

Research topics for graduate students for 2025

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Acceptable course(s)

- Master's Degree
- Doctoral Degree

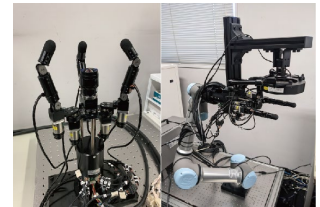


Research Topics

By connecting various sensors on the network, centered on high-speed vision, we construct sensor network systems to quickly and comprehensively recognize the real world. Then we also feed back to actuation systems (robot arm and robot hand, etc.) in real time. We aim to develop high-speed intelligent systems that realize dynamic interaction to the real world. Currently, we are pursuing developments and researches in the following research fields.

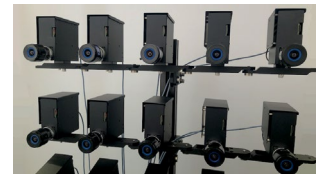
1. High-speed Robot

We have been developing high-speed robot including high-speed vision, high-speed image processing, and high-speed sensory feedback. For example, we developed a high-speed robot hand, which can perform speed of $180^\circ / 0.1 \text{ s}$, and a high-speed hand-arm system. Then, we have achieved dynamic tasks with these systems and new methods.



2. High-speed Sensor Network

We are developing a measurement system capable of processing 1,000 images per second, facilitating precise object detection and tracking across large areas. Leveraging high-speed image processing technology and networking, our system enables seamless observation of dynamic object motion, providing invaluable spatiotemporal information.



3. Intelligent Transport Systems

We investigate sensing technologies for vehicles through high-speed, high-accuracy recognition of the vehicle and its surrounding environment using high-speed vision sensor network system. For example, we are developing systems for vehicle's posture estimation and localization by capturing and analyzing proximate road surface.



Articles Related to Research Topics

- [1] Y. Yamakawa and K. Yoshida: Teleoperation of High-Speed Robot Hand with High-Speed Finger Position Recognition and High-Accuracy Grasp Type Estimation, *Sensors*, Vol.22, Issue 10, Article No. 3777 (2022)
- [2] T. Wang and Y. Yamakawa: Real-Time Occlusion-Robust Deformable Linear Object Tracking With Model-Based Gaussian Mixture Model, *Frontiers in Neurorobotics*, Volume 16, Issue ISS, Article No. 886068, pp 1-14 (2022)
- [3] M. Hirano, Y. Yamakawa, T. Senoo, N. Kishi, M. Ishikawa: Multiple Scale Aggregation with Patch Multiplexing for High-speed Inter-vehicle Distance Estimation, *IEEE Intelligent Vehicles Symposium (IV)*, pp. 1436-1443 (2021)

Lab. Web page: <http://www.hfr.iis.u-tokyo.ac.jp/index-e.html>