Kenji Koide

Ph.D. in Engineering
Research fellow
Smart Mobility Research Team
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Experience

National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan – Research fellow

June 2019 – PRESENT

Toyohashi University of Technology, Toyohashi, Japan – Research fellow

April 2019 – June 2019

University of Padova, Padova, Italy – Research fellow

April 2018 – April 2019

Education

Toyohashi University of Technology, Toyohashi, Japan – Ph.D. in Engineering

April 2015 – May 2019

Toyohashi University of Technology, Toyohashi, Japan – Master of Engineering

April 2013 – March 2015

Toyohashi University of Technology, Toyohashi, Japan – Bachelor of Engineering

April 2011 – March 2013

Maizuru National College of Technology, Maizuru Japan

April 2006 – March 2011

University of Padova, Padova, Italy – Visiting Ph.D. student

October 2016 – April 2017

Awards

21st All National Colleges of Technology Programming Contest, Kochi, Japan, Excellent Award, Oct, 2010
14th SICE System Integration Annual Conference, Kobe, Japan, Excellent Presentation Award, Dec, 2013
Robocup@home Nagoya, Domestic Standard Platform League 4th place, July, 2017

Research topics

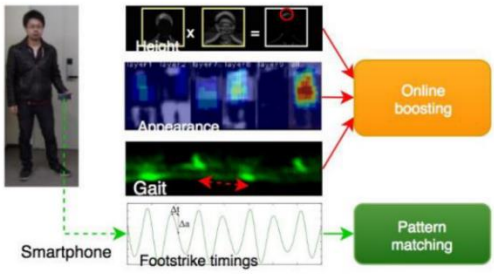
Kenji Koide's research interests are in the field of intelligent robotic systems. In particular, he has been working on person identification and motion prediction for mobile robots, on 3D environmental mapping

systems, on interactive and distributed camera network systems, and on geometrical calibration for vision, LIDAR, and industrial systems.

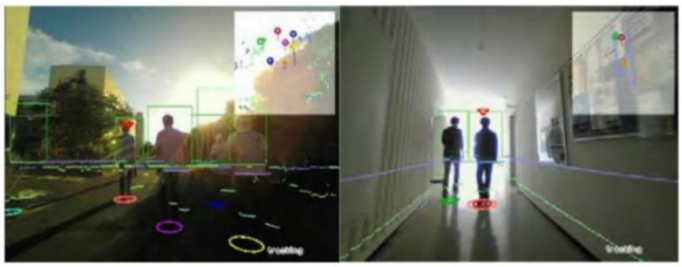
Projects

Robust person identification for person following robots

In this project, we developed person identification methods which exploit multi-modal person features and online learning strategy to enable the robot to reliably follow a specific target person. We proposed CNN-based discriminative appearance features and illumination-independent gait and height features, and integrated them using an online feature selection approach to construct a target person identification model. We also proposed a walking pattern matching method to identify a person holding a smartphone among the persons around the robot. By adaptively selecting good features among the multi-modal features according to the current circumstance, the robot reliably identifies and follows the target person in any situations.
As an application of the person following robot, we designed a robotic attendant system for elderly. In this system, the robot follows an elderly while assessing the risk of accidents, e.g., falling and stumbling, and alert the elderly if an accident is anticipated to keep him/her away from dangerous situations.



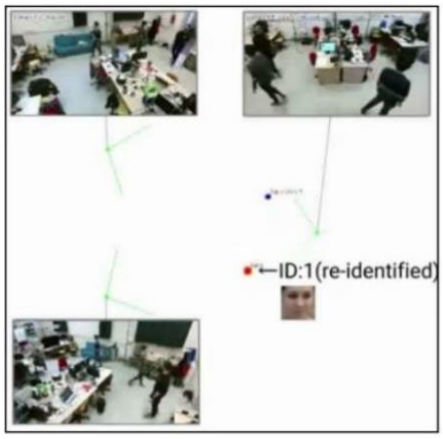
(a)Multi-modal person identification


(b) Person following under severe illumination conditions

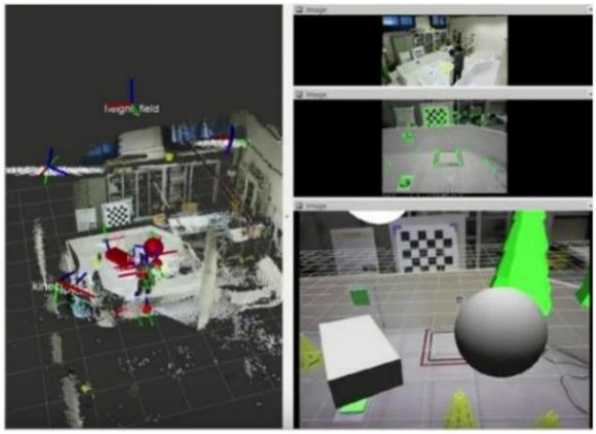
Human-machine interaction in a camera network

Camera network systems have attracted much attention as affordable consumer RGB-D cameras are made available in the last decade. As a part of OpenPTrack, a UNIPD-UCLA joint research project to develop an open source camera network-based people tracking framework, we developed HMI (human-machine interaction) functionalities for camera networks to construct rich and interactive systems.
First, we developed a deep neural network-based face recognition framework for long-term person re-identification in a camera network. This allows us to keep tracking the positions of specific persons over days. We demonstrated that this can be applied to a household robotic service in which the system locates a registered person (e.g., a member of a family) and lets a robot serve a cup of coffee to them.
Second, we created an augmented reality-based information presentation system. In this system, to render entities tracked by the camera network on a mobilephone's screen, we estimate the phone's pose with

respect to the reference frame of the camera network using visual odometry and visual fiducial tag-based landmark SLAM techniques. This system is expected to be applied to interactive and immersive information presentation systems in daily and industrial environments.



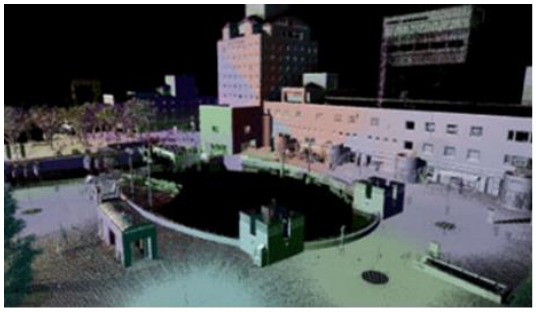
(a) Face recognition-based person re-identification



(b) Augmented reality in a camera network

Smart personal mobility system in an urban environment

Toward carbon-free smart personal mobility society, we have been developing an autonomous wheelchair driving system in an urban environment. There are two key factors in this project: 1) The accuracy and reliability of localization is crucial for autonomous driving. To realize a mobility navigation system, we have been developing robust and reliable mapping and localization techniques by combining affordable multi-modal sensors, e.g., LIDAR, camera, and IMU. 2) To be socially acceptable, the autonomous mobility has to be able to avoid obstacles and surrounding persons smoothly, and its behavior has to be predictable for the persons. We have been investigating a data-driven method for generating robot behavior with a deep neural network. In this way, we let the robot imitate natural behavior made by human demonstrators.
This project is running under a collaboration of academia and industrial partners, and we are aiming the commercialization of the autonomous wheelchair.



(a) 3D mapping in urban environments

(b) Automatic wheelchair driving system