Kei Ota

Senior Research Scientist | Mitsubishi Electric

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Education

2021-2024 **PhD. in Computer Science**, Tokyo Institute of Technology, Tokyo, Japan.
2015-2017 **M.Sc. in Mechanical Engineering**, Tokyo Institute of Technology, Tokyo, Japan.
2011-2015 **B.Sc. in Mechanical Engineering**, Tokyo Institute of Technology, Tokyo, Japan.

Work

January 2024 – Present | **Senior Research Scientist | Mitsubishi Electric, Kanagawa, Japan,**
- Dexterous manipulation using tactile sensors
- Autonomous robotic assembly
- Multimodal LLM for Task and Motion Planning (w3,c16)

Collaboration with Devesh K. Jha (MERL) and Asako Kanezaki (TokyoTech)

Manipulation | Tactile Sensing | Assembly | Reinforcement Learning

August 2022 – January 2024 | **Visiting Research Scientist | Mitsubishi Electric Research Laboratories, Cambridge, MA, US,**
- Articulated object manipulation (c10)
- Dexterous manipulation using tactile sensors (c12,c13,c14,w1)
- Autonomous robotic assembly (c15)
- Multimodal LLM for Task and Motion Planning (c11)

Collaboration with Devesh K. Jha (MERL) and Josh Tenenbaum (MIT)

Manipulation | Tactile Sensing | Assembly | Interactive Perception

April 2017 – August 2022 | **Research Scientist | Mitsubishi Electric, Kanagawa, Japan,**
- Motion planning for industrial/mobile robots using RL (c6,c7,c4)
- State representation learning for RL (c5,j3)
- A novel algorithm for sample-efficient Inverse RL (c9)
- A deep RL library that supports a set of RL/IL/IRL/MPC algorithms - tf2rl
- Object-goal navigation using Transformer with external memories (c8)
- Human-inspired model-based RL for complex and real-time physical problem solving (j1)

Collaboration with Devesh K. Jha (MERL), Josh Tenenbaum (MIT), and Asako Kanezaki (TokyoTech)

Motion Planning | Reinforcement Learning | Navigation | Cognitive Science

January 2017 – October 2015 | **Research Intern | AxelSpace, Tokyo, Japan,**
- Implemented CNN from scratch in C++ for real-time onboard satellite image classification (c3)
- Developed software that decrypts encrypted data sent from satellites

Computer vision | Onboard programming

Refereed conference publications

* *equal first-authorship*

C16. **Interactive Robot Action Replanning using Multimodal LLM Trained from Human Demonstration Videos**. InterSpeech 2025 (under submission)
Chiori Hori, Motonari Kambara, Komei Sugiura, **Kei Ota**, Sameer Khurana, Siddarth Jain, Radu Corcodel, Devesh Jha, Diego Romeres, Jonathan Le Roux.

C15. **Autonomous Robotic Assembly: From Part Singulation to Precise Assembly**. IROS 2024
Kei Ota*, Devesh K Jha*, Siddarth Jain, Bill Yerazunis, Radu Corcodel, Yash Shukla, Antonia Bronars, Diego Romeres.

C14. **Tactile Estimation of Extrinsic Contact Patch for Stable Placement**. ICRA 2024
Kei Ota, Devesh K. Jha, Krishna Murthy Jatavallabhula, Asako Kanezaki, Joshua B. Tenenbaum.

C13. **Robust In-Hand Manipulation with Extrinsic Contacts**. ICRA 2024
Boyuan Liang, **Kei Ota**, Masayoshi Tomizuka, Devesh Jha, "Robust In-Hand Manipulation with Extrinsic Contacts.

C12. **Tactile-Filter: Interactive Tactile Perception for Part Mating**. RSS 2023
Kei Ota, Devesh K Jha, Hsiao-Yu Tung, Joshua B Tenenbaum.

C11. **Style-transfer based Speech and Audio-visual Scene understanding for Robot Action Sequence Acquisition from Videos**. INTERSPEECH 2023
Chiori Hori, Puyuan Peng, David Harwath, Xinyu Liu, **Kei Ota**, Siddarth Jain, Radu Corcodel, Devesh Jha, Diego Romeres, Jonathan Le Roux.

C10. **H-SAUR: Hypothesize, Simulate, Act, Update, and Repeat for Understanding Object Articulations from Interactions**. ICRA 2023
Kei Ota, Hsiao-Yu Tung, Kevin A. Smith, Anoop Cherian, Tim K. Marks, Alan Sullivan, Asako Kanezaki, and Joshua B. Tenenbaum.

C9. **OPIRL: Sample Efficient Off-Policy Inverse Reinforcement Learning via Distribution Matching**. ICRA 2022
Hana Hoshino, **Kei Ota**, Asako Kanezaki, and Rio Yokota.

C8. **Object Memory Transformer for Object Goal Navigation**. ICRA 2022
Rui Fukushima, **Kei Ota**, Asako Kanezaki, Yoko Sasaki, and Yusuke Yoshiyasu.

C7. **Deep Reactive Planning in Dynamic Environments**. CoRL 2022
Kei Ota, Devesh K. Jha, Tadashi Onishi, Asako Kanezaki, Yusuke Yoshiyasu, Yoko Sasaki, Toshisada Mariyama, Daniel Nikovski.

C6. **Efficient Exploration in Constrained Environments with Goal-Oriented Reference Path**. IROS 2020
Kei Ota, Yoko Sasaki, Devesh K Jha, Yusuke Yoshiyasu, and Asako Kanezaki.

C5. **Can Increasing Input Dimensionality Improve Deep Reinforcement Learning?**. ICML 2020
Kei Ota, Tomoaki Oiki, Devesh K Jha, Toshisada Mariyama, Daniel Nikovski.

C4. **Trajectory Optimization for Unknown Constrained Systems using Reinforcement Learning**. IROS 2019
Kei Ota, Devesh K. Jha, Tomoaki Oiki, Mamoru Miura, Takashi Nammoto, Daniel Nikovski, Toshisada Mariyama.

C3. **On-board Satellite Imagery Classification using Convolutional Neural Networks**. ISTS 2017
Kei Ota, Takehiko Koike, Yoichi Yatsu, and Saburo Matunaga.

C2. **Fault Tolerant Circuit Design for Low-cost and Multi-Functional Attitude Sensor Using Real-time Image Recognition**. ISTS 2017
Yuhei Kikuya, Masanori Matsushita, Masaya Koga, **Kei Ota**, Yuki Hayashi, Takehiko Koike, Toshiki Ozawa, Yoichi Yatsu, and Saburo Matunaga.

C1. **Proposal and Results of an Automatic Operation System for Nano Satellites Using Multiple Ground Stations**. ISTS 2015
Kei Ota, Masaya Koga, Sota Suzuki, Kazuyoshi Miyasato, Shota Kawajiri, EuGene Kim and Saburo Matunaga.

Journal publications

J3. **A Framework for Training Larger Networks for Deep Reinforcement Learning**. Machine Learning 2024
Kei Ota, Devesh K. Jha, Asako Kanezaki.

J2. **Development and In-Orbit Operation of Deep Learning Attitude Sensor**. Journal of Spacecraft and Rockets 2023
Yuhei Kikuya, **Kei Ota**, Yohei Iwasaki, Toshiki Ozawa, Kei Watanabe, Yoichi Yatsu, Saburo Matunaga.

J1. **Data-Efficient Learning for Complex and Real-Time Physical Problem Solving using Augmented Simulation**. RAL 2021
Kei Ota, Devesh K Jha, Diego Romeres, Jeroen van Baar, Kevin A Smith, Takayuki Semitsu, Tomoaki Oiki, Alan Sullivan, Daniel Nikovski, Joshua B Tenenbaum.

Refereed workshop publications

W3. **Human Action Understanding-based Robot Planning using Multimodal LLM**. ICRA Workshops 2024
Motonari Kambara, Chiori Hori, Komei Sugiura, **Kei Ota**, Devesh K Jha, Sameer Khurana, Siddarth Jain, Radu Corcodel, Diego Romeres, Jonathan Le Roux.

W2. **Tactile Estimation of Extrinsic Contact Patch for Stable Placement**. IROS Workshops 2023
Kei Ota, Devesh K. Jha, Krishna Murthy Jatavallabhula, Joshua B. Tenenbaum.

W1. **Tactile Pose Feedback for Closed-loop Manipulation Tasks**. RSS Workshops 2023
Kei Ota, Siddarth Jain, Mengchao Zhang, Devesh K Jha.

Select Honors and Awards

2024 **Head of CR&D Award** for the Autonomous Assembly demonstrations at CES2024.
2019 **Head of CR&D Award** for developing an efficient RL framework.
2015 **First place** in 23rd Satellite Design Contest in Japan (idea award).
2014 **First place** in 22nd Satellite Design Contest in Japan (design award).
2014 **First place** in 17th Robot GrandPrix in Japan. We developed a robot that cooks fried rice.
2013 **First place** in ARLISS (A Rocket Launch for International Student Satellites) 2013 in the US. We developed a CanSat that autonomously controls its attitude and deploys a parabola antenna.

Professional Service and Volunteering

2024-Present Associate editor; ICRA
2024-Present Program Committee Member, Innovative Robotics Learning and Cognitive Development Research, The Robotics Society of Japan
2020-2023 Expert; ISO/IEC JTC 1/SC 42 (Artificial Intelligence) WG1, WG2, WG3, WG4, WG5
2019-Present Reviewer; Robotics (ICRA, IROS, RAL, CoRL) and ML (Neurips, ICML) venues

Workshops and Sessions Co-organized

Nov 2021 Program Committee Member, Workshop on Machine Learning for Mobile Robot Vision and Control (ACML 2021 Workshop). Webpage
Dec 2021 Program Committee Member, Ecological Theory of RL (NeurIPS 2021 workshop). Webpage

Talks

Jun 25 2024 Invited talk - "Interactive Perception and Control for Robotic Manipulation using Tactile Sensors," 153rd Robotics seminar, The Robotics Society of Japan (150 attendees). Webpage
Apr 16 2024 Invited talk - Denso IT Lab
Feb 21 2024 Invited talk - RoboNight Seminar, Matsuo Lab, The University of Tokyo.
Dec 1 2023 Invited talk - Toyota Research Institute
May 10 2022 Invited talk - "Motion Planning in Dynamic Environments," 140th Robotics seminar, The Robotics Society of Japan (200 attendees). Webpage
Aug 1 2021 Invited talk - Omron Sinic X
Jul 27 2021 Tutorial talk - "The Basics and Applications of Deep Reinforcement Learning," MIRU 2021 (300 attendees). Webpage
Nov 4 2020 Invited talk - "Motion Planning in Dynamic Environments," Matsuo Lab, The University of Tokyo.

Teaching

Nov 17 2021 (Instructor) **Model-based RL** at Deep RL Autumn Seminar at The University of Tokyo.
Mar 1 2021 (Instructor) **Continuous Deep RL Algorithms** at Deep RL Spring Seminar at The University of Tokyo.
Aug 18 2020 (Teaching assistant) **Model-based RL** at Deep RL Summer Seminar at The University of Tokyo.
2016 (Teaching assistant) **CanSat** at Tokyo Institute of Technology.

Students Mentored

A list of students I have closely mentored on a research or technical project. (Criteria: Mentorship lasted 3 months or longer or current)

4 Students at their PhD level or equivalent.
4 Students pursuing Masters programs

8	Students at their undergraduate level of study

2024-Present	Mark Van der Merwe, PhD, University of Michigan (Intern) - Dexterous manipulation for stable placements
2023-Present	Jiawei Jiang, PhD, TokyoTech - Visuo-tactile manipulation
2024-Present	Yusuke Kojima, MS, TokyoTech - Multi-agent RL for soccer game
2024-Present	Kuanting Wu, Undergrad, NTHU - Foundation model for manipulation
2024-Present	Ryota Hasegawa, Undergrad, TokyoTech - Articulated object manipulation
2024-Present	Ryoya Yoshimura, Undergrad, TokyoTech - Robot interactive object segmentation
2024-Present	Masaru Yajima, Undergrad, TokyoTech - Tactile perception for robotic assembly
2023-2024	Antonia Bronars, PhD, MIT (Intern) - Tactile pose estimation
2023-2024	Motonari Kambara, PhD, Keio University (Intern) - Multimodal LLM for robotic motion generation
2022-2023	Kanoko Goto, Undergrad, TokyoTech - Model-based RL using NeRF
2021-2023	Yugo Makita, MS, KyushuTech - Deformable objects manipulation
2021-2022	Keigo Kamiyama, Undergrad, TokyoTech - Dynamics-aware motion planning
2021-2022	Ryosuke Takanami, Undergrad, TokyoTech - Dynamics-aware motion planning
2020-2022	Hanna Hoshino, MS, TokyoTech - Inverse reinforcement learning
2020-2022	Rui Fukushima, MS, AIST - Multimodal model for navigation
2019-2020	Toshinori Kitamura, Undergrad Keio University - Deep RL for navigation

Skills

Programming	Python, C, C++, Microsoft .Net (C#), ROS
Frameworks	Pytorch, Tensorflow, Caffe
OSS	tf2rl - Tensorflow 2 implementations of Deep RL (including IL, IRL, MPC), 465 stars
Tools	Git/GitHub, Unix Shell, PyCharm, VS Code, Vim, wandb, Slurm
Mechanical Engineering	3D CAD (AutoDesk Fusion360/Inventor, SolidWorks), 3D Printer, Laser machine, CNC, Milling machine, etc. (can design/build zigs/tools for research purposes.)
Electrical Engineering	Design circuits (MBE, Eagle). Microcontrollers (PIC, mbed, Arduino, Raspberry PI)

Misc.

News Releases

Dec 19 2023	Mitsubishi Electric to Showcase Sustainable Smart Society at CES 2024. Website
Jun 3 2020	Mitsubishi Electric Develops Cooperative AI for Human-Machine Work. Webpage
Feb 13 2019	Mitsubishi Electric's Fast Stepwise-learning AI Shortens Motion Learning. Webpage
Sep 20 2018	Mitsubishi Electric to Exhibit at CEATEC JAPAN 2018. Website
Feb 14 2018	New Technology Uses Model-based AI Learning to Control Equipment. Webpage
Feb 8 2018	Mitsubishi Electric Develops Smart-control AI Technology that Adapts Rapidly and Nimbly to Changing Conditions. Webpage

Patents

2024	Chiori Hori, **Kei Ota**, etal., "System and Method For Robot Planning Using Large Language Models"
2024	**Kei Ota**, "Controller, Control Method And Control System"
Sep 22 2022	**Kei Ota**, "Robot control device, robot control method, and learning model generation device"
Jan 20 2022	**Kei Ota**, Takashi Nammoto, "Moving object control device, moving object control learning device, and moving object control method"

Media

Apr 19 2024	"MERL introduces a new autonomous robotic assembly technology," IEEE Video Friday. Webpage
Aug 11 2020	"Mitsubishi Electric developed state-of-the-art RL algorithm," Nikkei Robotics

Demonstrations at Exhibitions

13-17 May 2024	"Autonomous Robotic Assembly," ICRA2024.
9-12 Jan 2024	"Autonomous Robotic Assembly," CES2024. YouTube
16-19 Oct 2018	"Technology with model-based AI learning to control equipment which enable to lead a ball to the goal of circular maze without teachings by human," CEATEC2018.

Review Articles (published on Domestic Journals)

T3. **Deep Reinforcement Learning for Motion Planning.** Artificial Intelligence Volume 37 No.4 (Jul 2022)
Kei Ota.

T2. **Motion Planning in Dynamic Environments.** Journal of the Robotics Society of Japan Volume 39 Issue 7 (May 2021)
Kei Ota, Asako Kanezaki.

T1. **Trends and Challenges of Reinforcement Learning.** The Journal of The Institute of Image Information and Television Engineers Volume 73 Issue (Apr 2019)
Toshisada Mariyama, **Kei Ota**.

References

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