

Tasuku Soma

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December 11, 2025

EDUCATION

The University of Tokyo <i>Ph.D (Information Science and Technology): supervised by Prof. Satoru Iwata</i>	Tokyo, Japan March 2016
Kyoto University <i>Master of Science: supervised by Prof. Satoru Iwata</i>	Kyoto, Japan March 2013
Kyoto University <i>Bachelor of Science</i>	Kyoto, Japan March 2011

ACADEMIC POSITIONS

Associate Professor <i>The Institute of Statistical Mathematics and The Graduate University for Advanced Studies, SOKENDAI</i>	April 2023 – current
Part-time Researcher <i>Kyoto University</i>	March 2023 – March 2023
Postdoctoral Fellow (JSPS) <i>Massachusetts Institute of Technology: mentored by Prof. Michel Goemans</i>	February 2021 – February 2023
Research Associate <i>The University of Tokyo</i>	April 2016 – March 2021
JSPS Research Fellowships for Young Scientists <i>The University of Tokyo</i>	April 2014 – March 2016
Research Assistant <i>JST ERATO Kawarabayashi Large Graph Project</i>	April 2013 – March 2014

GRANTS

JST PRESTO: Mathematical Sciences for the Future 40,000,000 JPY	<i>October 2024 – March 2028</i>
JSPS Overseas Research Fellowships 12,556,000 JPY	<i>March 2021 – February 2023</i>
JSPS Grant-in-Aid for Early-Career Scientists 4,000,000 JPY	<i>April 2019 – March 2022</i>
JST ACT-I 3,000,000 JPY	<i>September 2017 – March 2019</i>
JSPS Grant-in-Aid for Research Activity Start-up 2,900,000 JPY	<i>September 2016 – March 2018</i>
JSPS Research Fellowships for Young Scientists 1,900,000 JPY	<i>April 2014 – March 2016</i>

AWARDS

Dean's list for Ph.D thesis

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, EPFL¹), 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.

¹He 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.