Keivan Faghih Niresi

Machine Learning and Signal Processing Researcher | Ph.D. Candidate at EPFL

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Research Interests

Signal Processing Computational sensing/imaging, Inverse problems, Graph signal processing, High-dimensional data analysis

Machine Learning Graph neural networks, Unsupervised domain adaptation, Physics-informed learning, Uncertainty quantification

Education

École Polytechnique Fédérale de Lausanne (EPFL)

Lausanne, CH

Docteur ès Sciences (Ph.D.) *Feb. 2023 - Sep. 2026 (Expected)*

- **Thesis:** *Informed Graph and Temporal Representation Learning for Networked Computational Sensing*
- **Advisor:** Prof. Olga Fink
- **Courses:** Optimization and Simulation, Graph Representations for Biology and Medicine, Frontiers of Deep Learning for Engineers, Image Analysis and Pattern Recognition

National Tsing Hua University (NTHU)

Hsinchu, TW

Master of Science (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
- **Courses:** 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

Bachelor of Science (B.Sc.) in Electrical Engineering *Sep. 2015 - Sep. 2019*

- **Thesis:** *Comparative Analysis of Modulation Methods in Visible Light Communication Systems*
- **Advisor:** Prof. Gholamreza Baghersalimi
- **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 Experience

Intelligent Maintenance and Operations Systems (IMOS) Lab. | EPFL

Lausanne, CH

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

- Designing novel physics-informed learning and graph data augmentation for the computational sensing of dynamical systems.
- Advancing techniques in graph signal processing, such as graph inference, sampling set selection, and time-vertex machine learning.
- Proposing unsupervised domain adaptation methods for spatial-temporal graph neural networks in regression tasks.
- Developing uncertainty quantification and sensor virtualization frameworks to validate measurement and sensing quality.

Data, Vibration and Uncertainty (DVU) Group | University of Cambridge

Cambridge, UK

Visiting Researcher (**Supervisor:** Prof. Alice Cicirello) *Sep. 2025 - Dec. 2025*

- Proposed a novel conformal prediction method for spatial-temporal graph neural networks to quantify uncertainty.
- Developed in-context learning frameworks using foundation models to perform distribution-free conformal inference.
- Improved reliability of data-driven models for anomaly detection.

Learning and Decisions Lab. | Aalborg University

Aalborg, DK

Visiting Researcher (**Supervisors:** Prof. Rafal Wisniewski and Prof. Carsten Skovmose Kallesøe) *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, 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

Journal Papers:

[1] **Keivan Faghih Niresi**, Christian Møller Jensen, Carsten Skovmose Kallesøe, Rafael Wisniewski, and Olga Fink
Virtual Smart Metering in District Heating Networks via Heterogeneous Spatial-Temporal Graph Neural Networks
Submitted, 2026

[2] Olga Fink, Ismail Nejjar, Vinay Sharma, **Keivan Faghih Niresi**, Han Sun, Hao Dong, Chenghao Xu, Amaury Wei, Arthur Bizzi, Raffael Theiler, Yuan Tian, Leandro Von Krannichfeldt, Zhan Ma, Sergei Garmaev, Zepeng Zhang, Mengjie Zhao, Kevin Steiner, Yusuf Kesmen
From Physics to Machine Learning and Back: Part II—Learning and Observational Bias in Prognostics and Health Management (PHM)
Reliability Engineering & System Safety, 2026

[3] Olga Fink, Vinay Sharma, Ismail Nejjar, Leandro Von Krannichfeldt, Sergei Garmaev, Zepeng Zhang, Amaury Wei, Gaetan Frusque, Florent Forest, Mengjie Zhao, Chi-Ching Hsu, **Keivan Faghih Niresi**, Han Sun, Hao Dong, Chenghao Xu, Raffael Theiler, Arthur Bizzi, Kevin Steiner
From Physics to Machine Learning and Back: Part I—Learning with Inductive Biases in Prognostics and Health Management (PHM)
Reliability Engineering & System Safety, 2026

[4] **Keivan Faghih Niresi**, Jun Qing, Mengjie Zhao, and Olga Fink
Time-Vertex Machine Learning for Optimal Sensor Placement in Temporal Graph Signals: Applications in Structural Health Monitoring
Reliability Engineering & System Safety, 2026

[5] **Keivan Faghih Niresi**, Zepeng Zhang, and Olga Fink
RINS-T: Robust Implicit Neural Solvers for Time-Series Linear Inverse Problems
IEEE Transactions on Instrumentation and Measurement, 2025

[6] **Keivan Faghih Niresi**, Ismail Nejjar, and Olga Fink
Efficient Unsupervised Domain Adaptation Regression for Spatial-Temporal Sensor Fusion
IEEE Internet of Things Journal, 2025

[7] **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

[8] **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

[9] **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

Peer-Reviewed Conference Papers:

[1] **Keivan Faghih Niresi**, and Olga Fink
Sensor Fault Detection via Virtual Smart Heat Metering with Spatial-Temporal Graph Neural Networks
Submitted, 2026

[2] **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

[3] **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

Invited Talks

[1] Graph Neural Networks for Smart Meters Monitoring
37th EURAMET TC Flow Meeting, Villeurbanne, France, 2026

[2] Conformalizing Spatial-Temporal Graph Neural Networks with In-Context Learning
Dynamics and Vibration Tea Time Talks, University of Cambridge, Cambridge, United Kingdom, 2025

[3] Physics-Guided Graph Inference for District Heating Networks
Fourth Workshop on Physics-Enhancing Machine Learning, Institute of Physics, London, United Kingdom, 2025

[4] Physics-Enhanced Neural Networks for Energy Systems
Let's Talk Research, Lauzhack, Lausanne, Switzerland, 2025

[5] Computational Sensing for Infrastructure Through the Lens of Graph Machine Learning
9th Intelligent Maintenance Conference, Lausanne, Switzerland, 2025

[6] Graph Neural Networks for Environmental and Infrastructure Sensing
Federal Institute of Metrology (METAS), Bern, Switzerland, 2024

[7] Integrating Physics in Graph Neural Networks for Interaction Modeling
Second Workshop on Physics-Enhancing Machine Learning in Applied Mechanics, Institute of Physics, London, United Kingdom, 2023

Teaching Experience

École Polytechnique Fédérale de Lausanne (EPFL) *Lausanne, CH*
Teaching Assistant *Feb. 2023 - Present*

- Data Science for Infrastructure Condition Monitoring (Spring 2026, Spring 2025, Spring 2024, Spring 2023)
- Machine Learning for Predictive Maintenance Applications (Fall 2024, Fall 2023)
- Analysis II (Spring 2025)
- Analysis I (Fall 2024)

National Tsing Hua University (NTHU) *Hsinchu, TW*
Teaching Assistant *Feb. 2021 - Jun. 2022*

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

University of Guilan *Rasht, IR*
Teaching Assistant *Feb. 2018 – Jun. 2019*

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

Skills and Expertise

Programming and Scripting: Python, MATLAB®, C, LaTeX

Machine Learning and Data Science: PyTorch, PyTorch Geometric, SciPy, CVXPY, scikit-learn, pandas, NumPy, TensorFlow

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

Data Infrastructure and DevOps: SQL, Git, Docker, Linux

Honors and Awards

- **EPFL EDCE Mobility Award**, *provided to selected PhD students to undertake an academic visit at an external research institution, 2025*
- **Travel Grant**, *awarded by Physics-Enhancing Machine Learning Workshop, 2025*
- **Awarded M.Sc. Full Scholarship (Merit-Based)**, *the highest award offered to NTHU graduate students, 2020*
- **Awarded B.Sc. Full Tuition-Waiving Scholarship**, *the highest award offered to Iranian undergraduate students, 2015*

Academic Services

Reviewer:

- **Journals:** IEEE Transactions on Industrial Informatics (2026), IEEE Internet of Things Journal (2025), Mechanical Systems and Signal Processing (2025, 2024), Engineering Applications of Artificial Intelligence (2025, 2024), Internet of Things (2024), IEEE Sensors Journal (2024, 2023), Signal, Image and Video Processing (2023, 2022)
- **Conferences:** IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP) (2026, 2025), IEEE International Workshop on Machine Learning for Signal Processing (MLSP) (2025), International Joint Conference on Neural Networks (IJCNN) (2025), Learning on Graphs Conference (2025, 2024)

Student Supervision (Co-advised with Prof. Olga Fink at EPFL):

- Matya Aydin, *Spatial-Temporal Denoising Diffusion Probabilistic Model for Industrial IoTs*, Semester project
- Julien Mollard, *Graph Neural Networks for Early Breast Cancer Detection*, Master's thesis
- Jun Qing, *Graph-Based Near-Optimal Sensor Placement: From Signal Processing to Neural Networks*, Master's thesis
- Lucas Kuhn, *Physics-Inspired Graph Signal Processing for District Heating Networks*, Semester project

Conference Organizer:
Intelligent Maintenance Conference (IMC) (2026, 2025, 2024, 2023)