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Department of Mechanical Engineering

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 (robots 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 below research field.

### 1. Human-Robot Interaction

By using a high-speed vision and a high-speed robot hand, we have constructed super low-latency and real-time human-robot interaction system. As concrete tasks, we have achieved Janken (rock-paper-scissors) robot with 100% winning rate, human-robot collaboration, assistance system and enhancement of human motion.

### 2. Dynamic Manipulation

We focus on flexible object manipulation which is considered to be difficult to perform by robots, and we aim to achieve dynamic and high-speed manipulation of flexible objects. We achieved one-handed knotting of a flexible rope and dynamic folding of a cloth using a high-speed robot hand system.
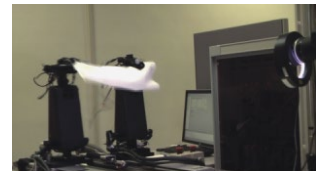
### 3. Intelligent Transport Systems

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