Maosheng Yang

Google Scholar | Github | Personal Website | LinkedIn | mshyang96@gmail.com

Profile

I love picking up new things and tools, and I enjoy the opportunity of doing research. I strive to bring research into practice. During my PhD, I have developed four *machine learning models* for *flow-type data* in networks such as information/money/water flows, ocean currents, etc. These models range from convolutions to neural networks, Gaussian processes, and generative models, being aware of the physical properties of the flow, such as flow conservation, arbitrage-free. I have demonstrated their applications in various real-world networks for filtering, regression, interpolation, and prediction. I see a lack of network-based machine learning tools in practice and hope to bring them into practice.

Education

Delft University of Technology Aug. 2025
Ph.D. candidate; Dept. Intelligent Systems

- Topic: Learning on Simplicial Complexes: from Convolutions to Generative models
- Advisors: Elvin Isufi, Geert Leus

Delft University of Technology Aug. 2020
M.Sc. (Cum laude); Electrical Engineering (specialized in Signal Processing) *GPA:9.3/10*

- Topic (thesis link): Large graph construction (matrix multiplication) and regularization techniques for graph data
- Advisors: Mario Coutiño, Elvin Isufi, Geert Leus
- Courses: statistical signal processing, network theory, convex opt., distributed opt., estimation & detection, etc.

Beijing Jiaotong University June. 2018
B.Sc.; Electrical Engineering (Telecommunication track) *GPA: 93/100*

- Training from mathematics to signal processing, electric circuits, communication systems, etc.

Research Projects

Generative models on networks

Topological Schrödinger Bridge Matching | paper, code | **Maosheng Yang** (single-author), ICLR 2025, Spotlight

- Main work: Build diffusion-based models for generative learning of networked node and edge data
- Theory: dynamic optimal transport, stochastic diffusion of networked process, stochastic differential, etc
- **Applications**: seismic signal and traffic flow generation, brain fMRI signals matching, single-cell RNA data trajectory interpolation, ocean current matching. (matching: translating the data from one state to another)

Gaussian Processes in networked domains

Hodge-compositional Edge Gaussian Processes | paper, code | AISTATS, 2024

- **Maosheng Yang**, Viacheslav Borovitskiy, Elvin Isufi
- Physics-informed Gaussian processes on simplicial complexes based on *combinatorial Hodge theory*
- **Applications**: interpolation for arbitrage-free foreign currency exchange, ocean currents interpolation, and state estimation in water supply networks

Learning for networked data on nodes, edges, triangles...

Convolutional Learning on Simplicial Complexes | paper, code | Preprint, 2023

- **Maosheng Yang**, Elvin Isufi
- Build a general convolutional learning framework for data in simplicial complexes, including node data, edge flows, triangle data and so on. Theoretical analysis of the framework, including locality and symmetry, spectral analysis based on Hodge decomposition and stability analysis
- **Applications**: Interpolation in foreign currency exchange, group link (triangle and tetrahedron) predictions, and ocean buoy trajectory prediction
- Implemented our model in the open source library TopoModelX for topological deep learning

Simplicial Convolutional Filters | paper, code | IEEE Transactions on Signal Processing, 2022

- **Maosheng Yang**, Elvin Isufi, Michael T. Schaub, Geert Leus.
- Build convolutions for signals defined on simplicial complexes like edge flows, together with spectral analysis and different filter design methods, such as large-scale filter implementation based on Chebyshev polynomials
- **Applications**: Edge flow filtering to preserve their properties like flow-conservation and curl-free, forex filtering, traffic network analysis
- Others: online edge flow prediction over expanding networks. paper

Academic Work

Open Source Project

Supervision of the open source project Topological Signal Processing and Learning Jan - Aug 2024

PyTSPL is a Python library to perform signal processing and learning on simplicial complexes.

Participation in the open source project GeometricKernels | software paper July 2024

GeometricKernels is a Python library for kernels on non-Euclidean spaces as Riemannian manifolds, graphs and meshes, where the Hodge kernels in our paper were implemented.

Participation in the open source project TopoModelX | software paper July 2023

TopoModelX is a Python framework for topological deep learning, where two models in our papers were implemented. Check the related overview paper 1 and paper 2.

Conferences and Talks

– ICLR, International Conference on Learning Representations (Apr 2025, Spotlight paper on Generative models for networked data)
– LOGML, London Geometry and Machine Learning (July 2024, Machine learning project on algebraic geometry)
– AISTATS, AI and Statistics, 2024, Spain (May 2024, poster presentation)
– Talk on Machine learning on simplicial complexes, Mathematical Modeling Group, Utrecht University (May 2024)
– DeepK – workshop on deep learning and kernel machines, (Mar 2024, oral presentation)
– Talk on *Simplicial Convolutions* in AMLab, Amsterdam (Feb 2024)
– Learning on graphs, Amsterdam (Nov 2023/2024); ICASSP (June 2023)
– Workshop on Machine learning and signal processing on graphs, CIRM, France (Nov 2022)

Teaching Assistance

Co-author a tutorial book on machine learning on graphs

Used as materials for two master courses in TU Delft

Bachelor and master graduation project supervisions 2022 – present

– Three projects involving 15 computer science bachelor students on three topics:
recommender systems, deep neural networks and graph neural networks
– Two master projects on topics:
topological unrolling networks and building a Python library for topological signal processing

Reviewer for papers on signal processing and machine learning

Journals: IEEE TSP, TSIPN, SPL, TNNLS; and conferences: ICASSP, EUSIPCO, SampTA, ICML, NeurIPS, ICLR.

Others

Awards

Faculty scholarship (50,000 Euros) by Microelectronics department of TU Delft 2018 – 2020

Academic Excellence Scholarship in Beijing Jiaotong University 2015 – 2018

Skills

Languages: English, Dutch (A2), Chinese
Tools: Python, PyTorch, Git, Transformers for LLM on HuggingFace, other popular ML libraries, Matlab