Tasuku Soma

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EDUCATION

The University of Tokyo — **Tokyo, Japan**
Ph.D (Information Science and Technology): supervised by Prof. Satoru Iwata — *March 2016*

Kyoto University — **Kyoto, Japan**
Master of Science: supervised by Prof. Satoru Iwata — *March 2013*

Kyoto University — **Kyoto, Japan**
Bachelor of Science — *March 2011*

ACADEMIC POSITIONS

Postdoctoral Fellow — **February 2021 – current**
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

GRANT

JSPS Overseas Research Fellowships — *March 2021 – March 2023*
12,556,000 JPY

JSPS Grant-in-Aid for Early-Career Scientists — *April 2019 – March 2022*
4,000,000 JPY

Japan Science and Technology Agency 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

Dean's list for Ph.D thesis
Graduate school of information science and technology, the university of Tokyo — *March 2016*

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[1]), 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 Columnbia** (hosted by Nicholas J. A. Harvey), August – September, 2019.
- **Max Planck Institute of Mathmatics 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.

Refereed Conference Proceedings

[9] T. Soma. "Fast deterministic algorithms for matrix completion problems". In: *Integer Programming and Combinatorial Optimization (IPCO)*. 2013, pp. 375–386.

[10] 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.

[1] He visited the university of Tokyo as an exchange student

[11] 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**.

[12] 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.

[13] 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.

[14] T. Soma and Y. Yoshida. “Maximizing monotone submodular functions over the integer lattice”. In: *Integer Programming and Combinatorial Optimization* (*IPCO*). 2016, pp. 325–336.

[15] 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.

[16] 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.

[17] 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**.

[18] 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.

[19] T. Soma. “No-regret algorithms for online k-submodular maximization”. In: *Proceedings of Machine Learning Research* (*AISTATS*). Vol. 89. 2019, pp. 1205–1214.

[20] 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.

[21] 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.

[22] 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**.

[23] 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.

[24] 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.

[25] 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.