Preface

This volume contains the papers accepted for presentation at ICAPS 2023, the Thirty-Third International Conference on Automated Planning and Scheduling, to be held in Prague, Czech Republic, July 8-13, 2023. The annual ICAPS conference series was formed in 2003 through the merger of two pre-existing biennial conferences, the International Conference on Artificial Intelligence Planning and Scheduling (AIPS) and the European Conference on Planning (ECP). ICAPS continues the traditional high standards of AIPS and ECP as an archival forum for new research in the field of automated planning and scheduling.

The 79 papers included in this volume, consisting of 66 long papers and 13 short papers, are those selected for plenary presentation at ICAPS 2023 from a total of 258 submissions. All submissions were reviewed by the International Program Committee, and this set of accepted papers reflects the Program Committee's high reviewing standards. As in previous years, ICAPS 2023 included also papers from three special tracks: Planning and Learning, Industry and Applications, and Robotics. All the special tracks have separate program committees with expertise in the relevant disciplines.

All these papers present the latest advances in the field of automated planning and scheduling, ranging in scope from theoretical analyses of planning and scheduling problems and processes, to new algorithms for planning and scheduling under various constraints and assumptions, to empirical evaluation of planning and scheduling techniques in practical applications. They reflect recent research trends in particular in the subareas of multi-agent path finding, reinforcement and deep learning, explainable planning and scheduling, and new developments in heuristics for planning algorithms. Applications that are considered span diverse areas ranging from more traditional applications (e.g., maintenance scheduling and robotics) to more recent applications (e.g., smart transportation in smart cities).

From this excellent collection of papers, six were selected for special recognition:

- “Landmark Progression in Heuristic Search” by Clemens Büchner, Thomas Keller, Salomé Eriksson, and Malte Helmert was selected for the Best Paper Award.
- “Operator Pruning using Lifted Mutex Groups via Compilation on Lifted Level” by Daniel Fišer was selected for the Best Paper Runner-Up Award.
- “Solving Domain-Independent Dynamic Programming Problems with Anytime Heuristic Search” by Ryo Kuroiwa and Chris Beck was selected for the Best Paper Runner-Up Award.
- “Planning for Temporally Extended Goals in Pure-Past Linear Temporal Logic” by
Luigi Bonassi, Giuseppe De Giacomo, Marco Favorito, Francesco Fuggitti, Alfonso Emilio Gerevini, and Enrico Scala was selected for the Best Student Paper Award.

- “Deadline-Aware Multi-Agent Tour Planning” by Taoan Huang, Vikas Shivashankar, Michael Caldara, Joseph Durham, Jiaoyang Li, Bistra Dilkina, and Sven Koenig was selected for the Best Student Paper Runner-Up Award.

- “Grounding Planning Tasks Using Tree Decompositions and Iterated Solving” by Augusto B. Corrêa, Markus Hecher, Malte Helmert, Davide Mario Longo, Florian Pommerening, and Stefan Woltran was selected for the Best Student Paper Runner-Up Award.

- “Automated Planning to Prioritise Digital Forensics Investigation Cases Containing Indecent Images of Children” by Saad Khan, Simon Parkinson, Monika Roopak, Rachel Armitage, and Andrew Barlow was selected for the Innovative Paper Award.

In addition to the oral presentation of these papers, the technical program of this year’s ICAPS conference includes invited talks by three distinguished speakers: Hadas Kress-Gazit (On Synthesis and planning for robot behaviors), Sheila McIlraith ((Formal) Languages Help AI agents Learn, Plan, and Remember), and Serena Villata (Formal and Natural Arguments for Effective Explanations). The technical program also includes Systems Demonstrations and Journal Presentation tracks, following past ICAPS editions.

The ICAPS 2023 Main Conference Program was preceded by two days of satellite events, including 12 workshops, six tutorials, and a doctoral consortium. The workshops this year are Planning and Scheduling for Financial Services (FinPlan); Human-Aware and Explainable Planning (HAXP); Planning and Ontology Workshop (PLATO); Bridging the Gap Between AI Planning and Reinforcement Learning (PRL); Reliable Data-Driven Planning and Scheduling (RDDPS); Hierarchical Planning (HPlan); Scheduling and Planning Applications (SPARK); Planning and Robotics (PlanRob); Integrated Acting, Planning and Execution (IntEx); Plan, Activity and Intent Recognition (PAIR); Heuristics and Search for Domain-Independent Planning (HSDIP); and Knowledge Engineering for Planning and Scheduling (KEPS).

The tutorials offer in-depth perspectives on the following topics: the computational complexity of planning; MDP Modeling and Interaction via RDDL and pyRDDLGym; Recent Advances in Temporal Networks for Planning and Scheduling; Model Acquisition in the Modern Era; Unified Planning: A Python Library Making Planning Technology Accessible; and a special tutorial on the role of Large Language Models in Planning. Following the tradition of ICAPS conferences, a Doctoral Consortium was once again organized, providing Ph.D. students in the field of automated planning and scheduling with the opportunity...
to present their current research during the conference and receive early feedback from experts in the field.

We would like to express our sincerest gratitude to all of the members of the Program Committee, who performed admirably in reviewing the submissions. We would like to also thank the Organizing Committee for their efforts, behind the scenes, in organizing the events and activities of this conference. Without their talent and dedication, and without the expertise and hard work of the Program Committee in reviewing the submitted papers, this conference would not have been possible.

Finally, we thank our sponsors: National Science Foundation (NSF), Artificial Intelligence Journal, Filuta AI, Alice Technologies, JPMorgan Chase Bank National Association, David E. Smith, SIFT, RSJ, Sony AI, Google, IBM, EurAI, Jiuzhang Intelligence, and Czech Society for Cybernetics and Informatics.

We hope this volume maintains the tradition of past ICAPS proceedings and becomes a valuable reference for researchers and practitioners in the field of automated planning and scheduling.

Roman Barták and Andrea Orlandini
ICAPS 2023 Conference Chairs

Mauro Vallati, Sven Koenig, and Roni Stern
ICAPS 2023 Program Chairs
Organizing Committee

Conference Chairs
Roman Barták (Charles University)
AndreA Orlandini (CNR-ISTC)

Program Chairs
Mauro Vallati (University of Huddersfield)
Sven Koenig (University of Southern California)
Roni Stern (Ben Gurion University)

Local Arrangement Chair
Milena Zeithamlová (Action M Agency)

Robotics Track Chairs
Tim Niemueller (Intrinsic Innovation)
Ron Petrick (Heriot-Watt University)

Industry and Applications Track Chairs
Daniel Harabor (Monash University)
Hana Rudová (Masaryk University)

Industry and Applications Track Chairs
Alan Fern (Oregon State University)
Eva Onaindia (Polytechnic University of Valencia)

Journal Track Chairs
Sebastian Sardina (RMIT University)
Laura Barbulescu (Carnegie Mellon University)
System Demo Chairs
Tiago S. Vaquero (Jet Propulsion Laboratory, California Institute of Technology)
Ron Alford (MITRE Corporation)

Workshop & Tutorial Chairs
Simon Parkinson (University of Huddersfield)
Mark Roberts (Naval Research Laboratory)

Doctoral Consortium Chairs
Gabriella Cortellessa (CNR-ISTC)
Enrico Scala (University of Brescia)

Diversity and Inclusion Chair
Iman Awaad (Hochschule Bonn-Rhein-Sieg University of Applied Sciences)
Masoumeh Iran Mansouri (University of Birmingham)

Sponsorship Chairs
Robert Goldman (SIFT)
Hankz Hankui Zhuo (Sun Yat-Sen University of China)
Neil Yorke-Smith (TU Delft)

Remote Participation Coordinator
Lukáš Chrpa (Czech Technical University)

Publicity Chairs
Alessandro Umbrico (CNR-ISTC)
Jindřich Vodrážka (Charles University)

Advisors
Lee McCluskey (University of Huddersfield)
Amedeo Cesta (CNR-ISTC)
Program Committee

Senior Program Committee
Andrea Micheli (Fondazione Bruno Kessler)
Andrew Coles (King's College London)
Cédric Pralet (ONERA Toulouse)
Chris Beck (University of Toronto)
Christian Muise (Queen's University)
Erez Karpas (Technion)
Felipe Meneguzzi (University of Aberdeen)
Gabriele Röger (University of Basel)
Guy Shani (Ben Gurion University)
Hankz Hankui Zhuo (Sun Yat-sen University)
Hector Geffner (ICREA & Universitat Pompeu Fabra)
Hoong Chuin Lau (Singapore Management University)
Marco Roveri (University of Trento)
Michael Katz (IBM)
Neil Yorke-Smith (Delft University of Technology)
Pascal Bercher (Australian National University)
Ronen Brafman (Ben-Gurion University)
Sara Bernardini (Royal Holloway)
Shirin Sohrabi (IBM)
Siddharth Srivastava (Arizona State University)
Susanne Biundo (University of Ulm)
Thomas McCluskey (University of Huddersfield)

Program Committee
Vaneet Aggarwal (Purdue University)
Diego Aineto Garcia (University of Brescia)
Zlatan Ajanovic (TU Delft)
Alexandre Albore (ONERA)
Ron Alford (MITRE Corporation)
Bo An (Nanyang Technological University)
Siddharth Aravindan (National University of Singapore)
Masataro Asai (IBM)
Dor Atzmon (Royal Holloway University of London)
Fernando Fernandez (Universidad Carlos III de Madrid)
Juan Fernández-Olivares (Universidad de Granada)
Alberto Finzi (University of Naples Federico II)
Daniel Fišer (Saarland University)
Santiago Franco (Royal Holloway University of London)
Jeremy Frank (NASA)
Simone Fratini (European Space Agency - ESA/ESOC)
Raquel Fuentetaja (Universidad Carlos III de Madrid)
Daniel Furelos-Blanco (Imperial College London)
Angel García-Olaya (Universidad Carlos III de Madrid)
Sankalp Garg (Carnegie Mellon University)
Alfonso Gerevini (University of Brescia)
Nicola Gigante (Free University of Bozen-Bolzano)
Mark Giuliano (Space Telescope Institute of Technology)
Daniel Gnad (Linköping University)
Robert P. Goldman (SIFT LLC)
Matthew Gombolay (Georgia Institute of Technology)
Alban Grastien (Australian National University)
Charles Gretton (Australian National University)
Sachin Grover (PARC, a Xerox Company)
Christophe Guettier (SAFRAN)
Daniel Guimarans (Amazon)
Vicenç Gómez (Universitat Pompeu Fabra)
Jin-Kao Hao (University of Angers)
Patrik Haslum (ANU)
Nick Hawes (University of Oxford)
Keyang He (University of Georgia)
Malte Helmert (University of Basel)
Laura Hiatt (U.S. Naval Research Laboratory)
Joerg Hoffmann (Saarland University)
Till Hofmann (RWTH Aachen University)
Daniel Höller (Saarland University)
Luca Iocchi (Sapienza University of Rome)
Sergio Jimenez Celorrio (Universitat Politècnica de València)
Anders Jonsson (Universitat Pompeu Fabra)
Leslie Kaelbling (MIT)
Mustafa O. Karabag (University of Texas at Austin)
Sammie Katt (Northeastern University)
Thomas Keller (University of Basel)
Jane Jean Kiam (Universität der Bundeswehr München)
Scott Kiesel (Amazon Robotics)
Lucas Kletzander (TU Wien)
Antonin Komenda (Czech Technical University in Prague)
Anurag Koul (Microsoft Research)
Anagha Kulkarni (Invitae)
T. K. Satish Kumar (University of Southern California)
Uwe Köckemann (Örebro University)
Philippe Laborie (LocalSolver)
Bruno Lacerda (University of Oxford)
Leonardo Lamanna (Fondazione Bruno Kessler)
Levi H. S. Lelis (University of Alberta)
Chu-Min Li (Université de Picardie Jules Verne)
Jiaoyang Li (Carnegie Mellon University)
Carlos Linares Lopez (Universidad Carlos III de Madrid)
Alan Lindsay (Heriot-Watt University)
Jiating Ling (Singapore Management University)
Yongmei Liu (Sun Yat-sen University)
Siow Meng Low (Singapore Management University)
Meghna Lowalekar (Swiggy)
Hang Ma (Simon Fraser University)
Mauricio Magnaguagno (Independent Researcher)
Adrien Maillard (Jet Propulsion Laboratory)
Masoumeh Mansouri (University of Birmingham)
Marco Maratea (University of Genova)
Jakub Marecek (Czech Technical University)
Reuth Mirsky (Bar Ilan University)
Argaman Mordoch (Ben Gurion University)
Bob Morris (NASA)
Nysret Musliu (TU Wien)
Karen Myers (SRI International)
Siriaam Natarajan (University of Texas at Dallas)
Daniel Neider (TU Dortmund University)
Grigory Neustroev (Delft University of Technology)
M. A. Hakim Newton (University of Newcastle)
Angelo Oddi (National Research Council of Italy (CNR-ISTC))
Conny Olz (Universität Ulm)
<table>
<thead>
<tr>
<th>Name</th>
<th>Institution/University</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hector Palacios</td>
<td>ServiceNow Research</td>
</tr>
<tr>
<td>Simon Parkinson</td>
<td>University of Huddersfield</td>
</tr>
<tr>
<td>Sunandita Patra</td>
<td>JPMorgan AI Research</td>
</tr>
<tr>
<td>Federico Pecora</td>
<td>Amazon Robotics</td>
</tr>
<tr>
<td>Damien Pellier</td>
<td>Laboratoire d'Informatique de Grenoble</td>
</tr>
<tr>
<td>Francesco Percassi</td>
<td>University of Huddersfield</td>
</tr>
<tr>
<td>André Grahi Pereira</td>
<td>Federal University of Rio Grande do Sul</td>
</tr>
<tr>
<td>Ramon Pereira</td>
<td>University of Manchester</td>
</tr>
<tr>
<td>Wiktor Piotrowski</td>
<td>Palo Alto Research Center</td>
</tr>
<tr>
<td>Florian Pommerening</td>
<td>University of Basel</td>
</tr>
<tr>
<td>Kanna Rajan</td>
<td>University of Porto and the RAND Corporation</td>
</tr>
<tr>
<td>Masood Feyzbakhsh Rankooh</td>
<td>Tampere University</td>
</tr>
<tr>
<td>Riccardo Rasconi</td>
<td>National Research Council of Italy (CNR-ISTC)</td>
</tr>
<tr>
<td>Marcus Ritt</td>
<td>Universidade Federal do Rio Grande do Sul</td>
</tr>
<tr>
<td>Alessandro Ronca</td>
<td>Sapienza University of Rome</td>
</tr>
<tr>
<td>Stefan Ropke</td>
<td>Technical University of Denmark</td>
</tr>
<tr>
<td>Leonardo Rosa Amado</td>
<td>PUCRS</td>
</tr>
<tr>
<td>Louis-Martin Rousseau</td>
<td>Polytechnique Montréal</td>
</tr>
<tr>
<td>Zachary Rubinstein</td>
<td>Carnegie Mellon University</td>
</tr>
<tr>
<td>Hana Rudová</td>
<td>Masaryk University</td>
</tr>
<tr>
<td>Wheeler Ruml</td>
<td>University of New Hampshire</td>
</tr>
<tr>
<td>Alessandro Saetti</td>
<td>University of Brescia</td>
</tr>
<tr>
<td>Miguel A. Salido</td>
<td>Universitat Politècnica de València</td>
</tr>
<tr>
<td>Scott Sanner</td>
<td>University of Toronto</td>
</tr>
<tr>
<td>Buser Say</td>
<td>Monash University</td>
</tr>
<tr>
<td>Enrico Scala</td>
<td>University of Brescia</td>
</tr>
<tr>
<td>Dominik Schreiber</td>
<td>Karlsruhe Institute of Technology</td>
</tr>
<tr>
<td>Laura Sebastia</td>
<td>Universitat Politècnica de València</td>
</tr>
<tr>
<td>Javier Segovia-Aguas</td>
<td>Universitat Pompeu Fabra</td>
</tr>
<tr>
<td>Jendrik Seipp</td>
<td>Linköping University</td>
</tr>
<tr>
<td>Ivan Serina</td>
<td>University of Brescia</td>
</tr>
<tr>
<td>Vikas Shivashankar</td>
<td>Amazon Robotics</td>
</tr>
<tr>
<td>Alexander Shleyfman</td>
<td>Bar-Ilan University</td>
</tr>
<tr>
<td>Silvan Sievers</td>
<td>University of Basel</td>
</tr>
<tr>
<td>Thiago D. Simão</td>
<td>Radbound University</td>
</tr>
<tr>
<td>Arambam James Singh</td>
<td>Singapore Management University</td>
</tr>
<tr>
<td>Pieter Smet</td>
<td>KU Leuven</td>
</tr>
<tr>
<td>David Smith</td>
<td>Independent Research</td>
</tr>
</tbody>
</table>
David Speck (University of Freiburg)
Sarath Sreedharan (Colorado State University)
Mohan Sridharan (University of Birmingham)
Sabine Storandt (University of Konstanz)
Nathan Sturtevant (University of Alberta)
Simon Ståhlberg (Linköping University)
Premysl Sucha (Czech Technical University)
Armando Tacchella (University of Genova)
Prasad Tadepalli (Oregon State University)
Ayal Taitler (University of Toronto)
Florent Teichteil-Königsbuch (Airbus Central Research & Technology)
Ufuk Topcu (University of Texas at Austin)
Álvaro Torralba (Aalborg University)
Felipe Trevizan (Australia National University)
Alessandro Umbrico (National Research Council of Italy (CNR-ISTC))
Tommaso Urli (Satalia)
Rick Valenzano (Toronto Metropolitan University)
Willem-Jan Van Hoeve (Carnegie Mellon University)
Martijn van Otterlo (Open University)
Greet Vanden Berghe (Katholieke Universiteit Leuven)
Tiago Stegun Vaquero (Jet Propulsion Laboratory, California Institute of Technology)
Ramiro Varela (University of Oviedo)
Petr Vilim (Coenzyme Fr)
Mark Wallace (Monash University)
Christabel Wayllace (University of Alberta)
Feng Wu (University of Science and Technology of China)
Konstantin Yokovlev (Russian Academy of Sciences)
Peng Yu (Mobi Systems)
Yinqian Zhang (Eindhoven University of Technology)
Rong Zhou (Google)

Additional Reviewers

Alison Paredes
Batuhan Altundas
Emil Keyder
Simon Dold
Jiaqi Tan
Remo Christen
Gabriel Paludo Licks
Issa Hangou
Dario Guidotti
Edo Fejzic
Yikang Gui
Songtuan Lin
Wei Qiu
Roberto Cipollone
Augusto B. Corrêa
Prasanth Sengadu Suresh
Mauricio Salerno
Alba Gragera
Matteo Iovino
Alessandro Burigana
Karthik Valmeekam
Paul Höft
Demian Hespe
Matthias Horn
Xiaoliang Yan
Wanqi Xue
Mattia Chiari
Stefano Demarchi
Anton Andreychuk
Issa Hanou
Cevahir Koprulu
Clemens Büchner
Rundong Wang
Kim Van den Houten
Cyrus Neary
Alexander Tuisov
Aditya Shinde
Romain Rombourg
Steven Carr
Noah Schutte
Shahaf Shperberg
Dominik Drexler