Editorial

Special collection of invited original research papers on "Contributions by women in theory and applications of artificial intelligence"

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Abstract. Artificial Intelligence research is presenting phenomenal progress in two directions: (i) new theories and methodologies, and (ii) applications that expand traditional domains with innovative interventions. As indicated by recent reports, this progress has created a disequilibrium, where demand for scientists with skills in Artificial Intelligence is not fulfilled, a trend that will intensify further in the years to come. A potential solution to this shortage of specialised workforce may come from encouraging more *women* to get educated and follow a career in one of the Artificial Intelligence areas. This special collection of invited papers is dedicated to all women researchers and practitioners in Artificial Intelligence and coincides with the March 8, 2023 International Women's Day. Moreover, it has two specific goals: (i) to inspire more women to study and practice Artificial Intelligence through presentation of recognized women researchers who can act as role models, and (ii) to highlight some streamlined research areas of Artificial Intelligence.

Editorial note

Artificial Intelligence can be defined as the broad scientific area that aims at incorporating *improvement abilities* into machines [1]. As such, Artificial Intelligence has been evolving for more than seven decades, following many and diverse directions. Relevant research has resulted in a very rich variety of mechanisms, methodologies, procedures and algorithms, which successfully and efficiently address very specific or more general tasks [2–4].

Despite its long history, Artificial Intelligence remains to date a field of intense research worldwide. On one hand, new theoretical advances are constantly announced, while on the other hand new application areas emerge at a dazzling rate and are met with success. In fact, the term "*disruptive technology*" is the most appropriate one to describe the impact of Artificial Intelligence on all aspects of human activities and social spaces, including the workplace, people's homes and both professional and social human relationships and interactions [5].

Looking at the foreseeable future, it appears certain that new technological challenges (e.g. 4th Industrial Revolution [6]) and societal demand (e.g. Society 5.0 [7,8]) will continue to exercise pressure for further

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progress in Artificial Intelligence theory and practice. Examples of areas requiring further research in Artificial Intelligence include the Internet of Things and the rate of collection of high-quality data with smart sensors, as in smart homes [9], smart cities [10–12], smart industries [13], smart medicine and healthcare [14,15], or smart education [16].

The shortage of trained scientists and researchers with education and skills in the domain of Artificial Intelligence and the related fields has reached a point where market demand significantly exceeds market availability [17,18]. A recent Deloitte report [19] suggests that the shortage in Artificial Intelligence talent could be overcome if more women got involved as "a 2020 World Economic Forum report, however, found that women make up only 26 percent of data and AI positions in the workforce, while the Stanford Institute for Human-Centered AI's 2021 *AI Index Report* found that women make up just 16 percent of tenure-track faculty focused on AI globally."

Consequently, attracting more women into the Artificial Intelligence field appears to be an urgent need [20]. This can be achieved either via formation of supporting communities [21] or via showcasing women at the forefront of Artificial Intelligence research [22]. As guest editors of the special issue on "Contributions by Women in the Theory and Applications of Artificial Intelligence", we were aiming at two targets:

– to highlight significant research led by *women* in areas of Artificial Intelligence and, thus, inspire other women to follow studies in the area and get involved in related research, and
– to highlight the state-of-the-art and current research in selected Artificial Intelligence areas and applications.

We *aspired to attract literary contributions* from a small number of selected women-researchers who are recognized for their research in areas of Artificial Intelligence. We also made sure that the invited contributors covered broader areas within the Artificial Intelligence discipline and that the overlap among papers was minimized. Finally, we made sure that the papers included were self-contained and accompanied by a sufficiently extensive related bibliography. A biographical sketch of the (leading) woman-researcher was also included at each paper end.

In more detail, the special issue consists of the current editorial note and an additional nine (9) papers, as follows:

The first paper, by Maria Virvou, is entitled: "*Artificial Intelligence and User Experience in Reciprocity: Contributions and State of the Art*". The author conducts a critical analysis of published academic works and research studies related to Artificial Intelligence and User Experience, exploring their interrelationship and the cause-effect cycle between the two. It is shown that, in order to create effective and user-friendly Artificial Intelligence systems, it is important to also consider the impact of Artificial Intelligence on the user experience in the emerging era of Human-Artificial Intelligence Interaction.

The second paper, by Mika Sato-Ilic, is entitled: "*Fuzzy Clustering-based Classifier for Extraction of Individualities from High Dimension Low Sample Size Data*". The author has previously proposed a fuzzy cluster scaled Principal Component Analysis. In this work, she presents a study of the applicability of her method on the discrimination of individual subjects monitored via sensors worn on their body during several activities.

The third paper, by Sheela Ramanna, is entitled: "*Tolerance – based Granular Methods: Foundations and Applications in Natural Language Processing*". The author presents a review of the foundations of three tolerance-based granular computing methods, namely rough sets, fuzzy-rough sets and near sets, for representing structured (documents) and unstructured (linguistic entities) text.

The fourth paper, by Margarita N. Favorskaya, is entitled: "*Face Presentation Attack Detection: Research Opportunities and Perspectives*". The author presents a systematic survey in face anti-spoofing with prognostic trends in this research area. Specifically, she examines five types of generalization, namely

transfer learning, anomaly detection, few-shot and zero-shot learning, auxiliary supervision, and multi-spectral methods, and discusses trends and perspectives in facial biometrics.

The fifth paper, by Tomoko Kaneko, is entitled: "*Naturally Decision Intelligence – Perfect Algorithm generated by Hypothetical and Synchronizing Model for Life System*". The author summarizes the ideas of proponents of Decision Intelligence, the promotion of digital decision making toward automation, and trends in Western companies and Japan. She also uses risk management procedures to ensure safety in automated driving and outlines current challenges in the area of Decision Intelligence.

The sixth paper, by Monica Bianchini and Giovanna Maria Dimitri, is entitled: "*Deep Learning Techniques for Biomedical Data Processing*". The authors present a broad overview of Deep Learning models and their applications to biomedical data processing, medical image analysis, sequence processing (RNA and proteins) and graph modelling of molecular data interactions.

The seventh paper, by Takako Nakatani, Kazuaki Sato and Osamu Shigo, is entitled: "*Traverser: A Method and a Tool to Extract User's Traverses within Web Systems from Ontology*". The authors present *Traverser*, which is a method to guide website visitors from a starting point to their destination. The effectiveness of *Traverser* is evaluated by comparing the requirements derived by *Traverser* with those of the use case approach.

The eighth paper, by Irina Astrova, is entitled: "*Anti-Money Laundering Powered by Graph Machine Learning: "Show Me Your Friends and I Will Tell You Who You Are"*". The author describes an algorithm called *Anti-TrustRank* and demonstrates how it can be used to identify money launderers. *Anti-TrustRank* uses a very small set of confirmed money launderers and seeks out customers directly or indirectly linked to them.

Finally, the ninth paper, by Smaranda Belciug is on "*Artificial Intelligence and the Second Trimester of Pregnancy – A Literature Survey*". The author presents the state-of-the-art in application of Artificial Intelligence to sonography during the second trimester of pregnancy.

It is our hope that this special collection will play some part in inspiring more women to study Artificial Intelligence and get involved in related application, development and research areas. It is also our hope that professors, researchers, scientists, engineers and students, as well as general readers, will benefit from the original research reported in this paper collection. Finally, as advances in the theory and applications of Artificial Intelligence are mounting, it is our commitment to continue to edit similar special collections.

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