Maosheng Yang

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Personal Profile

I enjoy and appreciate the opportunity of doing research. Over the years, 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, physics-based learning, statistical learning, generative models, as well as applications in financial problems, physics problems, climate science, etc.

Education

Delft University of Technology Aug. 2025
Ph.D. candidate; Dept. Intelligent Systems; Advisor: Elvin Isufi, Geert Leus

Delft University of Technology Aug. 2020
M.Sc. (Cum laude); Electrical Engineering, Advisor: Mario Coutiño, Elvin Isufi, Geert Leus *GPA:9+/10*

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

Research Projects

Hodge-compositional Edge Gaussian Processes | paper, code | Artificial Intelligence and Statistics (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.

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.

Simplicial Convolutional Filters | paper | 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
- Chebyshev polynomial filter implementation

Simplicial Trend Filtering | paper | Asilomar, 2022
- **Maosheng Yang**, Elvin Isufi.
- Proposed trend filtering methods for edge flows on simplicial complexes

Convolutional Filtering in Simplicial Complexes | paper | ICASSP, 2022
- **Maosheng Yang**, Elvin Isufi.
- Joint convolutional filters for signals on simplices of different orders, e.g., node signal, edge flow, triangle signal

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

Finite Impulse Response Filters for Simplicial Complexes | paper | EUSIPCO, 2021
- **Maosheng Yang**, Elvin Isufi, Michael T. Schaub, Geert Leus.
- Early work on filtering data on simplices of one certain order (several neural network papers perform convolutions based on this method)

Topological Volterra Filters | paper | ICASSP, 2021
- Geert Leus, **Maosheng Yang**, Mario Coutino, Elvin Isufi.

Academic Work

Supervising the open source project Topological Signal Processing and Learning Jan - July 2024
PyTSPL is a Python library to perform signal processing and learning on simplicial complexes based on my previous research.

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 module for topological deep learning, where two models in our papers were implemented. Check the related overview paper 1 and paper 2.

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.

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

Conferences, Talks, Summer schools and Workshops
– 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)

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, Julia (beginner), LaTeX
Tools: PyTorch, Jax, Git/GitHub, scikit-learn, chebfun, Gudhi, etc