

XIMENA L. FERNÁNDEZ

contact: ximena.l.fernandez@durham.ac.uk

webpage: <https://ximenafernandez.github.io/>

CURRENT POSITION

- Postdoctoral Research Associate at the Department of Mathematical Sciences, Durham University.
- Member of the UK Centre for Topological Data Analysis.

ACADEMIC APPOINTMENTS

- Sep 2021 - Present **Postdoctoral Research Associate**, Durham University, UK.
Advisor: Prof. Jeffrey Giansiracusa.
- Oct 2020 - Aug 2021 **Postdoctoral Research Associate**, Swansea University, UK.
Advisor: Prof. Jeffrey Giansiracusa.
- Jan 2020 - Sep 2020 **Research Assistant**, University of Buenos Aires, Argentina.

INDUSTRIAL APPOINTMENTS

- May 2019 - Dec 2019 **Data Scientist**, Properati, OLX Group, Argentina.
- Oct 2018 - Apr 2019 **Mathematical Models Specialist**, CAMMESA, Argentina.

EDUCATION

- 2011 - 2017 **PhD in Mathematics**, Department of Mathematics, University of Buenos Aires.
Advisor: Prof. Elías Gabriel Minian.
Thesis: Combinatorial methods and algorithms in low dimensional topology and the Andrews-Curtis conjecture.
- 2005 - 2011 **Licenciate in Mathematics (equivalent to Bachelor + M.Sc.)**, Department of Mathematics, University of Buenos Aires.
Advisor: Prof. Elías Gabriel Minian.
Thesis: Topology of finite spaces: an algorithmic approach.

RESEARCH PUBLICATIONS AND PREPRINTS

Authors are listed alphabetic order unless it is marked with * the first (co-) author(s).

- 2023 X. Fernández, *Morse theory for group presentations*. Transactions of the AMS (in press).
- 2023 X. Fernández*, E. Borghini, G. Mindlin and P. Groisman. *Intrinsic persistent homology via density-based metric learning*. Journal of Machine Learning Research, **24** (2023) no. 75, 1-42.
- 2022 X. Fernández*, D. Mateos. *Topological biomarkers for real-time detection of epileptic seizures*. Preprint. [arxiv:2211.02523](https://arxiv.org/abs/2211.02523).
- 2022 S. Benas*, X. Fernández* and E. Kropff. *Modeled grid cells aligned by a flexible attractor*. Preprint. [bioRxiv 2022.06.13.495956](https://doi.org/10.1101/2022.06.13.495956).
- 2020 X. Fernández and E.G. Minian. *The cylinder of a relation and generalized versions of the Nerve Theorem*. Discrete Comput. Geom. **63** (2020), no. 3, 549–559.
- 2016 X. Fernández and E.G. Minian. *Homotopy colimits of diagrams over posets and variations on a theorem of Thomason*. Homology Homotopy Appl. **18** (2016), no. 2, 233–245.

OTHER PUBLICATIONS

- 2019 Book *Algebra A* (Introduction to Linear Algebra for Engineering, Computer Science and Mathematics). N. Capitelli, R. Escayola, X. Fernández and G. Rossi. Publisher: EUDEBA. ISBN 9789502329703.
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SOFTWARE

- 2023 Contributor of Giotto-tda. Developer of the method `Fermat distance` and a tutorial *Intrinsic Persistent Homology* within the module `graphs` (*in progress*).
- 2019 GAP package `Posets`. With Iván Sadofski Costa and Kevin Piterman.
Code: github.com/isadofski/posets
Documentation: mate.dm.uba.ar/~isadofski/posets/
- 2017 SAGE Module `Finite Topological Spaces`
Code: github.com/ximenafernandez/Finite-Spaces
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INVITED LECTURES

- Jul 2022 European TOPology Interdisciplinary Action (EUTOPIA) Summer School 2022. Paris, France. 27 June - 6 July 2022.
Course: Persistent homology and applications in biology.
- Jun 2022 International Summer School on Modeling Nature BIOMAT 2022. Multiscale Models and Methods in Life Sciences. Granada, Spain. 6-10 June 2022.
Course: Topological data analysis and applications in dynamics.
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RECENT TALKS

- Apr 2023 *Density-based distance learning and applications to topological data analysis.*
Probability & Statistics Seminar, Universidad de la Republica, Uruguay (online, **invited**).
- Mar 2023 *Morse theory for group presentations & applications to the persistent fundamental group.*
Applied Topology Seminar, CIMAT Center for Research in Mathematics, Mexico (online, **invited**).
- Feb 2023 *Density-based intrinsic persistent homology & applications to time series analysis.*
Applied CATS Seminar, KTH Royal Institute of Technology, Sweden (**invited**).
- Feb 2023 *Intrinsic persistent homology via density-based metric learning.*
DATASHAPE Seminar, Université Paris-Saclay, France (**invited**).
- Jan 2023 *Topological biomarkers for real-time detection of epileptic seizures.*
Centre for Topological Data Analysis Group Meeting, Oxford University, UK (**invited**).
- Nov 2022 *Morse theory for group presentations.*
3rd International Meeting on Geometric Group Theory and Low Dimensional Topology (online, **invited**).
- Jul 2022 *Morse theory for group presentations and the persistent fundamental group.*
Applied Algebraic Topology Research Network Seminar (online, **invited**).
- Jun 2022 *From topological data analysis to computational brain modelling: the case studies of grid cells and epilepsy.*
Oxford Mathematical Brain Modelling Seminar, Oxford University, UK (**invited**).
- Jun 2022 *Topology of the neural connectivity of grid cells.*
Algebraic Topology: Methods, Computation and Science (ATMCS10), Oxford University, UK (poster).

Jun 2022	<i>The persistent fundamental group of point clouds.</i> 11th International Conference on Geometric and Topological Methods in Computer Science (GETCO 2022), EPITA, Paris, France.
May 2022	<i>Morse theory for group presentations.</i> Transpennine Topology Triangle Meeting 116, Liverpool University, UK (online, invited).
Apr 2022	<i>Morse theory for group presentations.</i> 35th British Topology Meeting, Durham University, UK.
Feb 2022	<i>Topological methods for real time detection of epileptic seizures in EEG recordings.</i> 13th Conference on Dynamical Systems Applied to Biology and Natural Sciences (DSABNS 2022), Basque Center for Applied Mathematics in Bilbao, Spain (online).
Nov 2021	<i>Density-based intrinsic persistent homology and applications to time series analysis.</i> Centre for Topological Data Analysis Group Meeting, Oxford University, UK (invited).
Oct 2021	<i>Morse theory for group presentations.</i> Geometry and Topology Seminar, Durham University, UK (invited).
Oct 2021	<i>Topological time series analysis.</i> Applied Math Seminar, Durham University, UK (invited).
Oct 2021	<i>Density-based persistent homology.</i> 2nd Workshop on Topological Methods in Data Analysis, Heidelberg University, Germany (online).
Jul 2021	<i>Morse theory for group presentations.</i> Mathematical Congress of the Americas 2021, Buenos Aires, Argentina (online, invited).
Jun 2021	<i>Intrinsic persistent homology via density-based metric learning.</i> The 38th Annual Workshop in Geometric Topology, USA (online).
Jun 2021	<i>Morse theory for group presentations.</i> Algebraic Topology Seminar, University of Buenos Aires, Argentina (online, invited).
Apr 2021	<i>Intrinsic persistent homology via density-based metric learning.</i> IMSI Topological Data Analysis Workshop 2021, Chicago, USA (online).
Apr 2021	<i>A density-based metric learning approach to geometric inference.</i> 37th European Workshop on Computational Geometry (EuroCG 2021), St. Petesburg, Russia (online).
Feb 2021	<i>Manifold learning for data analysis.</i> V Encuentro de Jóvenes Topólogos, Universidad Distrital Francisco José de Caldas, Colombia (online, invited).
Dec 2020	<i>Geometric and topological inference for data analysis.</i> 11th meeting Applied Algebra and Geometry in the UK, University of York, UK (online, invited).
Dec 2020	<i>Density-based manifold learning for topological data analysis.</i> Algebraic Topology Seminar, University of Buenos Aires, Argentina (online, invited).

PROJECT SUPERVISION

2023	Master Thesis , Department of Mathematics, University of Buenos Aires. <i>Student:</i> Lola Lopez Mellaned. <i>Project:</i> Dowker's Theorem for network dynamics and applications to neural data.
2022	Summer Project. Grant URB-2022-07. Undergraduate Research Bursary, funded by the London Mathematical Society. Joint supervision with Jeffrey Giansiracusa. <i>Student:</i> Leo Zhang. <i>Project:</i> Reconstruction of surfaces from high dimensional point clouds and applications to data analysis.

SCHOLARSHIPS, FELLOWSHIPS AND GRANTS

- 2022 *LMS-EPSRC ECR ICM Travel Grant* to attend to the International Congress of Mathematicians 2022 in Saint Petersburg. (Cancelled due to Ukraine-Russia war).
- 2020 *International Travel Scholarship AUIP - Andalusian and Iberoamerican Universities Program.* Research stay at the Department of Applied Mathematics, University of Sevilla, Spain. (Cancelled due to COVID). *Mentor:* Prof. Rocio Gonzalez Diaz.
- 2018 *International Travel Scholarship AUIP - Andalusian and Iberoamerican Universities Program.* Research stay at the Department of Algebra, Geometry and Topology, University of Málaga, Spain. *Mentor:* Prof. Aniceto Murillo.
- 2011-2016 *CONICET PhD Fellowship.* *Advisor:* Prof. Elías Gabriel Minian.
- 2010-2011 *UBACyT Scholarship for finalization of career.* *Advisor:* Prof. Elías Gabriel Minian.
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TEACHING

University of San Andrés, Argentina

- 2020 **Lecturer**, Department of Mathematics.
Course: Calculus.

Torcuato DiTella University, Argentina

- 2016 - 2018 **Lecturer**, Department of Mathematics.
Courses: Calculus I (one variable) and Calculus II (several variables).

University of Buenos Aires, Argentina

- 2015 - 2018; 2020 **Lead Teaching Assistant**, Department of Mathematics.
Courses: Introduction to Calculus, Introduction to Number Theory, Topology, Advanced Calculus, Probability and Statistics.
- 2013 - 2015 **Graduate Teaching Assistant**, Department of Mathematics.
Courses: Introduction to Number Theory, Linear Algebra, Topology, Advanced Calculus.
- 2009 - 2011 **Undergraduate Teaching Assistant**, Department of Mathematics.
Courses: Introduction to Calculus, Introduction to Number Theory, Linear Algebra, Topology.
- 2007 - 2017 **Instructor**, Course of Admission.
Courses: Introduction to Calculus, Introduction to Linear Algebra.
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SERVICE AND OUTREACH

- 2021 - 2023 Refereed for the International Journal of Computational Geometry and Applications (IJCGA) and the Journal of Applied and Computational Topology (JACT).
- 2021 Tutorials *Intrinsic Persistent Homology* and *Morse Theory 2.0*, AATRN Applied Algebraic Topology Research Network YouTube Channel.
- 2006 - 2021 Speaker and collaborator in several outreach events in Argentina: *Math's Week*, *Data Science's Week*, *Matbaires*, *Math Festival*.
- 2020 Panel *Women in Science*, Swansea Science Festival 2020.
- 2015 - 2018 Jury member at several primary and secondary math level national competitions (Argentina) including: Olimpiada Matemática Argentina, Olimpiada Matemática Nandú and Olimpiada de los Mateclubes.
- 2011 Collaborator in the organization of WATACBA *Workshop in Algebraic Topology and Combinatorics*, University of Buenos Aires, Argentina.