

Hiroki Kanezashi

Hiroki Kanezashi is a post-doctoral researcher at the AIST-Tokyo Tech Real World Big-Data Computation Open Innovation Laboratory (RWBC-OIL) after finishing his Ph.D. at the Graduate School of Information Science and Engineering of the Tokyo Institute of Technology in June 2019. His research field is large-scale data processing in high-performance computing (HPC) environments. His current research interests are graph analytics, including community detection and graph pattern matching, machine learning, and data analytics algorithms for financial services such as anti-money laundering (AML). He is supervised by Prof. Satoshi Matsuoka at Tokyo Institute of Technology and Prof. Toyotaro Suzumura in IBM T.J. Watson Research Center. He received the Best Paper Award on the 25th IEEE International Conference on High-Performance Computing, Data, and Analytics (HiPC 2018).

Ph.D. thesis

- title *Performance Optimization of Large-Scale Dynamic Graph Analytics*
- supervisors Prof. Satoshi Matsuoka and Prof. Toyotaro Suzumura
- description Large-scale graph analysis has been fundamental techniques for real-world analytics to investigate and validate more detailed analytic results. The scale of data has become much larger, and HPC systems with ample memory space and multiple processors and computation nodes are indispensable to conduct such analytics. However, many performance issues happen such as load imbalances and communication overheads while handling dynamic graph data. To address the problem, we proposed incremental graph analytics algorithms to minimize the computation time for time-evolving graphs. In community detection, we proposed IncrementalDEMON for time-evolving graphs. We used dynamic social networks with millions of edges with timestamps, and our incremental community detection algorithm performs up to 101 times speedup compared to the original algorithm. We also proposed an incremental graph pattern matching (IGPM) algorithm as an extension of an existing approximate subgraph isomorphism algorithm, and parameter adjustment framework named Partial Execution Manager (PEM) with reinforcement learning to determine the vertex sets for re-computations. Our incremental graph pattern matching algorithm performs up to 10.1 times speedup compared to the original subgraph isomorphism algorithm, and our adaptive optimization framework achieves up to an additional 1.95 times speedup. Moreover, the adaptive and incremental algorithm found up to 73% other patterns compared to the original algorithm.

Master thesis

- title *Performance Optimization of Large-Scale Traffic Simulation on Parallel and Distributed Systems*
- supervisors Prof. Toyotaro Suzumura, Prof. Takehiro Tokuda and Prof. Satoshi Matsuoka

description It is indispensable to make full use of parallel and distributed systems with increasing demands for large-scale traffic simulation, but problems remain about insufficient scalability due to costs of synchronization by load unbalancing among compute nodes. To tackle this problem, we propose performance optimization methods for traffic simulations applying graph contraction to underlying road networks as well as introducing adaptive synchronization interval based on time-series traffic congestion. By applying these optimizations and running the simulation of the real-world Dublin city on 16 compute nodes of TSUBAME 2.5, the simulation performance has improved by 4 times with the proposed graph contraction method and improved by 3 times with adaptive synchronization method with comparison to regular 1 synchronization per step while keeping the simulation precision up to 10% difference.

Education

- 2015–2019 **Ph.D. Mathematical and Computing Sciences**, *Tokyo Institute of Technology*, Tokyo, Japan.
- 2013–2015 **M.Sc. Computer Science**, *Tokyo Institute of Technology*, Tokyo, Japan.
- 2009–2013 **B.Sc. Computer Science**, *Tokyo Institute of Technology*, Tokyo, Japan.

Experience

Visiting Ph.D. Student

- 2016–2018 **Visiting Ph.D. Student, IBM T.J. Watson Research Center**, *IBM T.J. Watson Research Center*, United States, Proposed an incremental community detection algorithm for large scale-free network, and as a future work, proposes more scalable graph data distribution methods for graph databases, supervised by Prof. Toyotaro Suzumura..
- 2014–2014 **Visiting Ph.D. Student, University Collage Dublin**, *University Collage Dublin*, Ireland, Validation of traffic simulation in Dublin city with open data, supervised by Prof. Toyotaro Suzumura.

Research Assistant

- 2011–2015 **Research Assistant**, *Tokyo Institute of Technology*, Japan, Research assistant about large-scale social simulation base.

Teaching Assistant

- 2015–2015 **Teaching Assistant**, *Tokyo Institute of Technology*, Japan, Teaching assistant in Graduate School of Mathematical and Computing Science, supervised by Prof. Satoshi Matsuoka.
- 2015–2015 **Teaching Assistant**, *Tokyo Institute of Technology*, Japan, Teaching assistant in Undergraduate School of Information Science, supervised by Prof. Satoshi Matsuoka.

Languages

- Japanese **Native**
- English **Intermediate**

Computer skills

Languages	C, C++, Java, Python, X10	HPC Library	OpenMP, MPI, CUDA
Distributed	Hadoop, Spark	Linux Server	CentOS 6 and 7
Database	JanusGraph, Titan		

Supervisors

Satoshi Matsuoka

Professor
RIKEN Center for Computational
Science (R-CCS) / Tokyo Institute of
Technology (Department of Mathe-
matical and Computing Sciences)
Tokyo, Japan
✉ matsu@acm.org

Toyotaro Suzumura

Research Staff Member / Manager,
Department of Cognitive Graph Com-
puting, IBM T.J. Watson Research
Center
New York, USA
Visiting Professor, Barcelona Super-
computing Center
Spain
✉ suzumura@acm.org

Awards

- 2018 **Best Paper Award**, *25th IEEE International Conference on High Performance Computing, Data, and Analytics (HiPC 2018)*, "Adaptive pattern matching with reinforcement learning for dynamic graphs".

Publications

- [1] Aldo Pareja, Giacomo Domeniconi, Jie Chen, Tengfei Ma, Toyotaro Suzumura, **Hiroki Kanezashi**, Tim Kaler, and Charles E. Leiserson. Evolvegc: Evolving graph convolutional networks for dynamic graphs. *CoRR*, abs/1902.10191, 2019.
- [2] **Hiroki Kanezashi**, Toyotaro Suzumura, Dario Garcia-Gasulla, Min-Hwan, and Satoshi Matsuoka. Adaptive pattern matching with reinforcement learning for dynamic graphs. *25th IEEE International Conference on High Performance Computing, Data, and Analytics (HiPC 2018)*, <https://arxiv.org/abs/1812.10321>.
- [3] Mark Weber, Jie Chen, Toyotaro Suzumura, Aldo Pareja, Tengfei Ma, **Hiroki Kanezashi**, Tim Kaler, Charles E. Leiserson, and Tao B. Schardl. Scalable graph learning for anti-money laundering: A first look. *CoRR*, abs/1812.00076, 2018.
- [4] Gabriel Tanase, Toyotaro Suzumura, Jinho Lee, Chun-Fu Chen, Jason Crawford, Song **Kanezashi**, **Hiroki** and Zhang, and Warut D. Vijitbenjaronk. System G distributed graph database. *CoRR*, abs/1802.03057, 2018.
- [5] **Hiroki Kanezashi** and Toyotaro Suzumura. An incremental local-first community detection method for dynamic graphs. In *Big Data (Big Data), 2016 IEEE International Conference on*, pages 3318–3325. IEEE, 2016.
- [6] Toyotaro Suzumura, Gavin McArdle, and **Hiroki Kanezashi**. A high performance multi-modal traffic simulation platform and its case study with the dublin city. In

Proceedings of the 2015 Winter Simulation Conference, pages 767–778. IEEE Press, 2015.

- [7] **Hiroki Kanezashi** and Toyotaro Suzumura. Performance optimization for agent-based traffic simulation by dynamic agent assignment. In *Proceedings of the Winter Simulation Conference, 2015.*, 2015.
- [8] Toyotaro Suzumura, Charuwat Hounkaew, and **Hiroki Kanezashi**. Towards billion-scale social simulations. In *Proceedings of the 2014 Winter Simulation Conference*, pages 781–792. IEEE Press, 2014.
- [9] Toyotaro Suzumura and **Hiroki Kanezashi**. Multi-modal traffic simulation platform on parallel and distributed systems. In *Proceedings of the 2014 Winter Simulation Conference*, pages 769–780. IEEE Press, 2014.
- [10] Toyotaro Suzumura and **Hiroki Kanezashi**. Accelerating large-scale distributed traffic simulation with adaptive synchronization method. In *20th ITS World Congress*, 2013.
- [11] Toyotaro Suzumura and **Hiroki Kanezashi**. A holistic architecture for super real-time multiagent simulation platforms. In *Simulation Conference (WSC), 2013 Winter*, pages 1604–1612. IEEE, 2013.
- [12] Toyotaro Suzumura, Sei Kato, Takashi Imamichi, Mikio Takeuchi, **Hiroki Kanezashi**, Tsuyoshi Ide, and Tamiya Onodera. X10-based massive parallel large-scale traffic flow simulation. In *Proceedings of the 2012 ACM SIGPLAN X10 Workshop*, page 3. ACM, 2012.
- [13] Toyotaro Suzumura and **Hiroki Kanezashi**. Highly scalable x10-based agent simulation platform and its application to large-scale traffic simulation. In *Proceedings of the 2012 IEEE/ACM 16th International Symposium on Distributed Simulation and Real Time Applications*, pages 243–250. IEEE Computer Society, 2012.