Boyang Ti

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EDUCATION

Dalian University of Technology *(2013.7-2017.6)* *Liaoning, China*

Bachelor of Mechanical Design manufacture and Automation

- GPA: Major **90.7**/100.0
- Rank: **2**/64
- Top Grade Scholarship (5%), twice, 2013-2014 & 2014-2015

Harbin Institute of Technology *(2017.9-Present)* *Heilongjiang, China*

Ph.D. candidate, Mechanical Engineering

- Research Topic: **Imitation Learning; Robot Skill Learning; Optimal Control; Riemannian Manifold**

Idiap Research Institute *(2021.2-2022.9)* *Martigny, Switzerland*

Research Intern

- Research Topic: **Optimal Control; Riemannian Manifold**

RESEARCH EXPERIENCE

Research on human-robot collaboration technology and application for aerospace manufacturing

Project Participant Sep. 2022-Present

- Solving the algorithm problem about robot skill learning part.
- Solving the representation problem on the assembly angle
- Propose a method based on Dynamic Movement Primitives to solve the generalization problem of assembly motion.
- Verify the effectiveness of the proposed algorithm in Simulation and UR10 robot platform

Funded by Major Research Plan, National Nature Science Foundation of China (Grant No. 92048301)

***--PhD project and main research*.**

Efficient Human-Machine Collaboration and Intelligent Planning Technology Based on Multiple Operational Modes

Project Participant Nov. 2022-Present

- Collaborative Task Planning and Mutual Adaptation in Robot-Doctor Cooperation
- Researching theoretical methods for task allocation, motion planning, and mutual adaptability in various operational modes (collaborative, partially autonomous) when a robot performs vertebral plate excision surgery alongside a doctor.

Funded by National Key Research and Development Program of China (Grant No. 2022YFB4700701)

Learning by Switching Roles in Physical Human-Robot Collaboration

Project Participant Feb. 2022-Sep. 2022

- Solving the algorithm problem about robot skill learning part
- Propose a method based on geometry and optimal control framework for online planning and robustness to human disturbances.
- Verify the effectiveness of the proposed algorithm in Simulation and Franka Panda robot platform

Funded by the Swiss National Science Foundation SWITCH project (https://switch-project.github.io/)

--Visiting PhD project

Memory of Motion

Project Participant Feb. 2021-Feb. 2022

- Solving the algorithm problem about robot skill learning part.
- Propose a method based on geometry and optimal control framework to generalize the robot learned skill.
- Verify the effectiveness of the proposed algorithm in Simulation and Franka Panda robot platform.

Funded by European Commission's Horizon 2020 Programme Memory of Motion, https://www.memmo-project.eu/, Grant Agreement 780684

--Visiting PhD project

Fundamental Researches on Cooperative Dual-Arm Mobile Robot

Project Participant Sep. 2017-Sep. 2022

- Solving the algorithm problem about robot skill learning
- Propose a strategy to extract the feature of demonstration trajectory encoded by Dynamic Movement Primitives (DMPs)
- Verify the effectiveness of the proposed algorithm in Simulation and UR10 robot platform
- Considering to apply neural network to construct the model between task parameters and trajectory parameters

Funded by Major Research Plan, National Nature Science Foundation of China (Grant No. 91648201)

--PhD project and main research

Automatic Grinding Platform Based on Laser Cleaning

Project Participant — May. 2019-Sep. 2021

- Build the communication links PC between SIMENS PLC, MiYi range sensor and KUKA KR6
- Design the upper computer software to control the automatic grinding platform

Funded by Shanghai space research institute

Fundamental Researches on Cooperative Dual-Arm Mobile Robot

Project Participant — Dec. 2017-Nov. 2020

- Research on motion planning algorithm of robot cutting key parts of knee

Funded by National Key Research and Development Program of China (Grant No. 2017YFB1303001)

Ant Colony Algorithm in the Mobile Robot Path Planning Simulation Research

Project Leader — Dec. 2016-Jun. 2017

- Propose an optimization algorithm of ant colony algorithm to speed up the stochastic search for the optimal path
- Propose an adaptive parameter optimization and correction strategy to improve the planning path
- Built the simulation platform using MATLAB/GUI for planning the optimal path and export the planning file

2019 JCAR Cup Inclusive Robot Industrial Application College Invitational Tournament

Team Leader — May. 2019-Aug. 2019

- Build the simulation grasping platform in Gazebo and complete the grasping task
- Complete the task of the physical platform to grasp the specified fruit from the stacked objects

PUBLICATIONS

Journal Article:

- **Ti B**, Gao Y, Zhao, J and Calinon, S. An Optimal Control Formulation of Tool Affordance Applied to Impact Tasks[J], IEEE Transactions on Robotics, 2024.
- **Ti B**, Razmjoo A, Gao Y, Zhao, J and Calinon, S. A geometric optimal control approach for imitation and generalization of manipulation skills[J], Robotics and Autonomous Systems, 2023.
- **Ti B**, Gao Y, Shi M and Zhao, J. Generalization of orientation trajectories and force–torque profiles for learning human assembly skill[J]. Robotics and Computer-Integrated Manufacturing, 2022.
- **Ti B**, Gao Y, Shi M, Fu L and Zhao, J. Movement generalization of variable initial task state based on Euclidean transformation dynamical movement primitives[J]. International Journal of Advanced Robotic Systems, 2021.
- **Ti B**, Gao Y, Li Q and Zhao J. Human intention understanding from multiple demonstrations and behavior generalization in dynamic movement primitives framework[J]. IEEE Access, 2019.

Conference Article:

- **Ti B**, Gao Y, Zhao J and Calinon, S. Imitation of Manipulation Skills Using Multiple Geometries[C] 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). IEEE, 2022.
- **Ti B**, Gao Y, Li Q and Zhao J. Dynamic movement primitives for movement generation using GMM-GMR analytical method[C] 2019 IEEE 2nd International Conference on Information and Computer Technologies (ICICT). IEEE, 2019.
- Shi M, Gao Y, **Ti B** and Zhao J. Obstacle avoidance methods based on geometric information under the dmps framework[C] Intelligent Robotics and Applications: 14th International Conference, (ICIRA). Springer. 2021.
- Li Q, Gao Y, **Ti B** and Zhao J. Model-Error-Observer-Based Control of Robotic Manipulator with Uncertain Dynamics[C] 2019 IEEE 2nd International Conference on Information and Computer Technologies (ICICT). IEEE, 2019.

AWARDS and SCHOLORSHIPS

HIWIN Scholarship — *(Twice) 2013-2015*
Learning Excellence Award (First Prize) — *(Twice) 2013-2015*
Three-Good Students of Dalian University of Technology — *(Twice) 2013-2015*
Technology Innovation Award of Dalian University of Technology — *2013-2014*
Excellent Graduate of Dalian University of Technology — *2016-2017*
National Scholarship — *2017*

SKILLS

- Computer Skills:
  - Python, MATLAB, C, C#.
  - ROS, Gazebo, MATLAB, PyCharm, Visual Studio, AutoCAD, SolidWorks.
  - Latex, Word, PowerPoint, Excel, Visio.
- Language Skills:
  - Chinese (Native), English (Fluent), Japanese (Some knowledge of) and French (Learning)

LANGUAGE PROFICIENCY

- College English Test Band 6 (CET6): **499/710** (Listening: 170, Reading: 191, Writing and Translating: 138)
- Japanese Language Proficiency Test (N2): **104/180** (Reading: 38, Listening: 32, Language Knowledge: 34)