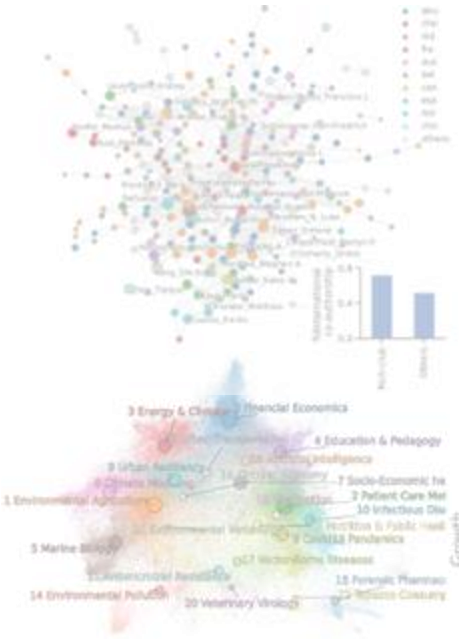
TMI/PSI Sakata, Mori, and Asatani Laboratory

(Rooms 201~203 and 307, Building 3 of Faculty of Engineering,
Room 637, Building 8 of Faculty of Engineering)



Prof. Sakata, Associate Prof. Mori, Lecturer Asatani,
Assistant Professor Nishimoto, Visiting Researcher Isonuma
https://www.youtube.com/watch?v=lOm-WkSMJAo
Contact: isakata@ipr-ctr.t.u-Tokyo.ac.jp, 03-5841-1161

Our Laboratory

We pioneer the field of technology management through world-class studies that combine deep knowledge of target phenomena and technologies with cutting-edge methods such as complex networks and large language models (LLMs). As new research fields, we have proposed **'Technology Informatics**' and '**Science Sensing**.'

The selection of research topics emphasizes students' autonomy, with faculty members providing full support. We also encourage students to present at academic and international conferences or submit to journals if they wish. Each year, students deliver approximately 10 presentations at top conferences and journals in fields such as ACL, AAAI, and technology management

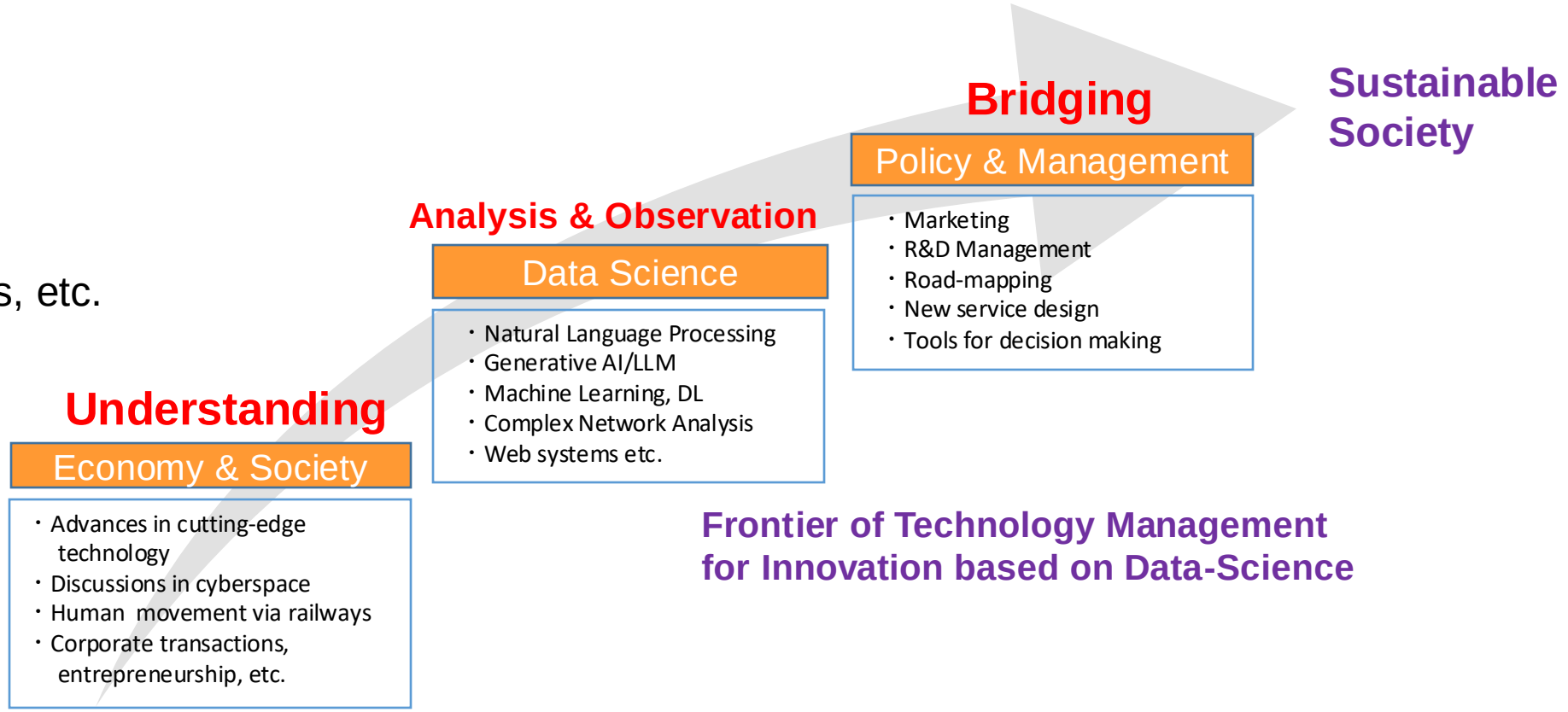
Members

4 (assistant) professors

6 Ph.D. students

13 Master's students

3 Undergraduate students, etc.



Faculty

* Guidance in the laboratory will be conducted jointly, so any faculty member can get guidance.

TECHNOLOGY MANAGEMENT FOR INNOVATION TMI | UTokyo

Assignment Targets

Ichiro Sakata, Professor

Faculty of Engineering, Building No. 3, Room 201

We advocate new methods of technology management, promote management reform, and train entrepreneurs.

Research Interests: Technology Informatics, Complex Systems Network Analysis, Science and Technology Policy

Lectures: Science, Technology and Industrial Policy (Social System Design), Advanced Tech Management, Deep Tech Entrepreneurship Practical Seminar, Invitation to Deep Tech Entrepreneurs

Assignment Targets

Junichiro Mori, Associate Professor

Concurrent position at the Graduate School of Information Science and Technology

We are conducting research on data mining using graphs, social network analysis, and expressive learning.

Research Areas: Artificial Intelligence, in particular user modeling, information extraction, social network analysis

Lecture: Quantitative Methods for Management and Policy Analysis

Assignment Targets

Kimii Asatani, Specially Appointed Lecturer

Faculty of Engineering, Building No. 8, Room 629

We analyze social data using complex networks and natural language processing methods.

Research Fields: Computational Social Sciences, Complex Networks, Science of Science

Lecture: Computational Social Science, Quantitative Methods for Management and Policy Analysis

Isonuma University, Visiting Researcher

University of Edinburgh

Graduated from Sakata Lab, I am developing basic methods for natural language processing. We participate in the world's top conferences in this field, ACL and EMNLP, almost every year.

I have been active in the program, winning the Grand Prize at the 30th Annual Conference of the Association for Natural Language Processing (NLP2024).

Research Fields: Natural Language Processing, Generative AI

Keita Nishimoto, Project Assistant Professor

Faculty of Engineering, Building No. 3, Room 307

We simulate complex systems and analyze data related to Science of Science.

Research Fields: Multi-Agent Simulation, Customer Behavior Analysis, Science of Science, Artificial Life

Lecture: Basic Project (Seminar)

Yasuko Yamano, Lecturer

Research Center for Future Initiatives

We conduct research on the dynamics, structure, and higher-order interactions of complex networks, as well as empirical analysis using actual data.

Author of "Regional Network Analysis: Structure and Metabolism of Connections in Business Ecosystems"

Research Activity

Laboratory Policy

Since the establishment of the lab, we have adopted a policy that fully respects students' autonomy in choosing their research topics. As a result, as referenced below, the research topics within the lab are quite diverse.

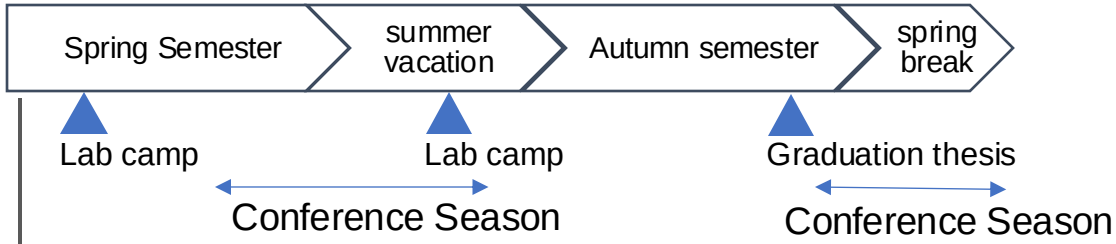
We, the faculty, provide advice on selecting research topics and support students in planning and carrying out their research based on the selected topics.

The main methods used in the lab include machine learning (including LLMs, deep learning, and representation learning), natural language processing (including large language models), and complex network analysis.

We encourage students to present their work at international journals or conferences, rather than stopping at undergraduate or master's theses. The lab covers the costs associated with these presentations.

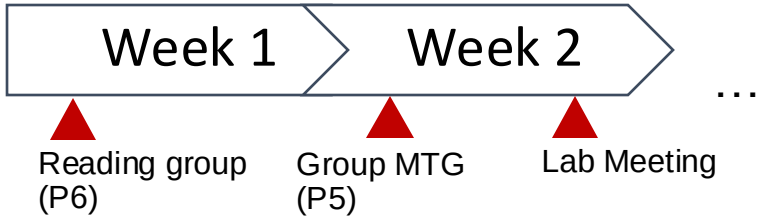
We collaborate closely with the Mori and Asatani labs, operating as a unified team. Students in the Sakata, Mori, and Asatani labs receive the same level of guidance and instruction.

Annual schedule



Events during the semesters

It consists of three activities: lab meeting, a group MTG divided into four groups according to interest, and a reading group for each theme



* Group MTG is held voluntarily during summer vacation and spring vacation.

Composition of the research group

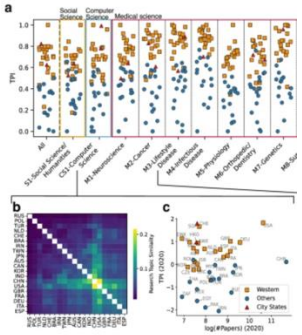
Students are assigned to one research group to conduct research, but discussions between groups are also active.

Science of Science Group

Asatani, Nishimoto

We mathematically analyze how technologies such as science and patents are created and the processes that affect society. Social factors such as diversity and gender are also covered. In recent years, it has become a hot field, with the establishment of the Science of Science Study Group.

Research examples: Analysis of progress and lag in international research topics, understanding of the scientific ecosystem centered on basic researchers, elucidation of policy citation mechanisms for papers, analysis of top researchers in the field of the circular economy, etc.



Analysis of progress and lag in research topics around the world

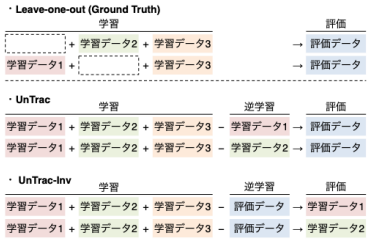
NLP Group

Isonuma

By developing cutting-edge technologies such as inverse learning, model synthesis, and training data distillation, we are mainly engaged in research to improve the transparency, safety, and efficiency of language models, as well as to clarify the mechanism of generalization of language models and the acquisition of inference capabilities.

Utilization as an agent of large language models, etc.
We are also focusing on research to find new ways to use it.

Research examples: Estimation of the impact of training data by reverse learning, development of general-purpose alignment techniques by distillation of training data, copyright infringement risk/bias removal by reverse learning, etc.



Estimation of the impact of training data by reverse learning

Computational Social Sciences Group

Asatani

We analyze human behavior and interactions on Twitter, transportation, and cities from data. We are actively conducting data analysis using LLM. In recent years, we have been focusing on analyzing Google Map data and Twitter interactions.

Research examples: Political communities on Twitter, understanding interactions in cities with Google Map analysis, understanding scientists' use and impact on Twitter, etc.

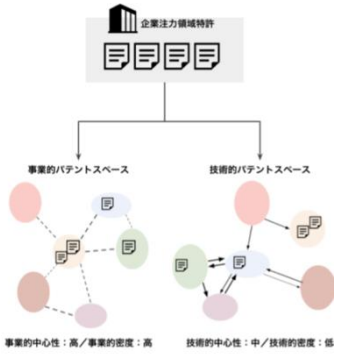
Analysis of urban structure based on Google Map reviews in large cities

Social/Economic Groups

Yamano (Future Vision)

We mathematically analyze how science, patents, and other technologies are created and how they impact society and the economy through the supply chain. In this research, we analyze how corporate activities such as M&A and technological innovations interact from the perspectives of network science, complex systems, and statistical physics by utilizing corporate attributes, corporate finance data, patent data, and text data.

Research examples: Characteristics of transaction distances in a business-to-business trading network focusing on regional banks, proposal of a patent space to evaluate a company's business portfolio strategy

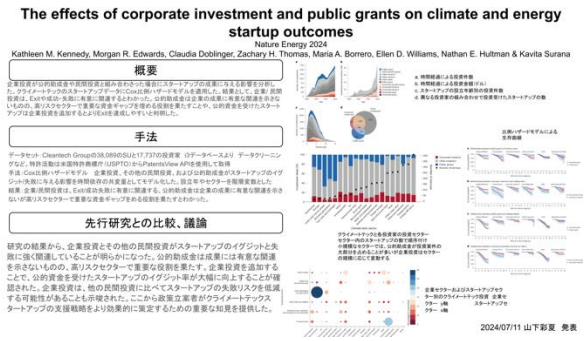


Patent space to evaluate a company's business portfolio strategy

Reading Group

We conduct paper reading sessions to understand the latest insights in the field. These sessions are held every two weeks, where each member of the group quickly skims through one paper, while one designated member thoroughly reads a paper and presents their findings.

Examples of binge-reading


The effects of corporate investment and public grants on climate and energy startup outcomes

Nature Energy 2024

Kathleen M. Kennedy, Morgan R. Edwards, Claudia Doblinger, Zachary H. Thomas, Maria A. Borrero, Ellen D. Williams, Nathan E. Hultman & Kavita Surana

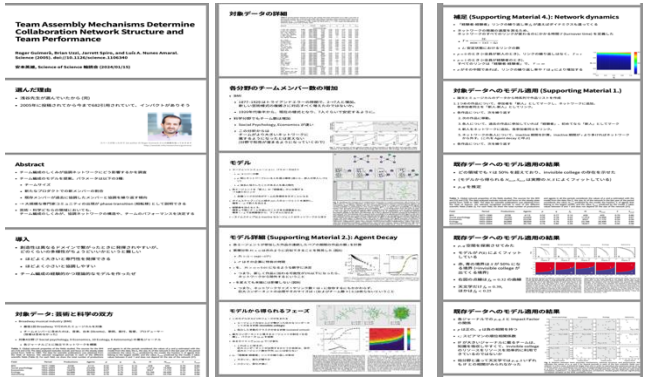
概要

手法

先行研究との比較、議論

2024/07/11 山下彩夏 発表

Examples of close reading


Team Assembly Mechanisms Determine Collaboration Network Structure and Team Performance

Roger Guimerà, Brian Uzzi, Jarrett Spiro, and Luís A. Nunes Amaral

Science (2005); doi:10.1126/science.1116340

Abstract

Broaden your horizons by participating in the reading activities of your own group and the reading activities of one other group.

Science of Science

Target Journal: Nature, Nature Human Behavior, Nature Communications, Science, Science Advance, ProNAS

Computational Social Science

Target Journal: Nature, Nature(cities, physics, human behaivor..), Nature Communications, Nature, Science, Science Advance, PNAS, PNAS Nexus, Physical Review Letters, Physical Review X

NLP

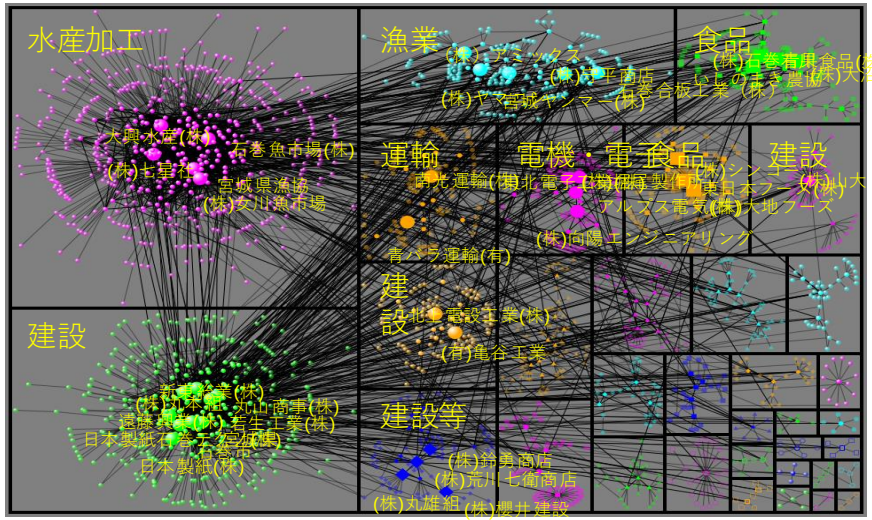
Target Journal: ACL, EMNLP, NAACL, Top conferences such as Neurips and ICLR, as well as other related journals

Society/Economy

Target Journal: Nature communications / Science Advances / PNAS Nature Physics / Communications Physics / Research Policy / Regional Studies Nature Sustainability / Communications Earth & Environment…

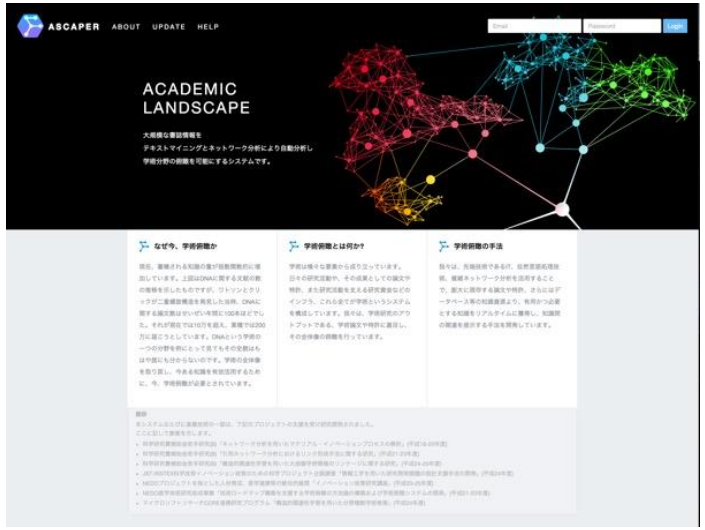
Characteristics of the Laboratory's Activities (3) Social Implementation

1. Regional Network/Connector Hub Metrics



- NHK Special: Earth quake Big Data II (2014)
- Selected 3,700 companies that will lead the future of the region (2017, 2018)
- Director, Regional Future Society Research Institute, The University of Tokyo (Sakata)

2. Academic Overview/Future Prediction System



- Provided for start-up planning
- Licensed to global companies
- NHK Special: I Asked AI What's going on?! Nippon (2018)

4. Utilization of knowledge in society

- Mainichi Shimbun (2023)
- The research outcomes, primarily focused on patent and paper analysis, are being applied in society through numerous collaborative projects with various companies

3. Extracted Lessons from the Great East Japan Earthquake and Raised Issues

- “Five years on from Fukushima”, Nature Vol. 531, Issue 7592, March 3, 2016
- Prof. Sakata Participated in the formulation of the "New Tohoku (Reconstruction Vision)" as an advisor to the Reconstruction Agency (2013-14)
- Cooperated in the development and dissemination of the Cabinet Office's RESAS (Regional Economic Information Analysis System) system

Participation in new engineering education

We are developing a "new engineering education" by participating in three endowed lectures.

< three features>

(1) Skills required by society, (2) Industry-academia collaborative education, (3) New educational methods

GCI / DL

More than 2,000 students a year learn deep learning, etc.
Implemented an educational platform and automated grading

AI Management Endowed Chair

150 students created business ideas to bridge social issues to AI technology

Entrepreneurship Educational Design Endowed Chair

"Industry-academia collaborative courses are offered at both the graduate and undergraduate levels. Each term, over 100 students from both humanities and sciences participate. Lectures are given by experienced entrepreneurs and numerous experts. A community is formed on Slack."

Research output: Computational Social Sciences, Science of Science

<Journal>

- Higashide, N., Zhang, Y., Asatani, K., Miura, T., & Sakata, I. (2024). Quantifying advances from basic research to applied research in material science. Technovation, 135, 103050.
- Rompho, N., Vinayavekhin, S., Sajjanit, C., Asatani, K. (2024) Evolving landscape of performance measurement research: A Bibliometric analysis, Measuring Business Excellence (To appear)
- Ishii, C., Asatani, K., & Sakata, I. (2024). Detecting possible pairs of materials for composites using a material word co-occurrence network. Plos one, 19(1), e0297361.
- Asatani, K., Oki, S., Momma, T., & Sakata, I. (2023). Quantifying progress in research topics across nations. Scientific Reports, 13(1), 4759.
- Miura, T., Asatani, K., & Sakata, I. (2023). Revisiting the uniformity and inconsistency of slow-cited papers in science. Journal of Informetrics, 17(1), 101378.
- Ishii, C., Asatani, K., & Sakata, I. (2022). Obtaining interactions among science, technology, and research policy for developing an innovation strategy: A case study of supercapacitors. Heliyon, e10721.
- Shao, B., Asatani, K., & Sakata, I. (2022). Categorisation of mergers and acquisitions in Japan using corporate databases: A fundamental research for recommendation. International Journal of Technology Management
- Maiko Kamada, Kimitaka Asatani(※equal contribution), K., Isonuma, M., & Sakata, I. (2021). Discovering Interdisciplinarily Spread Knowledge in the Academic Literature. IEEE Access, 9, 124142-124151.
- Vinayavekhin, S., Phaal, R., Thanamaitreejit, T., & Asatani, K. (2021). Emerging trends in roadmapping research: A bibliometric literature review. Technology Analysis & Strategic Management, 1-15.
- Miura, T., Asatani, K., & Sakata, I. (2021). Large-scale analysis of delayed recognition using sleeping beauty and the prince. Applied Network Science, 6(1), 48.

Representative international conferences attended by students from the 2023 academic year onwards.

- IC2S2 2022(2 papers) 2023(3 papers) 2024(2 papers)
- PICMET 2023(1 paper) 2024(1 paper)
- Complex Networks 2023(1 paper)

Research Results: NLP

- 2024 Received the "Grand Prize" at the 30th Annual Conference of the Association for Natural Language Processing
  - Masaru Isonuma, Ivan titov. Analysis of language models by inverse learning (in Japanese).
- 2023 Received the "Excellence Award" at the 37th National Conference of the Japanese Society for Artificial Intelligence
  - Masaru Isonuma, Junichiro Mori, Ichiro Sakata. Prompt Optimization for General-Purpose Language Model Training (in Japanese).
- 2023 Received the "Excellence Award" at the 29th Annual Conference of the Association for Natural Language Processing
  - Nozomu Miyamoto, Dai Isonuma, Sho Takase, Junichiro Mori, Ichiro Sakata. Time Series Structured Neural Topic Models (in Japanese).
- ACL 2024 main conference、ACL2023 findings (long paper)

  ※ Top International Conference on Computational Linguistics
  - Masaru Isonuma, Ivan Titov. Unlearning Traces the Influential Training Data of Language Models. Proceedings of the 62nd Annual Meeting of the Association for Computational Linguistics (ACL, long paper), pp.6312-6325, 2024. https://aclanthology.org/2024.acl-long.343/
  - Nozomu Miyamoto, Masaru Isonuma, Sho Takase, Junichiro Mori, Ichiro Sakata. "Dynamic Structured Neural Topic Model with Self-Attention Mechanism." Findings of the 61st Annual Meeting of the Association for Computational Linguistics, 2023. https://aclanthology.org/2023.findings-acl.366/
  - Tetsu Kasanishi, Masaru Isonuma, Junichiro Mori, Ichiro Sakata. "SciReviewGen: A Large-scale Dataset for Automatic Literature Review Generation." Findings of the 61st Annual Meeting of the Association for Computational Linguistics, 2023. https://aclanthology.org/2023.findings-acl.418/
  - Masaru Isonuma, Junichiro Mori, Ichiro Sakata. "Differentiable Instruction Optimization for Cross-Task Generalization." Findings of the 61st Annual Meeting of the Association for Computational Linguistics, 2023. https://aclanthology.org/2023.findings-acl.667/

Examples of graduation theses, master's theses, and erudition

Graduation Thesis

Evaluation of Diversity of Encounters in Urban Spaces Using Restaurant Reviews [FY2023] Outstanding Graduation Research Award]
Prediction between railway stations and analysis of barriers by modeling movement
Topic network classification that reflects the content of posts and conversation structure on Twitter
Analysis of the classification of attacks on SNS with a focus on users and their mechanisms
Proposal of an evaluation index for the innovation of papers that takes into account cross-disciplinary nature
Identify a group of users who can adequately evaluate collective creative activity
Evaluation of Stratification and Growth Potential of Academic Concepts Based on Spatial Distribution
Characteristics of Transaction Distances in Business-to-Business Trading Networks Focusing on Regional Banks

Master's thesis

Analysis of the relationship between researchers' social media follow-up activities and research results [2023 Dean's Award of the Graduate School of Engineering]
Extraction of expertise by combining pre-trained language models and graph neural networks
Pretraining a Text-to-Image Model with Artificial Images
The Analysis of Asymmetric Influences in Science based on the Author Citation Networks
Public Attention and Academic Interest: Comparing AI-Related Knowledge on Wikipedia and Scientific Papers
Research on field formation through discontinuous discoveries using Sleeping Beauty and Prince in academic fields [2020 Dean's Award of the Graduate School of Engineering]
Proposal and evaluation of M&A metrics based on financial indicators and social awareness
Proposal of a patent space to evaluate a company's business portfolio strategy [2021 Chair's Award]
Extraction of inter-word implications by hierarchical embedding using deep distance learning [Findings of EMNLP adopted]

Ph.D. Dissertation

Analysis of the relationship between researchers' social media follow-up activities and research results [2023 Dean's Award of the Graduate School of Engineering]
Unsupervised summary generation that captures the latent topic structure of a document [Winner of the 2021 Dean's Award of the Graduate School of Engineering]
Research on prediction of combinable knowledge and material combinations for the development of new composite materials
Research on the dynamics of regional clusters and the role of rare connections