Hiroki Furuta

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Education

The University of Tokyo Tokyo, Japan

Ph.D. Student *April 2022 - (March 2025)*

- Department of Technology Management for Innovation, Graduate School of Engineering
- Supervisor: Yutaka Matsuo (Chairperson, AI Strategy Council, Cabinet Office, Japan)
- Research Topic: Web Navigation with Large Language Models, Foundation Models for Decision Making

Master of Engineering *April 2020 - March 2022*

- Department of Technology Management for Innovation, Graduate School of Engineering
- Supervisor: Yutaka Matsuo, Advisor (Adjunct Professor): Shixiang Shane Gu
- Research Topic: Deep Reinforcement Learning for Continuous Control, Data-Centric View of Deep Reinforcement Learning
- Coursework: Statistical Machine Learning, Deep Learning, Artificial Intelligence, Advanced Programming Techniques, Internet Engineering, Biosignal Processing, etc. (GPA: 3.9)
- **Dean's Award**, from Graduate School of Engineering (2022)

Bachelor of Engineering *April 2016 - March 2020*

- Department of Systems Innovation, School of Engineering
- Research Topic: Application of Machine Learning for Space Exploration Research, Object Detection for Planetary Science Images
- Coursework: Statistical Machine Learning, Artificial Intelligence, Image Processing, Applied Statistics, Data Mining, Algorithms and Data Structures, Mathematical Programming and Optimization, Probability theory, Human Interface Engineering, Multi-Agent System, System Control Theory, Complex Theory, etc.

Employment

Google DeepMind July 2022 – (March 2025)

Student Researcher Program *Tokyo, Japan*

- Research Topic: Real-World Web Navigation with Large Language Models. Multimodal Web Navigation.
- Host: Heiga Zen, Izzeddin Gur , Collaborator: Kuang-Huei Lee, Aleksandra Faust, Shixiang Shane Gu, etc.

Matsuo Institute, Inc. September 2019 – March 2022

Part-time Student Researcher *Tokyo, Japan*

- Research Topic: Reinforcement and Imitation Learning for Robotics. Object Detection for Autonomous Driving.

NABLAS Inc. August 2018 – March 2019

Research Intern *Tokyo, Japan*

- Research Topic: Probabilistic Generative Models for Anomaly Detection of Chemistry Industrial Process.

Selected Publication

Conference Publications

- Kuang-Huei Lee, Xinyun Chen, Hiroki Furuta, John Canny, Ian Fischer. A Human-Inspired Reading Agent with Gist Memory of Very Long Contexts. **ICML 2024**.
- Izzeddin Gur*, Hiroki Furuta*, Austin Huang, Mustafa Safdari, Yutaka Matsuo, Douglas Eck, Aleksandra Faust. (*Equal Contribution). A Real-World WebAgent with Planning, Long Context Understanding, and Program Synthesis . **ICLR 2024 (Oral)**
- Hiroki Furuta, Kuang-Huei Lee, Ofir Nachum, Yutaka Matsuo, Aleksandra Faust, Shixiang Shane Gu, Izzeddin Gur. Multimodal Web Navigation with Instruction-Finetuned Foundation Models. **ICLR 2024**. (Also accepted to ICLR 2023 Workshop on Multimodal Representation Learning as **Spotlight**, Project Page)
- Open X-Embodiment Collaboration, et al (One of 170+ authors). Open X-Embodiment: Robotic Learning Datasets and RT-X Models. **ICRA 2024**. (Project Page)

- Hiroki Furuta, Yusuke Iwasawa, Yutaka Matsuo, Shixiang Shane Gu. A System for Morphology-Task Generalization via Unified Representation and Behavior Distillation. **ICLR 2023 (notable-top-25%)**. (Also accepted to NeurIPS 2022 Offline Reinforcement Learning Workshop as **Contributed Talk**, Project Page)
- Hiroki Furuta, Yutaka Matsuo, Shixiang Shane Gu. Generalized Decision Transformer for Offline Hindsight Information Matching. **ICLR 2022 (Spotlight)**. (Project Page)
- Hiroki Furuta, Tadashi Kozuno, Tatsuya Matsushima, Yutaka Matsuo, Shixiang Shane Gu. Co-Adaptation of Algorithmic and Implementational Innovations in Inference-based Deep Reinforcement Learning. **NeurIPS 2021**.
- Hiroki Furuta, Tatsuya Matsushima, Tadashi Kozuno, Yutaka Matsuo, Sergey Levine, Ofir Nachum, Shixiang Shane Gu. Policy Information Capacity: Information-Theoretic Measure for Task Complexity in Deep Reinforcement Learning. **ICML 2021**. (Also accepted to ICLR 2021 Workshop on Never-Ending RL as **Contributed Talk**)
- Tatsuya Matsushima*, Hiroki Furuta*, Yutaka Matsuo, Ofir Nachum, Shixiang Gu (*Equal Contribution). Deployment-Efficient Reinforcement Learning via Model-Based Offline Optimization. **ICLR 2021**.

Preprints

- Hiroki Furuta, Gouki Minegishi, Yusuke Iwasawa, Yutaka Matsuo. Interpreting Grokked Transformers in Complex Modular Arithmetic. (ICLR 2024 Workshop Bridging the Gap Between Practice and Theory in Deep Learning, **Oral**)
- Hiroki Furuta, Yutaka Matsuo, Aleksandra Faust, Izzeddin Gur. Exposing Limitations of Language Model Agents in Sequential-Task Compositions on the Web. arXiv preprint arXiv:2311.18751, 2023.

Academic Activitites

- Co-organizer for Ecological Theory of RL Workshop at NeurIPS 2021.
- Reviewer for International Conference on Learning Representations (ICLR), 2022†, 2023, 2024.
- Reviewer for Neural Information Processing Systems (NeurIPS), 2021, 2022†, 2023†.
- Reviewer for International Conference on Machine Learning (ICML), 2021, 2022, 2023, 2024.
- Reviewer for Transactions on Machine Learning Research (TMLR).
- Reviewer for Advanced Robotics (AR).
- Program Committee for Foundation Models for Decision Making Workshop at NeurIPS 2022, 2023.

†Highlighted as **Top Reviewer**

Awards and Honours

- **Forbes JAPAN 30 UNDER 30 2023**, Forbes JAPAN, 2023
- **The Japan Society for the Promotion of Science Research Fellow (DC1)**, April 2022 - March 2025 (2,400,000 JPY + research grants 1,100,000 JPY per year).
- **Toyota/Dwango Scholarship for Advanced Artificial Intelligence Researcher**, April 2021 - March 2022 (1,200,000 JPY).
- **Dean's Award** (Research), from Graduate School of Engineering, The University of Tokyo, 2022.
- **Specially Selected Bachelor Thesis Award**, from Department of Systems Innovation, School of Engineering, The University of Tokyo, 2020. "Automated Identification of Gravel Particles in High-Resolution Images of Asteroids using Convolutional Neural Networks".
- **Specially Selected Student Award**, Global Consumer Intelligence Endowed Chair, The University of Tokyo, 2018.

Technical Skills

Languages: Python (Expert), MATLAB (Proficient), JavaScript (Proficient), ROS (Proficient), C (Proficient), R (Familiar), Java (Familiar)
Frameworks:JAX (Expert), TensorFlow (Expert), PyTorch (Expert), NumPy (Expert)

Teaching

World Models Endowed Course Winter 2023
Lecturer *Tokyo, Japan*

- Held in Winter 2023 at The University of Tokyo (about 300 students).
- Giving lectures about Transformer, Foundation Models and Large Language Models.

Deep Reinforcement Learning Course Summer 2020 – Spring 2023
Organizer, Lecturer and Teaching Assistant *Tokyo, Japan*

- Held in Summer 2020, Spring 2021, Fall 2021, and Spring 2023 at The University of Tokyo (about 150 students per course).
- Giving lectures about Imitation Learning, Offline Reinforcement Learning, Unsupervised (Reward-Free) Reinforcement Learning, and Foundation Models.

Research Interest

My expertise lies in building real-world autonomous agents. Initially, I focused on data-driven deep reinforcement learning (RL). However, with the emergence of GPT-3, I pivoted to explore the revolutionary potential of Large Language Models (LLMs) for decision-making tasks, with a particular emphasis on the web navigation domain. LLMs offer a distinct advantage: their inherent common sense and understanding of preferred behaviors eliminate the need for extensive training from scratch, unlike RL agents.

I would like to realize a multimodal generalist agent to control all digital devices (web browsers, computers, and smartphones) across any platform via the graphical user interface. Throughout my successive works on web agents, I hypothesize that the key to success would be (1) the development of automated actor and episode evaluator via prompting for scalable data collection, and (2) finetuning the most capable model with dataset as large as possible (including both success and failure).

In addition, such a generalist agent for controlling all digital devices can have huge impacts to the entire society around the world from both research and product aspects. I have a strong passion for this direction.