

# TAKAHIRO MAEDA

PhD student at Toyota Technological Institute

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## EDUCATION

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### **Toyota Technological Institute Japan**

*November 2021 - present*

Doctor of Philosophy, Engineering

Department of Electronics and Information Engineering

### **Toyota Technological Institute Japan**

*April 2019 - March 2021*

Master of Science, Engineering

Department of Electronics and Information Engineering

### **Toyota Technological Institute Japan**

*April 2015 - March 2019*

Bachelor of Science, Engineering

## RESEARCH INTEREST

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My main research interests are in Computer Vision and Robotics. I worked on Human Pose Estimation, Human Motion Prediction, and Reinforcement Learning with a physics simulator environment. I want to develop a system that observes, physically interacts with, and assists humans more robustly and safely.

## RESEARCH PROJECTS

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### **Multimodal Active Measurement for Human Mesh Recovery in Close Proximity**

*under review for RA-L*

Most previous human pose estimation or mesh recovery methods assume that target people are far enough and fully visible by cameras. However, in physical human-robot interaction (pHRI) scenarios that require accurate human poses, the assumption above cannot hold true because target people are usually close to robots for interactions. Therefore, we propose the active measurement and sensor fusion frameworks for human mesh recovery for accurate pose estimation in close proximity by integrating the touch and 2D LiDAR sensors, which are naturally obtained in pHRI scenarios. This work was done during the three-months research internship at Frontier Research Center, Toyota Motor Corporation.

Paper link

**Fast Inference and Update of Density Estimation on Temporal Prediction** Safety-critical applications such as autonomous vehicles and social robots require fast computation and accurate probability density estimation on trajectory prediction. We propose a new normalizing flow-based trajectory prediction model named FlowChain to address both requirements. This work is accepted at ICCV2023.

Paper link

Code link

### **Data Augmentation with Physical Correction for Human Motion Prediction**

The project tries to address the high cost and time limitations of Motion Capture. We produced diverse and physically plausible motions by training physically simulated humanoid agents to mimic generated motion by Inverse Kinematics and Variational AutoEncoder which are potentially physically incorrect. The augmented dataset can be used for Motion Generation and Motion Prediction methods. This work is accepted at CVPR2022.

Paper link

Code link

### Real Robot Challenge

I worked on the Real Robot Challenge hosted by the Max Planck Institute for Intelligent Systems. This challenge aims to achieve dexterous robotic manipulation in the real world. We developed a method for rotating and translating a cube to an arbitrary pose in a workspace by using a three-fingered robot. We use a Rapidly-exploring Randomized Tree (RRT) with an augmented pose space and Residual Policy Learning to solve the problem. Our team won first place in Phase 2 and Phase 3. €12500 in total were granted.

Arxiv report link

### Automatic Human Pose Annotation for Loose-Fitting Clothes

The project addresses the difficulty of annotating human poses occluded by clothes. We annotated images automatically by projecting pre-annotated poses without loose clothes to images of humans with occluding clothes. I presented the poster of this project at Machine Vision Applications 2019.

Paper link

### Interactive Human Motion Prediction by supervised learning

The project aims at developing a supervised human motion prediction method for interactive setting *e.g.* performing high five with multiple people. Specifically, I captured pairs of human motions by using *Microsoft Kinect v2* and constructed an RNN model with a residual path to predict one motion from the input of another.

## PUBLICATIONS

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**T. Maeda** and N. Ukita.

*Fast Inference and Update of Probabilistic Density Estimation on Trajectory Prediction*

The IEEE/CVF International Conference on Computer Vision, Paris, France, 2023.

**T. Maeda** and N. Ukita.

*MotionAug: Augmentation with Physical Correction for Human Motion Prediction.*

The IEEE/CVF Conference on Computer Vision and Pattern Recognition, New Orleans, United States, 2022.

**T. Maeda** and N. Ukita.

*Data Augmentation for Human Motion Prediction*

17th International Conference on Machine Vision and Applications, virtual, 2021

T. Yoneda, C.Schaff, **T. Maeda**, & M. Walter.

*Grasp and motion planning for dexterous manipulation for the real robot challenge.*

arXiv preprint arXiv:2101.02842, 2021

T. Matsumoto, K. Shimosato, **T. Maeda**, T. Murakami, K. Murakoso, K. Mino, & N. Ukita.

*Human Pose Annotation Using a Motion Capture System for Loose-Fitting Clothes.*

IEICE Transactions on Information and Systems, 103(6), 1257-1264, 2020.

T. Matsumoto, K. Shimosato, **T. Maeda**, T. Murakami, K. Murakoso, K. Mino, & N. Ukita.

*Automatic Human Pose Annotation For Loose-Fitting Clothes.*

16th International Conference on Machine Vision Application, Tokyo, Japan, 2019.

## SKILLS

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<b>Programming</b>	Python, C++
<b>Machine learning framework</b>	Tensorflow, Pytorch
<b>Robotics</b>	ROS
<b>Simulator</b>	Bullet Physics, Gazebo
<b>Software &amp; Tools</b>	Latex

## LICENSES

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**Certified Care Worker**      April 2022, Japan

## EXPERIENCES

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Frontier Research Center, Toyota Motor Corporation.  
Research Internship, May-August 2023.

Toyota Technological Institute at Chicago.  
Research Internship, September-December 2019.

## SERVICES

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Reviewed for Journal Computer Vision and Image Understanding.

## HONORS & AWARDS

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### **Conference Presentation Award**

IEEE Nagoya Section  
2023

### **The first place, €3500 granted**

Phase2 of Real Robot Challenge 2021, the Max Planck Institute for Intelligent Systems

### **The first place, €9000 granted**

Phase3 of Real Robot Challenge 2021, the Max Planck Institute for Intelligent Systems

### **Best Poster Award**

Machine Vision and Applications Organization  
Tokyo, Japan, 2019