TAKAHIRO MAEDA

PhD student at Toyota Technological Institute
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EDUCATION

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

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

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

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

Programming	Python, C++
Machine learning framework	Tensorflow, Pytorch
Robotics	ROS
Simulator	Bullet Physics, Gazebo
Software & Tools	Latex

LICENSES

Certified Care Worker April 2022, Japan

EXPERIENCES

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

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

SERVICES

Reviewed for Journal Computer Vision and Image Understanding.

HONORS & AWARDS

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