Soo Min Kwon

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Research Interests

Convex & non-convex optimization, multi-dimensional (tensor) data analysis, differential privacy, distributed learning

Education

Rutgers University — New Brunswick, NJ
M.S., Electrical and Computer Engineering — Sept. 2020 – May 2022
Thesis: "Optimization Problems with Low Rank Structures"
Advisor: Prof. Anand D. Sarwate

Rutgers University — New Brunswick, NJ
B.S., Electrical and Computer Engineering, Minor in Mathematics — Sept. 2016 – May 2020
Thesis: "Learning Predictors from Multidimensional Data with Tensor Factorizations"
Advisor: Prof. Anand D. Sarwate

Relevant Coursework

Graduate: Optimization Methods for Machine Learning, Theory of Probability, Convex Optimization, Detection & Estimation Theory, Stochastic Signals & Systems, Machine Vision, Information Theory

Undergraduate: Linear Algebra, Machine Learning for Engineers, Linear Systems & Signals, Digital Signals Processing, Linear Optimization

Academic Experience

Teaching Assistant — May 2020 – Present
Rutgers University — New Brunswick, NJ

- Currently a Teaching Assistant for **440:127 – Introduction to Computers for Engineers (MATLAB)** with 500+ students
- Served as a Teaching Assistant for **332:346 – Digital Signal Processing** for Prof. Waheed Bajwa with approximately 100 students
- Served as a Teaching Assistant for **332:345 – Linear Systems and Signals** with approximately 50 students

Graduate Research Assistant — May 2020 – Present
Rutgers University — New Brunswick, NJ

- Conducting research in imposing low-rank structures on different optimization problems
- Researched in distributed **differential privacy** – a machine learning framework in which multiple sites can collaborate to learn under sensitive data
- Previously researched machine learning algorithms that can learn under low–rank tensor structure

Research Intern — May 2019 – Sept. 2019
Wireless Information Network Laboratory — North Brunswick, NJ

- Performed data collection and pre-processed millimeter-wave sensor data for Convolutional Neural Networks to infer the type of activity performed
- Results were presented in the WINLAB Symposium, MIT Undergraduate Research Conference, IEEE DySPAN 2019, and ECE Research Day 2019
- Lead author to publication for demonstration at an IEEE conference

Selected Projects

Low-Rank Phase Retrieval with Structured Tensor Models

- Researched and implemented an algorithm in Python that recovered images given the magnitude of its linear measurements
- Conducted experiments that demonstrated the effectiveness of the algorithm under multiple settings compared to existing methods

Privacy-Preserving Quality Control of Neuroimaging Data in Federated Environments

- Implemented a differentially private algorithm that clustered data samples in a distributed, federated setting
- Analyzed the trade-off between the privacy parameters using Rényi Differential Privacy and the moments accountant

A Friendly Introduction to Differential Privacy

- Wrote a tutorial that explained the basics of differential privacy
- Explained the need for differential privacy and topics such as differentially private ERM, SGD, Rényi Differential Privacy and the moments accountant

Learning Predictors from Multidimensional Data with Tensor Factorizations

- Developed a Python library that consists of machine learning algorithms that can learn predictors efficiently from multidimensional data
- Work was completed as an honors thesis at Rutgers University and was selected amongst the honors cohorts for a presentation at a symposium

Publications

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

2. D. K. Saha, V. D. Calhoun, Y. Du, Z. Fu, R. Panta, **S. Kwon**, A. D. Sarwate, S. M. Plis. "Privacy-preserving quality control of neuroimaging datasets in federated environments". Submitted to *Human Brain Mapping*, 2021.

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

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

Poster Presentations

1. D. K. Saha, V. D. Calhoun, Y. Du, Z. Fu, R. Panta, **S. Kwon**, A. D. Sarwate, S. M. Plis. "Visualizing Neuroimaging Data Located at Different Sites with Privacy Guarantees". Presented in *Human Brain Mapping*, 2021.

2. **S. Kwon**, A. D. Sarwate. "Learning Predictors from Multidimensional Data with Tensor Factorizations". Presented in *J.J. Slade Honors Research Presentation*, 2020.

3. **S. Kwon**, A. D. Sarwate. "Tensor Regression with Applications in Neuroimaging Data Analysis". Presented in *ECE Research Day*, 2019.

4. **S. Kwon**, S. Yang, X.Yang. "Hands-Free Human Activity Recognition Using Millimeter-Wave Sensors". Presented in *MIT Undergraduate Research Technology Conference*, 2019.

5. **S. Kwon**, S. Yang, J. Liu, X. Yang, W. Saleh, S. Patel, C. Mathews, Y. Chen. "mmWave-based Human Activity Recognition". Presented in *IEEE International Symposium on Dynamic Spectrum Access Networks*, 2019.

Professional Experience

Data Science Intern May 2020 – Sept. 2020
Centene Corporation Remote

- Automated the process of detecting expedition phrases in healthcare forms using Restricted Boltzmann Machines in Tensorflow
- Designed and optimized several machine learning algorithms (Support Vector Machines, Logistic Regression, XGBoost) for statistical inference on diseases given pharmacy data

Awards & Memberships

Rutgers WINLAB GA/TA Grant	2020 – 2022
Magna Cum Laude (High Honors)	2020
Rutgers ECE Departmental Leadership & Service Award	2020
James J. Slade Honors Scholar	2019 – 2020
Rutgers University Dean's List	2018 – 2020

Technical Skills

Programming Languages: Python, MATLAB, SQL, C++
Libraries: Tensorflow, Scikit-learn, NumPy, SciPy, Pandas, Matplotlib
Software: Git, Visual Studio, Tableau, Jupyter Notebook, Microsoft Office,LaTeX

Certificates

Neural Networks and Deep Learning (License #M6TYH2SFB6QV, by Andrew Ng, Coursera)