JONGHA (JON) RYU

jongha@mit.edu jongharyu.github.io

RESEARCH INTERESTS

Mathematical foundations of scientific machine learning, with recent focus on neural spectral methods [C1], [C7], [C8], probabilistic and generative modeling [C4], [C5], [P1], and uncertainty quantification and sequential decision making with anytime-valid inference [J2], [C2], [C3], [C6].

EMPLOYMENT

Massachusetts Institute of Technology (MIT) Aug. 2022 – present
Postdoctoral Associate, Department of EECS/Research Laboratory of Electronics
· Advisor: Prof. Gregory W. Wornell.

EDUCATION

University of California San Diego (UCSD) Sep. 2015 – Jun. 2022
Ph.D. in Electrical Engineering (GPA: 3.99/4.0)
· Thesis advisors: Prof. Young-Han Kim and Prof. Sanjoy Dasgupta.
· Thesis title: "From Information Theory to Machine Learning Algorithms: A Few Vignettes".

M.S. in Electrical Engineering Dec. 2018

Seoul National University (SNU) Mar. 2008 – Aug. 2015
Bachelor of Science (*summa cum laude*, GPA: 4.11/4.3)
· Double major in **Electrical and Computer Engineering** and **Mathematical Sciences**; minor in **Physics**.

JOURNAL PAPERS

(* indicates equal contribution. † indicates alphabetical order.)

[J1] **J. Jon Ryu***, S. Ganguly*, Y.-H. Kim, Y.-K. Noh, D. Lee, "Nearest neighbor density functional estimation from inverse Laplace transform," *IEEE Trans. Inf. Theory*, vol. 68, no. 6, pp. 3511–3551, Jun. 2022.

[J2] **J. Jon Ryu**, A. Bhatt, "On confidence sequences for bounded random processes via universal gambling strategies," *IEEE Trans. Inf. Theory*, vol. 70, no. 10, pp. 7143–7161, Oct. 2024.

SELECTED CONFERENCE PAPERS

[C1] **J. Jon Ryu**, X. Xu, H. S. M. Erol, Y. Bu, L. Zheng, G. Wornell, "Operator SVD with neural networks via nested low-rank approximation," in *ICML*, Jul. 2024.

[C2] **J. Jon Ryu**, G. W. Wornell, "Gambling-based confidence sequences for bounded random vectors," in *ICML*, Jul. 2024. **Spotlight** (top 3.5%).

[C3] M. Shen*, **J. Jon Ryu***, S. Ghosh, Y. Bu, P. Sattigeri, S. Das, G. W. Wornell, "Are uncertainty quantification capabilities of evidential deep learning a mirage?," in *NeurIPS*, Dec. 2024.

[C4] T. Jayashankar*, **J. Jon Ryu***, G. W. Wornell, "Score-of-mixture training: Training one-step generative models made simple via score estimation of mixture distributions," in *ICML*, Jul. 2025. **Spotlight** (top 2.6%).

[C5] **J. Jon Ryu**, A. Shah, G. W. Wornell, "A unified view on learning unnormalized distributions via noise-contrastive estimation," in *ICML*, Jul. 2025.

[C6] **J. Jon Ryu**, J. Kwon, B. Koppe, K.-S. Jun, "Improved offline contextual bandits with second-order bounds: Betting and freezing," in *Proc. Conf. Learning Theory (COLT)*, Jun. 2025.

[C7] M. Jeong*, **J. Jon Ryu***, S.-Y. Yun, G. W. Wornell, "Efficient parametric SVD of Koopman operator for stochastic dynamical systems," in *NeurIPS*, Dec. 2025.

[C8] **J. Jon Ryu**, S. Zhou, G. W. Wornell, "Revisiting orbital minimization for neural operator decomposition," in *NeurIPS*, Dec. 2025.

Selected Preprints

[P1] **J. Jon Ryu**, P. Yeddanapudi, X. Xu, G. W. Wornell, "Contrastive predictive coding done right for mutual information estimation," arXiv:2510.25983.

[P2] **J. Jon Ryu**, Y. Choi, Y.-H. Kim, M. El-Khamy, J. Lee, "Learning with succinct common representation with Wyner's common information," arXiv:1905.10945. Preliminary versions presented at NeurIPS Bayesian Deep Learning Workshops (2018, 2021).

Invited Talks

- **From Information Theory to Machine Learning Algorithms: Two Vignettes**, Signals, Information and Algorithms Laboratory, MIT, 2022; Center for AI and Natural Sciences, KIAS, 2022.
- **From Wyner's Common Information to Learning with Succinct Representation**, Information Theory and Applications Workshop (ITA), 2022; Machine Intelligence and Data Science Laboratory, SNU, 2023; Inference and Information for Data Science Lab, KAIST, 2023.
- **Nearest Neighbor Density Functional Estimation from Inverse Laplace Transform**, Center for AI and Natural Sciences, KIAS, 2022.
- **On Confidence Sequences from Universal Gambling**, Prof. Aaditya Ramdas's Group, CMU, 2022; Hanyang University, 2023.
- **Operator SVD with Neural Networks via Nested Low-Rank Approximation**, MLTea, MIT, 2023; ITA Workshop, 2024; MERL, 2024; KAIST AI, 2024; KIAS, 2024; Flatiron Institute, 2024; MIT JTL Urban Mobility Lab, 2025; Prof. Devavrat Shah's Group, MIT, 2025.
- **Efficient Generative Modeling and Operator Learning from First Principles**, Frontier Research, Prescient Design, Genentech, 2025; Department of Electrical Engineering, POSTECH, 2025; Department of Computer Science and Engineering, POSTECH, 2025.
- **Tools for Scalable and Reliable Scientific Inference from First Principles**, Prescient Design, Genentech, 2025.

Honors and Awards

Spotlight Recognitions (top ∼3%) — ICML 2024, ICML 2025

Top Reviewer Awards — NeurIPS 2023, NeurIPS 2025

Departmental Fellowship — Sep. 2015 – Jun. 2016
Department of ECE, UCSD

Kwanjeong Scholarship for Graduate Study — Sep. 2015 – Jun. 2020
Kwanjeong Scholarship Foundation, South Korea

Kwanjeong Scholarship for Undergraduate Study — Mar. 2010 – Dec. 2013
Kwanjeong Scholarship Foundation, South Korea

University Students Contest of Mathematics
Korean Mathematical Society
· Among non-math majors: Gold prize (2010), honorable mention (2009).
· Among math majors: Bronze prize (2013).

Professional Service

- **Journals**: IEEE Trans. Inf. Theory, IEEE J. Sel. Areas Inf. Theory.
- **Conferences**: ISIT (2017, 2023, 2024, 2025), ITW (2022), AISTATS (2022, 2023, 2024), ICML (2022–2025), NeurIPS (2022–2025, top reviewer 2023 and 2025), ICLR (2024, 2026).

Internship Experience

Research Intern — Jun. 2019 – Dec. 2019
AI Research Group, Qualcomm Technologies, Inc.
· Researched deep-learning-based compression for speech processing.

Research Intern — Jun. 2018 – Sep. 2018
Deep Learning Team, SoC R&D, Samsung Semiconductor Inc.
· Developed an information-theoretic representation learning principle [P2].

Teaching Experience

Instructor (MIT)

- **6.7800 Inference and Information** Spring 2024, Spring 2025
  - Designed and taught a five-lecture sequence of advanced special sessions as co-instructor.
  - Topics: minimax bit prediction, group testing, universal inference and concentration, universal learning approach for Rock–Paper–Scissors machine, variational perspective on generative modeling.
  - Evaluations: overall rating 7.0/7 (Spring 2024), 6.3/7 (Spring 2025).

Teaching Assistant (UCSD)

- **ECE 250 Random Processes** Winter 2017
- **ECE 154C Communication Systems** Spring 2017
  - Designed hands-on programming assignments using Julia.
  - Topics: basic source coding and channel coding algorithms.
- **ECE 225B Universal Probability and Applications in Data Science** Spring 2018
  - Designed hands-on programming assignments using Python.
  - Topics: Lempel–Ziv probability assignment, context-tree weighting, universal portfolio.
- **ECE 269 Linear Algebra and Applications** Winter 2019

Mentoring Experience

Tejas Jayashankar, Ph.D. student, MIT (now at Meta) Sep. 2022 – Jun. 2025
- Worked on generative modeling and representation learning; co-authored a spotlight paper on one-step image generation (ICML 2025) [C4].

Abhin Shah, Ph.D. student, MIT (now at Five Rings) Sep. 2022 – Aug. 2024
- Worked on fairness and unnormalized models; co-authored papers on fairness (ISIT 2024) and noise-contrastive estimation (ICML 2025) [C5].

Maohao Shen, Ph.D. student, MIT Sep. 2022 – present
- Worked on evidential deep learning; co-authored a paper characterizing its behavior (NeurIPS 2024) [C3]; working on RLHF and memory-based LLM methods.

Minchan Jeong, Ph.D. student, KAIST Sep. 2024 – present
- Worked on applications of neural spectral methods; co-authored a paper on stochastic dynamical systems (NeurIPS 2025) [C7]; working on excited-states computation in quantum chemistry.

Rachana Madhukara, Ph.D. student, MIT Mar. 2025 – present
- Working on Koopman-operator-based approaches for efficient generative modeling.

Axel Adjei, M.Eng. student, MIT Sep. 2025 – present
- Working on theoretical analysis of convergence behavior of iterative spectral decomposition algorithms; developing guarantees for a new streaming canonical correlation analysis algorithm.

Samuel Zhou, undergraduate student, MIT Mar. 2025 – present
- Worked on neural spectral methods; co-authored a paper on linear-algebraic operator decomposition (NeurIPS 2025) [C8]; working on interpretable representation learning in LLMs.

Pavan Yeddanapudi, undergraduate student, MIT Sep. 2024 – present
- Worked on information-measure estimation; co-authored a paper on mutual information estimation (arXiv 2025, under review) [P1]; working on score-based representation learning.

Other Experience

Military service (mandatory) Mar. 2011 – Dec. 2012
Republic of Korea Army

References

Gregory W. Wornell
Professor of EECS, MIT
Postdoc advisor
gww@mit.edu

Young-Han Kim
Professor of ECE, UCSD
Ph.D. advisor
yhk@ucsd.edu

Sanjoy Dasgupta
Professor of CSE, UCSD
Ph.D. advisor
sadasgupta@ucsd.edu