

Davide BUFFELLI

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EDUCATION

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

WORK EXPERIENCE

- MAY 2023-PRESENT | **SENIOR DEEP LEARNING RESEARCHER at MediaTek Research, London (UK)**
Working in the AI research arm of MediaTek on both applied and fundamental research projects.
- Proposal, direction, and execution of fundamental (2nd order-optimization) and applied reserach projects (AI for communication systems; Foundation model for modem-related tasks)
- Held collaborations with academia (found collaborators, and directed projects)
- Supervision of interns (PhD students)
- Consulting the investment arm of the company on the technology behind startups
- 2 NeurIPS 2024 papers, 1 CVPR Workshop paper, 1 LoG 2024 paper
- SEPT. 2022-DEC. 2022 | **RESEARCH SCIENTIST INTERN at Meta AI, London (UK)**
Supervisor: Dr. Vassilis Plachouras.
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 [online](#).
- AUG. 2022-AUG. 2022 | **VISITING RESEARCHER at Helmholtz Munich, Munich (DE)**
Supervisor: Dr. Bastian Rieck.
As a recipient of the Helmholtz Visiting Research Grant, I have performed research at the intersection of Graph Neural Networks and Topological Data Analysis.
- 1 LoG 2024 paper
- APR. 2022-JUL. 2022 | **VISITING RESEARCHER at University of Cambridge, Cambridge (UK)**
Supervisor: Professor Pietro Liò.
I continued my research on Graph Neural Networks, working on the problem of size-generalization.
- 1 NeurIPS 2022 paper
- JAN. 2021-JUL. 2021 | **RESEARCH INTERN at Samsung AI Research, Cambridge (UK)**
Supervisors: Dr. Efthymia Tsamoura.
Research on neurosymbolic approaches combining Deep Learning and Logical Reasoning. The research focused on the development of a method for injecting *commonsense knowledge* into scene graph generation models.
- 1 AAAI 2023 paper & 1 patent (pending)
- APR. 2019-SEPT. 2019 | **RESEARCH FELLOW at University of Padova, Padova (IT)**
Project: "Machine Learning for Temporal Data" - Supervisor: Professor Fabio Vandin.
Executed research project on the development of novel Deep Learning frameworks for multimodal times series.
- 1 IEEE Sensors journal paper
- JAN. 2019-FEB. 2019 | **DATA SCIENTIST, MACHINE LEARNING ENGINEER at Machine Learning Reply, Milan (IT)**
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 | **MACHINE LEARNING INTERN at Philips Digital and Computational Pathology, Belfast (UK)**
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.
- Deployed a deep learning model into production

PUBLICATIONS

- **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

- **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

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

TALKS & PRESENTATIONS

- **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

- **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

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

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

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