



Preface for the Special Issue on the Project “Foundation of Innovative Algorithms for Big Data”

Naoki Katoh¹ · Yuya Higashikawa¹ · Hiro Ito² · Shun Kataoka³ · Takuya Kida⁴ · Toshiki Saitoh⁵ · Tetsuo Shibuya⁶ · Kazuyuki Tanaka⁷ · Yushi Uno⁸

Published online: 8 October 2019
© Springer Japan KK, part of Springer Nature 2019

We are demanding innovative changes to algorithm theory for big data that is attracting attention this century. For example, we have considered that polynomial time algorithms have been “fast” in the past, but if we applied an $O(n^2)$ time algorithm for the big data which has peta byte scale or more, we would encounter problems on the computational resource or the running time. Therefore, we require linear, sublinear, or constant time algorithms for such problems.

In such situations, the academic research project “Foundations of Innovative Algorithms for Big Data,”¹ whose research director is Naoki Katoh, Professor of Hyogo University, has started as the period between October, 2014 and March 2020. The project is one of them in the research area “Advanced Core Technologies for Big Data Integration” in Japan Science and Technology Agency (JST). In this project, we suggest a new paradigm, “Sublinear-time Paradigm” for supporting the innovation, and we have been trying to construct a foundation of innovative algorithms by developing algorithms, data structures, and modeling techniques for the big data. The project is organized by three sub-teams, Team A for Sublinear Time Algorithms, Team D for Sublinear Data Structures, and Team M for Sublinear Modeling. They are intended to provide high level academic research results with strong computational and algorithmic interests.

¹ Webpage: <http://crest-sublinear.jp/en/>. Project ID in JST: JPMJCR1402.

✉ Kazuyuki Tanaka
kazu@tohoku.ac.jp

¹ School of Social Information Science, University of Hyogo, Kobe, Japan

² School of Informatics and Engineering, UEC, Tokyo, Japan

³ Department of Commerce, Otaru University of Commerce, Otaru, Japan

⁴ Faculty of Information Science and Technology, Hokkaido University, Sapporo, Japan

⁵ School of Computer Science and Systems Engineering, Kyutech, Kitakyushu, Japan

⁶ Human Genome Center, The University of Tokyo, Tokyo, Japan

⁷ Graduate School of Information Sciences, Tohoku University, Sendai, Japan

⁸ Graduate School of Science, Osaka Prefecture University, Sakai, Japan

This special issue is planned to overview research in this area, to present results in the projects, and to discuss possible future directions. It consists of ten papers: five of them are from Team A, two of them are from Team D, and the other three are from Team M.

This project will finish in March 2020. However, our challenge to explore Sub-linear Paradigm has just started. We are confident that this paradigm will play a key role in the big data era. We do anticipate that this special issue will stimulate further development of the computational and algorithmic research fields of informatics as well as computer sciences. We hope that researchers all over the world will have interests in this paradigm and will join in this research field.

Naoki Katoh