

# Keisuke Otaki

RESEARCH SCIENTIST, TOYOTA CENTRAL R&D LABS., INC.

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## Summary

Keisuke Otaki received the B.E. degree in Engineering (Computer Science) in 2011 from Kyoto University, Japan. He also received his Ph.D. degree in Informatics from Kyoto University in 2016. He was a visiting doctor course student at the University of Bonn and Fraunhofer IAIS from 2013 to 2014 during his Ph.D. course. He was also an research fellow of JSPS from 2014 to 2016. He then joined the current position.

**Statements on Recent Work:** I'm working at Toyota Central R&D Labs., Inc. in Japan (whose headquarter is located in Aichi, and its branch office is in Tokyo). Recent targeting international conferences of our team: AAAI, IJCAI, ITSC, AAMAS, ICAPS, etc. My recent research topics are

- combinatorial optimization (both problem modeling and solving) for applications such as path-planning, vehicle operations, ride-sharing, multi-agent path-findings, etc. (60%),
- utilizing discrete data structures (e.g., decision diagrams, graphs, succinct data structures) in optimization and machine learning (30%), and
- developing spatio-temporal data mining algorithms (10%)

Note: TCRDL is a research institute in the Toyota group, whose mission statement is doing advanced researches and development for the modern and sustainable transportation system. We often do collaborative research with other companies in the Toyota group (e.g., Toyota Motor Corp., Denso, etc.) and also with other universities or institutes.

## Education

### Graduate School of Informatics, Kyoto University

PH.D IN INFORMATICS, AND M.S. IN INFORMATICS

*Kyoto, Japan*

*Apr. 2011 - Mar. 2016*

- Ph.D Thesis: Algorithmic Approaches to Pattern Mining from Structured Data
- Supervisor: Akihiro Yamamoto, Committee: Akutsu Tatsuya, Kashima Hisashi

### Faculty of Engineering, Kyoto University

B.S. IN COMPUTER SCIENCE AND ENGINEERING

*Kyoto, Japan*

*Mar. 2011 - Apr. 2009*

### National Institute of Technology, Fukui College

QUASI-UNDERGRADUATE COURSE OF ENGINEERING

*Fukui, Japan*

*Mar. 2009 - Apr. 2004*

## Research Experiences

### Toyota Central R&D Labs., Inc.

RESEARCHER

*Aichi and Tokyo, Japan*

*Jan. 2017 - present*

### Japan Society for the Promotion of Science

RESEARCH FELLOW (DC2)

*Kyoto, Japan*

*Apr. 2014 - Mar. 2016*

- Project: Studies on mining from structured data and their visualization
- Supervisor: Dr. Akihiro Yamamoto
- Research topics: Pattern mining, Visualization, Graph-structured data

### Fraunhofer IAIS and University of Bonn

VISITOR (VISITING STUDENT)

*Sankt Augustin, Germany*

*Mar. 2013 - Feb. 2014*

- Project: Studies on mining algorithms from structured data and methods for preserving privacy, particularly for graph-structured data
- Supervisor: Dr. Tamás Horváth
- Research topics: Mining algorithms, Graph pattern mining, Probabilistic algorithms

## Selected Publications

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These are selected papers. See my researchmap page for details.

### Multi-agent Path Planning with Heterogeneous Cooperation

K. OTAKI, S. KOIDE, K. HAYAKAWA, A. OKOSO, T. NISHI

[IEEE ICTAI2019](#)

Nov. 2019

### Multi-Agent Path Finding with Priority for Cooperative Automated Valet Parking

A. OKOSO, K. OTAKI, T. NISHI

[IEEE ITSC2019](#)

Oct. 2019

### NERO: Hierarchical-approximated Rebalancing Optimization for Mobility on Demand

T. NISHI, S. KOIDE, K. OTAKI, A. OKOSO

arXiv:1906.10835, 2019

[arXiv](#)

2019

### Cooperative Routing with Heterogeneous Vehicles

K. OTAKI, S. KOIDE, A. OKOSO, T. NISHI

[AAMAS2019](#)

May. 2019

### Traffic Signal Control Based on Reinforcement Learning with Graph Convolutional Neural Nets

T. NISHI, K. OTAKI, K. HAYAKAWA, T. YOSHIMURA

[IEEE ITSC2018](#)

Nov. 2018

### Learning Concepts and Their Unions from Positive Data with Refinement Operators

S. OUCHI, T. OKAYAMA, K. OTAKI, R. YOSHINAKA, A. YAMAMOTO

DOI:10.1007/s10472-015-9458-6.

[Annals of Mathematics and Artificial Intelligence](#)

2017

### Periodic Pattern Mining with Periodical Co-occurrences of Symbols

K. OTAKI, A. YAMAMOTO

vol.9(1), pp.33-42, 2016.

[IPSJ TOM](#)

2016

### Periodical Skeletonization for Partially Periodic Pattern Mining

K. OTAKI, A. YAMAMOTO

[DS2015](#)

Oct. 2015

## Awards

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### DOMESTIC

2019 **Poster Award**, JAWS2019

[Hiroshima, Japan](#)

2016 **IPSJ Yamashita SIG Research Award**, IPSJ

[Japan](#)

2015 **Best Presentation Award**, IPSJ SIG-MPS #105

[Kitami, Japan](#)

## Extracurricular Activity

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### Machine Learning Summer School 2015

THE WEB MASTER, A LOCALIZER, AND A LOCAL ARRANGEMENT MEMBER

[Kyoto, Japan](#)

- Sep. 2015

### Trends in Machine Learning, A Workshop at Kyoto University

A MEMBER OF THE ORGANIZATION TEAM

[Kyoto, Japan](#)

Mar. 2014

### Machine Learning Summer School 2012

THE WEB MASTER AND A LOCAL ARRANGEMENT MEMBER

[Kyoto, Japan](#)

- Sep. 2012

### The Kyoto School Project

A WEB DEVELOPER

[Kyoto, Japan](#)

2011-2012

- Arranged and created electrical archive Web pages for famous philosophers worked in Kyoto University

# Projects at TCRDL

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## **(Tentative) Optimization for Social Transportation System**

MULTI-AGENT SYSTEM PROGRAM, SOCIAL-SCIENCE RESEARCH DOMAIN

*Bunkyo, Tokyo*

*Jan. 2020 - present.*

## **Combinatorial Optimization for Intelligent Transportation Systems**

MULTI-AGENT SYSTEM PROGRAM, DATA-ANALYTICS RESEARCH DOMAIN

*Bunkyo, Tokyo*

*Apr. 2019 - Dec. 2019*

- Worked on cooperative transportation systems and did research on multi-agent systems (MAS).
- Did large-scale numerical experiments of combinatorial optimizations for multiple vehicles.
- Developed optimization methods using data structures for MAS.

## **Learning and Optimization for Intelligent Transportation Systems**

MULTI-AGENT SYSTEM PROGRAM, DATA-ANALYTICS RESEARCH DOMAIN

*Nagakute, Aichi*

*Feb. 2018 - Mar. 2019*

- Learned foundations on mathematical programmings and implementations by Gurobi.
- Modeled and did experiments on recent transportation systems such as ride-sharing, transfer, vehicle routing, etc.
- Proposed a new mathematical model for heterogeneous vehicles.

## **Reinforcement Learning for Transportation System and Maintenance Systems**

INTELLIGENT SYSTEM CONTROL PROGRAM, DATA-ANALYTICS RESEARCH DOMAIN

*Nagakute, Aichi*

*Oct. 2017 - Jan. 2018*

- Surveyed and tested the maintenance domain for RL.
- Worked on the warm-up problem of RL, particularly on the routing domain.

## **Reinforcement Learning for Transportation System**

DATA SCIENCE PROGRAM, DATA-ANALYTICS RESEARCH DOMAIN

*Nagakute, Aichi*

*Apr. 2017 - Sep. 2017*

- Learned fundamental concepts on Reinforcement Learning (RL) and Deep RL (DRL) via OpenAI gym.
- Worked on proposed RL applications for transportation systems, including routing and traffic signal control.

## **Learning and Inference System**

LEARNING AND INFERENCE PROGRAM, DATA-ANALYTICS RESEARCH DOMAIN

*Nagakute, Aichi*

*Feb. 2017 - Mar. 2017*

- Surveyed Topological Data Analysis (TDA) and program developments for computing persistent diagrams for 3D protein structures.