

Davide Gurnari

Dioscuri Centre in Topological Data Analysis
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EDUCATION	PhD in Mathematics Polish Academy of Sciences, Warsaw, PL	Oct 2020 - ongoing
	Master's Degree in Data Science (graduated cum laude) Università degli Studi di Padova, Padova, IT	Oct 2018 - Sep 2020
	Bachelor's Degree in Physics Università degli Studi di Padova, Padova, IT	Oct 2013 - Apr 2017

- PUBLICATIONS**
- [1] 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
 - [2] 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

- [3] 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
- [4] 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

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

RELEVANT EXPERIENCES

PhD candidate

IM PAN - University of Warsaw
Warsaw, PL

October 2020 - ongoing

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.

TEACHING

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;
L^AT_EX: proficient.

**LANGUAGE
SKILLS**

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