

Professional Summary

Experienced Research Scientist with a PhD in Electrical Engineering, specializing in prediction, machine learning, and optimization. Proficient in developing forecasting and optimization models using Python, with demonstrated expertise in processing diverse datasets. A dedicated team player adept at managing complex projects and performing under pressure. Open to learning new knowledge and continuously enhancing technical expertise.

Experience

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| 11/2024 – Present | Research Scientist, Sony AI (Zurich, Switzerland) <ul style="list-style-type: none">• Working on AI on Chip Design project. |
| 05/2023 – 11/2024 | Postdoctoral Researcher, University of Southern California (Los Angeles, USA) <ul style="list-style-type: none">• Led the project "Neural Networks on Graphs and Their Filter Design."• Defined and formulating mathematical models to process signals on graphs.• Extracted data from large-scale traffic networks and performing pre-processing.• Analyzed large amounts of sensor data to find spatio-temporal patterns.• Developed prediction systems and machine learning algorithms for traffic forecasting.• Managed project schedules, budgets, and conference trip logistics.• Presented research findings at international conferences. |
| 11/2022 – 04/2023 | Postdoctoral Researcher, École Polytechnique Fédérale de Lausanne (EPFL) (Lausanne, Switzerland) <ul style="list-style-type: none">• Analyzed citation data (from Scopus) to extract patterns.• Set up and maintained an HPC server for laboratory use.• Supervised and mentored a master's student.• Prepared and secured a grant for postdoctoral research. |
| 04/2017 – 10/2022 | Research Assistant, École Polytechnique Fédérale de Lausanne (EPFL) (Lausanne, Switzerland) <ul style="list-style-type: none">• Developed statistical models, machine learning algorithms, and predictive analytics solutions to address challenges in traffic forecasting.• Used machine learning tools to select features, create, and optimize regression models.• Designed experiments to test the models and algorithms and measure the enhancements in traffic prediction accuracy.• Supervised and collaborated with junior researchers to collect and preprocess data, and build and maintain data pipelines.• Served as head teaching assistant for a master's course and graded exams.• Used data visualization tools to communicate insights and findings with collaborators. |
| 05/2016 – 03/2017 | Research Associate, Korea Institute of Science and Technology (KIST) (Seoul, South Korea) <ul style="list-style-type: none">• Managed a large-scale project involving 8 research institutions by introducing and overseeing a version control system (Git).• Designed software architecture to ensure seamless data flow between different models. |
| 03/2013 – 02/2015 | Research Assistant, Korea Advanced Institute of Science and Technology (KAIST) (Daejeon, South Korea) <ul style="list-style-type: none">• Conducted research in radar signal processing and beamforming.• Collaborated with Samsung Electronics to develop a 5G communication system in South Korea.• Presented lectures and assisted in a master's course on radar signal processing. |

Education

04/2017 – 10/2022	Ph.D. in Electrical Engineering École Polytechnique Fédérale de Lausanne (EPFL), Switzerland Thesis: Multivariate Time Series Forecasting for Freeway Networks
03/2013 – 02/2015	M.S. in Electrical Engineering Korea Advanced Institute of Science and Technology (KAIST), South Korea
03/2007 – 02/2013	B.S. in Electrical Engineering Yonsei University, South Korea

Skills

Programming Skills

- Proficiency in data processing with Python and MATLAB.
- Embedded system programming using C/C++ and Java.
- Front-end development using HTML/CSS and JavaScript.
- Working knowledge of SQL, R, and the Robot Operating System (ROS).

Statistics and Mathematics

- Advanced statistical skills, including in-depth knowledge of statistical tests, probability distributions, regression, maximum likelihood estimators, maximum a posteriori estimators, and Bayesian inference.
- Proficiency in linear algebra, signal processing, convex optimization, and multivariable calculus.

Machine/Deep Learning Theories and Models

- Extensive experience in using classical machine learning models such as k-Nearest Neighbors, logistic regression, linear regression, SVM, and random forest.
- Hands-on experience in implementing and training neural network models such as CNN, RNN, LSTM, GRU (Gated Recurrent Unit), GNN, GCN, GAT (Graph Attention Network), and TCN (Temporal Convolutional Network).
- Good theoretical knowledge of deep learning models including Transformer, ResNet, U-Net, and GAN.

Machine/Deep Learning Libraries

- Data processing: Scikit-learn, Pandas, and NumPy.
- Training: PyTorch, PyTorch Lightning, and TensorFlow.
- Hyper-parameter tuning: Ray Tune.
- Data visualization: Plotly, Matplotlib, Seaborn, ggplot, d3.js, and TensorBoard.

Development Tools

- Version control: Git.
- Editors: VS Code, PyCharm, and Vim.
- Deployment: Docker.

Soft Skills

- Critical and creative thinking, being proactive in identifying and solving problems.
- Excellent communication and presentation skills.
- A dedicated team player adept at collaborating in multidisciplinary teams and open to learning.
- Goal-oriented and able to perform under pressure.

Language Skills

- English (fluent), Korean (native)

Awards

05/2023 – 04/2025	Swiss National Science Foundation Postdoc.Mobility Grant • Postdoctoral grant for excellent researchers in Switzerland (USD 150,000).
03/2013 – 02/2015	Korea Government Fellowship for Graduate Study • Full scholarship plus stipends for master's study.
02/2007 – 02/2013	National Science and Engineering Undergraduate Scholarship • Full scholarship for bachelor's study (top 1% nationwide).

Selected Publications & Patents

- Kwak, Semin, and Nikolas Geroliminis. "Travel time prediction for congested freeways with a dynamic linear model". *IEEE transactions on intelligent transportation systems*, vol. 22, no. 12, 2020, pp. 7667–77.
- Kwak, Semin, et al. "Asymmetric sum and difference beam pattern synthesis with a common weight vector". *IEEE Antennas and Wireless Propagation Letters*, vol. 15, 2016, pp. 1622–25.
- Kwak, Semin, et al. Beamforming method and apparatus for serving multiple users. Apr. 2017, US Patent 9,634,750.
- Kwak, Semin, et al. "Frequency analysis and filter design for directed graphs with polar decomposition". *ICASSP 2024-2024 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*. IEEE, 2024, pp. 9661–65.
- Kwak, Semin, et al. "Traffic signal prediction on transportation networks using spatio-temporal correlations on graphs". *IEEE Transactions on Signal and Information Processing over Networks*, vol. 7, 2021, pp. 648–59.
- Kwak, Semin, et al. "TwoResNet: Two-level resolution neural network for traffic forecasting on freeway networks". *2022 IEEE 25th International Conference on Intelligent Transportation Systems (ITSC)*. IEEE, 2022, pp. 3963–69.