Davide Buffelli

Personal Data

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About Me

I am a PhD student working on Graph Representation Learning, Graph Neural Networks, Meta-Learning, and Commonsense-Aware Neural Networks. I have a broad interest in Deep Learning, and I'm very passionate about it.

Education

Oct. 2019-*Present* Ph.D Student in Information Engineering,
Università degli studi di Padova, Padova (IT).
Supervisor: Prof. Fabio Vandin.

Feb. 2019 Master's Degree in Computer Science Engineering,
with final grade 110/110 with honors, **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,
with full marks, **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

Sept. 2022-Present — Research Scientist Intern at Meta AI, London (UK)
Working on cool stuff!

Aug. 2022-Aug. 2022 — Visiting Researcher at Helmholtz Munich, Munich (DE)
Supervisor: Dr. Bastian Rieck.
As a recipient of the Helmholtz Visiting Research Grant, awarded by the Helmholtz Information and Data Science Academy, I have performed research at the intersection of Graph Neural Networks and Topological Data Analysis.

Apr. 2022-Jul. 2022 — Visiting Researcher at University of Cambridge, Cambridge (UK)
Supervisor: Professor Pietro Liò.
I continued my research on Graph Neural Networks. In more detail I have worked on the problem of size-generalization, and on topological techniques to capture higher-order structures in graphs.

Jan. 2021-Jul. 2021 — Research Intern at Samsung AI Research, Cambridge (UK)
Supervisors: Efthymia Tsamoura and Timothy Hospedales.
I have worked on neurosymbolic approaches combining Deep Learning and Logical Reasoning. In more detail, the research done at Samsung focused on the development of a logic-based loss function for deep learning models with the goal of injecting *commonsense knowledge* into scene graph generation models. This work has led to a paper (currently under review), and a patent (pending).

Apr. 2019-Sept. 2019 — Research Fellow at University of Padova, Padova (IT)
Project: "Machine Learning for Temporal Data"
Supervisor: Professor Fabio Vandin.
The research project revolved around the development of novel Deep Learning frameworks for multimodal times series. The outcome of this project has led to a publication on the IEEE Sensors journal.

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 important clients on machine learning related projects. In particular I contributed to the development of a chatbot, and to the development of an automatic system for the analysis of documents and invoices. The main technologies involved were: Python, Rasa, Google Cloud Vision, Java.

Jul. 2018-Dec. 2018 — Machine Learning Intern at Philips Digital and Computational Pathology, Belfast (UK)
I worked in the team responsible for the development of algorithms that aid pathologists in the analysis of medical slides (inside the TissueMark application). This implied the creation, training and validation of Deep Learning models and the engineering, processing and analysis of data. In more details I have contributed to the development of the algorithm for the identification of the appropriate tumour regions for
macrodissection for lung tissue slides (which included the analysis and engineering of data and the
training and validation of Deep Learning models).
The main technologies involved were: Python, Keras, TensorFlow.

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.

Publications & Submitted Papers

- **Scalable Regularization of Scene Graph Generation Models using Symbolic Theories**
  Davide Buffelli, Efthymia Tsamoura, *Preprint*, 2022.
- **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 to appear] [PDF (arXiv)]
- **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 to appear] [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]
- **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]

Talks/Presentations/Posters

- **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* 2020, *ISMB* 2020, *KDD* 2020, *ICDM* 2020, *NeurIPS Workshop on Meta-Learning (Meta-Learn)* 2020-2021, *TheWebConf* 2021, *NeurIPS I Can't Believe It's Not Better! (ICBINB) Workshop* 2021.
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: Advanced C1.