Francesco Di Giovanni

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Work Experience

University of Oxford, Department of Computer Science Nov. 2023 - present
Senior Research Associate *Oxford*

University of Cambridge, Department of Computer Science Jan. 2023 - Nov. 2023
Research Associate *Cambridge*

Twitter, Cortex Sep. 2021 - Dec. 2022
Machine Learning Researcher *London*

Education

University College London Sep. 2017 - August 2021
PhD in Mathematics *London*
- Topics: Riemannian geometry, Functional Analysis, and Partial Differential Equations

University of Oxford Sep. 2016 - June 2017
Master of Science in Mathematical & Theoretical Physics—Distinction *Oxford*
- Topics: Differential and Algebraic Geometry, General Relativity, Functional Analysis, Networks

University of Pavia Sep. 2013 - July 2016
Bachelor in Physics—110/110 cum laude *Pavia*
- (Advanced) Topics: Quantum Mechanics, Differential Equations, Solid State Physics

Additional experience

Supervision of 2 research interns at Twitter (one PhD student from the University of Cambridge, and one PhD student from MIT)
Reviewer for ICLR22, NeurIPS22, ICML23, NeurIPS23, LOG, and several workshops.
Teaching Assistant at Department of Mathematics, UCL, 2017-2021—Courses included Linear Algebra, Analysis I and II, Logic, Complex Analysis

Publications and Preprints

Selected Publications and Preprints

1. **F. Di Giovanni***, T.K. Rusch*, et al., *How does over-squashing affect the power of GNNs?*, arXiv preprint 2023, submitted.

2. F. Barbero, A. Velingker, A. Saberi, M. Bronstein, **F. Di Giovanni**, *Locality-Aware Sequential Graph-Rewiring in GNN*, 2023, submitted.

3. **F. Di Giovanni** et al., *On Over-Squashing in Message Passing Neural Networks: The Impact of Width, Depth, and Topology*, ICML23, 2023.

4. B. Gutteridge, X. Dong, M. Bronstein, **F. Di Giovanni**, *DRew: Dynamically Rewired Message Passing with Delay*, ICML23, 2023

5. **F. Di Giovanni***, J. Rowbottom*, et al., *Understanding convolution on graphs via energies*, TMLR, 2023.

6. C. Bodnar, **F. Di Giovanni**, et al., *Neural Sheaf Diffusion: A Topological Perspective on Heterophily and Oversmoothing in GNNs*, Advances in Neural Information Processing Systems 36, 2022.

7. J. Topping*, **F. Di Giovanni*** et al., *Understanding over-squashing and bottlenecks on graphs via curvature*, **Outstanding Paper Honorable Mention** (top 0.3 %) at ICLR22, 2022.

8. **F. Di Giovanni**, *Convergence of Ricci flow solutions to Taub-NUT*, Communications in Partial Differential Equations, 2021, https://doi.org/10.1080/03605302.2021.1883651.

9. **F. Di Giovanni**, *Rotationally symmetric Ricci flow on $\mathbb{R}^{n+1}$*, Advances in Mathematics, 381, 2021, https://doi.org/10.1016/j.aim.2021.107621

10. **F. Di Giovanni**, *Ricci flow of warped Berger metrics on $\mathbb{R}^4$*, Calculus of Variations and Partial Differential Equations, 59, 162, 2020, https://doi.org/10.1007/s00526-020-01823-4

Other Publications

11. F. Eijkelboom, E. Bekkers, M. Bronstein, **F. Di Giovanni**, *Can strong structural encoding reduce the importance of Message Passing?* accepted at TAG-ICML workshop, 2023.

12. E. Rossi, B. Charpentier, **F. Di Giovanni**, et al., *Edge Directionality Improves Learning on Heterophilic Graphs*, accepted at the Second Edition of LOG, 2023.

13. **F. Di Giovanni***, G. Luise*, et al., *Heterogeneous manifolds for curvature-aware graph embedding*, GTLR workshop at ICLR22, 2022.

14. B.P.Chamberlain*, J. Rowbottom*, D. Eynard, **F. Di Giovanni**, et al., *Beltrami Flow and Neural Diffusion on Graphs*, Advances in Neural Information Processing Systems 35, 2021.

Skills

Programming: Python, PyTorch, Git
Languages: Italian (native), English (proficient)

Selection of Talks and Presentations

- (Invited) Mathematics of Geometric Deep Learning workshop, ICIAM 2023, **keynote speaker**
- (Invited) CECAM-Psi-k Conference on 'Bridging length scales with machine learning: from wavefunctions to thermodynamics', Berlin, 2023
- (Invited) Topological Data Analysis seminar, Mathematical Institute, University of Oxford, 2023
- (Invited) LOG^2 Seminar, Mathematical Institute, University of Oxford, 2023
- (Invited) **Guest lecture** at University of Cambridge, 2023
- (Invited) Local Meetup for LOG conference, University of Cambridge, 2022, **keynote speaker**
- (Invited) Neurips 2022 Workshop: New Frontiers on Graph Learning, 2022, **keynote speaker**
- (Invited) **Panelist** at LOG workshop on graph rewiring, 2022
- (Invited) MML seminar at UCLA, 2022
- (Invited) Stanford GNN Reading Group, 2022
- (Invited) Hammers & Nails Workshop at Weizmann Institute, 2022
- (Invited) **Guest Lecture** at the First Italian School in Geometric Deep Learning, 2022
- (Invited) **Guest Lecture** at AMMI course, 2022
- (Invited) **Panelist** at GT-RL Workshop, ICLR 2022
- (Invited) Dagstuhl Seminar 22132 "Graph Embeddings: Theory meets Practice", 2022

Awards, Grants, Scholarship

- UCL 4-year Ph.D. Teaching Assistantship, 2017-2021.
- Archibald Richardson Scholarship, UCL, 2020.
- Mayer de Rothschild Scholarship, UCL, 2018.
- National Scholarship Universitaly for outstanding undergraduate students, 2013-2016.