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Aurona Gerber (Ed.)

Artificial Intelligence Research

First Southern African Conference for AI Research, SACAIR 2020
Muldersdrift, South Africa, February 22–26, 2021
Proceedings

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Preface

This volume of Springer CCIS (CCIS 1342) contains the revised accepted papers of the the First Southern African Conference for Artificial Intelligence Research (SACAIR 2020)[1].

Foreword from the Conference Chair

Dear authors and readers,

It is with great pleasure that I write this foreword to the proceedings of the First Southern African Conference for Artificial Intelligence Research (SACAIR 2020), to be held on the West Rand of Johannesburg, South Africa, during February 22–26, 2021[2]. The program includes an unconference for students on February 22 (a student driven event for students to interact with each other as well as with sponsors and other possible employers), a day of tutorials on February 23, and the main conference during February 24–26.

SACAIR 2020 is the second international conference focused on Artificial Intelligence (AI), hosted by the Centre for AI Research (CAIR), South Africa. The inaugural CAIR conference, the Forum for AI Research (FAIR 2019), was held in Cape Town, South Africa, in December 2019, and SACAIR 2020 will build on its success.

The Centre for AI Research (CAIR)[3] is a South African distributed research network that was established in 2011 with the aim of building world class AI research capacity in South Africa. CAIR conducts foundational, directed, and applied research into various aspects of AI through its nine research groups based at six universities (the University of Pretoria, the University of KwaZulu-Natal, the University of Cape Town, Stellenbosch University, University of the Western Cape, and North West University). Research groups at CAIR include an Adaptive and Cognitive Systems Lab situated at the University of Cape Town, an AI and Cybersecurity research group at the University of the Western Cape, an AI for Development and Innovation group at the University of Pretoria, two Machine Learning groups focused on deep learning at North West University and the University of Kwa-Zulu Natal, a Knowledge Abstraction and Representation group at Stellenbosch University, an Ethics of AI research group at the University of Pretoria, a Knowledge Representation and Reasoning group at the

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[1] https://sacair.org.za/

[2] The original date was November 30–December 4, 2020, but, due to the COVID-19 pandemic, the conference was pushed into 2021 in the hope of being able to retain its face-to-face format in the interest of building an AI community in Southern Africa.

[3] https://www.cair.org.za/.

University of Cape Town, and a Mathematical and Computational Statistics group focused on applied data science at the University of Pretoria.

The theme for SACAIR 2020 is "AI transforming Humanity." AI technologies in their current data-driven form have the potential to transform our world for the better. Applications of AI technologies in healthcare, agriculture, restoration of the environment and ecosystems, energy, water management, identification of social patterns and bias, law enforcement, education, information, connectivity, smart city and infrastructure planning, performing and creative arts, and many other areas are proof of this.

However, humans are faced with serious challenges in the context of AI advances in all areas of their lives, as wide apart as employment and labor on the one hand, and social companionship on the other. In the context of Machine Learning applications, these challenges lead to concerns around fairness, structural bias, and amplification of existing social stereotypes, privacy, transparency, accountability, and responsibility, and trade-offs among all these concerns, especially within the context of security, robustness, and accuracy of AI systems. Furthermore, AI technologies can perform tasks that previously only humans could perform, such as calculating the best treatment for certain illnesses and caring for older persons. In some cases this is a good thing, but in some it challenges human agency and experience, and even political stability in profound ways. Human notions of morality, of responsibility, and of ethical decision-making are challenged in ways humanity has never before encountered. In addition, children grow up in novel contexts impacted on by technological manipulation of social narratives and we do not yet know what the impact of this will be. In its turn, media and information literacy has become an essential skill just as important as technical skills. Finally, there are also cultural concerns such as the loss of nuances of human languages and expression in the context of NLP, concerns around the ownership of art, and others.

The choice of conference theme was intended to ensure multi-disciplinary contributions that focus both on the technical aspects and social impact and consequences of AI technologies. In addition, there is a healthy balance between contributions from logic-based AI and those from data-driven AI, as the focus on knowledge representation and reasoning remains an important ingredient of studying and extending human intelligence. In line with the above, it was decided that the conference topics would cover five broad areas of AI: Machine Learning, Knowledge Representation and Reasoning, Applications of AI, AI for Ethics and Society, and AI for Development and Social Good. In line with the theme, Peter-Paul Verbeek, the chair of the UNESCO Commission on the Ethics of Scientific Knowledge and Technology (COMEST), and chair of the Philosophy of Human-Technology Relations research group, and co-director of the DesignLab at the University of Twente, The Netherlands, will deliver the opening keynote.

We expect this multi- and interdisciplinary conference to grow into the premier AI conference in Southern Africa, as it brings together nationally and internationally established and emerging researchers from across various disciplines including Computer Science, Mathematics, Statistics, Informatics, Philosophy, and Law. The conference is also focused on cultivating and establishing a network of talented students working in AI from across Africa.

I sincerely thank the technical chair, Aurona Gerber, for her hard work on the volume and the editorial duties performed. A thank you to the program chairs (Aurona Gerber, Anne Gerdes, Giovanni Casini, Marelie Davel, Alta de Waal, Anban Pillay, Deshendran Moodley, and Sunet Eybers), the local and international panel of reviewers, our keynotes, and the authors and participants for their contributions. Last but not least, our gratitude to the members of the Organizing Committee (Aurona Gerber, Anban Pillay, and Alta de Waal), student organizers (Karabo Maiyane, Emile Engelbrecht, Nirvana Pillay, and Yüvika Singh) and our sponsors, specifically the AIJ division of IJCAI, without whom this conference would not have been realized.

November 2020   Emma Ruttkamp-Bloem

Message from the Technical Chair

Dear readers,

This volume of CCIS contains the revised accepted papers of SACAIR 2020. We are thankful that our first annual Southern African Conference for Artificial Intelligence Research elicited the support it did during this challenging year with all the uncertainties due to the COVID-19 pandemic.

We received more than 70 abstracts, and after submission and a first round of evaluation, 53 papers were sent out for review to our SACAIR Program Committee. The 53 SACAIR submissions were solicited according to five topics: AI for Ethics and Society (9), AI in Information Systems, AI for Development and Social Good (3), Applications of AI (25), Knowledge Representation and Reasoning (8), and Machine Learning Theory (8).

The Program Committee comprised 72 members, 13 of whom were from outside Southern Africa. Each paper was reviewed by at least three members of the Program Committee in a rigorous, double-blind process whereby especially the following criteria were taken into consideration: Relevance to SACAIR, Significance, Technical Quality, Scholarship, and Presentation that included quality and clarity of writing. For this CCIS volume, 19 full research papers were selected, which translates to an acceptance rate of 35.8%. The accepted full research papers per topic are: AI for Ethics and Society (3), AI in Information Systems, AI for Development and Social Good (1), Applications of AI (8), Knowledge Representation and Reasoning (4), and lastly, Machine Learning Theory (3).

Thank you to all the authors and Program Committee members, and congratulations to the authors whose work was accepted for publication in this Springer volume. We wish our readers a fruitful reading experience with these proceedings!

November 2020   Aurona Gerber

SACAIR Sponsors

The sponsors of SACAIR 2020, *The Journal of Artificial Intelligence* and the *Centre for AI Research (CAIR)*, are herewith gratefully acknowledged.

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