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 Programming*

*: Course Grade A **: Currently Enrolled

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. 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.

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

3. **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)