) is a relatively new scientific area that emerged from the efforts of a handful of scientists from diverse fields approximately 70 years ago. The achievements of AI in the era of the 4th Industrial Revolution are amazing and the expectations are continuously rising. Today AI applications are found in almost all areas of human activities. Healthcare, finance, industry, security, robotics, molecular biology, and autonomous vehicles are only a small sample of the domains that have been influenced by artificial intelligence. However, serious ethical matters have emerged (e.g., privacy, surveillance, bias-discrimination, elimination of entire job categories) requiring corrective legislative actions.

The 18th International Conference on Artificial Intelligence Applications and Innovations (AIAI 2022) 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 also introduced.

AIAI is a mature international scientific conference that has been held all over the world and it is well established in the scientific area of AI. Its history is long and very successful, following and propagating 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 series and it contains the papers that were accepted to be presented orally at the AIAI 2022 conference. An additional volume collates the papers that were accepted and presented at the workshops which were held as parallel events. The event was collocated with the 23rd International Conference on Engineering Applications of Neural Networks (EANN 2022) and held during June 17–20, 2022, in Crete, Greece. The diverse nature of papers presented demonstrates the vitality of AI algorithms and approaches. It certainly proves the very wide range of AI applications as well.

The response of the international scientific community to the AIAI 2022 call for papers was more than satisfactory, with 158 papers initially submitted. All papers were peer reviewed by at least two independent academic referees. Where needed, a third referee was consulted to resolve any potential conflicts. A total of 72 papers (45.5%) of the submitted manuscripts were accepted to be published as full papers (12 pages long) in the proceedings. Owing to the high quality of the submissions, the Program Committee also decided to accept 11 manuscripts as short papers (10 pages long). The accepted papers cover the following thematic topics and application areas:

- Adaptive Modeling
- Adversarial Neural Networks

- AI and Energy Modeling
- Anomaly Detection Modeling and AI
- Autonomous Shuttles Modeling and AI
- Classification
- Cloud Data Modeling and AI
- Clustering
- Convolutional Neural Networks
- Cybersecurity and AI
- Deep Learning in Medical Applications
- Deep Learning and Fraud Detection
- Deep Learning Models for Face Mask Detection
- Environmental AI Modeling
- Evolutionary and Genetic Algorithms
- Explainable AI
- Feature Selection
- Financial Applications of AI
- Fuzzy Modeling
- Graph Representation of AI Models
- Intrusion Detection Using AI
- IoT
- Industry 4.0
- Learning
- Machine Learning
- Medical AI Modeling
- Metaheuristics
- Molecular Biology AI Modeling
- Natural Language
- Neural Networks Modeling
- Object Detection-Tracking and AI
- Pruning and AI
- Recommendation Systems
- Recurrent Modeling of the Primary Visual Cortex
- Reinforcement Models for Cryptocurrency
- Sentiment Analysis
- Speech and Emotion Recognition
- Text Mining and AI
- Timeseries AI Modeling
- Trading
- Transfer Learning Modeling
- Unsupervised Modeling

The authors of the accepted papers are based in 28 different countries all over the globe, namely, Austria, Brazil, Cyprus, the Czech Republic, Denmark, France, Germany, Greece, Hungary, India, Ireland, Italy, Japan, Lebanon, the Netherlands, Norway, China, Pakistan, Poland, Portugal, South Africa, Saudi Arabia, Serbia, Singapore, Spain, Turkey, the UK, and the USA.

The following seven scientific workshops on timely AI subjects were organized under the framework of AIAI 2022.

- The 11th Mining Humanistic Data Workshop (MHDW 2022)

MHDW 2022 was organized by the University of Patras and the Ionian University, Greece. It aimed to bring together interdisciplinary approaches that focus on the application of innovative as well as existing artificial intelligence, data matching, fusion and mining, and knowledge discovery and management techniques to data derived from all areas of humanistic sciences.

- The 7th Workshop on 5G-Putting Intelligence to the Network Edge (5G-PINE 2022)

The 7th 5G-PINE workshop was organized by the research team of the Hellenic Telecommunications Organization (OTE) in cooperation with many major partner companies. The 5G-PINE workshop was established to disseminate knowledge obtained from ongoing 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 on artificial intelligence in modern 5G telecommunications infrastructures. This is achieved by emphasizing results, methodologies, trials, concepts and/or findings originating from technical reports/deliverables, related pilot actions, and/or any other relevant 5G-based applications intending to enhance intelligence to the network edges.

- The 2nd Workshop on Artificial Intelligence and Ethics (AIETH 2022)

The 2nd AIETH workshop was coordinated and organized by John Macintyre (University of Sunderland, UK). It aimed to emphasize the need for responsible global AI. The respective scientific community must be preparing to act preemptively and ensure that our societies will avoid negative effects of AI and of the 4th Industrial Revolution in general. This workshop offered an extensive discussion on potential major ethical issues that might arise in the near future.

- The 2nd Workshop on Defense Applications of AI (DAAI 2022)

The 2nd DAAI workshop was organized by the European Defense Agency (EDA), a European Union (EU) organization. Defense and security systems are becoming more and more complicated and at the same time equipped with a plethora of sensing devices which collect an enormous amount of information both from their operating environment as well as from their own functioning. Considering the accelerating technology advancements of AI, it is likely that it will have a profound impact on practically every segment of daily life, from the labor market to business and service provision. The security and defense sectors will not remain idle or unaffected by this technological evolution. On the contrary, AI is expected to transform the nature of future defense and security domains, because by definition defense and security forces are highly dependent on (accurate) data and (reliable) information. DAAI 2022 aimed at presenting recent evolutions in artificial intelligence applicable to defense and security applications.

- The 1st Workshop on AI in Energy, Buildings and Micro-Grids (AIBMG 2022)

This workshop was organized by Center for Research and Technology (CERTH), Greece. Sustainable energy is hands down one of the biggest challenges of our times. As the EU sets its focus on reaching its 2030 and 2050 goals, the role of artificial intelligence in the energy domain at the building, district, and micro-grid level becomes more prevalent. The EU and member states are increasingly highlighting the need to complement IoT capacity (e.g., appliances and meters) with artificial intelligence capabilities (e.g., building management systems, proactive optimization, prescriptive maintenance). Moreover, moving away from the centralized production schema of the grid, novel approaches are needed not just for reducing energy consumption but also for the optimal management and/or balancing of local (or remote aggregated net metering) generation and consumptions.

The aim of the AIBMG workshop was to bring together interdisciplinary approaches that focus on the application of AI-driven solutions for increasing and improving energy efficiency of residential and tertiary buildings without compromising the occupants' well-being. Applied directly at either the device, building, or district management system level, the proposed solutions should enable more energy efficient and sustainable operation of devices, buildings, districts, and micro-grids. The workshop also welcomed cross-domain approaches that investigate how to support energy efficiency by exploiting decentralized, proactive, plug-n-play solutions.

- The 2nd Workshop on Artificial Intelligence in Biomedical Engineering and Informatics (AIBEI 2022)

Artificial intelligence (AI) is gradually changing the routine of medical practice, and the level of acceptance by medical personnel is constantly increasing. Recent progress in digital medical data acquisition through advanced biosignal and medical imaging devices, machine learning, and high-performance cloud computing infrastructures push health-related AI applications into areas that were previously thought to be only the province of human experts. Such applications employ a variety of methodologies, including fuzzy logic, evolutionary computing, neural networks, or deep learning, for producing AI-powered models that simulate human physiology.

- The 1st Workshop/Special Session on Machine Learning and Big Data in Health Care (ML@HC 2022)

In the present era, machine learning (ML) has been extensively used for many applications to real-world problems. ML techniques are very suitable for big data mining, to extract new knowledge and build predictive models that, given a new input, can provide in the output a reliable estimate. On the other hand, healthcare is one of the fastest growing data segments of the digital world, with healthcare data increasing at a rate of about 50% per year. There are three primary sources of big data in healthcare: providers and payers (including EMR, imaging, insurance claims, and pharmacy data), -omic data (including genomic, epigenomic, proteomic, and metabolomic data), and patients and non-providers (including data from smart phone and Internet activities, sensors, and monitoring tools).

The growth of big data in oncology, as well as other severe diseases (such as Alzheimer's Disease) can provide unprecedented opportunities to explore the biopsychosocial characteristics of these diseases and for descriptive observation, hypothesis generation, and prediction for clinical, research and business issues. The results of big data analyses can be incorporated into standards and guidelines and will directly impact clinical decision making. Oncologists and professionals from related medical fields can increasingly evaluate the results from research studies and commercial analytical products that are based on big data, based on ML techniques. Furthermore, all these applications can be Web-based, so are very useful for the post-treatment of the patients.

The aim of this workshop/special session was to serve as an interdisciplinary forum for bringing together specialists from the scientific areas of computer and web engineering, data science, semantic computing, and bioinformatics-personalized medicine, along with clinicians and caregivers. The focus of this special session was on current technological advances and challenges regarding the development of big data-driven algorithms, methods, and tools; furthermore, it sought to investigate how ML-aware applications can contribute towards big data analysis on post-treatment follow up.

In addition to the paper presentations and workshops, five invited speakers gave keynotes on timely aspects or state-of-the-art applications of artificial intelligence. The keynote presentations were held jointly with EANN 2022. Hojjat Adeli from Ohio State University, USA, gave a speech on "Machine Learning: A Key Ubiquitous Technology in the 21st Century". Riitta Salmelin from Aalto University, Finland, addressed "What neuroimaging can tell about human brain function". Elisabeth André from the University of Augsburg, Germany, discussed "Socially Interactive Artificial Intelligence: Perception, Synthesis and Learning of Human-like Behaviors". Verena Rieser from Heriot-Watt University, UK, gave a speech on the subject of "Responsible Conversational AI: Trusted, Safe and Bias-free" and John Macintyre from the University of Sunderland, UK, addressed the wider AI and ethics area in his talk "Is Big Tech Becoming the Big Tobacco of AI?".

On behalf of the organizers, we would like to thank everyone involved in AIAI 2022, and we hope that you find the proceedings interesting and insightful.

June 2022   Ilias Maglogiannis
                                                                                          Lazaros Iliadis
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Abstracts of Invited Talks

What Neuroimaging Can Tell About Human Brain Function

Riitta Salmelin

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Abstract. Over the past few decades, real-time tracking of cortical current flow (magneto/electroencephalography, MEG/EEG) and accurate localization of blood oxygenation changes (functional magnetic resonance imaging, fMRI) have offered windows to the functional architecture of the human brain. The neuroimaging domain has reached its first level of maturity: we now know how to measure and quantify different types of signals and, phenomenologically, we know what type of group-level functional effects to expect in a large variety of experimental conditions. Specific brain areas, networks and electrophysiological dynamics have been proposed to be linked with various perceptual, motor and cognitive functions and their disorders. To reach the next phase in human neuroscience, we need to advance from group-level descriptions to quantitative model-based individual-level predictions. These developments will be illustrated with focus on language function for which descriptive models, largely based on observations of patients with language disorders, are being supplemented by computationally explicit models of mechanisms and representations. Machine learning approaches are essential tools in this endeavor.

Socially Interactive Artificial Intelligence: Perception, Synthesis and Learning of Human-Like Behaviors

Elisabeth Andre

Human-Centered Artificial Intelligence, Institute for Informatics,
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Abstract. The automatic analysis and synthesis of social signals conveyed by voice, gestures, mimics, etc., will play a vital role for next-generation interfaces as it paves the way towards a more intuitive and natural human-computer interaction with robots and virtual agents. In my talk, I will present computational methods to implement socially interactive behaviors in artificial agents, focusing on three essential properties of socially interactive interfaces: Social Perception, Socially Aware Behavior Synthesis, and Learning Socially Aware Behaviors. I will highlight opportunities and challenges that arise from deep learning approaches that promise to achieve the next level of human-likeness in virtual agents and social robots. I will illustrate my talk with examples from various applications with socially interactive characters or robots, including art and entertainment, cultural training and social coaching, and personal well-being and health.

Responsible Conversational AI: Trusted, Safe and Bias-Free

Verena Rieser

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Abstract. With recent progress in deep learning, there has been an increased interest in learning dialogue systems from data, also known as "Conversational AI". In this talk, I will focus on the task of response generation, for which I will highlight lessons learnt and ongoing challenges, such as reducing `hallucinations for task-based systems, safety critical issues for open-domain chatbots, and the often-overlooked problem of 'good' persona design. I will argue that we will need to solve these challenges to create trusted, safe and bias-free systems for end-user applications.

Is Big Tech Becoming the Big Tobacco of AI?

John Macintyre

Dean of the Faculty of Applied Sciences and Pro Vice Chancellor at University of Sunderland
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Abstract. The future of AI is being shaped by many forces – politics, economics, and technology all play their part. Whilst science and academia continue to push forward the boundaries of knowledge, private sector investment in AI is growing exponentially, with commercial revenues from AI expected to exceed $500 billion in the near future. At the forefront of this commercial boom in AI is so-called "Big Tech" – the biggest technology companies driving the commercialization of AI products and systems for profit. These companies have vast R&D budgets, and employ an increasingly large fraction of the AI R&D workforce globally. The question is: are they living up to their responsibilities to develop AI for the good of society, or are they just pursuing profit? Will Big Tech follow the very negative pattern of huge companies prepared to inflict harms on society to boost their profits and shareholder dividends? Professor John MacIntyre's talk will look at the emerging issues in AI and examine what impact the behaviour of Big Tech is having on the whole field of AI.

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