



Luigi Caputi

Curriculum Vitae

Date: 19/07/2024

Personal Details

First name **Luigi**
Family name **Caputi**
Place of Birth **Mesagne, Italy**
Date of Birth **May 21, 1989**
Current city **Torino, (IT)**
E-mail **luigi.caputi@unibo.it**
Homepage **<https://luigicaputi.github.io/>**

Mathematical Interests

I am broadly interested in algebraic and combinatorial topology, in coarse geometry, Hochschild and cyclic homology theories, stable homology, representations of categories, and K-theory. I am also interested in applications of these to graph theory and neuroscience.

Experience

Jan. 2024 – Postdoctoral researcher (Assegnista) supported by the Starting Grant 101077154 now “Definable Algebraic Topology” of M. Lupini from the ERC, Dipartimento di Matematica, Università di Bologna (Italy)
Jan. 2023 – Postdoctoral researcher (Assegnista), Dipartimento di Matematica, Università di
Dec. 2023 Torino (Italy)
Sept. 2022 – Postdoctoral researcher, Czech Academy of Sciences (Prague, Czech Republic).
Dec. 2022
Nov. 2020 – Research Fellow at the School of Natural and Computing Sciences of the University
Aug. 2022 of Aberdeen (UK).
Nov. 2019 – Postdoctoral researcher, Czech Academy of Sciences (Prague, Czech Republic).
Oct. 2020

Jun. 15th - Wissenschaftliche Mitarbeiter, supported by the DFG-Graduiertenkolleg 1692 “Curvature, Cycles, and Cohomology”, Regensburg Universität (Germany)
 Sept. 2019
 March 2016 - PhD student, supported by the DFG-Graduiertenkolleg 1692 “Curvature, Cycles, and Cohomology” and the DFG SFB 1085 “Higher Invariants”, Universität Regensburg (Germany)
 May 2019

Education

May 2nd, 2019 **Dr. Rer. Nat. (Ph.D.) in Mathematics**, *University of Regensburg*, Regensburg
 Final mark: Magna cum laude
 Oct. 16th, 2015 **Master Degree in Mathematics**, *Università degli Studi di Pisa*, Pisa
 Final mark: 110 cum laude/110
 Oct. 2014 - **Exchange student**, *Freie Universitaet Berlin*, Berlin
 June 2015 Arbeitsgruppe Prof. Dr. H. Reich
 22/07/2012 **Bachelor Degree in Mathematics**, *Università degli Studi di Pisa*, Pisa, Italy
Ph.D. details
 Thesis **Hochschild and cyclic homology for bornological coarse spaces**, available at <https://epub.uni-regensburg.de/40219/>
 Advisers Prof. Dr. U. Bunke, Prof. Dr. C. Löh, Univeristy of Regensburg
 Scholarship DFG Graduiertenkolleg GRK 1692 “Curvature, Cycles, and Cohomology”, University of Regensburg

Master Thesis

Title *Homological stability for general linear groups*
 Advisers Prof. Dr. H. Reich, Freie Universitaet, Berlin, and Prof. Dr. M. Salvetti, Università degli studi di Pisa, Pisa

Published and accepted Papers (inverse order)

1. **Localization for coarse homology theories**, with Ulrich Bunke, to appear in *Annals of K-theory*. Preprint version Arxiv:<https://arxiv.org/abs/1902.04947>
2. **On reachability categories and commuting algebras of quivers**, (with Henri Riihimäki), *Theory Appl. Categ.* 41, 426-448 (2024). Preprint version Arxiv:2306.15388
3. **On the homotopy type of multipath complexes**, (with Carlo Collari, Sabino Di Trani, and Jason P. Smith, *Mathematika* 70, No. 1, Article ID e12235, 26 (2024). Preprint version Arxiv:2208.04656
4. **Multipath cohomology of directed graphs**, (with Carlo Collari and Sabino Di Trani), to appear in *Algebraic & Geometric Topology*. Preprint version Arxiv:2108.02690
5. **Monotone cohomologies and oriented matchings**, (with Daniele Celoria and Carlo Collari), to appear in *Homology, Homotopy & Applications*. Preprint version Arxiv:2203.03476

6. **From the Mayer-Vietoris spectral sequence to überhomology**, (with Daniele Celoria and Carlo Collari), *Proc. A Royal Soc. Edinburgh*, 2023 DOI: doi:10.1017/prm.2023.104. Preprint version Arxiv:2304.10134
7. **Hochschild homology, and a persistent approach via connectivity digraphs**, (with Henri Riihimäki), *Journal of Applied and Computational Topology*, 2023, DOI:10.1007/s41468-023-00118-9
8. **Categorifying connected domination via graph überhomology**, (with Daniele Celoria and Carlo Collari), *Journal of Pure and Applied Algebra* 227 (9), 2023
9. **Combinatorial and Topological Aspects of Path Posets, and Multipath Cohomology**, (with Carlo Collari and Sabino Di Trani), *Journal of Algebraic Combinatorics* 57: 617–658, 2023
10. **Controlled objects as symmetric monoidal functor**, (with Ulrich Bunke), *Higher Structures* 6(1): 182-211, 2022
11. **Promises and pitfalls of Topological Data Analysis for brain connectivity analysis**, (with Anna Pidnebesna, and Jaroslav Hlinka), *Neuroimage* (238), 2021
12. **Cyclic homology for bornological coarse spaces**, *Journal of Homotopy and Related Structures* (15), 2020

Preprints (Submitted)

1. **On finite generation in magnitude (co)homology, and its torsion**, joint work with Carlo Collari, <https://arxiv.org/abs/2302.06525>
2. **The weak categorical quiver minor theorem and its applications: matchings, multipaths, and magnitude cohomology**, joint work with Carlo Collari and Eric Ramos, <https://arxiv.org/abs/2401.01248>
3. **Integral Betti signature confirms the hyperbolic geometry of brain, climate, and financial networks**, joint work with Anna Pidnebesna and Jaroslav Hlinka, <https://arxiv.org/abs/2406.15505>
4. **Bridging between überhomology and double homology**, joint work with Daniele Celoria and Carlo Collari, <https://arxiv.org/abs/2406.18778>

Grants & other funding

1. **PhD scholarship**, from the DFG-Graduiertenkolleg 1692 “Curvature, Cycles, and Cohomology”, Regensburg, 2016–2019
2. **Heilbronn Small Grants Scheme**, for a research collaboration with Carlo Collari, Summer 2022
3. **INDAM**, for a research visiting in Regensburg (Germany), within “Concorso a n. 30 mensilità di borse di studio per l'estero per l'a.a. 2022-2023.”, 2023
4. **INDAM**, for a research visiting in Fukuoka (Japan), thanks to “Concorso a n. 45 mensilità di borse di studio per l'estero per l'a.a. 2023-2024.”, 2024

Teaching experience

WS 2021-22 **“Algebraic Topology”**, Course coordinator, University of Aberdeen

WS 2020-21 **“Algebraic Topology”**, *Course coordinator*, University of Aberdeen

Visitings

- March, 2024 **Visiting U. Bunke**, *supported by Indam*, University of Regensburg, Regensburg
- November 5 - 21, 2023 **Visiting I. Patchkoria**, *supported by the Heibronn Small Scheme Grant*, University of Aberdeen, Aberdeen
- July 17 - 25, 2023 **Research visiting**, *University of Aberdeen*, Aberdeen
- June 26 - 30, 2023 **Visiting C. Collari**, *Università degli Studi di Pisa*, Pisa
- June 09 - 16, 2022 **Visiting J. Hlinka**, *ICS Prague*, Prague
- April 06 - 14, 2022 **Visiting C. Collari**, *Università degli Studi di Pisa*, Pisa
- March 09 - 15, 2017 **Visiting F. Callegaro**, *Università degli Studi di Pisa*, Pisa

Organized conferences

- Oct. 1–4, 2024 **Co-organizer of the workshop “CATA II: Combinatorial Algebraic Topology, and Applications”**, Centro E. De Giorgi, Pisa, (IT)
- Aug. 2024 **Co-organizer of the summer school “HPRT 2024”**, *Website of the conference: here*, University of Hokkaido, Hokkaido, (JP)
- Nov. 29, 2023 **Co-organizer of the workshop “TDA in Turin”**, Campus Einaudi, Turin, (IT)
- Nov. 27–28, 2023 **Co-organizer of the workshop “CATA: Combinatorial Algebraic Topology, and Applications”**, Centro E. De Giorgi, Pisa, (IT)
- Sept. 2023 **Co-organizer of the workshop “HPRT 2023”**, *Website of the conference: here*, University of Turin, Turin, (IT)

Talks and selected conferences

- 26-26/07/2024 **“Überhomology, connected domination and the Mayer Vietoris spectral sequence”**, *Invited talk*, AMS-UMI Conference, 2024 , Palermo, IT
- 10/04/2024 **“The weak categorical quiver minor theorem and its applications”**, *On-line Talk*, BIMS Topology seminars, Beijing, Chine
- 16/01/2024 **“On finite generation in magnitude homology, and its torsion”**, *Seminar*, SFB Lecture, Regensburg, Germany
- 06/12/2023 **“On finite generation in magnitude homology, and its torsion”**, *Invited talk*, Conference Magnitude 2023, Osaka, Japan
- 16/11/2023 **“Reachability categories and commuting algebras of quivers”**, *Seminar*, Topology and Algebra seminars, Institute of Mathematics, Aberdeen

- 01/11/2023 **"From the Mayer-Vietoris spectral sequence to überhomology"**, *Seminar*, Cohomology in algebra, geometry, physics and statistics , Institute of Mathematics of the Czech Academy of Sciences, Prague
- 06/10/2023 **"Multipath cohomology of directed graphs"**, *On-line Talk*, Jornadas sobre Matemáticas Contemporáneas, Departamento de Matemáticas del Cinvestav-IPN, Mexico
- 26/09/2023 **"On finite generation in magnitude homology, and its torsion"**, *Seminar*, Algebra and Geometry Seminar, Bologna, Italy
- 31/08/2023 **"A gentle introduction to Topological Data Analysis, and applications"**, *Invited talk*, Summer school HPRT 2023, Torino, Italy
- 24/07/2023 **"On reachability categories and commuting algebras of quivers"**, *Seminar*, Representation Theory Group Seminar, On-line talk, Cologne, Germany
- 06/06/2023 **"Multipath cohomology of directed graphs – Part II"**, *On-line talk*, CIMAT Applied Geometry and Topology Seminar, Guanajuato, Mexico
- 09/05/2023 **"Multipath cohomology of directed graphs"**, *On-line talk*, CIMAT Applied Geometry and Topology Seminar, Guanajuato, Mexico
- February 20-24, 2023 **Winter School: Geometry, Algebra and Combinatorics of Moduli Spaces and Configurations V**, *Invited Talk: "Multipath cohomology of directed graphs"*, Dobbiaco
- 13/02/2023 **"Multipath cohomology of directed graphs"**, *Seminar*, Seminari di Algebra e Geometria Algebrica, Dipartimento di Matematica, Torino
- 14 - 16/11/2022 **Interactions and Applications of Homotopical Algebra and Geometry**, *Poster session: "Controlled objects as symmetric monoidal functor"*, University of Luxembourg, Luxembourg
- 21/09/2022 **"On the homotopy type of multipath complexes"**, *Seminar*, Aberdeen Topology and Algebra seminars, Institute of Mathematics, Aberdeen
- 15 - 16/09/2022 **Topology of Data in Rome**, *Poster session: "On the homotopy type of multipath complexes"*, Università di Roma Tor Vergata, Rome
- 13/04/2022 **"Coarse homology theories"**, *Seminar*, Geometry Seminars, Università degli Studi di Pisa
- 26/11/2021 **"Multipath cohomology of digraphs"**, *Seminar*, Aberdeen Topology and Algebra seminars, Institute of Mathematics, Aberdeen
- 10/06/2020 **"Cyclic homology for bornological coarse spaces"**, *Seminar*, Cohomology in algebra, geometry, physics and statistics seminars, CAS, Prague
- 01/12/2018 **"Cyclic homology for bornological coarse spaces"**, *Invited talk*, A conference in honour of Prof. Fabrizio Broglia, University of Pisa
- 29/06/2018 **"Coarse Hochschild and cyclic homology"**, *Seminar*, Geometry and Topology Seminar, University of Warwick
- June 18 - 22, 2018 **"Coarse Hochschild and cyclic homology"**, *Contributed talk*, International Conference on Manifolds, Groups and Homotopy, Isle of Skye
- May 14 - 18, 2018 **Workshop on Large Scale Geometry and Applications**, *Poster session*, The Fields Institute, Toronto

January 14 - **Oberwolfach Seminars**, *Topology of Arrangements and Representation Stability*,
20, 2018 Oberwolfach

October 15 - **Oberwolfach Seminars**, *Algebraic K- and L-Theory and Geometric Group Theory*,
21, 2017 Oberwolfach

Spoken Languages

Italian Mothertongue
English Fluent
German Basic

Computer skills

Basic Matlab, Python

Software

1. **L. Caputi and A. Pidnebesna**, ***TDA-brain-connectivity***, Codes for the paper Caputi et al. 2021 "Promises and pitfalls of Topological Data Analysis for brain connectivity analysis", https://github.com/cobragroup/TDA_brain_connectivity