

# Tasuku Soma

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December 11, 2025

## EDUCATION

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### The University of Tokyo

*Ph.D (Information Science and Technology): supervised by Prof. Satoru Iwata*

**Tokyo, Japan**

*March 2016*

### Kyoto University

*Master of Science: supervised by Prof. Satoru Iwata*

**Kyoto, Japan**

*March 2013*

### Kyoto University

*Bachelor of Science*

**Kyoto, Japan**

*March 2011*

## ACADEMIC POSITIONS

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### Associate Professor

**April 2023 – current**

*The Institute of Statistical Mathematics and The Graduate University for Advanced Studies, SOKENDAI*

### Part-time Researcher

**March 2023 – March 2023**

*Kyoto University*

### Postdoctoral Fellow (JSPS)

**February 2021 – February 2023**

*Massachusetts Institute of Technology: mentored by Prof. Michel Goemans*

### Research Associate

**April 2016 – March 2021**

*The University of Tokyo*

### JSPS Research Fellowships for Young Scientists

**April 2014 – March 2016**

*The University of Tokyo*

### Research Assistant

**April 2013 – March 2014**

*JST ERATO Kawarabayashi Large Graph Project*

## GRANTS

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### JST PRESTO: Mathematical Sciences for the Future

**October 2024 – March 2028**

40,000,000 JPY

### JSPS Overseas Research Fellowships

**March 2021 – February 2023**

12,556,000 JPY

### JSPS Grant-in-Aid for Early-Career Scientists

**April 2019 – March 2022**

4,000,000 JPY

### JST ACT-I

**September 2017 – March 2019**

3,000,000 JPY

### JSPS Grant-in-Aid for Research Activity Start-up

**September 2016 — March 2018**

2,900,000 JPY

### JSPS Research Fellowships for Young Scientists

**April 2014 – March 2016**

1,900,000 JPY

## AWARDS

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### Dean's list for Ph.D thesis

*Graduate School of Information Science and Technology, The University of Tokyo*  
**Student Paper Award**  
*Japan Operations Research Society*

March 2013

# TEACHING

## Courses Taught.

- Exercise course of geometry 2017 Fall, 2018 Fall, 2019 Fall, the university of Tokyo
  - Exercise course of algebra 2016 Summer, the university of Tokyo

## Students Supervised

- Benjamin Qi (UROP, MIT), 2022. His paper based on the project received **Best Paper Award in ISAAC 2022**.
  - Joachim Moussalli (M.Sc, EPFL<sup>1</sup>), 2019.

## RESEARCH INTERESTS

- Submodular optimization and its applications in machine learning
  - Linear algebra in combinatorial optimization and algorithm design
  - Convex optimization, online learning, and compressed sensing

# RESEARCH VISITS

- **University of British Columbia** (hosted by Nicholas J. A. Harvey), August – September, 2019.
  - **Max Planck Institute of Mathematics in Sciences** (hosted by André Uschmajew), September, 2018.

## PUBLICATIONS

## Refereed Journal Articles

- [1] T. Soma. "Fast deterministic algorithms for matrix completion problems". *SIAM Journal on Discrete Mathematics* 28.1 (2014), pp. 490–502.
  - [2] T. Soma. "Multicasting in linear deterministic relay network by matrix completion". *IEEE Transactions on Information Theory* 62.2 (2016), pp. 870–875.
  - [3] Y. Nakatsukasa, T. Soma, and A. Uschmajew. "Finding a low-rank basis in a matrix subspace". *Mathematical Programming* 162.1-2 (2017), pp. 325–361.
  - [4] Z. Li, Y. Nakatsukasa, T. Soma, and A. Uschmajew. "On orthogonal tensors and best rank-one approximation ratio". *SIAM Journal on Matrix Analysis and Applications* 39.1 (2018), pp. 400–425.
  - [5] T. Soma and Y. Yoshida. "Maximizing monotone submodular functions over the integer lattice". *Mathematical Programming* 172 (2018), pp. 539–563.
  - [6] K. Fujii, T. Soma, and Y. Yoshida. "Polynomial-time algorithms for submodular laplacian systems". *Theoretical Computer Science* 892 (2021), pp. 170–186.
  - [7] T. Matsuda and T. Soma. "Information geometry of operator scaling". *Linear Algebra and its Applications* 649 (2022), pp. 240–267.
  - [8] T. Soma and Y. Yoshida. "Online risk-averse submodular maximization". *Annals of Operations Research* 320.1 (2023), pp. 393–414.

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<sup>1</sup>He visited the university of Tokyo as an exchange student

- [9] H. Hirai, Y. Iwamasa, T. Oki, and T. Soma. "Algebraic combinatorial optimization on the degree of determinants of noncommutative symbolic matrices". *Mathematical Programming* 213 (2025), pp. 941–984.
- [10] T. Oki and T. Soma. "Algebraic algorithms for fractional linear matroid parity via noncommutative rank". *SIAM Journal on Computing* 54.1 (2025), pp. 134–162.
- [11] T. Soma, K. C. Tung, and Y. Yoshida. "Online algorithms for spectral hypergraph sparsification". *Mathematical Programming* (2025).

### Refereed Conference Proceedings

- [12] T. Soma. "Fast deterministic algorithms for matrix completion problems". In: *Integer Programming and Combinatorial Optimization (IPCO)*. 2013, pp. 375–386.
- [13] T. Soma. "Multicasting in linear deterministic relay network by matrix completion". In: *Proceedings of the IEEE International Symposium on Information Theory (ISIT)*. 2014, pp. 1191–1195.
- [14] T. Soma, N. Kakimura, K. Inaba, and K. Kawarabayashi. "Optimal budget allocation: theoretical guarantee and efficient algorithm". In: *Proceedings of the 31st International Conference on Machine Learning (ICML)*. 2014, pp. 556–568. **cycle 1**.
- [15] T. Soma and Y. Yoshida. "A generalization of submodular cover via the diminishing return property on the integer lattice". In: *Advances in Neural Information Processing Systems (NIPS)*. 2015, pp. 847–855.
- [16] T. Soma and Y. Yoshida. "Non-convex compressed sensing with the sum-of-squares method". In: *Proceedings of 27th the Annual ACM-SIAM Symposium on Discrete Algorithms (SODA)*. 2016, pp. 570–579.
- [17] T. Soma and Y. Yoshida. "Maximizing monotone submodular functions over the integer lattice". In: *Integer Programming and Combinatorial Optimization (IPCO)*. 2016, pp. 325–336.
- [18] T. Soma and Y. Yoshida. "Non-monotone DR-submodular function maximization". In: *Proceedings of the 31st AAAI Conference on Artificial Intelligence*. 2017, pp. 898–904.
- [19] T. Soma and Y. Yoshida. "Regret ratio minimization in multi-objective submodular function maximization". In: *Proceedings of the 31st AAAI Conference on Artificial Intelligence*. 2017, pp. 905–911.
- [20] K. Fujii and T. Soma. "Fast greedy algorithms for dictionary selection with generalized sparsity constraints". In: *Advances in Neural Information Processing Systems (NeurIPS) 31*. 2018, pp. 4749–4758. **spotlight**.
- [21] T. Soma and Y. Yoshida. "A new approximation guarantee for monotone submodular function maximization via discrete convexity". In: *Proceedings of the 45th International Colloquium on Automata, Languages, and Programming (ICALP)*. 2018, 99:1–99:14.
- [22] T. Soma. "No-regret algorithms for online  $k$ -submodular maximization". In: *Proceedings of Machine Learning Research (AISTATS)*. Vol. 89. 2019, pp. 1205–1214.
- [23] T. Soma and Y. Yoshida. "Spectral sparsification of hypergraphs". In: *Proceedings of the 30th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA)*. 2019, pp. 2570–2581.
- [24] N. J. A. Harvey, C. Liaw, and T. Soma. "Improved algorithms for online submodular maximization via first-order regret bounds". In: *Advances in Neural Information Processing Systems (NeurIPS) 33*. 2020, pp. 123–133.
- [25] S. Ito, S. Hirahara, T. Soma, and Y. Yoshida. "Tight first- and second-order regret bounds for adversarial linear bandits". In: *Advances in Neural Information Processing Systems (NeurIPS) 33*. 2020, pp. 2028–2038. **spotlight**.

- [26] T. Soma and Y. Yoshida. "Online risk-averse submodular maximization". In: *Proceedings of the 50th International Joint Conference on Artificial Intelligence (IJCAI)*. 2021, pp. 2988–2994.
- [27] C. Franks, T. Soma, and M. X. Goemans. "Shrunk subspaces via operator sinkhorn iteration". In: *Proceedings of the 2023 Annual ACM-SIAM Symposium on Discrete Algorithms (SODA)*. 2023, pp. 1655–1668.
- [28] T. Oki and T. Soma. "Algebraic algorithms for fractional linear matroid parity via non-commutative rank". In: *Proceedings of the 2023 Annual ACM-SIAM Symposium on Discrete Algorithms (SODA)*. 2023, pp. 4188–4204.
- [29] T. Soma, K. C. Tung, and Y. Yoshida. "Online algorithms for spectral hypergraph sparsification". In: *Integer Programming and Combinatorial Optimization (IPCO)*. 2024, pp. 405–417.
- [30] Y. Iwamasa, T. Oki, and T. Soma. "Algorithmic aspects of semistability of quiver representations". In: *52nd International Colloquium on Automata, Languages, and Programming (ICALP)*. Vol. 334. 2025, 99:1–99:18.
- [31] M. Kimura, T. Kawashima, T. Soma, and H. Hino. "Difference-of-submodular bregman divergence". In: *The 13th International Conference on Learning Representations (ICLR)*. 2025.