



Digital Twin Unit

Overview

Efforts are being made worldwide to realize Society 5.0 (a super-smart society) by constructing digital twins (integrating physical and cyber spaces) using the latest mathematical and information technologies, thereby addressing various challenges faced by cities, regions, and industries. To this end, our unit collaborates with private companies to advance projects that integrate reality and virtual spaces. We achieve practical applications in collaboration with academia and industry by developing algorithms in mathematical optimization, deep learning, reinforcement learning, graph analysis, high-performance computing, and quantum computing, and by utilizing high-performance computing in the cloud.

Research Goals

We are developing a mobility optimization engine that conducts optimization and simulation in cyberspace using massive amounts of sensor data (such as the movement of people and objects) and open data. Our unit aims to construct a collection of services that contribute to the creation of new industries, reduction of costs and waste, and computation of optimal control schedules for transportation systems, with the goal of providing users with optimal time and space solutions. We focus on the following two types of mobility, that will drive forward the proposal and development of new techniques in mathematics and information technology:

- 1. Mobility of People and Goods:** Location detection and tracking (using deep learning), congestion detection, optimization, and visualization of flow.
- 2. Traffic Mobility:** Route optimization and delivery optimization.

Moving forward, we plan to build a platform that accelerates social implementation by integrating the latest technologies in manufacturing, optimization, AI, IoT, cloud, and quantum computing.



Research Unit
Leader

Katsuki Fujisawa

Profile

- 2023 Professor, Institute of Innovative Research, Tokyo Institute of Technology
- 2018 Director, Real World Big-Data Computation Open Innovation Laboratory(RWBC-OIL), AIST
- 2014 Professor, Institute of Mathematics for Industry, Kyushu University
- 2012 Professor, Department of Industrial and Systems Engineering, Chuo University
- 2007 Associate Professor, Department of Industrial and Systems Engineering, Chuo University
- 2002 Associate Professor, Department of Mathematical Science, Tokyo Denki University
- 1998 Assistant Professor, Department of Architecture and Architectural Systems, Kyoto University
- 1998 Doctor of Science, Department of Mathematical and Computing Sciences, Graduate School of Information Science and Engineering, Tokyo Institute of Technology
- 1993 Bachelor of Engineering, Department of Industrial Management, Waseda University

WEB

<https://sites.google.com/view/fujisawa-lab-en/>

Components of Cyber-Physical Systems (CPS)

By digitizing phenomena occurring in the real world, it becomes possible to develop applications aimed at creating a better real-world experience. In CPS, the construction of digital twins is facilitated through the pairing of physical (real-world) and cyber spaces.

