Jiaoyang Li

Curriculum Vitae

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Education

2017-Present **Ph.D. in Computer Science**, *University of Southern California (USC)*, Los Angeles, CA, USA.
- Advisor: Sven Koenig.

2013-2017 **B.Eng. in Automation**, *Tsinghua University (THU)*, Beijing, China.
- GPA: 91/100; Rank: 5/118.
- Excellent Graduate Awards of Department of Automation, Tsinghua and of Beijing.
- Thesis: Group decision making in car-following and lane-changing maneuvers for autonomous vehicles.

Research Experience

02/2020-01/2021 Visiting Researcher, **Monash University**, Australia
- Advisor: Daniel Harabor and Peter J. Stuckey, Faculty of Information Technology.
- Project: Symmetry-Breaking for Multi-Agent Path Finding. Paper published at AAAI 2021.

05/2019 Research Intern (14 weeks), **Amazon Robotics**, USA
- Mentor: Andrew Tinka.
- Project: Multi-Agent Path Finding for Large-Scale Warehouses. Paper published at AAAI 2021.

12/2018, 11/2019 Visiting Student (5 weeks in total), **Ben-Gurion University**, Israel
- Advisor: Ariel Felner, Department of Software and Information Systems Engineering.
- Project: Heuristics for Multi-Agent Path Finding. Paper published at IJCAI 2019.

08/2016 Visiting Student (5 weeks), **University of California, Berkeley**, USA
- Advisor: Zuojun (Max) Shen, Department of Industrial Engineering and Operations Research.
- Supported by Tsinghua Top Open Program and Tsinghua Spark Talents Program.
- Project: Electric Taxi Fleets Dispatching System. Paper published at ITEC-AP 2017.

06/2016 Visiting Student (6 weeks), **University of Southern California**, USA
- Advisor: Sven Koenig, Department of Computer Science.
- Supported by USC-Tsinghua Summer Research Program.
- Project: Lifelong Multi-Agent Pickup and Delivery Problem. Paper published at AAMAS 2017.

2014-2017 Research Assistant, **Tsinghua University**, China
- Advisor: Jianming Hu, Department of Automation.
- Project 1: Bus Routing and Scheduling Problem. Paper published at TST 2017.
- Project 2 (Bachelor Thesis): Decision Making and Trajectory Planning for Teams of Autonomous Vehicles. Nominated for Best Bachelor Thesis Award in Tsinghua.

Honors and Awards

Fellowships and Scholarships

2020 WiSE Qualcomm Top-Off Fellowship, *Women in Science and Engineering Program at USC*.

2017 Viterbi/Graduate School Fellowship, *USC*.

2017 Excellent Graduate Award of Beijing, *Beijing Municipal Education Commission*.

2016 Fellowship of USC-Tsinghua Summer Research Program, *Tsinghua and USC*.

2016 Top Open Program Summer Research Funding, *Tsinghua*, (200/3500).

2016 Tsinghua-AVIC Scholarship, *Tsinghua*, (top 5%).

2014-2016 3x Academic Excellence Award, *Tsinghua*.

2015 Fellowship of Spark Talents Program, *Tsinghua*, (50/3500) .

2015 "12.9" Scholarship, *Tsinghua*, (1/560).

2015 Weimin Zheng Scholarship, *Tsinghua*, (2/560).

2014 Tsinghua-Evergrande Scholarship, *Tsinghua*, (top 5%).

Research Awards

2020 Outstanding Student Paper Award, *International Conference on Automated Planning and Scheduling*.

2019 Technology Commercialization Award, *USC Stevens Center for Innovation Technology*.

Competition Awards

2020 Winner of both rounds of the 2nd Flatland Challenge: NeurIPS Competition on Multi-Agent Reinforcement Learning on Trains.

2016 Honorable Mention of Interdisciplinary Contest in Modeling.

2015 Third Price of the 26th Beijing College Students Math Competition.

2014 Third Price of the 31th Chinese National College Physics Competition.

2013 Silver Medal of the 28th Chinese Mathematical Olympiad (CMO) (ranked 4th in Gansu Province).

2012 Silver Medal of the 26th Chinese Chemistry Olympiad (CChO) (ranked 2nd in Gansu Province).

2012 First Price of the 29th Chinese Physics Olympiad in Gansu Province (ranked 22nd in Gansu Province).

2012 Silver Medal of the 11th Chinese Girls' Mathematical Olympiad (CGMO).

Publications

Conferences

2021 [C21] **J. Li**, W. Ruml and S. Koenig. **EECBS: Bounded-Suboptimal Search for Multi-Agent Path Finding**. In *Proceedings of the AAAI Conference on Artificial Intelligence (**AAAI**)*, (in print), 2021. Acceptance rate: 1692/7911=21.4%.

[C20] **J. Li**, A. Tinka, S. Kiesel, J. Durham, T. K. S. Kumar and S. Koenig. **Lifelong Multi-Agent Path Finding in Large-Scale Warehouses**. In *Proceedings of the AAAI Conference on Artificial Intelligence (**AAAI**)*, (in print), 2021. Acceptance rate: 1692/7911=21.4%.

[C19] J. Chen, **J. Li**, C. Fan and B. Williams. **Scalable and Safe Multi-Agent Motion Planning with Nonlinear Dynamics and Bounded Disturbances**. In *Proceedings of the AAAI Conference on Artificial Intelligence (**AAAI**)*, (in print), 2021. Acceptance rate: 1692/7911=21.4%.

[C18] Z. Chen, D. Harabor, **J. Li** and P. Stuckey. **Symmetry Breaking for k-Robust Multi-Agent Path Finding**. In *Proceedings of the AAAI Conference on Artificial Intelligence (**AAAI**)*, (in print), 2021. Acceptance rate: 1692/7911=21.4%.

2020 [C17] P. Surynek, **J. Li**, H. Zhang, S. Kumar and S. Koenig. **Mutex Propagation for SAT-Based Multi-Agent Path Finding**. In *Proceedings of the International Conference on Principles and Practice of Multi-Agent Systems (**PRIMA**)*, (in print), 2020. Acceptance rate: 19/50=38.0%.

[C16] D. Atzmon, **J. Li**, A. Felner, E. Nachmani, S. Shperberg, N. R. Sturtevant and S. Koenig. **Multi-Directional Heuristic Search**. In *Proceedings of the International Joint Conference on Artificial Intelligence (**IJCAI**)*, pages 4062-4068, 2020. Acceptance rate: 592/4717=12.6%.

[C15] E. Boyarski, A. Felner, D. Harabor, P. Stuckey, L. Cohen, **J. Li** and S. Koenig. **Iterative-Deepening Conflict-Based Search**. In *Proceedings of the International Joint Conference on Artificial Intelligence (**IJCAI**)*, pages 4084-4090, 2020. Acceptance rate: 592/4717=12.6%.

[C14] **J. Li**, G. Gange, D. Harabor, P. Stuckey, H. Ma and S. Koenig. **New Techniques for Pairwise Symmetry Breaking in Multi-Agent Path Finding**. In *Proceedings of the International Conference on Automated Planning and Scheduling (**ICAPS**)*, pages 193-201, 2020. Acceptance rate: 69/216=31.9%.

[C13] H. Zhang, **J. Li**, P. Surtnek, S. Koenig and T. K. S. Kumar. **Multi-Agent Pathfinding with Mutex Propagation**. In *Proceedings of the International Conference on Automated Planning and Scheduling (**ICAPS**)*, pages 323-332, 2020. Acceptance rate: 69/216=31.9%. Outstanding student paper award.

[C12] **J. Li**, K. Sun, H. Ma, A. Felner, T. K. S. Kumar and S. Koenig. **Moving Agents in Formation in Congested Environments**. In *Proceedings of the International Joint Conference on Autonomous Agents and Multiagent Systems (**AAMAS**)*, pages 726-734, 2020. Acceptance rate: 186/808=23.0%.

2019 [C11] **J. Li**, E. Boyarski, A. Felner, H. Ma and S. Koenig. **Improved Heuristics for Conflict-Based Search for Multi-Agent Path Finding**. In *Proceedings of the International Joint Conference on Artificial Intelligence (**IJCAI**)*, pages 442-449, 2019. acceptance rate: 850/4752=17.9%.

[C10] **J. Li**, A. Felner, S. Koenig and T. K. S. Kumar. **Using FastMap to Solve Graph Problems in a Euclidean Space** (short paper). In *Proceedings of the International Conference on Automated Planning and Scheduling (**ICAPS**)*, pages 273-278, 2019.

[C9] **J. Li**, D. Harabor, P. Stuckey, A. Felner, H. Ma and S. Koenig. **Disjoint Splitting for Multi-Agent Path Finding with Conflict-Based Search** (short paper). In *Proceedings of the International Conference on Automated Planning and Scheduling (**ICAPS**)*, pages 279-283, 2019.

[C8] M. Liu, H. Ma, **J. Li** and S. Koenig. **Task and Path Planning for Multi-Agent Pickup and Delivery**. In *Proceedings of the International Joint Conference on Autonomous Agents and Multiagent Systems (**AAMAS**)*, pages 1152-1160, 2019. Acceptance rate: 189/781=24.2%.

[C7] **J. Li**, P. Surynek, A. Felner, H. Ma, T. K. S. Kumar and S. Koenig. **Multi-Agent Path Finding for Large Agents**. In *Proceedings of the AAAI Conference on Artificial Intelligence (**AAAI**)*, pages 7627-7634, 2019. Acceptance rate: 1150/7095=16.2%.

[C6] **J. Li**, D. Harabor, P. Stuckey, H. Ma and S. Koenig. **Symmetry Breaking Constraints for Grid-Based Multi-Agent Path Finding**. In *Proceedings of the AAAI Conference on Artificial Intelligence (**AAAI**)*, pages 6087-6095, 2019. Acceptance rate: 1150/7095=16.2%.

[C5] H. Ma, D. Harabor, P. Stuckey, **J. Li** and S. Koenig. **Searching with Consistent Prioritization for Multi-Agent Path Finding**. In *Proceedings of the AAAI Conference on Artificial Intelligence (**AAAI**)*, pages 7643-7650, 2019. Acceptance rate: 1150/7095=16.2%.

2018 [C4] A. Felner, **J. Li**, E. Boyarski, H. Ma, L. Cohen, T. K. S. Kumar and S. Koenig. **Adding Heuristics to Conflict-Based Search for Multi-Agent Path Finding** (short paper). In *Proceedings of the International Conference on Automated Planning and Scheduling (**ICAPS**)*, pages 83-87, 2018. Acceptance rate: 69/209=33.0%.

[C3] H. Ma, G. Wagner, A. Felner, **J. Li**, T. K. S. Kumar and S. Koenig. **Multi-Agent Path Finding with Deadlines**. In *Proceedings of the International Joint Conference on Artificial Intelligence (**IJCAI**)*, pages 417-423, 2018. Acceptance rate: 710/3470=20.5%.

2017 [C2] H. Ma, **J. Li**, T. K. S. Kumar and S. Koenig. **Lifelong Multi-Agent Path Finding for Online Pickup and Delivery Tasks**. In *Proceedings of the International Joint Conference on Autonomous Agents and Multiagent Systems (**AAMAS**)*, pages 837-845, 2017. Acceptance rate: 155/595=26.1%.

[C1] Y. Jia, H. Chen, **J. Li**, F. He, M. Li, Z. Hu, and Z. Shen. **Planning for Electric Taxi Charging System from the Perspective of Transport Energy Supply Chain: A Data-Driven Approach in Beijing**. In *Proceedings of IEEE Transportation Electrification Conference & EXPO Asia-Pacific (**ITEC-AP**)*, pages 1-6, 2017.

Journals

2017 [J1] **J. Li**, J. Hu and Y. Zhang. **Optimal Combinations and Variable Departure Intervals for Micro Bus System**. *Tsinghua Science and Technology (**TST**)*, 22(3):282-292, 2017.

Symposiums, Forums and Workshops

* Symposium, forums and workshop papers with a conference version are not listed below.

2020 [W4] S. Chan, **J. Li**, D. Harabor, P. J. Stuckey, G. Gange, L. Cohen and S. Koenig. **Nested ECBS for Bounded Suboptimal Multi-Agent Path Finding**. In *the IJCAI-20 Workshop on Multi-Agent Path Finding (**WoMAPF**)*, 2020.

[W3] T. Neller, S. Keeley, M. Guerzhoy, W. Hoenig, **J. Li**, S. Koenig, A. Soni, K. Thomason, L. Zhang, B. Sebatian, C. Resnick, A. Oliver, S. Bhupatiraju, K. Agrawal, J. Allingham, S. Yoon, J. Chen, T. Larsen, M. Neumann, N. Norouzi, R. Hausen and M. Evett. **Model AI Assignments 2020**. In *Proceedings of the Symposium on Educational Advances in Artificial Intelligence (**EAAI**)*, 2020.

[W2] R. Stern, N. R. Sturtevant, A. Feler, S. Koenig, H. Ma, T. Walker, **J. Li**, D. Atzmon, L. Cohen, T. K. S. Kuamr, E. Boyarski and R. Bartak. **Multi-Agent Pathfinding: Definitions, Variants, and Benchmarks** (position paper). In *Proceedings of the Symposium on Combinatorial Search (**SoCS**)*, pages 151-159, 2019. Acceptance rate: 14/31=45.2%.

[W1] **J. Li**, H. Zhang, M. Gong, Z. Liang, W. Liu, Z. Tong, L. Yi, R. Morris, C. Pasareanu and S. Koenig. **Scheduling and Airport Taxiway Path Planning under Uncertainty**. In *Proceedings of the AIAA Aviation and Aeronautics Forum and Exposition (**AIAA AVIATION Forum**)*, 2019.

Extended Abstracts

* Extended abstracts with a conference version are not listed below.

2019 [E1] J. Wang, **J. Li**, H. Ma, S. Koenig and T. K. S. Kumar. **A New Constraint Satisfaction Perspective on Multi-Agent Path Finding: Preliminary Results** (extended abstract). In *Proceedings of the International Joint Conference on Autonomous Agents and Multiagent Systems (**AAMAS**)*, pages 2253-2255, 2019.

Media Coverage

05/2020 **Amazon studies anti-collision method for robots to increase throughput**, *Supply Chain Dive*, https://www.supplychaindive.com/news/amazon-robots-from-colliding-increasing-throughput-warehouse/578599/.

05/2020 **Amazon's AI tool can plan collision-free paths for 1,000 warehouse robots**, *Venture Beat*, https://venturebeat.com/2020/05/18/amazons-ai-tool-can-plan-collision-free-paths-for-1000-warehouse-robots/.

Teaching and Mentoring Experience

Teaching Assistant

Fall 2019 Introduction to Artificial Intelligence, CSCI360 at USC.

Student Mentor

Fall 2020 Xinyi Zhong (Master Student in Computer Science at Simon Fraser University).

Summer & Fall 2020 Wooju Yim (Undergraduate Student in Computer Science at USC); Leon Durrenberger (Undergraduate Student in Computer Science at USC), *Directed Research Project*; and Eugene (Zijun) Lin (Master Student in Computer Science at USC).

Fall 2019 Moli Yang (Master Student in Computer Science at Melbourne University), *Visiting student*.

Summer & Fall 2018 Jiangxing Wang (Undergraduate Student in Computer Science at USC), *Directed Research Project*. Paper published at AAMAS, 2019.

Summer 2018 Minghua Liu (Undergraduate Student in Computer Science at Tsinghua University, now a PhD student at UCSD), *USC-Tsinghua Summer Research Program*. Paper published at AAMAS, 2019.

Academic Activities

Conference and Workshop Organizing Committee

2020 Co-chair at IJCAI Workshop on Multi-Agent Path Finding (WoMAPF)

Conference and Workshop (Senior) Program Committee

2021 PC at International Conference on Automated Planning and Scheduling (ICAPS)
2021 PC at AAAI Conference on Artificial Intelligence (AAAI)
2021 PC at International Conference of the Florida Artificial Intelligence Research Society (FLAIRS)
2021 SPC at International Joint Conference on Artificial Intelligence (IJCAI)
2020 PC at International Joint Conference on Artificial Intelligence (IJCAI)
2019, 2020 PC at International Conference on Autonomic and Autonomous Systems (ICAS)
2019 PC at IJCAI Workshop on Multi-Agent Path Finding (WoMAPF)

Conference and Workshop Reviewer (of Individual Papers)

2021 IEEE International Conference on Robotics and Automation (ICRA)
2021 Undergraduate Consortium at AAAI Conference on Artificial Intelligence (AAAI)
2020 Workshop on the Algorithmic Foundations of Robotics (WAFR)
2019 Global Conference on Artificial Intelligence (GCAI)
2019 International Joint Conference on Artificial Intelligence (IJCAI)
2019 International Conference on Automated Planning and Scheduling (ICAPS)
2019 International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS)
2018, 2019 AAAI/ACM Conference on Artificial Intelligence, Ethics, and Society (AIES)
2018, 2019 International Symposium on Combinatorial Search (SoCS)
2018 AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE)
2018 ACM Siggraph Conference on Motion, Interaction and Games (MIG)
2018 IEEE Conference on Computational Intelligence and Games (CIG)
2018 ICAPS Workshop on Planning and Robotics (PlanRob)

Journal Reviewer

2020 IEEE Transactions on Control of Network Systems (TCNS)
2020 Journal of Aerospace Information Systems (JAIS)
2020 Aerospace Lab (AL)
2020 IEEE Transactions on Automation Science and Engineering (T-ASE)
2019, 2020 3x IEEE Robotics and Automation Letters (RA-L)
2017 Tsinghua Science and Technology (TST)

Talks and Presentations

Invited Talks

10/2019 **Fast and Realistic Multi-Agent Path Finding**. Amazon Research Awards - Robotics Symposium.

Presentations at Conferences

12/2020 **Winning the 2020 Flatland Challenge**. Conference on Neural Information Processing Systems (NeurIPS).

10/2020 **New Techniques for Pairwise Symmetry Breaking in Multi-Agent Path Finding**. International Conference on Automated Planning and Scheduling (ICAPS).

10/2020 **Pairwise Symmetry Reasoning for Multi-Agent Path Finding**. Doctoral Consortium at the International Conference on Automated Planning and Scheduling (ICAPS).

05/2020 **Moving Agents in Formation in Congested Environments**. Symposium on Combinatorial Search (SoCS).

05/2020 **New Techniques for Pairwise Symmetry Breaking in Multi-Agent Path Finding**. Symposium on Combinatorial Search (SoCS).

05/2020 **Moving Agents in Formation in Congested Environments**. International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS).

05/2020 **Lifelong Multi-Agent Path Finding in Large-Scale Warehouses**. International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS).

02/2020 **A Project on Multi-Agent Path Finding**. Educational Advances in Artificial Intelligence (EAAI).

08/2019 **Improved Heuristics for Conflict-Based Search for Multi-Agent Path Finding**. International Joint Conference on Artificial Intelligence (IJCAI).

08/2019 **Disjoint Splitting for Multi-Agent Path Finding with Conflict-Based Search**. IJCAI-19 Workshop on Multi-Agent Path Finding (WoMAPF).

07/2019 **Using FastMap to Solve Graph Problems in a Euclidean Space**. International Conference on Automated Planning and Scheduling (ICAPS).

07/2019 **Disjoint Splitting for Multi-Agent Path Finding with Conflict-Based Search**. International Conference on Automated Planning and Scheduling (ICAPS).

01/2019 **Multi-Agent Path Finding for Large Agents**. AAAI Conference on Artificial Intelligence (AAAI).

01/2019 **Symmetry Breaking Constraints for Grid-Based Multi-Agent Path Finding**. AAAI Conference on Artificial Intelligence (AAAI).