

# Davide BUFFELLI

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## EDUCATION

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| MAR. 2023 | Ph.D in INFORMATION ENGINEERING, <b>Università degli studi di Padova</b> , Padova (IT).<br>Thesis: "Improving the Effectiveness of Graph Neural Networks in Practical Scenarios"<br>Supervisor: Prof. Fabio VANDIN.                            |
| FEB. 2019 | Master's Degree in COMPUTER SCIENCE ENGINEERING, <b>Università degli studi di Padova</b> , Padova (IT).<br>Thesis: "A Deep Learning Model for Personalised Human Activity Recognition."<br>Advisor: Prof. Fabio VANDIN.                        |
| JULY 2016 | Bachelor's Degree in INFORMATION TECHNOLOGY ENGINEERING, <b>Università degli studi di Padova</b> , Padova (IT).<br>Thesis: "Algorithms for the determination of node centralities in a graph."<br>Advisor: Prof. Andrea Alberto PIETRACAPRINA. |

## WORK EXPERIENCE

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| MAY 2023-PRESENT     | <b>SENIOR DEEP LEARNING RESEARCHER at MediaTek Research, London (UK)</b><br>Working in the AI research arm of MediaTek on both applied and fundamental research projects. <ul style="list-style-type: none"><li>- Proposal, direction, and execution of fundamental (2nd order-optimization) and applied reserach projects (AI for communication systems; Foundation model for modem-related tasks)</li><li>- Held collaborations with academia (found collaborators, and directed projects)</li><li>- Supervision of interns (PhD students)</li><li>- Consulting the investment arm of the company on the technology behind startups</li><li>- 2 NeurIPS 2024 papers, 1 CVPR Workshop paper, 1 LoG 2024 paper, 1 Globecom Tutorial</li></ul> |
| SEPT. 2022-DEC. 2022 | <b>RESEARCH SCIENTIST INTERN at Meta AI, London (UK)</b><br>Supervisor: Dr. Vassilis Plachouras.<br>Performed research on using multi-modal data to alleviate the cold-start problem in recommendation systems. A technical publication regarding part of the work done is available <a href="#">online</a> .                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| AUG. 2022-AUG. 2022  | <b>VISITING RESEARCHER at Helmholtz Munich, Munich (DE)</b><br>Supervisor: Dr. Bastian Rieck.<br>As a recipient of the Helmholtz Visiting Research Grant, I have performed research at the intersection of Graph Neural Networks and Topological Data Analysis. <ul style="list-style-type: none"><li>- 1 LoG 2024 paper</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                            |
| APR. 2022-JUL. 2022  | <b>VISITING RESEARCHER at University of Cambridge, Cambridge (UK)</b><br>Supervisor: Professor Pietro Liò.<br>I continued my research on Graph Neural Networks, working on the problem of size-generalization. <ul style="list-style-type: none"><li>- 1 NeurIPS 2022 paper</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| JAN. 2021-JUL. 2021  | <b>RESEARCH INTERN at Samsung AI Research, Cambridge (UK)</b><br>Supervisors: Dr. Efthymia Tsamoura.<br>Research on neurosymbolic approaches combining Deep Learning and Logical Reasoning. The research focused on the development of a method for injecting <i>commonsense knowledge</i> into scene graph generation models. <ul style="list-style-type: none"><li>- 1 AAAI 2023 paper &amp; 1 patent (pending)</li></ul>                                                                                                                                                                                                                                                                                                                   |
| APR. 2019-SEPT. 2019 | <b>RESEARCH FELLOW at University of Padova, Padova (IT)</b><br>Project: "Machine Learning for Temporal Data" - Supervisor: Professor Fabio Vandin.<br>Executed research project on the development of novel Deep Learning frameworks for multimodal times series. <ul style="list-style-type: none"><li>- 1 IEEE Sensors journal paper</li></ul>                                                                                                                                                                                                                                                                                                                                                                                              |
| JAN. 2019-FEB. 2019  | <b>DATA SCIENTIST, MACHINE LEARNING ENGINEER at Machine Learning Reply, Milan (IT)</b><br>During my time at Machine Learning Reply I had the chance to work for international clients on machine learning related projects, including chatbots, and automatic systems for the analysis of documents and invoices.                                                                                                                                                                                                                                                                                                                                                                                                                             |
| JUL. 2018-DEC. 2018  | <b>MACHINE LEARNING INTERN at Philips Digital and Computational Pathology, Belfast (UK)</b><br>Worked in the team developing AI algorithms aiding pathologists in the analysis of medical slides. Participated in all aspects: data collection and cleaning, model training and evaluation, model deployment. <ul style="list-style-type: none"><li>- Deployed a deep learning model into production</li></ul>                                                                                                                                                                                                                                                                                                                                |

## PUBLICATIONS

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- **Group Think: Multiple Concurrent Reasoning Agents Collaborating at Token Level Granularity**  
Chan-Jan Hsu, [Davide Buffelli](#), Jamie McGowan, Feng-Ting Liao, Yi-Chang Chen, Sattar Vakili, Da-shan Shiu, *arXiv*, 2025.  
[\[PDF \(arXiv\)\]](#)
- **Towards a Foundation Model for Communication Systems**  
[Davide Buffelli](#)\*, Sowmen Das\*, Yu-Wei Lin\*, Sattar Vakili\*, Chien-Yi Wang, Masoud Attarifar, Pritthijit Nath, Da-shan Shiu *arXiv*, 2025.  
[\[PDF \(arXiv\)\]](#)
- **Exact, Tractable Gauss-Newton Optimization in Deep Reversible Architectures Reveal Poor Generalization**  
[Davide Buffelli](#)\*, Jamie McGowan\*, Wangkun Xu, Alexandru Cioba, Da-shan Shiu, Guillaume Hennequin, Alberto Bernacchia, *Thirty-Eighth Annual Conference on Neural Information Processing Systems (NeurIPS)*, 2024.  
[\[Paper\]](#) [\[PDF \(arXiv\)\]](#) [\[Code\]](#)
- **Deep Equilibrium Algorithmic Reasoning**  
Dobrik Georgiev, JJ Wilson, [Davide Buffelli](#), Pietro Liò, *Thirty-Eighth Annual Conference on Neural Information Processing Systems (NeurIPS)*, 2024.  
[\[Paper\]](#) [\[PDF \(arXiv\)\]](#) [\[Code\]](#)
- **CliquePH: Higher-Order Information for Graph Neural Networks through Persistent Homology on Clique Graphs**  
[Davide Buffelli](#)\*, Farzin Soleymani\*, Bastian Rieck, *Proceedings of the Third Learning on Graphs Conference (LoG)*, PMLR 269, 2024.  
[\[Paper coming soon\]](#) [\[PDF \(arXiv\)\]](#) [\[Code\]](#)
- **The Deep Equilibrium Algorithmic Reasoner**  
Dobrik Georgiev, Pietro Liò, [Davide Buffelli](#), *CVPR Workshop on Multimodal Algorithmic Reasoning*, 2024, [Spotlight](#).  
[\[Paper\]](#) [\[PDF \(arXiv\)\]](#)
- **Is Meta-Learning the Right Approach for the Cold-Start Problem in Recommender Systems?**  
[Davide Buffelli](#), Ashish Gupta, Agnieszka Strzalka, Vassilis Plachouras, *Preprint*, 2023.  
[\[PDF \(arXiv\)\]](#)
- **Improving the Effectiveness of Graph Neural Networks in Practical Scenarios**  
[Davide Buffelli](#), *PhD Thesis, University of Padova*, 2023.  
[\[Full Text\]](#)
- **Scalable Theory-Driven Regularization of Scene Graph Generation Models**  
[Davide Buffelli](#)\*, Efthymia Tsamoura\*, *Thirty-Seventh AAAI Conference on Artificial Intelligence (AAAI)*, 2023.  
[\[Paper\]](#) [\[PDF \(arXiv\)\]](#)
- **SizeShiftReg: a Regularization Method for Improving Size-Generalization in Graph Neural Networks**  
[Davide Buffelli](#), Pietro Liò, Fabio Vandin, *Thirty-sixth Conference on Neural Information Processing Systems (NeurIPS)*, 2022.  
[\[Paper\]](#) [\[PDF \(arXiv\)\]](#) [\[Code\]](#)
- **Graph Representation Learning for Multi-Task Settings: a Meta-Learning Approach**  
[Davide Buffelli](#), Fabio Vandin, *International Joint Conference on Neural Networks (IJCNN)*, 2022, [Oral](#).  
[\[Paper\]](#) [\[PDF \(arXiv\)\]](#) [\[Code\]](#)
- **The Impact of Global Structural Information in Graph Neural Networks Applications**  
[Davide Buffelli](#), Fabio Vandin, *Data* (special issue “[Knowledge Extraction from Data Using Machine Learning](#)”), 2022.  
[\[Paper\]](#) [\[PDF \(arXiv\)\]](#) [\[Code\]](#)
- **Extending Logic Explained Networks to Text Classification**  
Rishabh Jain, Gabriele Ciravegna, Pietro Barbiero, Francesco Giannini, [Davide Buffelli](#), Pietro Liò, *The 2022 Conference on Empirical Methods in Natural Language Processing (EMNLP)*, 2022.  
[\[Paper\]](#) [\[PDF \(arXiv\)\]](#)
- **Attention-Based Deep Learning Framework for Human Activity Recognition with User Adaptation**  
[Davide Buffelli](#), Fabio Vandin, *IEEE Sensors Journal*, 2021.  
[\[Paper\]](#) [\[PDF \(arXiv\)\]](#) [\[Code\]](#)
- **A Meta-Learning Approach for Graph Representation Learning in Multi-Task Settings**  
[Davide Buffelli](#), Fabio Vandin, *NeurIPS Workshop on Meta-Learning (Meta-Learn)*, 2020.  
[\[PDF\]](#) [\[PDF \(arXiv; with Appendix\)\]](#) [\[Video\]](#) [\[Slides\]](#) [\[Poster\]](#) [\[Code\]](#)

## AWARDS & GRANTS

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- **Helmholtz Visiting Researcher Grant** - 08/2022  
Grant awarded by the Helmholtz Information and Data Science Academy (HIDA), as part of the Helmholtz Association, to support a research stay at a Helmholtz centre.
- **Fondazione Luciano Iglesias Scholarship** - 07/08/2020  
Award given to the 10 best M.Sc. graduates in Computer Engineering at the University of Padova in 2019.
- **Full PhD Scholarship from the Department of Information Engineering (University of Padova)** - 2019-2022.
- **ERASMUS+ Traineeship Grant** - July 2018-Dec. 2018.

## PATENTS

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- **Method and System for Scene Graph Generation**  
Davide Buffelli, Efthymia Tsamoura, 2022 (*filed; patent pending*).

## TALKS, TUTORIALS, & PRESENTATIONS

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- **Tutorial** - *"Foundation Models for Communication Systems"*  
To be given at the IEEE Globecom 2025 conference - 08-15/12/2025.
- **Invited Talk** - *"Exact, Tractable Gauss-Newton Optimization in Deep Reversible Architectures"*  
Presented at the NeurIPS @ Cambridge meetup (University of Cambridge) - 06/12/2024.
- **Invited Talk** - *"The Problem of Size-Generalization in Graph Neural Networks"*  
Presented at the Artificial Intelligence Research Group Talks (University of Cambridge) - 04/07/2022. [\[Link\]](#) [\[Video\]](#)
- **Invited Talk** - *"Word Embeddings & Graph Neural Networks for Automatic Reasoning over Knowledge Graphs"*  
Presented at the Word Embedding Reading Group (University of Padova) - 25/05/2020. [\[Video\]](#) [\[Slides\]](#)
- **Poster (Refereed Workshop)** - *"Are Graph Convolutional Networks Fully Exploiting Graph Structure?"*  
Presented at the [ELLIS Workshop on Geometric and Relational Deep Learning](#) - 24/02/2020. [\[Video\]](#) [\[Slides\]](#)

## STUDENT SUPERVISION

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- **Master's Thesis Supervision:** - Matteo Terranova ("Study of Regularization Techniques for Semi-Supervised Learning on Graphs with Graph Convolutional Networks"; co-supervised with Prof. Fabio Vandin, 2020).

## SERVICE

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**Reviewer** CONFERENCES: *RECOMB*, *ISMB*, *KDD*, *ICDM*, *NeurIPS Workshop on Meta-Learning (Meta-Learn)*, *TheWebConf*, *NeurIPS I Can't Believe It's Not Better! (ICBINB) Workshop*.  
JOURNALS: *ACM Transactions on Information Systems*, *IEEE Sensors Journal*.

## COMPUTER SKILLS

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**Proficient:** PYTHON

I worked extensively, both in an academic and in a professional environment, with the main Machine Learning and Deep Learning libraries such as TensorFlow, PyTorch, Keras, Pandas, scikit-learn.

## LANGUAGES

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ITALIAN: Mother tongue.  
ENGLISH: Fluent - Bilingual Proficiency.