Soo Min Kwon

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Education

University of Michigan   *Ann Arbor, MI*
PH.D. ELECTRICAL AND COMPUTER ENGINEERING   *Sept. 2022 – May 2026*
- Dissertation: Deep Learning via Low-Dimensional Representations: Theory and Algorithms
- Advisor(s): Prof. Laura Balzano and Prof. Qing Qu

Rutgers University   *New Brunswick, NJ*
M.S. ELECTRICAL AND COMPUTER ENGINEERING   *Sept. 2020 - May 2022*
- Advisor: Prof. Anand D. Sarwate

Rutgers University   *New Brunswick, NJ*
B.S. ELECTRICAL AND COMPUTER ENGINEERING   *Sept. 2016 - May 2020*
- Advisor: Prof. Anand D. Sarwate

Work Experience

Amazon   *Seattle, WA*
APPLIED SCIENTIST INTERN   *Aug. 2024 – Nov. 2024*
- Developed a causal inference framework using deep learning methods for the SCOT team that reduced variance estimates by over 10%

University of Michigan   *Ann Arbor, MI*
GRADUATE RESEARCH ASSISTANT   *Sept. 2022 - Present*
- Published works on theory of deep learning, diffusion models, and Transformers in ICLR, NeurIPS, AISTATS, ICASSP, etc.

LinkedIn Corporation   *Remote*
APPLIED SCIENTIST INTERN   *May 2022 - Aug. 2022*
- Productionized a machine learning pipeline for the infrastructure team, reducing MAPE by over 15% in forecasting hardware needs for the next calendar year

Preprints († = Equal Contribution)

S. M. Kwon[†], A. S. Xu[†], C. Yaras, L. Balzano, Q. Qu. "Out-of-Distribution Generalization of In-Context Learning: A Low-Dimensional Subspace Perspective". Submitted to *Neural Information Processing Systems (NeurIPS)*, 2025.

L. Balzano, T. Ding, B. D. Haeffele, **S. M. Kwon**, Q. Qu, P. Wang, Z. Wang, C. Yaras. "An Overview of Low-Rank Structures in the Training and Adaptation of Large Models". Submitted to *IEEE Signal Processing Magazine*, 2025 (α-β Order).

S. M. Kwon[†], C. Blocker[†], H. Raja, J. Fessler, L. Balzano. "Dynamic Subspace Estimation from Undersampled Data using Grassmannian Geodesics". Submitted to *Transactions on Machine Learning Research (TMLR)*, 2025.

X. Li, **S. M. Kwon**, I. Alkhouri, S. Ravishankar, Q. Qu. "Decoupled Data Consistency for Solving General Inverse Problems with Diffusion Models." Submitted to the *International Journal of Computer Vision (IJCV)*, 2024.

Publications

A. Ghosh[†], **S. M. Kwon**[†], R. Wang, S. Ravishankar, Q. Qu. "Learning Dynamics of Deep Matrix Factorization Beyond the Edge of Stability". In *International Conference on Learning Representations (ICLR)*, 2025.

C. Lee, **S. M. Kwon**, Q. Qu, H. Lee. "BLAST: Block-Level Adaptive Structured Matrices for Efficient Deep Neural Network Inference." In *Neural Information Processing Systems (NeurIPS)*, 2024.

S. M. Kwon, L. Ding, L. Balzano, Q. Qu. "On the Relationship Between Small Initialization and Flatness in Deep Networks." In *International Conference on Learning Representations (ICLR) BGPT Workshop*, 2024.

S. M. Kwon, Z. Zhang, D. Song, L. Balzano, Q. Qu. "Efficient Compression of Overparameterized Deep Models." In *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2024.

B. Song[†], **S. M. Kwon**[†], Z. Zhang, X. Hu, Q. Qu, L. Shen. "Solving Inverse Problems with Latent Diffusion Models via Hard Data Consistency." In *International Conference on Learning Representations (ICLR)*, 2024 (**Spotlight, Top 5%**).

D. K. Saha, V. Calhoun, **S. M. Kwon**, A. D. Sarwate, R. Saha, S. Plis. "Federated, Fast, and Private Visualization of Decentralized Data". In *International Conference on Machine Learning (ICML) Workshop on Federated Learning*, 2023.

S. M. Kwon, X. Li, A. D. Sarwate. "Low-Rank Phase Retrieval with Structured Tensor Models." In *International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2022.

D. K. Saha, V. D. Calhoun, Y. Du, Z. Fu, R. Panta, **S. M. Kwon**, A. D. Sarwate, S. M. Plis. "Privacy-Preserving Quality Control of Neuroimaging Datasets in Federated Environments". In *Organization for Human Brain Mapping (OHBM)*, 2021.

S. M. Kwon, A. D. Sarwate. "Learning Predictors from Multidimensional Data with Tensor Factorizations". In *Rutgers University Aresty Undergraduate Research Journal*, 2021.

S. M. Kwon, S. Yang, J. Liu, X. Yang, W. Saleh, S. Patel, C. Mathews, Y. Chen. "Hands-Free Human Activity Recognition Using Millimeter-Wave Sensors". In *IEEE International Symposium on Dynamic Spectrum Access Networks (DySPAN)*, 2019.

Awards, Fellowships & Grants

2024   **Harvey G. and Joyce H. Behner Graduate Fellowship**, University of Michigan

2022   **PhD Rackham Merit Fellowship**, University of Michigan
        ECE Outstanding Master's Student Award, Rutgers University
        ECE Outstanding Teaching Assistant Award, Rutgers University
        ECE Departmental Leadership & Service Award, Rutgers University

2020   **WINLAB Grant**, Rutgers University

Technical Skills

Programming Languages: Python, MATLAB, Scala, SQL, C++
Libraries: PyTorch, TensorFlow, Jax, Scikit-learn, NumPy, SciPy, Pandas
Software: AWS, Git, Visual Studio, Tableau, Jupyter Notebook, Microsoft Office, LaTeX

Reviewer Service

International Conference on Machine Learning (ICML), 2024
Neural Information Processing Systems (NeurIPS), 2024
Conference on Parsimony and Learning (CPAL), 2024
Neural Information Processing Systems (NeurIPS) Workshop on Diffusion Models, 2023