Alessio **Gravina**

PHD STUDENT IN COMPUTER SCIENCE

☎ (+39) 3460870815 | ✉ gravina.alessio@gmail.com | ⌂ pages.di.unipi.it/gravina

○ gravins | in alessio-gravina | 🎓 Alessio Gravina

Education

PhD in Computer Science, UNIVERSITY OF PISA, ITALY   *Nov. 2020 - PRESENT*
- Thesis title: *Information propagation dynamics in Deep Graph Networks*
- Main Theme: *Representation learning for graphs inspired by dynamical systems and neural differential equations.*
- Supervisors: Prof. Davide Bacciu and Prof. Claudio Gallicchio.

Oxford Machine Learning Summer School, VIRTUAL   *Aug. 2021*
- 15-days specialized AI school that covers the topics of Rep. Learning & Statistical ML, ML in Healthcare, NLP, and AI for Good.
- Acceptance rate 15%.

MSc in Computer Science, UNIVERSITY OF PISA, ITALY   *Sep. 2018 - Mar. 2020*
- Curriculum: Artificial Intelligence.
- Thesis: *Machine Learning prediction of compounds impact on Schizophrenia treatment* (110/110 Hons., equiv. GPA: 4/4).

ERASMUS+ Student Programme, UNIVERSITY COLLEGE DUBLIN, IRELAND   *Jan. 2019 - May 2019*
- Student at the Computer Science Department in the framework of the EU Erasmus+ programme.
- Main Theme: *Artificial Intelligence and Cognitive Science*.

BSc in Computer Science, UNIVERSITY OF PISA, ITALY   *Sep. 2014 - Mar. 2018*
- Thesis: *Machine Learning for the prediction of Bronchopulmonary dysplasia risk* (103/110, equiv. GPA: 3.75/4).

Experience

Research scholarship, UNIVERSITY OF PISA, ITALY   *Nov. 2023 - PRESENT*
- Main Theme: Representation learning for dynamic graphs
- Reference: decree of the Director n. 615/2023, 25/10/2023

Machine Learning Research Intern, HUAWEI RESEARCH CENTER, MUNICH, GERMANY   *Mar. 2023 - Aug. 2023*
- Supervisors: Claas Grohnfeldt, Giulio Lovisotto and Michele Russo.
- Joined the AI4Sec team to work on dynamical systems-based neural architectures for long-range propagation within Continuous-Time Dynamic Graphs, achieving state-of-the-art performance on various synthetic and real-world benchmarks.

Visiting Phd Student, IDSIA USI-SUPSI, SWITZERLAND   *Apr. 2022 - Jul. 2022*
- Supervisors: Prof. Cesare Alippi and Daniele Zambon
- Designed a general modeling framework (by means of dynamical systems) for temporal graphs that can effectively operate with irregularly and sparsely sampled observations, achieving state-of-the-art performance on various synthetic and real-world benchmarks.

Teaching Assistant, UNIVERSITY OF PISA, ITALY   *Feb. 2021 - May 2021*
- Course: Introduction to Programming and Algorithms
- Reference: protocol n. 249/2021, protocol date: 11/02/2021
- Weekly office hours for homework assistance and reinforcement of learned concepts.

Research scholarship, UNIVERSITY OF PISA, ITALY   *Jul. 2020 - Nov. 2020*
- Main Theme: Deep learning per biomedical data
- Reference: decree of the Director n. 797/2020, 20/05/2020
- Released a resource that collects all the clinical evidence on COVID-19 and the human genomic and proteomic information to foster COVID-19 research.
- Developed Deep Learning for graphs method in *Python* to repurpose drugs given sets of proteins. The model has been used to propose a list of 27 COVID-19 candidate drugs.

Machine Learning Engineer, VYDIANT   *Jan. 2020 - Jun. 2020*
- Developed an NLP model in *Python* to identify sentences containing relations between entities from a biomedical corpus, improving precision by 3%.

Visiting Student Researcher, STANFORD UNIVERSITY, USA   *Sep. 2019 - Dec. 2019*
- Developed a Graph Deep Learning model in *Python* to automatize drug repurposing screenings in the field of Schizophrenia treatment, discovering 64 new candidate drugs.
- Research in collaboration with SPARK research group.

Publications

- A. Gravina, D. Zambon, D. Bacciu, C. Alippi. *Temporal Graph ODEs for Irregularly-Sampled Time Series.* In IJCAI 2024.
- A. Gravina*****, G. Lovisotto*****, C. Gallicchio, D. Bacciu, C. Grohnfeldt. *Long Range Propagation on Continuous-Time Dynamic Graphs.* In ICML 2024. **(* Equal Contrib.)**
  Also accepted in Temporal Graph Learning Workshop, NeurIPS 2023 under the title *Effective Non-Dissipative Propagation for Continuous-Time Dynamic Graphs*.
- A. Gravina and D. Bacciu. *Deep learning for dynamic graphs: models and benchmarks.* In IEEE TNNLS 2024.
- J. Reha, G. Lovisotto, M. Russo, A. Gravina, and C. Grohnfeldt. *Continuous-Time Temporal Graph Learning on Provenance Graphs.* In Temporal Graph Learning Workshop, NeurIPS 2023.
- A. Gravina, C. Gallicchio, and D. Bacciu. *Non-Dissipative Propagation by Randomized Anti-Symmetric Deep Graph Networks.* In Deep Learning meets Neuromorphic Hardware Workshop, ECML-PKDD 2023.
- F. Errica*****, A. Gravina*****, D. Bacciu., A. Micheli. *Hidden Markov Models for Temporal Graph Representation Learning.* In ESANN, 2023. **(* Equal Contrib.)**
- A. Gravina, D. Bacciu, and C. Gallicchio. *Anti-Symmetric DGN: a stable architecture for Deep Graph Networks.* In ICLR 2023.
  Also accepted in DGL-AAAI'23 workshop, AAAI 2023 under the title *Non-Dissipative Propagation by Anti-Symmetric Deep Graph Networks* and awarded with the **Best Student Paper Award**.
- D. Bacciu, F. Errica, A. Gravina*****, L. Madeddu, M. Podda, and G. Stilo. *Deep Graph Networks for Drug Repurposing with Multi-Protein Targets.* In IEEE Transactions on Emerging Topics in Computing 2023. **(* First Author - Alphabetical Order)**
- A. Gravina, J.L. Wilson, D. Bacciu, K.J. Grimes, and C. Priami. *Controlling astrocyte-mediated synaptic pruning signals for schizophrenia drug repurposing with Deep Graph Networks.* In PLOS Computational Biology, 2022.
- A. Gravina*****, F. Rossetto*****, S. Severini*****, and G. Attardi. *A comparative study of models for answer sentence selection.* In CLiC-it, 2019. **(* Equal Contrib.)**
- A. Gravina*****, F. Rossetto*****, S. Severini*****, and G. Attardi. *Cross attention for selection-based question answering.* In NL4AI@AI*IA, 2018. **(* Equal Contrib.)**

Projects

Continuous-Time Graph Anti-Symmetric Network   *2024*
- URL: `https://github.com/gravins/non-dissipative-propagation-CTDGs`
- Used *Python* and *Pytorch* to develop a deep graph network inspired on non-dissipative <u>dynamical systems</u> to achieve long-range information propagation between nodes within dynamic graphs.
- The model outperforms state-of-the-art deep graph networks on synthetic long-range tasks but as well as several real-world benchmark datasets.

Temporal Graph Ordinary Differential Equation   *2024*
- URL: `https://github.com/gravins/TG-ODE`
- Used *Python* and *Pytorch* to develop a deep graph network inspired on <u>dynamical systems</u> for learning complex spatio-temporal patterns of dynamic graphs under the real-world assumption of irregularly and severely under-sampled data, thus overcoming the common assumption of dealing with regularly sampled temporal graph snapshots.
- The model outperforms modern deep graph networks on synthetic and real-world benchmarks.

Anti-SymmetricDGN   *2023*
- URL: `https://github.com/gravins/Anti-SymmetricDGN`
- Used *Python* and *Pytorch* to develop a deep graph network inspired on non-dissipative <u>dynamical systems</u> to achieve long-range information propagation between nodes within static graphs.
- The model outperforms classical deep graph networks over several datasets even when dozens of layers are used.

NumGraph, <small>GROUP PROJECT</small>   *2021*
- URL: `https://github.com/gravins/NumGraph`
- Num(py)Graph is a library for synthetic graph generation. The main principle of NumGraph is to be a lightweight library (i.e., *Numpy* is the only dependency) that generates graphs from a broad range of distributions in both the static and temporal domain.

Deep Graph Networks for Drug Repurposing with Multi-Protein Targets   *2021*
- URL: `https://github.com/gravins/covid19-drug-repurposing-with-DGNs`
- Developed Deep Learning for graphs method in *Python* and *Pytorch* to repurpose drugs given sets of proteins instead of single-protein/single-drug associations (as widespread in literature), increasing the AUROC by 9% with respect to the single-protein repurposing scenario.
- The model was used to discover 27 new potential COVID-19 candidate drugs.

Graph learning for Schizophrenia treatment   *2020*
- URL: `https://github.com/gravins/DGNs-for-schizophrenia`
- Used *Python* and *Pytorch* to develop a ML for graph framework to predict compounds that can reduce glial phagocytic activity in Schizophrenia patients.
- The framework was used by SPARK research group at Stanford to optimize drug phenotypic screens, discovering 64 new potential drug candidates.

Cross-Attentive CNN for QA, GROUP PROJECT   *2018*
- **1st Place, Fujitsu AI-NLP Challenge,** *Prize $20,000*
- Implemented a Cross-Attentive Convolutional Neural Network (using *Python* and *Keras*) to tackle the task of Answer Sentence Selection. The model was assessed over SelQA and WikiQA datasets with different types of word embeddings: FastText, GloVe, and ELMo.

Awards

2023	**Research Scholarhip,** Research scholarhip funded by University of Pisa from November 2023 for 1 year	*University of Pisa*
2023	**Best Student Paper Award,** Non-Dissipative Propagation by Anti-Symmetric Deep Graph Networks	*DGL-AAAI'23 workshop, AAAI*
2020	**PhD Scholarhip,** Full Scholarship for the Ph.D. programme in Computer Science, funded by Regione Toscana from November 2020 to November 2023	*University of Pisa*
2020	**Research Scholarhip,** Research scholarhip funded by University of Pisa from July 2020 for 5 months	*University of Pisa*
2018	**1st Place,** Fujitsu AI-NLP Challenge, *Prize $20,000*	*Contest*

Talks

31st European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning (ESANN), BRUGES, BELGIUM	*Oct 2023*
Presentation of the paper *"Hidden Markov Models for Temporal Graph Representation Learning"*	
9th International Workshop on Deep Learning on Graphs: Method and Applications (DLG-AAAI'23), WASHINGTON D.C., USA	*Feb 2023*
Presentation of the paper *"Non-Dissipative Propagation by Anti-Symmetric Deep Graph Networks"*	

Reviewing activity

2024	**Neural Networks,** ISSN: 0893-6080	*Journal*
2024	**International Joint Conference on Neural Networks (IJCNN),**	*Conference*
2024	**International Conference on Artificial Neural Networks (ICANN),**	*Conference*
2023-2024	**IEEE Transactions on Neural Networks and Learning Systems (TNNLS),** ISSN: 2162-237X	*Journal*
2023-2024	**European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning (ESANN),**	*Conference*

Skills

Programming	Python, Java, C, C++
Frameworks/Libraries	Pytorch, Sklearn, Numpy, Pandas, Keras
Languages	Italian (*Native*), English (*Fluent*), Spanish (*Elementary*)

Lucca, 06/06/2024   Signature,