ANDREA CAVALLO

PhD student at TU Delft – Learning and processing over dynamic graphs

SUMMARY

I am a PhD student at TU Delft working on **learning and processing over dynamic graphs**. I hold a M.Sc. Degree in Computer Engineering and Artificial Intelligence from Politecnico di Torino, where I worked as a research assistant on network traffic data analysis using **Graph Machine Learning** techniques. My Master Thesis focuses on Graph Neural Networks and their limitations when applied to heterophilous graphs. I also worked with **Explainable AI** applied to the healthcare world. I enjoy diving into the details of Machine Learning algorithms, understanding their limitations and trying to explain the motivations behind their predictions. I am also fascinated by the impact these algorithms can have in real-world scenarios, and I aim to improve them and solve challenging problems.

CONTACT

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SKILLS

Programming

- *Advanced*: Python
- *Intermediate*: C, C++, SQL
- *Basic*: Java, JavaScript

Software & Tools

- *Advanced*: Pytorch, Numpy
- *Intermediate*: Pandas, MATLAB, LaTeX
- *Basic*: TensorFlow, Hadoop, Spark, React, Git

Main ML and CS topics

- *Machine Learning and Deep Learning*: Graph Machine Learning, Explainable AI, Computer Vision, Natural Language Processing
- *Computer Science*: Databases (DBMS and Data Warehouses), Operating Systems (Unix/Linux environment and concurrent programming), Computer Networks, Cybersecurity, Embedded Systems

PUBLICATIONS

- Gioacchini L.; Cavallo A.; Mellia M.; Vassio L.; Exploring Temporal GNN Embeddings for Darknet Traffic Analysis. *In Proceedings of the 2nd on Graph Neural Networking Workshop 2023 (GNNet '23)*. Association for Computing Machinery, New York, NY, USA, 31–36. https://doi.org/10.1145/3630049.3630175
- Cavallo, A.; Grohnfeldt, C.; Russo, M.; Lovisotto, G.; Vassio, L.; GCNH: A Simple Method For Representation Learning On Heterophilous Graphs, *IJCNN 2023*, https://arxiv.org/abs/2304.10896
- Cavallo, A.; Grohnfeldt, C.; Russo, M.; Lovisotto, G.; Vassio, L.; 2-hop Neighbor Class Similarity (2NCS): A graph structural metric indicative of graph neural network performance, *accepted at AAAI GCLR 2023*, https://arxiv.org/abs/2212.13202

LANGUAGES

Italian (native speaker)
English (IELTS 8.0)

EDUCATION

10/2023 - ongoing
TU Delft, Delft
PhD Program
- Topic: Learning and Processing over Dynamic Graphs
- Supervisor: Prof. Elvin Isufi

09/2020 - 10/2022
Politecnico di Torino, Turin
Master's - Computer Engineering
- Specific track: Artificial Intelligence and Data Analytics
- Final grade: 110/110 cum laude (GPA: 29.6/30)
- Master Thesis: *Graph Neural Networks on heterophilous graphs: performance analysis and new architectures*, supervised by Prof. Luca Vassio, Dr. Claas Grohnfeldt, Michele Russo and Dr. Giulio Lovisotto

02/2021 - 09/2022
Alta Scuola Politecnica, Turin - Milan
Excellence Program
- Program involving the best 150 students from Politecnico di Torino and Politecnico di Milano
- Participated in conferences and group activities on innovation, management of change, design and complex decision making
- Realized a Clinical Decision Support System (NEAR) based on Explainable AI in collaboration with Dedalus, a leading company in software for healthcare

09/2017 - 09/2020
Politecnico di Torino, Turin
Bachelor's - Electronic Engineering
- Final grade: 110/110 cum laude (GPA: 29.88/30)
- Member of Percorso Giovani Talenti, a program for the best 200 students in the university

08/2019 - 12/2019
University of Georgia, Athens, GA, USA
Exchange Program
- Won a scholarship to finance the program

WORK EXPERIENCE

10/11/2022 - 30/09/2023
Politecnico di Torino, Turin
Research Assistant
- Performed research on network traffic data analysis using dynamic Graph Neural Networks

01/04/2022 - 30/09/2022
Huawei Munich Research Center, Munich
Research Intern
- Performed research on Node Anomaly Detection and Graph Neural Networks on heterophilous graphs for the Master Thesis

01/10/2021 - 30/06/2022
Team PoliTOcean, Turin
Computer Vision team member
- Implemented computer vision tasks (line detection, object detection) for an ROV to take part in the international Mate ROV Competition

01/04/2020 - 30/06/2021
Team Icarus PoliTo, Turin
Machine Learning team member
- Applied Machine Learning algorithms for flight parameters estimation and trajectory prediction

15/01/2020 - 29/02/2020
WeStudents s.r.l., Turin
Data Analyst
- Applied ML techniques to improve the design and analyze customers' behavior for a mobile app

SELECTED RESEARCH PROJECTS

Graph Neural Networks on heterophilous graphs
- Defined 2NCS, a new metric to characterize a graph property that affects GNN performance
- Designed and tested GCNH, a simple GNN model that achieves SOTA results on both homophilous and heterophilous graphs

Network traffic data analysis with Graph Neural Networks
- Applied GNNs to network traffic data to learn the behavior of nodes in an unsupervised and self-supervised manner.

Explainable AI for cardiac event risk prediction
- Implemented NEAR, an explainable ML-based model to predict the risk of cardiac events
- The explainable model is built based on the explanations provided by SHAP