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Advances in Computer Games (ACG 2023) conference report

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The 18th *Advances in Computer Games* conference (ACG 2023) took place during 28–30 November 2023. The conference was held under the auspices of the International Computer Games Association (ICGA). It was conducted online and coordinated between the University of Siegen (Germany), Japan Advanced Institute of Science and Technology (Japan), Maastricht University (the Netherlands), IBM Research (Japan), and the University of Alberta (Canada), who provided the Zoom stream on which the conference was conducted.

The biennial *Advances in Computer Games* conference series is a major international forum for researchers and developers interested in all aspects of artificial intelligence and computer game playing. Earlier conferences took place in London (1975), Edinburgh (1978), London (1981, 1984), Noordwijkerhout (1987), London (1990), Maastricht (1993, 1996), Paderborn (1999), Graz (2003), Taipei (2005), Pamplona (2009), Tilburg (2011), Leiden (2015, 2017), Macao (2019) and online (2021). For the past 20 years, the conference has been held every second year, alternating with the *Computers and Games* conference.

A total of 29 papers were submitted to ACG 2023, with 2 being desk-rejected and 14 accepted for presentation. In the single-blind review process, nearly every submission underwent at least three reviews, except for four submissions with two reviews available. The ACG 2023 program consisted of four keynote talks and five regular paper sessions, as listed below. All presentation videos are available online.[1]

1. SESSION 1: CHESS AND ITS VARIANTS

The opening session, chaired by Todd Neller, focussed on game-playing programs in chess-related games. These included "Making Superhuman AI More Human in Chess" by Daniel Barrish, Steve Kroon and Brink van der Merwe, "Merging Neural Networks with Traditional Evaluations in Crazyhouse" by Anei Makovec, Johanna Pirker and Matej Guid, and "STOCKFISH or LEELA CHESS ZERO? A Comparison Against Endgame Tablebases" by Quazi Asif Sadmine, Asmaul Husna and Martin Müller.

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[1] https://youtube.com/playlist?list=PLkyigfX_YEA4_mG2-FOhOINjLHeuf9q7-

2. KEYNOTE: MARTIN MÜLLER *Solution Methods for Two Player Games*

The first keynote speaker was Martin Müller, the DeepMind Chair in Artificial Intelligence at the University of Alberta. He was introduced by Jonathan Schaeffer. Martin has spent thirty years advancing the fields of algorithms, artificial intelligence, and combinatorial game theory. His dedication to advancing heuristic search techniques and his impact on the theoretical and practical aspects of AI research are evident in numerous publications and successful applications. In his talk, he provided a comprehensive overview of the current status of solution methods in gaming. He covered games that have been solved in the past 21 years, along with ongoing challenges that researchers are currently addressing as well as challenges that will be interesting to tackle in the future.

3. SESSION 2: SOLVING GAMES

This session, chaired by Ryan Hayward, presented new methods for game solving or new results of game analyses. The papers presented were "Solving NoGo on Small Rectangular Boards" by Haoyu Du, Ting Han Wei and Martin Müller, and "Optimal Play of the Great Rolled Ones Game" by Todd W. Neller, Quan H. Nguyen, Phong T. Pham, Linh T. Phan and Clifton G.M. Presser.

4. KEYNOTE: FRANK LANTZ *Games, Computability, AI, and Aesthetics*

The second keynote speech was given by Frank Lantz (NYU Game Center), introduced by Cameron Browne. Frank is a visionary game designer and founding chair of the New York University Game Center. With over 20 years of experience, he has not only shaped the landscape of game design but also co-founded influential game development entities and pioneered large-scale, real-world games. In his talk, he endeavored to redefine our perception of "aesthetics", urging us to view it as a broad category encompassing all games within the realm of human activity. He challenged us to recognize games not merely as entertainment but as an art form——an overarching aesthetic experience that transcends traditional boundaries.

5. KEYNOTE: HIROYUKI IIDA *Using Games to Study Law of Motions in Mind*

Ting Han Wei introduced the third keynote speaker, Hiroyuki Iida, the Vice-President of the Japan Advanced Institute of Science and Technology. Hiroyuki's extensive expertise lies in heuristic search, artificial intelligence, game-refinement theory, and entertainment technology. Over the years, he has significantly contributed to the development of AI, particularly in the realm of game tree search and decision-making systems. He is well known for his contribution to the game of shogi. In his talk, he explored the concept of gravity in mind, shaping the balance between objectivity and subjectivity in gameplay. He suggested that when a game's outcome becomes predictable, a timely conclusion is crucial to prevent monotony, emphasizing the losing player's role in maximizing the game's artistic value. He argued that this concept can be utilized to provide and analyze exciting game experiences, ensuring that comfort and discomfort are in harmony.

6. SESSION 3: BOARD GAMES AND CARD GAMES

Kazuki Yoshizoe chaired this session on various investigations based on classical board games and card games. This session included the papers "MCTS with Dynamic Depth Minimax" by James Ji and Michael Thielscher, "Can We Infer Move Sequences in Go from Stone Arrangements?" by Chu-Hsuan Hsueh and Kokolo Ikeda, and "Quantifying Feature Importance of Games and Strategies via Shapley Values" by Satoru Fujii.

7. SESSION 4: PLAYER INVESTIGATION

This session, chaired by Reijer Grimbergen, investigated player experience in video games. The papers included "The Impact of Wind Simulation on Perceived Realism of Players" by Zeynep Burcu Kaya Alpan and Şenol Pişkin, and "Hades Again and Again: A Study on Frustration Tolerance, Physiology and Player Experience" by Maj Frost Jensen, Laurits Dixen and Paolo Burelli.

8. KEYNOTE: TRISTAN CAZENAVE *Bootstrapping Artificial Intelligence*

The fourth and final keynote speaker was Tristan Cazenave (LAMSADE Université Paris Dauphine PSL CNRS), introduced by Jaap van den Herik. Tristan is a prominent figure in the field of artificial intelligence, particularly known for his work on computer games, artificial intelligence in games, and game-playing programs. He has made significant contributions to areas such as computer chess, computer Go, and other strategy games. He has been actively involved in research towards optimizing Monte Carlo searches for specific problem domains, accelerating ALPHAZERO-type deep reinforcement learning, and applying a fusion of Monte Carlo search and deep learning to diverse optimization challenges. In his talk, Tristan explored the concept of "Bootstrapping Artificial Intelligence", emphasizing the synergy between search and learning to enhance AI capabilities. He discussed diverse applications, from improving game-playing programs using introspective learning to algorithm discovery through the combination of Monte Carlo tree search and deep reinforcement learning.

9. SESSION 5: MATH, GAMES, AND PUZZLES

Bruno Bouzy chaired Session 5, which collected research work on games involving math, analyses of games based on math, and new content generation for puzzles. The papers included "Analysis of a Collatz Game and Other Variants of the 3n+1 Problem" by Ingo Althöfer, Michael Hartisch and Thomas Zipproth, "Implicit QBF Encodings for Positional Games" by Irfansha Shaik, Valentin Mayer-Eichberger, Jaco van de Pol and Abdallah Saffidine, "The Mathematical Game" by Marc Pierre, Quentin Cohen-Solal and Tristan Cazenave, and "Slitherlink Art" by Cameron Browne.

10. CONCLUSIONS

Following the CG 2022 experiment, we set different time slots on the three days, which were friendly to attendees from America, Eastern Asia, and Europe. Specifically, all keynote speakers and presenters gave talks at their comfortable times.

Over 400 people registered for ACG 2023. There was no charge to attend – just the requirement to register in advance. Because of our time-zone friendly schedule, every attendee found that some talks were at a convenient time and others at an inconvenient time. Nevertheless, the keynotes each attracted close to 100 attendees, and all the paper sessions were well attended. Conference attendeess gave strongly positive feedback on the quality of the conference.

The *Advances in Computer Games* conference alternates annually with the *Computers and Games* conference. The next ICGA conference will be CG 2024, online, November 26–28. The proceedings will be published by Springer in their *Lecture Notes in Computer Science* series. We look forward to your submissions!

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