

Hang Ma

Curriculum Vitæ

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RESEARCH INTERESTS

Artificial intelligence, robotics, and machine learning. Specifically, automated planning, multi-agent/robot systems, spatio-temporal and constraint reasoning, applications of probabilistic methods, and other topics related to graphs, combinatorial optimization, and algorithms.

EDUCATION

- 2014– **Ph.D. Computer Science**, *University of Southern California*, Los Angeles, CA, United States.
Advisor: Sven Koenig.
- 2012–2014 **M.Sc. Computer Science**, *McGill University*, Montreal, QC, Canada.
Advisor: Joelle Pineau.
- 2010–2012 **B.Sc. Computing Science (First Class with Distinction)**, *Simon Fraser University*, Burnaby, BC, Canada.
Ranked 1st in the Faculty. Graduated on the President’s and Dean’s Honour Rolls.
- 2008–2012 **B.Eng. Computer Science and Technology**, *Zhejiang University*, Hangzhou, Zhejiang, China.
Excellent Student Award. Outstanding Student Leader Award.

PUBLICATIONS

Conferences

- 2019** [C1] **Hang Ma**, Daniel Harabor, Peter J. Stuckey, Jiaoyang Li, and Sven Koenig. “Searching with Consistent Prioritization for Multi-Agent Path Finding”. *AAAI Conference on Artificial Intelligence*. 2019. ACCEPTED. ACCEPTANCE RATE: 1150/7095 = 16.21%.
- [C2] **Hang Ma**, Wolfgang Hönig, T. K. Satish Kumar, Nora Ayanian, and Sven Koenig. “Lifelong Path Planning with Kinematic Constraints for Multi-Agent Pickup and Delivery”. *AAAI Conference on Artificial Intelligence*. 2019. ACCEPTED. ACCEPTANCE RATE: 1150/7095 = 16.21%.
- [C3] Jiaoyang Li, Pavel Surynek, Ariel Felner, **Hang Ma**, T. K. Satish Kumar, and Sven Koenig. “Multi-Agent Path Finding for Large Agents”. *AAAI Conference on Artificial Intelligence*. 2019. ACCEPTED. ACCEPTANCE RATE: 1150/7095 = 16.21%.
- [C4] Jiaoyang Li, Daniel Harabor, Peter J. Stuckey, **Hang Ma**, and Sven Koenig. “Symmetry-Breaking Constraints for Grid-Based Multi-Agent Path Finding”. *AAAI Conference on Artificial Intelligence*. 2019. ACCEPTED. ACCEPTANCE RATE: 1150/7095 = 16.21%.

- [C5] Jiaoyang Li, Eli Boyarski, Ariel Felner, **Hang Ma**, and Sven Koenig. “Improved Heuristics for Multi-Agent Path Finding with Conflict-Based Search”. *International Joint Conference on Artificial Intelligence*. 2019. ACCEPTED. ACCEPTANCE RATE: $850/4752 = 17.89\%$.
- [C6] Minghua Liu, **Hang Ma**, Jiaoyang Li, and Sven Koenig. “Task and Path Planning for Multi-Agent Pickup and Delivery”. *International Conference on Autonomous Agents and Multiagent Systems*. 2019, pp. 2253–2255. ACCEPTANCE RATE: $189/781 = 24.20\%$.
- [C7] Jiangxing Wang, Jiaoyang Li, **Hang Ma**, Sven Koenig, and T. K. Satish Kumar. “A New Constraint Satisfaction Perspective on Multi-Agent Path Finding”. *International Conference on Autonomous Agents and Multiagent Systems*. 2019, pp. 417–423.
- [C8] Jiaoyang Li, Daniel Harabor, Peter J. Stuckey, Ariel Felner, **Hang Ma**, and Sven Keonig. “Disjoint Splitting for Conflict-Based Search for Multi-Agent Path Finding”. *International Conference on Automated Planning and Scheduling*. 2019. ACCEPTANCE RATE: $69/209 = 33.01\%$.
- 2018 [C9] **Hang Ma**, Glenn Wagner, Ariel Felner, Jiaoyang Li, T. K. Satish Kumar, and Sven Koenig. “Multi-Agent Path Finding with Deadlines”. *International Joint Conference on Artificial Intelligence*. 2018, pp. 417–423. ACCEPTANCE RATE: $710/3470 = 20.64\%$.
- [C10] Liron Cohen, Matías Greco, **Hang Ma**, Carlos Hernandez, Ariel Felner, T. K. Satish Kumar, and Sven Koenig. “Anytime Focal Search with Applications”. *International Joint Conference on Artificial Intelligence*. 2018, pp. 1434–1441. ACCEPTANCE RATE: $710/3470 = 20.64\%$.
- [C11] **Hang Ma**, Glenn Wagner, Ariel Felner, Jiaoyang Li, T. K. Satish Kumar, and Sven Koenig. “Multi-Agent Path Finding with Deadlines: Preliminary Results”. *International Conference on Autonomous Agents and Multiagent Systems*. 2018, pp. 2004–2006.
- [C12] Ariel Felner, Jiaoyang Li, Eli Boyarski, **Hang Ma**, Liron Cohen, T. K. Satish Kumar, and Sven Keonig. “Adding Heuristics to Conflict-Based Search for Multi-Agent Pathfinding”. *International Conference on Automated Planning and Scheduling*. 2018, pp. 83–87. ACCEPTANCE RATE: $69/209 = 33.01\%$.
- 2017 [C13] **Hang Ma**, T. K. Satish Kumar, and Sven Koenig. “Multi-Agent Path Finding with Delay Probabilities”. *AAAI Conference on Artificial Intelligence*. 2017, pp. 3605–3612. ACCEPTANCE RATE: $638/2590 = 24.63\%$.
- [C14] **Hang Ma**, Jiaoyang Li, T. K. Satish Kumar, and Sven Koenig. “Lifelong Multi-Agent Path Finding for Online Pickup and Delivery Tasks”. *International Conference on Autonomous Agents and Multiagent Systems*. 2017, pp. 837–845. ACCEPTANCE RATE: $155/595 = 26.05\%$.
- [C15] **Hang Ma**, Jingxing Yang, Liron Cohen, T. K. Satish Kumar, and Sven Koenig. “Feasibility Study: Moving Non-Homogeneous Teams in Congested Video Game Environments”. *AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment*. 2017, pp. 270–272.
- [C16] Wolfgang Hönic, T. K. Satish Kumar, Liron Cohen, **Hang Ma**, Hong Xu, Nora Ayanian, and Sven Koenig. “Summary: Multi-Agent Path Finding with Kinematic Constraints”. *International Joint Conference on Artificial Intelligence*. 2017, pp. 4869–4873. SISTER CONFERENCE BEST PAPER TRACK.

- 2016 [C17] **Hang Ma**, Craig Tovey, Guni Sharon, T. K. Satish Kumar, and Sven Koenig. “Multi-Agent Path Finding with Payload Transfers and the Package-Exchange Robot-Routing Problem”. *AAAI Conference on Artificial Intelligence*. 2016, pp. 3166–3173. ACCEPTANCE RATE: $549/2132 = 25.75\%$.
- [C18] **Hang Ma** and Sven Koenig. “Optimal Target Assignment and Path Finding for Teams of Agents”. *International Conference on Autonomous Agents and Multiagent Systems*. 2016, pp. 1144–1152. ACCEPTANCE RATE: $137/550 = 24.91\%$. INVITED FOR JOURNAL PUBLICATION.
- [C19] Wolfgang Hönig, T. K. Satish Kumar, Liron Cohen, **Hang Ma**, Hong Xu, Nora Ayanian, and Sven Koenig. “Multi-Agent Path Finding with Kinematic Constraints”. *International Conference on Automated Planning and Scheduling*. 2016, pp. 477–485. ACCEPTANCE RATE: $65/184 = 35.33\%$. THIS PAPER WON THE OUTSTANDING PAPER AWARD IN THE ROBOTICS TRACK OF ICAPS 2016.
- [C20] Wolfgang Hönig, T. K. Satish Kumar, **Hang Ma**, Nora Ayanian, and Sven Koenig. “Formation Change for Robot Groups in Occluded Environments”. *IEEE/RSJ International Conference on Intelligent Robots and System*. 2016, pp. 4836–4842. ACCEPTANCE RATE: $832/1719 = 48.40\%$.
- 2015 [C21] **Hang Ma** and Joelle Pineau. “Information Gathering and Reward Exploitation of Subgoals for POMDPs”. *AAAI Conference on Artificial Intelligence*. 2015, pp. 3320–3326. ACCEPTANCE RATE: $531/1991 = 26.67\%$.
- [Journals and Magazines](#)
- 2018 [J1] Sven Koenig, Sanmay Das, Rosemary D. Paradis, John P. Dickerson, Yolanda Gil, Katherine Guo, Benjamin Kuipers, **Hang Ma**, Nicholas Mattei, Amy McGovern, Larry Medsker, Todd W. Neller, Plamen Petrov, Michael Rovatsos, and David G. Stork. “ACM SIGAI Activity Report”. *AI Matters* 4(3). 2018, pp. 7–11.
- [J2] Wolfgang Hönig, T. K. Satish Kumar, **Hang Ma**, Liron Cohen, Hong Xu, Sven Koenig, and Nora Ayanian. “Path Finding for Multi-Robot Systems with Kinematic Constraints in Occluded Environments”. *Journal of Artificial Intelligence Research*. 2018. TO APPEAR.
- 2017 [J3] **Hang Ma**, Wolfgang Hönig, Liron Cohen, Tansel Uras, Hong Xu, T. K. Satish Kumar, Nora Ayanian, and Sven Koenig. “Overview: A Hierarchical Framework for Plan Generation and Execution in Multi-Robot Systems”. *IEEE Intelligent Systems* 32(6). 2017, pp. 6–12.
- [J4] **Hang Ma** and Sven Koenig. “AI Buzzwords Explained: Multi-Agent Path Finding (MAPF)”. *AI Matters* 3(3). 2017, pp. 15–19.
- [Workshops and Symposia](#)
- 2019 [W1] Roni Stern, Nathan Sturtevant, Ariel Felner, Sven Koenig, **Hang Ma**, Thayne Walker, Jiaoyang Li, Dor Atzmon, Liron Cohen, T. K. Satish Kumar, Eli Boyarski, and Roman Bartak. “Multi-Agent Pathfinding: Definitions, Variants, and Benchmarks”. *International Symposium on Combinatorial Search*. 2019.
- 2016 [W2] **Hang Ma**, Sven Koenig, Nora Ayanian, Liron Cohen, Wolfgang Hönig, T. K. Satish Kumar, Tansel Uras, Hong Xu, C. Tovey, and G. Sharon. “Overview: Generalizations of Multi-Agent Path Finding to Real-World Scenarios”. *IJCAI-16 Workshop on Multi-Agent Path Finding*. 2016.

- [W3] Robert Morris, Corina Pasareanu, Kasper Luckow, Waqar Malik, **Hang Ma**, T. K. Satish Kumar, and Sven Koenig. “Planning, Scheduling and Monitoring for Airport Surface Operations”. *AAAI-16 Workshop on Planning for Hybrid Systems*. 2016.
- [W4] Wolfgang Hönig, T. K. Satish Kumar, Liron Cohen, **Hang Ma**, Sven Koenig, and Nora Ayanian. “Path Planning with Kinematic Constraints for Robot Groups”. *Southern California Robotics Symposium*. 2016.

HONORS AND AWARDS

- 2019 Technology Commercialization Award, *Stevens Center for Innovation, University of Southern California*
- 2014–2019 Annenberg Graduate Fellowship, *University of Southern California*
- 2018 IJCAI-AIJ Travel Grant, *IJCAI*
- 2016, 2017 2× AAMAS Student Scholarship, *AAMAS*
- 2016 Outstanding Paper Award in the Robotics Track (publication [C19]), *ICAPS*
- 2016 GSG Travel Grant, *University of Southern California*
- 2016 Ph.D. Fellowships Travel/Research Award, *University of Southern California*
- 2013, 2014 2× Graduate Scholarship, *McGill University*
- 2013 Differential Fee Waiver, *McGill University*
- 2012 2× Open Scholarship, *Simon Fraser University*
- 2011–2012 3× Alumni Scholarship, *Simon Fraser University*
- 2010 Entrance Scholarship, *Simon Fraser University*
- 2009, 2010 2× Scholarship for Outstanding Merits, *Zhejiang University*
- 2009, 2010 2× Scholarship for Outstanding Students, *Zhejiang University*
- 2009, 2010 2× Excellent Student Award, *Zhejiang University*
- 2009 Outstanding Student Leader Award, *Zhejiang University*

TEACHING

Teaching Assistant at McGill University

- Winter 2014 Information Structures, (*COMP-610, 17 students*)
- Winter 2014 Algorithms and Data Structures, (*COMP-252, 43 students*)
- Fall 2013 Theory of Computation, (*COMP-330A, 77 students*)
- Fall 2013 Foundations of Computing, (*COMP-202, 668 students*)
- Fall 2012 Theory of Computation, (*COMP-330A, 97 students*)

STUDENT SUPERVISION AND ADVISING

Research Project Supervision at USC

- Summer, Fall 2018 Jiangxing Wang (Undergraduate Student in Computer Science at USC), *Directed Research Project*.
- Summer 2018 Minghua Liu (Undergraduate Student in Computer Science at Tsinghua University), *USC-Tsinghua Summer Experience Program*.

- Summer 2017 Jingxing Yang (Undergraduate Student in Computer Science at USC), *Directed Research Project*.
- Summer 2016 Jiaoyang Li (Undergraduate Student in Automation at Tsinghua University, joined UCS as a Ph.D. student in Fall 2017), *USC-Tsinghua Summer Experience Program*.
- Summer 2016 James Drain (Undergraduate Student in Mathematics at Dartmouth College, joined UCLA as a Ph.D. student in Fall 2017), *Viterbi Summer Undergraduate Research Experience (SURE) Program*.
- Summer 2016 Zhi Wang (Undergraduate Student in Computer Science at USC, Computer Science Award for Best Research, joined UC San Diego as a Ph.D. student in Fall 2018), *Summer Research Project*.
- Summer 2016 Zhaowei Xu (Undergraduate Student in Computer Science at USC), *Summer Research Project*.
- Spring 2015 Maxwell Weiner (Undergraduate Student in Computer Science at USC), *Directed Research Project*.

Conference Mentoring

- Feb 2017 Aishwarya Reganti (Undergraduate Student in Electronics and Communication Engineering at the Indian Institute of Information Technology, Sri City, joined Carnegie Mellon University as a Master's student in Fall 2018), *ACM-W Scholarship Program, AAAI*.

TALKS

Invited Talks and Presentations

- Jan 8, 2018 "Progress on Multi-Agent Path Finding in Real-World Scenarios", *School of Data and Computer Science, Sun Yat-Sen University*.
- Dec 20, 2017 "Progress on Multi-Agent Path Finding in Real-World Scenarios", *Cainiao Network Technology Co., Alibaba Group*.
- Jun 8, 2016 "Generalizations of Multi-Agent Path Finding to Real-World Scenarios", *School of Data and Computer Science, Sun Yat-Sen University*.
- Apr 13, 2016 "Optimal Target Assignment and Path Finding for Teams of Agents", *U.S. Army Research Lab West Open House*.
- Oct 30, 2015 "POMDP Planning and Its Applications for Optimizing Building Energy", *Civil Engineering Department, University of Southern California*.
- Feb 13, 2014 "Information Gathering and Reward Exploitation of Subgoals for POMDPs", *Graduate Seminar Series, School of Computer Science, McGill University*.

Conference Presentations

- Jan 30, 2019 "Lifelong Path Planning with Kinematic Constraints for Multi-Agent Pickup and Delivery", *AAAI*.
- Jan 30, 2019 "Searching with Consistent Prioritization for Multi-Agent Path Finding", *AAAI*.
- Jul 18, 2018 "Multi-Agent Path Finding with Deadlines", *IJCAI*.
- May 11, 2017 "Lifelong Multi-Agent Path Finding for Online Pickup and Delivery Tasks", *AAMAS*.
- Feb 6, 2017 "Multi-Agent Path Finding with Delay Probabilities", *AAAI*.
- May 12, 2016 "Optimal Target Assignment and Path Finding for Teams of Agents", *AAMAS*.

- Feb 14, 2016 “Multi-Agent Path Finding with Payload Transfers and the Package-Exchange Robot-Routing Problem”, *AAAI*.
- Feb 27, 2015 “Information Gathering and Reward Exploitation of Subgoals for POMDPs”, *AAAI*.

SERVICE

Executive Committees

- 2017– Information Officer (Appointed) of the ACM Special Interest Group on Artificial Intelligence (SIGAI)

Workshop Chair or Co-Chair

- 2019 3rd International Workshop on Multi-Agent Path Finding at IJCAI

Conference Program Committees

- 2019 International Joint Conference on Artificial Intelligence (IJCAI)
 2019 International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)

Journal Reviewer

- 2019 ACM Transactions on Intelligent Systems and Technology (ACM TIST)
 2018(2×), 2019 Autonomous Robots (AURO)
 2018, 2019 Discrete Event Dynamic Systems (DEDS)
 2018 Journal of Artificial Intelligence Research (JAIR)
 2018 Science China Information Sciences
 2017 Artificial Intelligence Journal (AIJ)

Conference and Workshop Reviewer

- 2016, 2017, 2019 AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE)
 2018, 2019 AAAI/ACM Conference on Artificial Intelligence, Ethics, and Society (AIES)
 2018(2×) IEEE International Conference on Robotics and Automation (ICRA)
 2016, 2018 International Workshop on the Algorithmic Foundations of Robotics (WAFR)
 2016, 2018 International Symposium on Combinatorial Search (SoCS)
 2018 ICAPS Workshop on Planning and Robotics (PlanRob)
 2018 International Conference of the Florida Artificial Intelligence Research Society (FAIRS)
 2018 AAAI Spring Symposium on Integrating Representation, Reasoning, Learning, and Execution for Goal Directed Autonomy (SIRLE)
 2017 IEEE Conference on Computational Intelligence and Games (CIG)
 2017 International Workshop on Optimisation in Multi-Agent Systems (OptMAS)
 2016, 2017(2×) International Conference on Automated Planning and Scheduling (ICAPS)
 2017 AAAI Workshop on Knowledge-Based Techniques for Problem Solving and Reasoning (KnowProS)

Conference Volunteer

- 2016, 2017 International Conference on Autonomous Agents and Multiagent Systems (AAMAS)

Service to the University

- 2017– Advisor of the USC’s Chapter of AAAI, *University of Southern California*.

INDUSTRIAL EXPERIENCE

Jun–Aug, 2016 **Research Intern**, *U.S. Army Research Laboratory West*, Playa Vista, CA, United States.

May–Dec, 2011 **Automated Test Associate**, *SV&V JDE Tools Team, BlackBerry Ltd (formerly Research in Motion Ltd)*, Waterloo, ON, Canada.

REFERENCES

Sven Koenig

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University of Southern California

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Peter Stone

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T. K. Satish Kumar

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