# Davide Gurnari

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**EDUCATION**

**PhD in Mathematics**                                 Oct 2020 - ongoing
Polish Academy of Sciences, Warsaw, PL

**Master's Degree in Data Science** (graduated cum laude)    Oct 2018 - Sep 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 and D. Gurnari, "Euler Characteristic Curves and Profiles: a stable shape invariant for big data problems", *GigaScience*, Oct. 9, 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*, 1 Apr. 29, 2021, DOI: 10.1038/s41598-021-88481-4

**Preprints**

D. Gurnari, A. Guzmán-Sáenz, F. Utro, A. Bose, S. Basu and L. Parida, "Probing omics data via harmonic persistent homology" Nov. 3, 2023, arXiv:2311.06357 submitted to RECOMB

P. Dłotko, D. Gurnari, and R. Sazdanovic, "Mapper-type algorithms for complex data and relations" Sep. 2, 2021, arXiv:2109.00831 submitted to JCGS

**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

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| **RESEARCH SOFTWARE** | **maTilDA** | https://github.com/IBM/matilda |

**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