

Alice Patania

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Alice Patania
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About Me I am Assistant Research Scientist at Indiana University Network Science Institute (IUNI) in Bloomington, IN. I received my Ph.D, in applied Mathematics at Politecnico di Torino in May 2017 with a dissertation titled: "Simplicial Data Analysis: theory, practice, and algorithms".

My main focus is on developing and applying new topological approaches to analyze complex systems. In particular, I work on applying these tools in network neuroscience together with the SpornsLab at Indiana University Bloomington.

Research Interests

Mathematical Modeling, Brain Networks, Gene interaction Networks, Computational Topology, Topological Data Analysis.

Publications

In Peer-Reviewed Journals

- "Navigating features: a topologically informed chart of electromyographic features space" - A. Phinyomark, R. N Khushaba, E. Ibáñez-Marcelo, **A. Patania**, E. Scheme, G. Petri. *Journal of The Royal Society Interface* 14.137 (2017) p.20170734
- "Construction of and efficient sampling from the simplicial configuration model" - J.-G. Young, G.Petri, F.Vaccarino, **A. Patania**. *Physical Review E* 96 (2017) p.032312 (arXiv:1705.10298) ¹
- "The shape of simplicial collaboration" - **A. Patania**, G. Petri, F. Vaccarino. *EPJ Data Science* (2017) 6(1), p.18
- "Topological Analysis of Data" - **A. Patania**, F. Vaccarino, G. Petri. *EPJ Data Science* (2017) 6(1), p.7
- "P-persistent homology of finite topological spaces" - **A. Patania**, G. Petri, F. Vaccarino. *Rendiconti del Seminario Matematico, Università e Politecnico di Torino* (2017) *In print* (arXiv:1502.04873)

In Preparation

- "Topological networks for gene-expression of microarray data" - **A. Patania**, M. Veronese, P. Selvaggi, P. Expert, G. Petri. *Article manuscript in progress*.
- "Quantum barcode for persistent homology" - **A. Patania**, F. Vaccarino, S. Lloyd. *Article manuscript in progress*.
- "Dopaminergic pathways revealed through topological studies of gene-expression" - **A. Patania**, M. Veronese, P. Selvaggi, P. Expert, G. Petri. *Data collection and analysis in progress*.

Pre-print

- "Complex Systems Techniques applied to Power Transmission Expansion Planning" - S. Lumbreras, M. Pereda, I. Bertazzi, **A. Patania**, J.-G. Young, D. Citron, M. Haraguchi - *Proc. CSSS 2015* - (2015)
Contribution in: "Part I: Generating Random Networks that are Consistent with Power Transmission".
- "Quantitative Semantic and Topological Analysis of UK House of Commons Debates" - S. Gurciullo, M. Smallegan, M. Pereda, F. Battiston, **A. Patania**, S. Poledna, D. Hedblom,

¹A C++ implementation is available at: <https://github.com/jg-you/scm>.

Appointments held

Assistant Research Scientist
IUNI, Bloomington (IN)

July 2017 - present

Assistant Research Scientist at Indiana University Network Science Institute (IUNI) in Bloomington, IN.

PhD Student
I.S.I. Foundation, Turin (IT)

Jan 2014 - May 2017

Part of the "Mathematics and Foundation of Complex Systems" research group at ISI Foundation.

Junior Researcher
I.S.I. Foundation, Turin (IT)

Jun 2013 - Dec 2013

Part of the "Mathematics and Foundation of Complex Systems" research group at ISI Foundation. Tasks:

- Writing a working code that computes the tidy set of a simplicial complex;
- Working on the categorical foundations of persistent homology;
- Working on application of discrete exterior calculus to complex systems and network theory.

Visiting

- Politecnico di Torino, Torino, IT September 2017
- Centre for Neuroimaging Science, King's College London, UK, January 2017
- Dynamica Research Group, Université Laval, Québec City (QC), Canada, August 2016
- Prof. Seth Lloyd, M.I.T., Cambridge (MA), Nov-Dec 2015

Education

Politecnico di Torino & I.S.I. Foundation

Jan 2014 - May 2017

PhD in Applied Mathematics cum laude - thesis: *Simplicial Data Analysis*

University of Torino

Sep 2009 - Mar 2013

MSc in Mathematics - thesis: *Persistent Homology*

University of Torino

Sep 2006 - Mar 2010

BSc in Mathematics - thesis: *Counterexamples in general topology*

Conference Communications

Talks

- "Topological gene expression networks capture spatial and gene-gene interactions"
Politecnico di Torino, Seminari di Geometria, Turin, Italy Sep 2017
- "Topological gene expression networks capture spatial and gene-gene interactions"
Network Neuroscience, NetSci 2017, Indianapolis (IN), U.S.A. Sep 2017
- "Topological gene expression networks for neuroimaging"
Centre for Neuroimaging Science, King's College London, London, U.K. Jan 2017
- "Topological gene expression networks capture spatial and gene-gene interactions"
Conference on Complex Systems, Amsterdam, Netherlands Sep 2016
- "Topological Data Analysis with applications to neuroscience"
Theoretical Physics Seminar Series, Université Laval, Québec City, Canada Aug 2016

- "A hierarchical stochastic growth model for simplicial complexes"
SINM Satellite Conference of NetSci - International Conference on Network Science,
Seoul, South Korea Jun 2016

Posters

- "Topology of Networks Time-delay Embeddings"
NetSci - International Conference on Network Science, Zaragoza, Spain Jun 2015
- "Poset persistence as sublevel filtration of weighted objects"
Workshop on Discrete, Computational and Algebraic Topology, University of Copenhagen, Denmark Nov 2014
- "One graph to rule them all"
Workshop on Topology and Geometry of Networks and Discrete Metric Spaces, Institute for Mathematics and its Applications, Minneapolis (MN), U.S.A. May 2014

Schools

Mathematical methods for high-dimensional data analysis TU München, Garching, Germany	Jul 2016
2nd EATCS young researchers school Camerino, Italy	Jul 2015
SFI Complex Systems Summer School Santa Fe Institute, NM, USA	Jun 2015
Homology: Theoretical and Computational Aspects Genova, Italy	Feb 2015
ECCS Warm up School and Conference IMT Lucca, Italy	Sep 2014
ACAT Summer School on computational topology and topological data analysis Ljubliana, Slovenia	Jul 2013

Grants and Awards

<i>PhD Fellowship, I.S.I. Foundation</i>	Feb 2014-Jan 2017
<i>Bridge Grant, Y.R.N.C.S.</i> with Jean-Gabriel Young, Université Laval	2016
<i>Logo Design for Y.R.N.C.S.</i>	2016

Other Information

Software Development Skills

Python Package

MapperTools - <https://alpatania.github.io/MapperTools>

Programming

- Python
- C
- HTML

Computer Software

- MS Office
- Bash
- Matlab

Academic Service

- Treasurer and Member of Advisory Board of the Young Researchers Network on Complex Systems, 2017-2019
- Volunteer, Applied Topology: Methods, Computation, and Science, Torino, Jul. 2016

- Member, Commissione Didattica Paritetica of the Department of Mathematics, Jun. 2009 - Jun. 2011
- Member, Commissione Didattica Paritetica of the Faculty of Mathematical, Physical, and Natural Sciences, Jun. 2009 - Jun. 2011

Membership

- Member of Women in Computational Topology
- Member of Complex Systems Society
- Member of the Young Researchers Network on Complex Systems
- Member of the Network Science Society