Fabrizio Frasca

Postdoctoral Fellow at Technion

Research Fellow in Geometric Deep Learning — principled methods for learning on structured data with a focus on symmetry, expressivity, and scalability. Currently working on learning on graphs and on the computational traces of Large Language Models (LLMs), and exploring the application of LLMs to structured domains.

Academic Appointments

Jan 2024 – present **Postdoctoral Fellow**, *Technion – Israel Institute of Technology*, Host: Prof. H. Maron.
Conducting research in Geometric Deep Learning, with a focus on learning on graphs and on the structured computational traces generated by LLMs, for applications such as hallucination and data-contamination detection.

March 2024 – Sept 2024 **Postdoctoral Research Visitor**, *TU Wien*.
Visited Prof. Thomas Gärtner's Machine Learning unit. Explored approaches for the development of Graph Foundation Models, led to [13].

Oct 2018 – Jan 2019 **Postgraduate Research Visitor**, *Imperial College London*.
Visited Dr. Kirill Veselkov for applications of Geometric Deep Learning to Drug Repurposing; led to [28].

Education

Sept 2018 – Nov 2023 **PhD Computing**, *Imperial College London*, Advisor: Prof. M. Bronstein.
Dissertation title: *Expressive and Efficient Graph Neural Networks*.
Geometric Deep Learning on graph-structured data. The thesis centres around the design and study of Graph Neural Network architectures attaining provable expressive power whilst retaining an advantageous computational complexity. The PhD programme originally started at Università della Svizzera Italiana (Switzerland) and was then moved to Imperial College London to follow my advisor.
Examination passed *without corrections*.

Sept 2015 – Apr 2018 **MSc Computer Science and Engineering**, *Politecnico di Milano*.
Dissertation title: *Data-driven Modeling of Epigenetic Transcriptional Regulation*.
Gained comprehensive theoretical understanding in the related fields of data analysis, machine learning, artificial intelligence, complex systems and networks. Learnt about advanced and parallel algorithmic techniques.
Grade: ***110 cum laude / 110***

Sept 2012 – Sept 2015 **BSc Computer Science and Engineering**, *Politecnico di Milano*.
Comprehensively learnt about engineering and computer science fundamentals.
Grade: ***110 cum laude / 110***

Industry Experience

May 2019 – Feb 2023 **Machine Learning Researcher**, *Twitter UK*.
Cortex Graph Learning team. Conducted research on the theoretical foundations and scalable applications of Graph Neural Networks, with a focus on misinformation and abusive-behaviour detection.

July 2018 – May 2019 **Data Scientist**, *Fabula AI*.
Researched and developed Geometric Deep Learning techniques and pipelines for misinformation detection. Fabula AI has been acquired by Twitter in May 2019.

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Publications (* indicates equal contribution)

Under review

[1] **Neural Message-Passing on Attention Graphs for Hallucination Detection**
Frasca* F, Bar-Shalom* G, Ziser Y, Maron H
(under review at ICLR 2026)

[2] **GraphBench: Next-generation graph learning benchmarking**
Siraudin* A, Qian* C, Finkelshtein* B, Parviz* A, Weber* D, **Frasca* F**, Shavit* H, Stoll* T, Mielke* A, Anastacio* M, Müller* E, Bechler-Speicher M, Bronstein M, Galkin M, Hoos H, Niepert M, Perozzi B, Tönshoff J, Morris C
(under review at ICLR 2026)

[3] **Lost in Serialization: Invariance and Generalization of LLM Graph Reasoners**
Herbst* D, Karbevska* L, Kumar* D, Ahuja* A, Gholamzadeh Nasrabadi* F, **Frasca F**
(under review at the GCLR AAAI Workshop 2026)

[4] **From Hidden States to Early Detection: Analyzing Activations to Predict Misalignment in Text-to-Image Models**
Galron Y, Bar-Shalom G, **Frasca F**, Ziser Y, Chechik G, Gal R, Maron H
(under review at the AIR-FM AAAI Workshop 2026)

[5] **FS-KAN: Permutation Equivariant Kolmogorov-Arnold Networks via Function Sharing**
Elbaz R, Bar-Shalom G, Eitan Y, **Frasca F**, Maron H
(under review at ICLR 2026)

[6] **On the Expressive Power of GNN Derivatives**
Eitan Y, Eliasof M, Gelberg Y, **Frasca F**, Bar-Shalom G, Maron H
(under review at ICLR 2026)

Peer-reviewed

[7] **Beyond Token Probes: Hallucination Detection via Activation Tensors with ACT-ViT**
Bar-Shalom* G, **Frasca* F**, Ziser Y, Maron H
NeurIPS 2025

[8] **Beyond Next Token Probabilities: Learnable, Fast Detection of Hallucinations and Data Contamination on LLM Output Distributions**
Bar-Shalom* G, **Frasca* F**, Lim D, Gelberg Y, Ziser Y, El-Yaniv R, Chechik G, Maron H
Question ICLR 2025 workshop *Spotlight presentation*

[9] **Understanding and Improving Laplacian Positional Encodings For Temporal GNNs**
Galron Y, **Frasca F**, Maron H, Treister E, Eliasof M
ECML-PKDD 2025

[10] **Balancing Efficiency and Expressiveness: Subgraph GNNs with Walk-Based Centrality**
Southern* J, Eitan Y, Bar-Shalom G, Bronstein M, Maron H, **Frasca* F**
ICML 2025

[11] **Position: Graph Learning Will Lose Relevance Due To Poor Benchmarks**
Bechler-Speicher* M, Finkelshtein* B, **Frasca* F**, Müller* L, Tönshoff* J, Siraudin A, Zaverkin V, Bronstein MM, Niepert M, Perozzi B, Galkin M, Morris C
ICML 2025

[12] **Topological Blindspots: Understanding and Extending Topological Deep Learning Through the Lens of Expressivity**

Eitan* Y, Gelberg* Y, Bar-Shalom G, **Frasca F**, Bronstein MM, Maron H
ICLR 2025 *Oral presentation (1.8% acceptance rate)*

[13] **Towards Foundation Models on Graphs: An Analysis on Cross-Dataset Transfer of Pretrained GNNs**
Frasca F, Jogl F, Eliasof M, Ostrovsky M, Schönlieb CB, Gärtner T, Maron H
NeurReps NeurIPS 2024 workshop

[14] **A Flexible, Equivariant Framework for Subgraph GNNs via Graph Products and Graph Coarsening**
Bar-Shalom* G, Eitan* Y, **Frasca F**, Maron H
NeurIPS 2024 & NeurReps NeurIPS 2024 Workshop *Best paper and oral at the NeurReps workshop*

[15] **Position: Future Directions in the Theory of Graph Machine Learning**
Morris C, **Frasca F**, Dym N, Maron H, Ceylan İ, Levie R, Lim D, Bronstein M, Grohe M, Jegelka S
ICML 2024

[16] **Edge Directionality Improves Learning on Heterophilic Graphs**
Rossi E, Charpentier B, Di Giovanni F, **Frasca F**, Günnemann S, Bronstein MM
Learning on Graph 2023

[17] **Graph Positional Encoding via Random Feature Propagation**
Eliasof M, **Frasca F**, Bevilacqua B, Treister E, Chechik G, Maron H
ICML 2023

[18] **Graph Neural Networks for link prediction with subgraph sketching**
Chamberlain* BP, Shirobokov* S, Rossi E, **Frasca F**, Markovich T, Hammerla N, Bronstein MM, Hansmire M
ICLR 2023 *Notable top 5% paper*

[19] **Understanding and extending Subgraph GNNs by rethinking their symmetries**
Frasca* F, Bevilacqua* B, Bronstein MM, Maron H
NeurIPS 2022 *Oral presentation (1.7% acceptance rate)*

[20] **Equivariant subgraph aggregation networks**
Bevilacqua* B, **Frasca* F**, Lim* D, Srinivasan B, Cai C, Balamurugan G, Bronstein MM, Maron H
ICLR 2022 *Spotlight presentation (5% acceptance rate)*

[21] **Accurate and highly interpretable prediction of gene expression from histone modifications**
Frasca F, Matteucci M, Leone M, Morelli MJ, Masseroli M
BMC Bioinformatics, 2022

[22] **Improving Graph Neural Network expressivity via subgraph isomorphism counting**
Bouritsas G, **Frasca F**, Zafeiriou SP, Bronstein MM
IEEE TPAMI, 2022

[23] **Weisfeiler and Lehman go cellular: CW networks**
Bodnar* C, **Frasca* F**, Otter N, Wang Y, Liò P, Montúfar GF, Bronstein MM
NeurIPS 2021

[24] **Weisfeiler and Lehman go topological: Message Passing Simplicial Networks**
Bodnar* C, **Frasca* F**, Wang* Y, Otter N, Montúfar* GF, Liò P, Bronstein MM
ICML 2021

[25] **Exposing and characterizing subpopulations of distinctly regulated genes by K-plane regression**
Frasca F, Matteucci M, Morelli MJ, Masseroli M
CIBB 2018, extended in Lecture Notes in Bioinformatics (LNBI), 2020

[26] **SIGN: Scalable Inception Graph Neural Networks**
Frasca* F, Rossi* E, Eynard D, Chamberlain B, Bronstein MM, Monti F
GRL+ ICML Workshop 2020

[27] **Temporal graph networks for deep learning on dynamic graphs**
Rossi E, Chamberlain B, **Frasca F**, Eynard D, Monti F, Bronstein MM
GRL+ ICML Workshop 2020

[28] **Learning interpretable disease self-representations for drug repositioning**
Frasca* F, Galeano* D, Gonzalez G, Laponogov I, Veselkov K, Paccanaro A, Bronstein MM
GRL NeurIPS Workshop 2019

[29] **Fake news detection on social media using geometric deep learning**
Monti F, **Frasca F**, Eynard D, Mannion D, Bronstein MM
RLGM ICLR Workshop 2019

[30] **Modeling gene transcriptional regulation by means of hyperplanes genetic clustering**
Frasca F, Matteucci M, Masseroli MJ, Morelli M
IJCNN 2018

Awards

AY 2024–2025 **Aly Kaufman Fellowship (two nominees per year)**, Technion.

AY 2023–2024 **Finci–Viterbi Fellowship**, *Faculty of Electrical and Computer Engineering*, Technion.

2025 **Top Reviewer (top 9.2%)**, *NeurIPS*.

2024 **Top Reviewer (top 8.7%)**, *NeurIPS*.

2022 **Best Reviewer (top 20)**, *Learning on Graphs (LoG)*.

Teaching

Invited Lectures

July 2025 **Graph Learning, Equivariance and Expressiveness**, *Course on Groups and Deep Learning*, Technion – Israel Institute of Technology.

Mar 2023 **Pack your subgraphs: A journey into subgraphs for powerful Graph Neural Networks**, *Geometric Deep Learning Course*, Oxford University.

Teaching Assistantship & Tutoring

Feb 2019 – June 2019 **Teaching Assistant – Linear Algebra**, Università della Svizzera Italiana.
Assisted in teaching the BSc course taught by Prof. I. Pivkin; held exercise sessions, prepared and graded homework, and supported examinations.

Apr 2016 – June 2017 **Course Tutor – Software Engineering; Computer Architectures & Operating Systems, Mathematical Analysis**, Politecnico di Milano.
Tutored both BSc and MSc students. Held theoretical lectures and exercise sessions.

Tutorials

Dec 2022 **Exploring the practical and theoretical landscape of expressive Graph Neural Networks**, Learning on Graph Conference 2022.

Aug 2021 **The expressive power of GNNs by the WL test**, London Geometry and Machine Learning Summer School 2021.

Invited Talks

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Expressive (and efficient) Graph Neural Networks

[9,18,19] ○ **Keynote**: "Advances in Subgraph GNNs for Expressive and Efficient Learning on Graphs", Learning on Graph Meetup, Siena, Dec 2024

[18,19,22,23] ○ "Towards Expressive and Efficient Graph Neural Networks", Weekly Talks, Prof. T. Gärtner's ML Research Unit, Mar 2024

[18,19] **Subgraphs for expressive Graph Neural Networks**

○ Seminar at Imperial College London, UK (Host: Prof. Yves-Alexandre de Montjoye), Mar 2023
○ Learning on Graphs and Geometry Reading Group, Nov 2022
○ Seminar at Università Sapienza, Rome, Italy (Host: Prof. Simone Scardapane), Nov 2022
○ Meta AI orgs Reading Meeting, Nov 2022
○ Seminar at École Polytechnique, France (Host: Prof. Maks Ovsjanikov), July 2022
○ African Masters of Machine Intelligence, 2^{nd} Geometric Deep Learning Course, July 2022
○ Learning on Graphs and Geometry Reading Group, Dec 2021
○ 3^{rd} NAAMI Nepal Winter School in AI, Dec 2021

[22,23] **Simplicial and Cellular Complexes for Graph Representation Learning**

○ Dagstuhl Seminars – Graph Embeddings: Theory meets Practice, Mar 2022
○ Learning on Graphs and Geometry Reading Group, Sept 2021
○ African Masters of Machine Intelligence, 1^{st} Geometric Deep Learning Course, July 2021
○ TopoNets 2021 – Networks Beyond Pairwise Interactions, June 2021
○ Seminar at Cambridge University, UK (Host: Prof. Mateja Jamnik), May 2021
○ Math Machine Learning seminar MPI MIS + UCLA, Apr 2021

About peer-reviewing

○ "Reviewing at LOG 2022, my experience and unsolicited thoughts", Learning on Graph 2022

Mentorship

July 2025 **London Geometry and Machine Learning Summer School 2025**.
Selected to mentor five students on the proposed project "Beyond Text: Exploring Adaptations of LLMs for Graph-Based Tasks". Led to [3].

○ Daniel Herbst (TUM)
○ Lea Kerbevska (University of Cambridge)
○ Divyanshu Kumar (Enkrypt AI)
○ Akanksha Ahuja (Univesity of Cambridge)
○ Fatemeh Gholamzadeh Nasrabadi (University of Amsterdam)

Research Mentoring.

2025 – present Ran Elbaz (Technion)
2024 – present Yam Eitan (Technion)
2024 – present Guy Bar-Shalom (Technion)
2024 – present Yoav Gelberg (Technion, University of Oxford)
2024 – 2025 Yaniv Galron (Technion)
2023 – 2024 Joshua Southern (Imperial College London)
2021 Cazamere Comrie (Cornell University)

Community Service

Oct 2024 – present **Cofounder and organiser – Graph Learning On Wednesdays Reading Group**.
Founded and leading an online, international reading group on Graph Machine Learning; moderated several interactive, panel-like discussions.

July 2024 **Panelist – The future and challenges of Graph Learning**.
Invited to the Graph Learning Social's panel at ICML 2024 on the future and challenges of Graph Machine Learning in the era of Generative AI.

Apr 2020 – present **Reviewer activity**.

- International Conference on Learning Representations (ICLR)
- International Conference on Machine Learning (ICML)
- Neural Information Processing Systems (NeurIPS)
- AAAI Conference on Artificial Intelligence (AAAI)
- Learning on Graph Conference (LoG)
- Mining and Learning with Graphs Workshop @ ECMLPKDD 2024, 2025 (MLG)
- Graph Representation Learning and Beyond Workshop @ ICML 2020 (GRL+)

Early Academic Training & Leadership

London Geometry and Machine Learning Summer School 2022.
Main contributor in the project: "Equivariant poset representations".

London Geometry and Machine Learning Summer School 2021.
Main contributor in the project: "Improved expressive power for message-passing networks via subgraph aggregation", which led to the ICLR publication [20].

Team Lead – Distributed and Outsourced Software Engineering, 2015, *Politecnico di Milano*.
Led a distributed team in software design, development and inspection at the 2015 Distributed and Outsourced Software Engineering (DOSE) Project organised by ETH Zurich.

Skills

Python [PyTorch (Geometric), TensorFlow/Keras, Sci-kit Learn, PySpark] · Java · C · MATLAB · Eiffel

Languages

Italian · English · German *(A1)* · French *(middle school)*

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