XIMENA L. FERNÁNDEZ

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CURRENT POSITION

- Postdoctoral Research Assistant at the Department of Mathematical Sciences, Durham University.

- Member of the UK Centre for Topological Data Analysis.

ACADEMIC APPOINTMENTS

Sep 2021 - Present   **Postdoctoral Research Assistant**, Grade 7, Durham University, UK.
Advisor: Prof. Jeffrey Giansiracusa.

Oct 2020 - Aug 2021   **Postdoctoral Research Associate**, Grade 7, 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 M.Sc.),** Department of Mathematics, University of Buenos Aires.
Advisor: Prof. Elías Gabriel Minian.
Thesis: Topology of finite spaces: an algorithmic approach.

RESEARCH INTERESTS

Topological Data Analysis, Applied and Computational Topology, Algebraic and Combinatorial Topology, Probability and Statistics, Neuroscience, Dynamical Systems, Data Science and Machine Learning.

RESEARCH PUBLICATIONS AND PREPRINTS

2022   *Modeled grid cells aligned by a flexible attractor.* S. Benas, X. Fernández and E. Kropff, Preprint. `bioRxiv 2022.06.13.495956`. Submitted.

2021   *Intrinsic persistent homology via density-based metric learning.* X. Fernández, E. Borghini, G. Mindlin and P. Groisman, Preprint. `arXiv:2012.07621`. Submitted.

2021   *Morse theory for group presentations.* X. Fernández, Preprint. `arXiv:1912.00115`. Submitted.

2020   *The cylinder of a relation and generalized versions of the Nerve Theorem.* X. Fernández and E.G. Minian, Discrete & Computational Geometry 63(8).

2016   *Homotopy colimits of diagrams over posets and variations on a theorem of Thomason.* X. Fernández and E.G. Minian, Homology, Homotopy and Applications. vol. 18 issue 2.

OTHER PUBLICATIONS

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

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.

SOFTWARE

2022   Contributor of `Giotto-tda`. Developer of the method `Fermat distance` and a tutorial *Intrinsic Persistent Homology* within the module `graphs` *(to appear soon).*

2019	GAP package `Posets`. With Iván Sadofschi Costa and Kevin Piterman.
	Code: `github.com/isadofschi/posets`
	Documentation: `mate.dm.uba.ar/~isadofschi/posets/`
2017	SAGE Module `Finite Topological Spaces`
	Code: `github.com/ximenafernandez/Finite-Spaces`

Recent Talks

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, 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	*The persistent fundamental group of point clouds.* 11th International Conference on Geometric and Topological Methods in Computer Science (GETCO 2022), EPITA School of Engineering and Computer Science, Paris, France.
May 2022	*Morse theory for group presentations and the persistent fundamental group.* Transpennine Topology Triangle Meeting 116, Liverpool University, UK (online, **invited**).
Apr 2022	*Morse theory for group presentations and the persistent fundamental group.* 35th British Topology Meeting, Durham University, UK.
Feb 2022	*Topological methods for real time detection of epileptic seizures in EEG recordings.* 13th Conference on Dynamical Systems Applied to Biology and Natural Sciences (DSABNS 2022), Basque Center for Applied Mathematics in Bilbao, Basque Country, Spain (online).
Nov 2021	*Density-based intrinsic persistent homology and applications to time series analysis.* Centre for Topological Data Analysis Group Meeting, Oxford University, UK (**invited**).
Oct 2021	*Morse theory for group presentations.* Geometry and Topology Seminar, Durham University, UK (**invited**).
Oct 2021	*Topological time series analysis.* Applied Math Seminar, Durham University, UK (**invited**).
Oct 2021	*Density-based persistent homology.* 2nd Workshop on Topological Methods in Data Analysis, Heidelberg University, Germany (online).

Jul 2021	*Morse theory for group presentations.*
	Mathematical Congress of the Americas 2021, Buenos Aires, Argentina (online, **invited**).
Jun 2021	*Intrinsic persistent homology via density-based metric learning.*
	The 38th Annual Workshop in Geometric Topology, USA (online).
Apr 2021	*Intrinsic persistent homology via density-based metric learning.*
	IMSI Topological Data Analysis Workshop 2021, Chicago, USA (online).
Apr 2021	*A density-based metric learning approach to geometric inference.*
	37th European Workshop on Computational Geometry (EuroCG 2021), St. Petesburg, Russia (online).
Feb 2021	*Manifold learning for data analysis.*
	V Encuentro de Jóvenes Topólogos, Universidad Distrital Francisco José de Caldas, Colombia (online, **invited**).
Dec 2020	*Geometric and topological inference for data analysis.*
	11th meeting, Applied Algebra and Geometry in the UK, University of York, UK (online, **invited**).

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. |

PROJECT SUPERVISION

| Summer 2022 | Grant URB-2022-07. Undergraduate Research Bursary, funded by the London Mathematical Society. Joint supervision with Jeffrey Giansiracusa.
 Student: Leo Zhang.
 Project: Reconstruction of surfaces from high dimensional point clouds and applications to data analysis.
 Code: github.com/shesturnedtheweansagainstus/quotient_rml |

RESEARCH VISITS

| 2022 | *Research visit.* 14 July. Department of Mathematics and Statistics, University of Sheffield, UK. |
| 2018 | *Research stay.* 20 May - 20 June. Department of Algebra, Geometry and Topology, University of Malaga, Spain. |

Teaching

University of Buenos Aires, Argentina

Jan 2020 - Sept 2020
& Mar 2013 - Sep 2018.
Lead Teaching Assistant (requires PhD), Department of Mathematics.

Mar 2009 - Feb 2013.
Teaching Assistant, Department of Mathematics.

Mar 2012 - Feb 2017
& Mar 2007 - Jun 2010.
Instructor, Course of Admission.

Courses: Introduction to Calculus, Introduction to Algebra, Linear Algebra, Topology, Advanced Calculus, Elementary Numerical Analysis, Probability and Statistics.

University of San Andrés, Argentina

Mar 2020 - Jul 2020. *Senior Lecturer*, Department of Mathematics.

Course: Calculus.

Torcuato DiTella University, Argentina

Mar 2016 - Feb 2018. *Senior Lecturer*, Department of Mathematics.

Course: Calculus I (one variable) and Calculus II (several variables).

Service and outreach

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