

CURRICULUM VITÆ

XIMENA 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 - **Postdoctoral Research Assistant**, Durham University, UK.
Advisor: Jeffrey Giansiracusa.

Oct 2020 - Aug 2021. **Postdoctoral Research Associate**, Swansea University, UK.
Advisor: 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: Dr. Elías Gabriel Minian.
Area: Low-dimensional topology and computational geometry.
Title: 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: Dr. 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

- 2021 *Morse theory for group presentations*. X. Fernández, Preprint. [arXiv:1912.00115](#). Submitted.
- 2021 *Intrinsic persistent homology via density-based metric learning*. X. Fernández, E. Borghini, G. Mindlin and P. Groisman, Preprint. [arXiv:2012.07621](#). 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, X. and E.G. Minian, Homology, Homotopy and Applications. vol. 18 issue 2.

RESEARCH VISITS

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

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).
- 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	<i>Topological time series analysis.</i> <i>Applied Math Seminar</i> , Durham University, UK (invited).
Oct 2021	<i>Density-based persistent homology.</i> <i>2nd Workshop on Topological Methods in Data Analysis</i> , Heidelberg University, Germany (online).
Jul 2021	<i>Morse theory for group presentations.</i> <i>Mathematical Congress of the Americas 2021</i> , Buenos Aires, Argentina (online, invited).
Jun 2021	<i>Intrinsic persistent homology via density-based metric learning.</i> <i>The 38th Annual Workshop in Geometric Topology</i> , USA (online).
Apr 2021	<i>Intrinsic persistent homology via density-based metric learning.</i> <i>IMSI Topological Data Analysis Workshop 2021</i> , Chicago, USA (online).
Apr 2021	<i>A density-based metric learning approach to geometric inference.</i> <i>37th European Workshop on Computational Geometry (EuroCG 2021)</i> , St. Petesburg, Russia (online).
Feb 2021	<i>Manifold learning for data analysis.</i> <i>V Encuentro de Jóvenes Topólogos</i> , Universidad Distrital Francisco José de Caldas, Colombia (online, invited).
Dec 2020	<i>Geometric and topological inference for data analysis.</i> <i>11th meeting, Applied Algebra and Geometry in the UK</i> , University of York, UK (online, invited).

SOFTWARE

2022	Contributor of Giotto-tda. Development of the method Fermat distance and a tutorial <i>Intrinsic Persistent Homology</i> within the module graphs (<i>to appear soon</i>).
2019	GAP package Posets . With Iván Sadofschi Costa and Kevin Piterman. Code: https://github.com/isadofschi/posets Documentation: http://mate.dm.uba.ar/~isadofschi/posets/
2017	SAGE Module Finite Topological Spaces Code: github.com/ximenafernandez/Finite-Spaces

INVITED LECTURES

2022	International Summer School on Modeling Nature BIOMAT 2022. Multiscale Models and Methods in Life Sciences. Granada, Spain. 6-10 June 2022. <i>Course</i> : Topological data analysis and applications in dynamics.
2022	EUropean TOPOlogy Interdisciplinary Action (EUTOPIA) Summer School 2022. Paris, France. 27 June - 6 July 2022. <i>Course</i> : Persistent homology and applications in biology.

PROJECT SUPERVISION

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

TEACHING

Publications

2019 Author of the **book** *Algebra A* (Introduction to Linear Algebra for Engineering, Computer Science and Mathematics). With Nicolás Capitelli, Rosa Escayola and Gerardo Rossi. Publisher: EUDEBA. ISBN 9789502329703.

University of Buenos Aires

Jan 2020 - Sept 2020 *Lead Teaching Assistant*, Department of Mathematics.
& Mar 2013 - Sep 2018.

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

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

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

University of San Andrés

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

Course: Calculus.

University Torcuato DiTella

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

Course: Calculus.

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:* Dr. 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:* Dr. Aniceto Murillo.

2011-2016 *CONICET PhD Fellowship*. *Advisor:* Dr. Elías Gabriel Minian.

2010-2011 *UBACyT Scholarship for finalization of career*. *Advisor:* Dr. Elías Gabriel Minian.

SERVICE AND OUTREACH

2021	Tutorials ' <i>Intrinsic Persistent Homology</i> ' and ' <i>Morse Theory 2.0</i> ', 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', 'Matbaire's', 'Math Festival'.
2020	Panel 'Women in Science', Swansea Science Festival 2020.
2015 - 2018	Member of the jury 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.

TECHNICAL SKILLS

- **Programming languages:** Python, R, Matlab, C++, Sage, Gap, Julia, Html, SQL, Latex.
- **TDA tools:** Ripser, Giotto-TDA, Gudhi, Eirene.
- **Data science tools:** Jupyter, NumPy, Pandas, SciKit-Learn, NetworkX, Statsmodels, Keras, PyTorch.
- **OS:** Linux, Windows, OSX.

Updated 22/07/2022