Davide Gurnari

davide.gurnari@gmail.com

EDUCATION

PhD in Mathematics — Oct 2020 - Sept 2024
Polish Academy of Sciences, Warsaw, PL

Master's Degree in Data Science (graduated cum laude) — Oct 2018 - Sept 2020
Università degli Studi di Padova, Padova, IT

Bachelor's Degree in Physics — Oct 2013 - Apr 2017
Università degli Studi di Padova, Padova, IT

RELEVANT EXPERIENCES

PhD candidate — IM PAN - University of Warsaw
October 2020 - ongoing — Warsaw, PL
I am a PhD student in the Dioscuri Centre in Topological Data Analysis. My research is focused on developing new and efficient shape descriptors, with a strong interest in practical real-world applications.

Research intern — IBM Research
May 2023 - August 2023 — Yorktown Heights, New York, USA
I worked with members of Dr. Laxmi Parida's computational genomics team and Prof. Saugata Basu on harmonic persistent homology and its applications, particularly in Health Care & Life Sciences problems. This project lead to two patent applications and a research paper which is currently under review.

Collaboration — University of Oxford
April 2020 - January 2021 — Oxford, England, UK
I contributed to the OxCOVID19 project, a large, multimodal relational database consisting of information related to the COVID-19 pandemic. I helped choosing the database keys to map administrative areas of all countries, at all levels of sub-division, in a coherent way. I wrote code to fetch pandemic, social statistics and weather data.

Erasmus+ traineeship — Swansea University
March 2020 - June 2020 — Swansea, Wales, UK
I worked with Dr. Paweł Dłotko on large scale computations of Euler Characteristic Curves of high dimensional datasets. This work resulted in my Master's thesis and it is currently being extended in my PhD research.

Research assistant — Fondazione Bruno Kessler
July - August 2019 — Trento, Italy
I worked with Prof. Luciano Serafini in the development of an algorithm for incremental learning of discrete planning domains.

PUBLICATIONS

P. Dłotko, D. Gurnari, and R. Sazdanovic, "Mapper-type algorithms for complex data and relations", *Journal of Computational and Graphical Statistics* (2024) DOI: 10.1080/10618600.2024.2343321

P. Dłotko and D. Gurnari, "Euler Characteristic Curves and Profiles: a stable shape invariant for big data problems", *GigaScience* (2023) DOI: 10.1093/gigascience/giad094

A. Mahdi, P. Blaszczyk, P. Dłotko, D. Salvi, T.-S. Chan, J. Harvey, D. Gurnari, Y. Wu, A. Farhat, N. Hellmer, A. Zarebski, B. Hogan, and L. Tarassenko, "OxCOVID19 Database, a multimodal data repository for better understanding the global impact of COVID-19", *Scientific Reports* (2021) DOI: 10.1038/s41598-021-88481-4

CONFERENCE PAPERS

P. Dłotko, D. Gurnari, and R. Sazdanovic, "The Art of Knot Data", *Bridges* (2024)

D. Gurnari, A. Guzmán-Sáenz, F. Utro, A. Bose, S. Basu and L. Parida, "Probing omics data via harmonic persistent homology", *RECOMB-CCB* (2024)

SELECTED TALKS AND POSTERS

"Harmonic Persistent Homology for disentangling multiway interaction in data" - GEOTOP-A International Conference, Mérida, Jan. 8-13 2024;

"Euler Characteristic Profiles" - 51st Conference on Applications of Mathematics, Kościelisko, Sep. 12 2023;

"Exploring relations between knots invariants using Mapper algorithms" - Winter Braids XII, Tours, Feb. 22 2023;

"Extensions of Mapper–type algorithms and their applications to knot theory" Poster - Young Topologists Meeting, Copenhagen, Jul. 19 2022;

"Euler Characteristic Curves (and Profiles)" - Applied Topology in Będlewo 2022, Będlewo, Jul. 04 2022;

"Distributed algorithms for Euler Characteristic Curves (and Profiles)" - Machine Learning 4 Society seminar, Oxford, online, Jan. 26 2022;

"Good data and where to find them: the challenges in modelling the pandemic" - 60th ERSA Congress, online, Aug. 25 2021;

"Euler Characteristic Curves" - Second Symposium on Machine Learning and Dynamical Systems, Fields Institute, online, Sep. 21 2020.

AWARDS AND SCHOLARSHIPS

IDUB Scholarships "The Challenge of Petabytes"

IM PAN Award for Outstanding Scientific Publications in 2023

Young Mathematicians Award for the best paper presented at the 51st Conference on Applications of Mathematics, Koscielisko, Sep. 10-16 2023

NC State Research Image Contest 2023, First place in the graphics and data visualization category

Research scholarship, Dioscuri Centre in Topological Data Analysis, Warsaw, 2020-2024

Erasmus+ traineeship scholarship, 2020

TEACHING

Mathematical Analysis 1 — Winter term 2022-23
Group instructor — University of Warsaw, PL

Invitation to Topological Data Analysis — Summer term 2022
Group instructor — University of Warsaw, PL

Linear Algebra — Winter term 2021-22
Group instructor — University of Warsaw, PL

Mathematical Analysis 2 — Summer term 2021
Group instructor — University of Warsaw, PL

RESEARCH SOFTWARE

maTilDA https://github.com/IBM/matilda
Multipurpose toolkit for TDA. I developed the `harmonic` module.

pyBallMapper github.com/dgurnari/pyBallMapper
Python implementation of the BallMapper algorithm.

pyEulerCurves github.com/dgurnari/pyEulerCurves
Python package for parallel computations of Euler Characteristic Curves.

TECHNICAL SKILLS

Python: proficient, in particular *NumPy*, *Pandas*, *GUDHI*, *Scikit-learn*, *PyTorch* and *pySpark*;
R: discrete knowledge;
C++: discrete knowledge;
LaTeX: proficient.

LANGUAGE SKILLS

Italian: Native
English: Proficient
Polish: Beginner
German: Beginner