Keivan Faghih Niresi

Ph.D. Candidate – EPFL

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Education

École Polytechnique Fédérale de Lausanne (EPFL) — *Lausanne, CH*

Ph.D. in Machine Learning — *Feb. 2023 - Present*

- **Advisor:** Prof. Olga Fink
- **Coursework:** Frontiers of Deep Learning for Engineers, Image Analysis and Pattern Recognition

National Tsing Hua University (NTHU) — *Hsinchu City, TW*

M.Sc. in Communications Engineering — *Sep. 2020 - Nov. 2022*

- **Thesis:** *Hyperspectral Image Restoration Framework Based on Robust Untrained Neural Networks*
- **Advisor:** Prof. Chong-Yung Chi
- **Coursework:** Machine Learning, Numerical Optimization, Convex Optimization, Random Processes, Mathematical Methods for Communications, Brain Computer Interfaces, Communications Theory, Analysis and Synthesis of Digital Audio Signals

University of Guilan — *Rasht, IR*

B.Sc. in Electrical Engineering — *Sep. 2015 - Sep. 2019*

- **Relevant Courses:** Digital Signal Processing, Optical Communications Systems, Digital Communications, Principle of Communications Systems, Numerical Analysis, Linear Algebra, Engineering Probability and Statistics, Antenna and Microwave, Communications Circuits

Research Interests

Signal Processing	Computational sensing/imaging, Inverse problems, Graph signal processing, High-dimensional data analysis
Machine Learning	Graph neural networks, Domain adaptation, Physics-informed learning, Uncertainty quantification
Main Applications	Internet of things, Remote sensing, Hyperspectral imaging, Smart cities and infrastructures, Sensor networks

Research Experience

Intelligent Maintenance and Operations Systems (IMOS) Lab. | EPFL — *Lausanne, CH*

Doctoral Research Assistant (**Supervisor:** Prof. Olga Fink) — *Feb. 2023 - Present*

- Developing **physics-informed graph neural networks** for **computational sensing** and **metrology**.
- Solving **topology/graph inference problems** from sensor data by **graph signal processing** and domain-specific knowledge injection.
- Proposing methods for **unsupervised domain adaptation** on **spatial-temporal graph neural networks** for **multisensor fusion**.

Section of Automation & Control | Aalborg University — *Aalborg, DK*

Visiting Researcher (**Supervisor:** Prof. Rafal Wisniewski) — *May. 2024 - Jun. 2024*

- Collected **pipeline network datasets (multivariate time series)** at the **Smart Water Infrastructures Laboratory (SWIL)**.
- Gained hands-on experience in **intelligent distribution systems modeling** and **smart meters calibration**.

Wireless Communications and Signal Processing (WCSP) Lab. | NTHU — *Hsinchu City, TW*

Research Assistant (**Supervisor:** Prof. Chong-Yung Chi) — *Sep. 2020 - Dec. 2022*

- Proposed **unsupervised** methods based on **robust statistics** and **deep learning** for solving **inverse problems in imaging**.
- Studied **convex optimization** techniques and applications in machine learning, signal processing, and communications systems.

➔ **Published two papers in top-tier signal processing, geoscience, remote sensing, and earth observation journals.**

PranaQ — *Taipei City, TW*

Machine Learning Research Engineer Intern (**Mentor:** Prof. Hau-Tieng Wu) — *May. 2022 - Aug. 2022*

- Focused on **multi-modal biomedical signal processing** for analyzing **SpO2, blood pressure trends, pulse, and respiration rate**.
- Collaborated with physicians from **Taipei Medical University Hospital** to collect biomedical data, including PPG, ECG, EMG, and EEG.

➔ **Led to performance improvement in sleep tracking; these algorithms are currently integrated into the TipTraQ device.**

Publications

[1] **Keivan Faghih Niresi**, Ismail Nejjar, and Olga Fink
Efficient Unsupervised Domain Adaptation Regression for Spatial-Temporal Air Quality Sensor Fusion
Submitted to Information Fusion, 2024

[2] **Keivan Faghih Niresi**, Hugo Bissig, Henri Baumann, and Olga Fink
Physics-Enhanced Graph Neural Networks For Soft Sensing in Industrial Internet of Things
IEEE Internet of Things Journal, 2024

[3] **Keivan Faghih Niresi**, Lucas Kuhn, Gaëtan Frusque, and Olga Fink
Informed Graph Learning By Domain Knowledge Injection and Smooth Graph Signal Representation
European Signal Processing Conference (EUSIPCO), 2024

[4] **Keivan Faghih Niresi**, Mengjie Zhao, Hugo Bissig, Henri Baumann, and Olga Fink
Spatial-Temporal Graph Attention Fuser for Calibration in IoT Air Pollution Monitoring Systems
IEEE SENSORS, 2023

[5] **Keivan Faghih Niresi**, and Chong-Yung Chi
Robust Hyperspectral Inpainting via Low-Rank Regularized Untrained Convolutional Neural Network
IEEE Geoscience and Remote Sensing Letters, 2023

[6] **Keivan Faghih Niresi**, and Chong-Yung Chi
Unsupervised Hyperspectral Denoising Based on Deep Image Prior and Least Favorable Distribution
IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 2022

Talks and Workshops

[1] **Integrating Physics in Graph Neural Networks for Interaction Modeling**
Second Workshop on Physics Enhancing Machine Learning in Applied Mechanics, Institute of Physics (IOP), London, UK, 2023

Teaching Experience

EPFL (School of Architecture, Civil and Environmental Engineering) — *Lausanne, CH*

Teaching Assistant — *Feb. 2023 - Present*

- CIVIL-426 - Machine Learning for Predictive Maintenance Applications (Fall 2023)
- CIVIL-332 - Data Science for Infrastructure Condition Monitoring (Spring 2024, Spring 2023)

NTHU (College of Electrical Engineering and Computer Science) — *Hsinchu City, TW*

Teaching Assistant — *Feb. 2021 - Jun. 2022*

- EE 367000 - Introduction to Convex Optimization (Spring 2022, and Spring 2021)

University of Guilan (Department of Electrical and Computer Engineering) — *Rasht, IR*

Teaching Assistant — *Feb. 2018 – Jun. 2019*

- Electrical Circuits I (Spring 2019, Fall 2018, and Spring 2018)

Guest Lecturer

- Introduction to Advanced Design System (ADS) for Communications Circuits

Skills and Expertise

Programming and Scripting Languages:
Python, MATLAB®, LaTeX

Machine Learning, Deep Learning, and Data Science:
PyTorch, PyTorch Geometric (PyG), PyG Temporal, Torch Spatiotemporal, CVXPY, scikit-learn, pandas, NumPy, SciPy, Tensorflow

Computer Vision, Computational Imaging, and Image Processing:
OpenCV, scikit-image, Pyxu, DeepInverse, Kornia, SCICO

Honors and Awards

2020 **Awarded M.Sc. Full Scholarship (Merit-Based)**, *highest award offered to NTHU graduate students*
2019 **Ranked 1st in GPA** *among all undergraduate students of Communications Engineering, University of Guilan, Class of 2015-2019*
2019 **Merit-Based Admission Offer** *for M.Sc. program (University of Guilan) without entrance exam as an exceptional talent (declined)*
2015 **Full Tuition-Waiving Fellowship** *for B.Sc. degree*

Academic Services

Student Supervision (Co-advised with Prof. Olga Fink):
Master's students: Jun Qing (EPFL), Lucas Kuhn (EPFL)

Reviewer:
Mechanical Systems and Signal Processing (2024), Internet of Things (2024), Engineering Applications of Artificial Intelligence (2024), IEEE Sensors Journal (2024, 2023), Signal, Image and Video Processing (2023, 2022)

Conference Organizer:
Intelligent Maintenance Conference (IMC) (2024, 2023)