Seiyun SHIN

Curriculum Vitae

Department of Electrical and Computer Engineering
University of Illinois Urbana-Champaign (UIUC)
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Research Interests

My research interests lie at the intersection of theoretical machine learning, algorithm design, information theory, and randomized numerical linear algebra, with the overarching goal of advancing our understanding of learning limits and developing efficient algorithms.

Specifically, I have been developing scalable algorithms and establishing theoretical guarantees on approximation and sample complexity, in (1) inference and learning from graph-structured data (with the use of graph neural networks and dynamic graph clustering), (2) privacy-preserving covariance estimation or regression, and (3) effective data attribution methods to ensure transparency and accountability in machine learning models, focusing on reliably tracing data contributions and building attributable AI frameworks.

Moving forward, I aim to study deep learning theory and high-dimensional statistics to broaden my research to include: (1) efficient model pruning to deploy resource-friendly models without significant loss in predictive power, (2) extending privacy-preserving frameworks to ensure security while maintaining performance in deep learning (3) addressing the impact of distributional shifts on model robustness and reliability.

Education

Ph.D. Electrical and Computer Engineering **Aug. 2019–Present**
University of Illinois Urbana-Champaign (UIUC), Urbana, IL
Advisor: Ilan Shomorony and Han Zhao

M.S. Electrical Engineering **Feb. 2015**
Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea
Advisor: Changho Suh

B.S. Electrical Engineering **Aug. 2012**
Mathematical Sciences
Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea
Summa Cum Laude

Honors and Awards

- **Awarded Mavis Future Faculty Fellow** 2023–2024
- **Nominated Olesen Award for Excellence in Undergraduate Teaching** 2022
- **Awarded Kwanjeong Educational Foundation Fellowship** 2019–2024

- **Awarded Academic Excellence Scholarship from KAIST EE Department** 2009–2011
- Awarded Korea Government Fellowship 2008–2015
- Graduated early from Hansung Science High School **(2-year completion)** 2008

Selected Publications

Conference Papers

[C-10] Yuzheng Hu*, **Seiyun Shin***, and Han Zhao, "Efficient Data Attribution via Compresssed Sensing," *In preparation for the International Conference on Machine Learning (ICML) 2025.* (*equal contributions)

[C-9] **Seiyun Shin**, Rajarshi Bhattacharjee, and Cameron Musco, "Differential Private Sketching for Covariance Estimation," *In preparation for the International Conference on Machine Learning (ICML) 2025.*

[C-8] **Seiyun Shin**, Ilan Shomorony, and Peter Macgregor, "Dynamic DBSCAN with Euler Tour Sequences," *submitted to the International Conference on Artificial Intelligence and Statistics (AISTATS) 2025.*

[C-7] **Seiyun Shin**, Ilan Shomorony, and Han Zhao, "Efficient learning of linear graph neural networks via node subsampling," *In Proceedings of the 37th Advances in Neural Information Processing Systems (NeurIPS), Dec. 2023.*

[C-6] **Seiyun Shin**, Han Zhao, and Ilan Shomorony, "Adaptive power method: Eigenvector estimation from sampled data," *International Conference on Algorithmic Learning Theory, Feb. 2023.*

[C-5] Hyejin Park*, **Seiyun Shin***, Kwang-Sung Jun, and Jungseul Ok, "Transfer learning in bandits with latent continuity," *International Symposium on Information Theory (ISIT),* July 2021. (*equal contributions)

[C-4] **Seiyun Shin**, Reinhard Heckel, and Ilan Shomorony, "Capacity of the erasure shuffling channel," *International Conference on Acoustics, Speech, and Signal Processing,* May 2020.

[C-3] **Seiyun Shin** and Changho Suh, "Capacity of a two-way function multicast channel," *Allerton Conference on Communication, Control, and Computing,* Oct. 2017.

[C-2] Kyungsik Min, Minchae Jung, **Seiyun Shin**, Seokki Kim, and Sooyong Choi, "System level simulation of mmWave based mobile Xhaul networks," *IEEE Vehicular Technology Conference (VTC Spring),* June 2017.

[C-1] **Seiyun Shin** and Changho Suh, "Two-way function computation," *Allerton Conference on Communication, Control, and Computing,* Oct. 2014.

Journal Papers

[J-2] Hyejin Park, **Seiyun Shin**, Kwang-Sung Jun, and Jungseul Ok, "Transfer learning in bandits with latent continuity," *IEEE Transactions on Information Theory,* Vol. 70, No. 11, Nov. 2024.

[J-1] **Seiyun Shin** and Changho Suh, "Two-way function computation," *IEEE Transactions on Information Theory,* Vol. 66, No. 2, Feb. 2020.

Courses in UIUC

ECE598 Fundamental Limits in Data Science (A+/A), CS598 Transfer Learning (A/A), CS598 Deep Learning Theory (A/A), CS598 Statistical Reinforcement Learning (A/A), ECE586 MDPs and Reinforcement Learning (A/A), ECE580 Optimization by Vector Space Method (A+/A), CS583 Approximation Algorithms (A-/A), ECE563 Information Theory (A+/A), ECE543 Statistical Learning Theory (A/A), ECE534 Random Processes (A/A), IE521 Convex Optimization (A/A), CS498 Algorithms for Big Data (A/A), CS498 Trustworthy Machine Learning (A/A), IE498 Online Learning (A/A), CS446 Machine Learning (A/A), CS445 Computational Photography (A/A), CS443 Reinforcement Learning (A/A)

Professional Service

- Reviewer for Conference on Neural Information Processing Systems (NeurIPS)
- Reviewer for International Conference on Machine Learning (ICML)
- Reviewer for International Conference on Learning Representations (ICLR)
- Reviewer for International Conference on Artificial Intelligence and Statistics (AISTATS)
- Reviewer for IEEE Transactions on Information Theory
- Reviewer for IEEE International Symposium on Information Theory (ISIT)
- Reviewer for IEEE Information Theory Workshop (ITW)
- Reviewer for International Conference on Acoustics, Speech, and Signal Processing (ICASSP)
- General Chair for the Coordinated Science Laboratory (CSL) Student Conference 2023 in UIUC
- Machine Learning Session Chair for the CSL Student Conference 2023

Work Experience

Visiting Graudate Student, UMass Amherst, Amherst, MA **Aug. 2024–Nov. 2024**
Supervisor: Cameron Musco

- Developed Differential Private Sketching Algorithms for Covariance Estimation.
- Preparing for submitting a conference paper in ICML 25'.

Research Associate, ETRI, Daejeon, Korea **July 2018–Apr. 2019**
Time-series analysis

- Applied Long Short-Term Memory (LSTM) approach to predict the concentration of PM2.5 from the other air pollutant factors.
- Demonstrated the superiority of the LSTM approach by comparing this with the conventional ARIMA model.

Research Associate, ETRI, Daejeon, Korea **Mar. 2015–June 2018**
5G Communication System Design

- Designed physical layer structures for mmWave-based mobile networks.
- Developed an interference alignment technique for multi-hop networks using delayed channel state information.

- Developed a system-level simulator using MATLAB.
- Published a conference paper in IEEE VTC as an outcome [C-2].

Research Assistant, LG Electronics, Seoul, Korea **Feb. 2013–Feb. 2015**

Interference Alignment Techniques Using Delayed Channel State Information

- Developed interference alignment techniques for a 2-cell, K-user cellular network.
- Generalized into G-cell, K-user cellular networks.
- Utilized MATLAB for implementation and performance evaluation.

Summer Intern, ETRI, Daejeon, Korea **June 2011–Aug. 2011**

Implementation of a Satellite Communication Design

- Developed an algorithm that tracks the direction of GPS jamming signals.
- Modeled the algorithm using interferometer technique and multiple antennas.
- Utilized MATLAB for implementation and performance evaluation.

Teaching Experience

- UIUC ECE534: Random Processes (Tentative) Spring 2025
- UIUC ECE313: Probability with Engineering Applications Spring 2022
  (**nomination for Olesen Award for excellence in undergraduate teaching**)
- UIUC ECE563: Information Theory Fall 2021
- KAIST EE321: Communication Engineering Spring 2014
- KAIST EE623: Information Theory Fall 2013
- KAIST EE202: Signals and Systems Fall 2011

Invited Talks

- Theory Group Seminar, UMass Amherst Oct. 2024
  "Inference and Learning on Partially Observed Graphs"
- Machine Learning Seminar, UIUC Jan. 2024
  "Inference and Learning on Partially Observed Graphs"
- MLOPT Idea Seminar, UW-Madison Apr. 2023
  "Adaptive Power Method: Eigenvector Estimation from Sampled Data"
- Qualcomm IT Tour, Qualcomm Head Quarter, San Diego July 2012
  "When augmented reality meets hope"

References

1. Prof. Ilan Shomorony
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University of Illinois Urbana-Champaign
324 Coordinated Science Laboratory
1308 W Main Street MC 228 Urbana, IL 61801, USA

2. Prof. Han Zhao
Department of Computer Science
University of Illinois Urbana-Champaign
3320 Siebel Center
201 N Goodwin Ave Urbana, IL, 61801, USA
Email: hanzhao@illinois.edu

3. Prof. Changho Suh
Department of Electrical Engineering
Korea Advanced Institute of Science and Technology
IT Convergence Building (N1) 912
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4. Prof. Cameron Musco
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University of Massachusetts Amherst
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140 Governors Drive Amherst, MA 01003, USA
Email: cmusco@cs.umass.edu

5. Prof. Maxim Raginsky
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