Tao Pang

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Research Interests

I aim to build generalist robots that can match and eventually surpass human-level manipulation capabilities by continuously learning from their experience and with minimal human supervision. In pursuit of that goal, I focus on building efficient and scalable representations of robot interaction experience by leveraging insights from contact mechanics, control, planning and optimization.

Employment

- **Roboticist** 02/2023 - Present
  RAI Institute (formerly Boston Dynamics AI Institute).
  - Led a team to build efficient planning and learning algorithms and pipelines for contact-rich manipulation.

Education

- **Massachusetts Institute of Technology** 09/2016 - 01/2023
  PhD in Mechanical Engineering.
  - Thesis: Planning, Sensing, and Control for Contact-rich Robotic Manipulation with Quasi-static Contact Models.
  - Advisor: Prof. Russ Tedrake.
- **National University of Singapore**
  M.Eng., Electrical and Computer Engineering. 08/2014 - 05/2016
  B.Eng (First Class Honors), Mechanical Engineering. 08/2008 - 05/2012
  - GPA: 4.89/5, with second major in mathematics.

Selected Awards & Honors

- **IJRR Best Paper of the Season Award (Q2 2025)** 2025
  For the paper titled "Dexterous Contact-Rich Manipulation via the Contact Trust Region".
- **Honorable Mention for the IEEE T-RO King-Sun Fu Memorial Best Paper Award** 2023
  For the paper titled "Global Planning for Contact-Rich Manipulation via Local Smoothing of Quasi-dynamic Contact models".
- **Lee Kuan Yew Gold Medal, IES Gold Medal, Exxonmobil Medal**. 2012
  National University of Singapore.
  - Student with the highest GPA in Mechanical Engineering during their period of study.

Additional Research Experience

- **Associate Scientist** 04/2013 - 08/2016
  Unmanned Systems Research Group, National University of Singapore.
  - Designed and built a 10kg gasoline-powered variable-pitch quadrotor which can fly for up to 3 hours.

- **Summer Research Undergraduate Fellowship (SURF)** 05/2010 - 08/2010
  California Institute of Technology.
  - Designed and implemented a path planning algorithm for Axel, a tethered Mars rover prototype.
  - Advisor: Prof. Joel W. Burdick.

Journal Publications

- **Dexterous Contact-Rich Manipulation via the Contact Trust Region** [website] 2025
  H.J.T. Suh, T. Pang*, T. Zhao, R. Tedrake*
  The International Journal of Robotics Research.
  IJRR Best Paper of the Season Award (Q2 2025)
- **Should We Learn Contact-Rich Manipulation Policies from Sampling-Based Planners?** 2025
  [pdf]
  H. Zhu, T. Zhao, X. Ni, J. Wang, K. Fang, L. Righetti, T. Pang
  IEEE Robotics and Automation Letters (RA-L).
- **Global Planning for Contact-Rich Manipulation via Local Smoothing of Quasi-dynamic Contact Models** [pdf] [MIT News] 2023
  T. Pang, H.J.T. Suh*, L. Yang, R. Tedrake*
  IEEE Transactions on Robotics (TR-O).
  Honorable Mention for the IEEE TR-O King-Sun Fu Memorial Best Paper Award.
- **Bundled Gradients through Contact via Randomized Smoothing** [pdf] 2022
  H.J.T. Suh, T. Pang*, R. Tedrake*
  IEEE Robotics and Automation Letters (RA-L).

Selected Conference Publications

- **Physics-Driven Data Generation for Contact-Rich Manipulation via Trajectory Optimization** [website] [MIT News] 2025
  L. Yang, H.J.T. Suh, T. Zhao*, B. Grasdal, T. Kelestemur, J. Wang, T. Pang, R. Tedrake*
  Robotics: Science and Systems (RSS).
- **Is Linear Feedback on Smoothed Dynamics Sufficient for Stabilizing Contact-Rich Plans?** 2025
  [pdf]
  Y. Shirai, T. Zhao, H.J.T. Suh, H. Zhu, X. Ni, J. Wang, M. Simchowitz, T. Pang
  IEEE International Conference on Robotics and Automation (ICRA).
- **Planning-Guided Diffusion Policy Learning for Generalizable Contact-Rich Bimanual Manipulation** [pdf] 2024
  X. Li, T. Zhao, X. Zhu, J. Wang, T. Pang, K. Fang
  Under Review.
- **SEED: Series Elastic End Effectors in 6D for Visuotactile Tool Use** [pdf] [MIT News] 2022
  H.J.T. Suh, N. Kuppuswamy, T. Pang, P. Mitiguy, A. Alspach, R. Tedrake
  IEEE International Conference on Intelligent Robots and Systems (IROS).
- **Easing Reliance on Collision-free Planning with Contact-aware Control** [pdf] 2022
  T. Pang, R. Tedrake
  IEEE International Conference on Robotics and Automation (ICRA).
- **A Convex Quasistatic Time-stepping Scheme for Rigid Multibody Systems with Contact and Friction** [pdf] 2021
  T. Pang, R. Tedrake

IEEE International Conference on Robotics and Automation (ICRA).

- **Identifying External Contacts from Joint Torque Measurements on Serial Robotic Arms and Its Limitations** [pdf] 2021
  T. Pang, J. Umenberger, R. Tedrake
  IEEE International Conference on Robotics and Automation (ICRA).
- **A Robust Time-Stepping Scheme for Quasistatic Rigid Multibody Systems** [pdf] 2018
  T. Pang, R. Tedrake
  IEEE International Conference on Intelligent Robots and Systems (IROS).
- **Design and Implementation of a Variable-pitch Long-endurance Gasoline-engine Quadrotor** [pdf] 2016
  T. Pang, F. Lin, K. Peng and B.M. Chen
  IEEE International Conference on Control and Automation (ICCA).

Preprints

- **Approximately Optimal Global Planning for Contact-Rich SE(2) Manipulation on a Graph of Reachable Sets** [pdf] 2025
  S. Liu, T. Zhao, B.P. Graesdal, P. Werner, J. Wang, J. Dolan, C. Liu, T. Pang

Teaching Experience

Teaching Assistant

- First & second offerings of MIT 6.800/6.843, Robotic Manipulation. Fall 2018 & 2019
  - Designed from scratch programming problem sets for basic topics in robotics, including kinematics, point cloud registration, force control and sampling-based motion planning.
  - Designed and supervised robot labs where students are asked to open a cabinet door, pick up a rubber brick and place it on a shelf using the Kuka iiwa robot arm.

Guest Lecturer

- *Efficient Planning and Learning for Contact-rich Manipulation via Structured Exploration* Fall 2025
  - ME 601 Advanced Robotics, taught by Xiaobin Xiong at the University of Wisconsin, Madison.
  - 6.2410/2, Robotic Manipulation, taught by Tomas Lozano-Perez at MIT.

Invited Talks

Efficient Planning and Learning for Contact-rich Manipulation via Structured Exploration

- UCSB ECE seminar 01/2026
- Caltech MCE seminar 01/2026
- ETH Zurich (Computational Robotics Lab) 01/2026
- Purdue University, ICON (Institute for Control, Optimization and Networks) Seminar 11/2025

Accelerating the Data Flywheel via Model-based Reasoning

- University of Pennsylvania (DAIR Lab) 7/2025
- New York University (Machines in Motion Lab) 5/2025
- Cornell University (Robotics Seminar) 4/2025
- Harvard University (Computational Robotics Group) 4/2025
- University of Wisconsin, Madison (Wisconsin Expeditious LeggedAI Lab) 3/2025

Planning and Control for Contact-rich Manipulation

- Stanford University (Robotic Exploration Lab) 10/2022

Mentoring

- **Tong Zhao** MIT M. Eng → Google Deepmind
- **Bo Ai** PhD candidate at UCSD.
- **Simin Liu** CMU PhD.
- **Lujie Yang** MIT PhD → Amazon FAR
- **Xuanlin Li** UCSD PhD → Hillbot
- **Huaijiang Zhu** NYU PhD.
- **Minkyung Kim** PhD candidate at UIUC
- **Xinpei Ni** PhD candidate at Georgia Tech
- **Yuki Shirai** UCLA PhD → Samsung Researh

Media Coverage

- **Simulation-based pipeline tailors training data for dexterous robots**: A. Shipps, MIT News. 2025
- **AI helps robots manipulate objects with their whole bodies**: A. Zewe, MIT News. 2023
- **Soft robots that grip with the right amount of force**: R. Gordan, MIT News. 2022

Service

Workshop Organization

- Organizer for Workshop on Leveraging Models for Contact-Rich Manipulation, IROS 2023

Thesis Committee

- Served together with Dr. Changliu Liu, Dr. John Dolan and Dr. Max Likhachev on the thesis committee of Dr. Simin Liu 2025

Program Committee

- World Symposium on the Algorithmic Foundations of Robotics (WAFR) 2026

Reviewer

- T-RO, IJRR, RA-L, RSS, ICRA, IROS, L4DC, CoRL.

References

- Russ Tedrake (`russt@mit.edu`)
- Tomas Lozano-Perez (`tlp@csail.mit.edu`)
- Ludovic Righetti (`ludovic.righetti@nyu.edu`)
- Kuan Fang (`kuanfang@cornell.edu`)
- Max Simchowitz (`msimchow@andrew.cmu.edu`)