Dr. Cai Panpan

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I am a roboticist. I have been conducting active research in robotic planning under uncertainty, robot learning, and integrating them to solve complex real-world problems. My vision is to develop robots that can efficiently work in large-scale, dynamic, and uncertain environments, seamlessly interact with human, and accomplish challenging tasks. Check this video for a 3-min introduction of my recent research.

Education

Nanyang Technological University **Singapore**
Doctor of Philosophy *2011.8–2016.7*
Research on robotic path planning, collision detection, and GPU computing.

Zhejiang University **Hangzhou, China**
Bachelor's Degree in Mathematics (specialized on Information and Computing Science)
Top student selected into the ChuKoChen Honors College *2007.8–2011.6*
Trained on Mathematics, scientific computing, and Computer Aided Geometric Design (CAGD).

Professional Experience

Department of Computer Science, National University of Singapore **Singapore**
Senior postdoctoral research fellow *2021–2022*

- Conduct independent research and lead research projects on integrating planning with reinforcement learning;
- Publish in top robotics conferences and journals, including 1 RSS paper, 1 RAL-ICRA paper and 1 draft under revision with T-RO;
- Mentored 1 undergraduate student for an award-winning final year project, 1 master student, and 1 research intern for independent research;
- Organized an international workshop (main organizer) under a top robotics conference, RSS 2021;
- Organize weekly reading groups for the research group;
- Taught 2 lectures in a graduate-level robotics class on POMDP planning, robot systems, and autonomous driving.

Department of Computer Science, National University of Singapore **Singapore**
Postdoctoral research fellow *2017–2020*

- Conduct independent research and lead research projects on planning under uncertainty, integrating planning and learning, and autonomous driving in crowded environments;
- Publish in top robotics conferences and journals, including 1 IJRR paper, 2 RSS papers, and 3 publications in ICRA, IROS, and RAL;
- Mentored 1 PhD student, 1 undergraduate student (final year project), and 2 research assistants;
- Organize weekly reading groups for the research group;
- Actively reviewing for top robotics conferences and journals;
- Taught 1 lecture in a graduate-level robotics class on sampling-based motion planning.

School of Mechanical and Aerospace Engineering, Nanyang Technological University **Singapore**
PhD student *2011–2016*

- Conduct independent research on parallel collision detection and path planning in large-scale industrial environments;
- Published 2 Q1 journal papers on crane-lifting planning in complex industrial environments;
- R&D experience on intelligent crane-lifting systems;
- Published one patent.
- Taught 1 undergraduate-level lab project.

Professional Services

- Program committee member, International Conference on Automated Planning and Scheduling (ICAPS), 2022.
- Main organizer, RSS 2021 workshop on Integrating Planning and Learning.
- Program committee member, Robotics: Science & Systems (RSS), 2020.
- Program committee member, Conference on Robot Learning (CORL), 2019.
- Reviewers for top robotics and AI conferences (RSS, ICRA, CORL, IROS, ACC, IJCAI) and top-tier journals (IJRR, TRO, RAL, AURO).

Teaching

- Co-lecturing, Module CS4278/CS5478 "Intelligent Robots: Algorithms and Systems", Semester 1&2, 2021/2022, Lecture 11 & 12, NUS.
- Co-lecturing, Module CS6244 "Robot Motion Planning & Control", Semester 1, 2017/2018, Lecture 3, NUS.
- Teaching assistance, Project P3.6 "Vibration Testing of Multiple DOF Systems" for AY 2015/16, S1 & S2, NTU.

Publications

Overview:
Citation: 315 (queried at 16.02.2022)
H-index: 9
i10-index: 9

Peer-reviewed journal papers:

- (Equal-contribution first author, corresponding author) Y. Luo*, P. Cai*, D. Hsu, and WS Lee. GAMMA: A General Agent Motion Model for Autonomous Driving. *IEEE Robotics and Automation Letters (RAL)*, ISSN: 2377-3766, 2022, DOI:10.1109/LRA.2022.3144501. (Impact factor: 3.741; Citation: 13).
- P. Cai, Y. Luo, D. Hsu, and W.S. Lee. HyP-DESPOT: A Hybrid Parallel Algorithm for Online Planning under Uncertainty. *International Journal of Robotics Research (IJRR)*, ISSN 0278-3649, 2021, DOI:10.1177/0278364920937074. (Impact factor: 4.703; Citation: 32).
- Y. Luo, P. Cai, A. Bera, D. Hsu, W.S. Lee, and D. Manocha. PORCA: Modeling and planning for autonomous driving among many pedestrians. *IEEE Robotics Automation Letters (RAL)*, ISSN 2377-3766, 2018, DOI:10.1109/LRA.2018.2852793. (Impact factor: 3.741; Citation: 81).
- P. Cai, Y. Cai, I. Chandrasekaran, and J. Zheng "Automatic Path Planning for Dual-Crane Lifting in Complex Environments Using a Prioritized Multi-objective PGA", *IEEE Transactions on Industrial Informatics (TII)*, ISSN 1551-3203, 2017, DOI:10.1109/TII.2017.2715835. (Impact factor: 10.215; Citation: 25).
- P. Cai, Y. Cai, I. Chandrasekaran, and J. Zheng. "Parallel GA based automatic crane lifting path planning in complex environments", *Automation in Construction (AIC)*, ISSN 0926-5805, 2016, DOI:10.1016/J.AUTCON.2015.09.007. (Impact factor: 7.7; Citation: 67).
- J. Zhang, P. Cai, and G. Wang. A New Approach to Design Rational Harmonic Surface over Rectangular or Triangular Domain. Journal of Information & Computational Science, 8(1), 2011. (Published during undergraduate study).

Journal papers under revision :

- P. Cai and D. Hsu. Closing the Planning-Learning Loop with Application to Autonomous Driving in a Crowd. *IEEE Transactions on Robotics (T-RO) (under revision)*, 2022. arXiv:2101.03834. (Impact factor: 5.567; Citation: 1).

Peer-reviewed conference papers:

- Y. Lee and P. Cai, and D. Hsu. MAGIC: Learning Macro-Actions for Online POMDP Planning using Generator-Critic. *Robotics: Science & Systems (RSS)*, ISSN 2330-765X, 2021, DOI:10.15607/RSS.2021.XVII.041. (Research impact score: 5.45; Citation: 1).
- (Equal-contribution first author) P. Cai*, Y. Lee*, Y. Luo, D. Hsu. SUMMIT: A Simulator for Urban Driving in Massive Mixed Traffic. *International Conference on Robotics and Automation (ICRA)*, 2020, DOI:10.1109/ICRA40945.2020.9197228. (Research impact score: 5.75; Citation: 17).
- P. Cai, Y. Luo, A. Saxena, D. Hsu, W.S. Lee. LeTS-Drive: Driving in a Crowd by Learning from Tree Search. *Robotics: Science & Systems (RSS)*, ISSN 2330-765X, 2019, DOI:10.15607/RSS.2019.XV.018. (Research impact score: 5.45; Citation: 18).
- M. Meghjani, Y. Luo, Q.H. Ho, P. Cai, S. Verma, D. Rus, D. Hsu. Context and Intention Aware Planning for Urban Driving. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2019, DOI:10.1109/IROS40897.2019.8967873. (Research impact score: 10.06; Citation: 12).
- P. Cai, Y. Luo, D. Hsu, and W.S. Lee. HyP-DESPOT: A Hybrid Parallel Algorithm for Online Planning under Uncertainty. *Robotics: Science & Systems (RSS)*, ISSN 2330-765X, 2018, DOI:10.15607/RSS.2018.XIV.004. (Research impact score: 5.45; Citation: 32).
- L. Huang, Y. Zhang, J. Zheng, P. Cai, S. Dutta, Y. Yue, N. Thalmann and Y. Cai. Point cloud based path planning for tower crane lifting. Computer Graphics International Conference, June 2018, DOI:10.1145/3208159.3208186.
- P. Cai, Y. Cai, I. Chandrasekaran, and J. Zheng, "A GPU-enabled parallel genetic algorithm for path planning", 2013 Symposium on GPU Computing and Applications (Best Paper), Oct 2013, DOI:10.1007/978-981-287-134-3_1.

Patent:

Y. Cai, P. Cai, C. Indhumathi, J. Zheng, N. M. Thalmann, P. Wong, T. S. Lim and Y. Gong, "Method and system for intelligent crane lifting", PCT filing (USA/German/China/Singapore) PCT/SG2014/000472, 8 October 2014.

Book chapters:

- P. Cai, I. Chandrasekaran, Y. Cai, Y. Chen, and X. Wu. Simulation-enabled vocational training for heavy crane operations. In Simulation and Serious Games for Education (pp. 47-59), ISBN 978-981-10-0861-0, 2017, DOI: 10.1007/978-981-10-0861-0_4.
- P. Cai, C. Indhumathi, Y. Cai, J. Zheng, Y. Gong, T. Lim, and P. Wong, "Collision detection using axis aligned bounding boxes", in *Simulations, Serious Games and Their Applications*, ISBN 978-981-4560-32-0, 2014, DOI:10.1007/978-981-4560-32-0_1.