Maosheng Yang

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Profile

I enjoy the opportunity of doing research and appreciate the idea of bringing research into practice. During my PhD, I have developed *signal processing and machine learning methods mainly on simplicial complexes* for *flow-type data* in networks such as information flow, trading flow (e.g., exchange rates). My current research interests include: learning on geometry and topology domains, statistical learning, optimal transport, generative models, and more importantly, their applications.

Education

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

- Topic: Signal processing and learning on simplicial complexes
- 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*

- Thesis: Graph signal regularizations and diamond sampling based graph construction
- Advisors: Mario Coutiño, Elvin Isufi, Geert Leus

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

Research Projects

Machine Learning

Schrödinger Bridge based Distribution Matching on Topology | paper, code | ICLR 2025, Spotlight

- **Maosheng Yang** (single-author).
- Main work: Investigate how to formulate Schrödinger Bridge problems for topological domains and build distribution matching models for generative learning on topological domains.
- Theory: Dynamic Optimal Transport (Schrödinger Bridge theory), Topological Stochastic Dynamics, Topological Gaussian Processes, Topological Machine Learning
- **Applications**: Brain signals matching, Single-cell data trajectory interpolation, Ocean current matching, etc.

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

- **Maosheng Yang**, Viacheslav Borovitskiy, Elvin Isufi.
- Theory: principled Gaussian processes on simplicial complexes based on *combinatorial Hodge theory*
- **Applications**: Foreign Currency Exchange, Ocean Currents and Water Supply Networks

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

- **Maosheng Yang**, Elvin Isufi.
- Proposed 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**: Foreign currency exchange, triangle and tetrahedron predictions, and trajectory prediction
- Implemented our model in the open source module TopoModelX for topological deep learning.

Simplicial Convolutional Neural Networks | paper, code | ICASSP, 2022

- **Maosheng Yang**, Elvin Isufi and Geert Leus.
- Designed a neural network based on simplicial convolutional filters for learning from data on simplices of one certain order, e.g., edge flows, which returns to graph convolutional neural networks for node data
- Implemented the proposed model in the open source module TopoModelX

Signal Processing

Simplicial Convolutional Filters | paper, code | IEEE Transactions on Signal Processing, 2022
- **Maosheng Yang**, Elvin Isufi, Michael T. Schaub, Geert Leus.
- Proposed spectral methods for signals defined on simplicial complexes, based on discrete calculus
- Built the convolutional filters for simplicial complexes based on the Hodge decomposition
- Large-scale filter implementation based on Chebyshev polynomials on simplicial complexes

Online Edge Flow Prediction Over Expanding Simplicial Complexes | paper | ICASSP, 2023
- **Maosheng Yang**, Bishwadeep Das, Elvin Isuf.
- Designed algorithms for predicting edge flows when the underlying topology is growing.

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

– LOGML, London Geometry and Machine Learning (July 2024, Machine learning project on algebraic geometry)
– AISTATS 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); 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 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 signal processing and machine learning journals and conferences
Reviewed for journals: IEEE TSP, TSIPN, SPL, TNNLS; and conferences: ICASSP, EUSIPCO, SampTA, ICML, NeurIPS.

Others

Awards

Master study scholarship 2018 – 2020
Faculty scholarship by Microelectronics department of TU Delft (total amount of 50,000 euros)

Academic Excellence Scholarship in Beijing Jiaotong University 2015 – 2018

Skills

Languages: Python, Matlab
Tools: PyTorch, Jax, Git/GitHub