

Curriculum Vitae

Ulderico Fugacci

Personal

Education

- **B.Sc. (Mathematics).** University of Genova, Department of Mathematics.
Thesis: *Ideals of the Ring of Formal Power Series*.
Advisor: Prof. M. E. Rossi. (September 2010)
- **M.Sc. (Mathematics).** University of Genova, Department of Mathematics.
Thesis: *Constructive Methods to Compute Simplicial Homology*.
Advisors: Prof. M. E. Rossi, Prof. L. De Floriani. (July 2012)
- **Ph.D. (Computer Science).** University of Genova, Department of Computer Science, Bioinformatics, Robotics and Systems Engineering.
Thesis: *Topological Data Analysis through Homology and Discrete Morse Theory*.
Advisors: Prof. L. De Floriani, Prof. M. E. Rossi. (May 2016)

Employments

- **September 2020 - Present.** Contract Professor, University of Genova, Italy.
- **July 2020 - Present.** Researcher (III level) at Istituto di Matematica Applicata e Tecnologie Informatiche (IMATI) “Enrico Magenes”, CNR (National Research Council), Genova, Italy.
- **July 2019 - June 2020.** Post-doctoral fellow at Department of Mathematical Sciences and Collaborator of SmartData@PoliTO center for Big Data and Machine Learning technologies, Polytechnic University of Torino, Italy.

- **November 2017 - June 2019.** Post-doctoral fellow, Institute of Geometry, Graz University of Technology, Austria.
- **November 2016 - October 2017.** Post-doctoral fellow, Department of Computer Science, Kaiserslautern University of Technology, Germany.
- **March 2016 - October 2016.** Post-doctoral fellow, Department of Computer Science, University of Maryland at College Park, MD, USA.
- **April 2016 - May 2016.** External collaborator, Department of Mathematics, University of Genova, Italy.
- **January 2013 - February 2016.** Research assistant, Department of Computer Science, Bioinformatics, Robotics and Systems Engineering, University of Genova, Italy.

Research Interests

- Topological Data Analysis and Visualization
- Computational Topology and Geometry
- Homology, Persistent and Multi-Parameter Persistent Homology
- Discrete Morse Theory
- Complex Network Analysis
- Algorithms and Spatial Data Structures
- Bioinformatics (Protein Classification, Binding Site Retrieval)
- Combinatorics and Commutative Algebra

Publications

Papers in Refereed Journals

1. **U. Fugacci, C. Romanengo, B. Falcidieno, S. Biasotti.** *Reconstruction and Preservation of Feature Curves in 3D Point Cloud Processing.* In *Computer-Aided Design*, vol. 167, page 103649, 2024.
2. **C. Romanengo, U. Fugacci, B. Falcidieno, S. Biasotti.** *Piecewise Polynomial Approximation of Spatial Curvilinear Profiles using the Hough Transform.* In *Applied Mathematics and Computation*, vol. 456, page 128213, 2023.
3. **A. Raffo, U. Fugacci, S. Biasotti.** *GEO-Nav: a Geometric Dataset of Voltage-Gated Sodium Channels.* In *Computers & Graphics*, vol. 11,5 pages 285-295, 2023.

4. **U. Fugacci, M. Kerber, A. Rolle.** *Compression for 2-Parameter Persistent Homology.* In Computational Geometry, page 101940, 2022.
5. **A. Raffo, L. Gagliardi, U. Fugacci, L. Sagresti, S. Grandinetti, G. Brancato, S. Biasotti, W. Rocchia.** *Chanalyzer: a Computational Geometry Approach for the Analysis of Protein Channel Shape and Dynamics.* In Frontiers in Molecular Biosciences, vol. 9, 2022.
6. **L. Gagliardi, A. Raffo, U. Fugacci, S. Biasotti, W. Rocchia, et al.** *SHREC 2022: Protein-Ligand Binding Site Recognition.* In Computers & Graphics, vol. 107, pages 20-31, 2022.
7. **A. Raffo, U. Fugacci, S. Biasotti, W. Rocchia, et al.** *SHREC 2021: Retrieval and Classification of Protein Surfaces Equipped with Physical and Chemical Properties.* In Computers & Graphics, vol. 99, pages 1-21, 2021.
8. **M. Ferrara, F. Della Santa, M. Bilardo, A. De Gregorio, A. Mastropietro, U. Fugacci, F. Vaccarino, E. Fabrizio.** *Design Optimization of Renewable Energy Systems for NZEBs based on Deep Residual Learning.* In Renewable Energy, vol. 176, pages 590-605, 2021.
9. **M. Guerra, A. De Gregorio, U. Fugacci, G. Petri, F. Vaccarino.** *Homological Scaffold via Minimal Homology Bases.* In Scientific Reports, vol. 11(1), page 5355, 2021.
10. **U. Fugacci, C. Landi, H. Varlı.** *Critical Sets of PL and Discrete Morse Theory: a Correspondence.* In Computers & Graphics, vol. 90, pages 43-50, 2020.
11. **R. Fellegara, F. Iuricich, L. De Floriani, U. Fugacci.** *Efficient Homology-Preserving Simplification of High-Dimensional Simplicial Shapes.* In Computer Graphics Forum, vol. 39(1), pages 244-259, 2020.
12. **D. Bolognini, U. Fugacci.** *Betti Splitting from a Topological Point of View.* In Journal of Algebra and Its Applications, vol. 19(6), page 2050116, 2020.
13. **R. Corbet, U. Fugacci, M. Kerber, C. Landi, B. Wang.** *A Kernel for Multi-Parameter Persistent Homology.* In Computers & Graphics, vol. 2, page 100005, 2019.
14. **U. Fugacci, F. Iuricich, L. De Floriani.** *Computing Discrete Morse Complexes from Simplicial Complexes.* In Graphical Models, vol. 103, page 101023, 2019.
15. **B. Rieck, U. Fugacci, J. Lukasczyk, H. Leitte.** *Clique Community Persistence: A Topological Visual Analysis Approach for Complex Networks.* In IEEE Transactions on Visualization and Computer Graphics, vol. 24(1), pages 822-831, 2018.
16. **F. Iuricich, U. Fugacci, L. De Floriani.** *Topologically-Consistent Simplification of Discrete Morse Complex.* In Computers & Graphics, vol. 51, pages 157-166, 2015.
17. **L. De Floriani, U. Fugacci, F. Iuricich, P. Magillo.** *Morse Complexes for Shape Segmentation and Homological Analysis: Discrete Models and Algorithms.* In Computer Graphics Forum, vol. 34(2), pages 761-785, 2015.

18. **L. Čomić, L. De Floriani, F. Iuricich, U. Fugacci.** *Topological Modifications and Hierarchical Representation of Cell Complexes in Arbitrary Dimensions.* In Computer Vision and Image Understanding, vol. 121, pages 2-12, 2014.

Refereed Book Chapters

1. **F. Vaccarino, U. Fugacci, S. Scaramuccia.** *Persistent Homology: a \hat{A} Topological Tool for \hat{A} Higher-Interaction Systems.* In F. Battiston, G. Petri (Eds.), Higher-Order Systems. Springer International Publishing, pages 97-139, 2022.
2. **L. De Floriani, U. Fugacci, F. Iuricich.** *Homological Shape Analysis through Discrete Morse Theory.* In M. Breuß, A. Bruckstein, P. Maragos, S. Wuhler (Eds.), Perspectives in Shape Analysis. Springer International Publishing, pages 187-209, 2016.

Refereed Conference Papers

1. **U. Fugacci, M. Kerber, H. Manet.** *Topology-Preserving Terrain Simplification.* In 28th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems, pages 36-47, 2020.
2. **F. Della Santa, M. Ferrara, M. Bilardo, A. De Gregorio, U. Fugacci, A. Mastropietro, E. Fabrizio, F. Vaccarino.** *Application of Deep Learning to Design Renewable Energy Systems for a Zero Energy Multifamily Building.* In 15th Conference on Sustainable Development of Energy, Water and Environment Systems, 2020.
3. **U. Fugacci, M. Kerber.** *Chunk Reduction for Multi-Parameter Persistent Homology.* In 35th International Symposium on Computational Geometry, vol. 129, pages 37:1-37:14, 2019.
4. **R. Fellegara, U. Fugacci, F. Iuricich, L. De Floriani.** *Analysis of Geolocalized Social Networks based on Simplicial Complexes.* In 9th ACM SIGSPATIAL International Workshop on Location-Based Social Networks, pages 5:1-5:8, 2016.
5. **U. Fugacci, S. Scaramuccia, F. Iuricich, L. De Floriani.** *Persistent Homology: a Step-by-Step Introduction for Newcomers.* G. Pintore and F. Stanco (Eds.). In Smart Tools and Apps for Graphics - Eurographics Italian Chapter Conference, The Eurographics Association, 2016.
6. **U. Fugacci, F. Iuricich, L. De Floriani.** *Efficient Computation of Simplicial Homology through Acyclic Matching.* In 16th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing, pages 587-593, 2014.

Communications at International Conferences and Workshops

1. **U. Fugacci, M. Kerber, H. Manet.** *Topology-Aware Terrain Simplification:*
 - (a) Poster, Algebraic Topology: Methods, Computation and Science, 2018.

- (b) Extended Abstract, Computational Geometry: Young Researchers Forum, 2018.
- 2. **R. Corbet, U. Fugacci, M. Kerber, C. Landi, B. Wang.** *A Kernel for Multi-Parameter Persistent Homology*:
 - (a) Poster, Algebraic Topology: Methods, Computation and Science, 2018.
 - (b) Extended Abstract, Computational Geometry: Young Researchers Forum, 2018.

Awards

- SMI 2015 - **Honorable Mention**, *Topologically-Consistent Simplification of Discrete Morse Complex* (joint work with F. Iuricich and L. De Floriani).
- **2016 Best Ph.D. Thesis in Computer Science**, University of Genova.
- SMI 2019 - **Best Paper**, *A Kernel for Multi-Parameter Persistent Homology* (joint work with R. Corbet, M. Kerber, C. Landi, B. Wang).

Participations in Research Projects

- Mesh-Based Representation and Topological Analysis of Static and Time-varying 3D Scalar Fields and 4D Shapes (NSF project IIS-1116747).
- Commutative Algebra and Applications (project CARIGE).
- Algorithms for Topological Data Analysis (Austrian Science Fund (FWF) - grant P29984-N35).
- Italian MIUR Award “Dipartimento di Eccellenza 2018-2022” Disma-PoliTO - CUP: E11G18000350001
- ELBA, Establishment of Training and Research Centers and Courses Development on Intelligent Big Data Analysis in Central Asia.
- PNRR - Ecosistema dell’Innovazione RAISE - Robotics and AI for Socio-Economic Empowerment.
- PNRR - National Biodiversity Future Center (NBFC).

Professional Service

Participations in Program Committees

- Graphics Replicability Stamp Initiative (GRSI), since 2022.
- IEEE Workshop on Topological Data Analysis and Visualization (TopoInVis), since 2023.

- Symposium on 3D Object Retrieval (3DOR), since 2023, in 2023 also member of Program Chair and Best Paper Award Committee.
- Smart Tools and Applications in Graphics (STAG), Thesis Awards Chair, 2024.

Organization of Scientific Events

- Local organizer for the School “Homology: Theoretical and Computational Aspects”, International School, jointly organized by the Department of Computer Science, Bioinformatics, Robotics and Systems Engineering and by the Department of Mathematics of the University Genova, February 2015.
- Organizer of the session on “Geometric Aspects of Applied Topology” at the Joint Meeting of UMI-SIMAI-PTM, Wrocław, Poland, September 2018.
- Organizer of the “6th SmartData@PoliTO Workshop” at Castello del Valentino, Torino, Italy, January 2020.
- Organizer of the “10th Annual Minisymposium on Computational Topology” workshop of the Computational Geometry Week 2022, Berlin, Germany, June 2022.
- Organizer of the “Symposium on 3D Object Retrieval (3DOR’23)”, Lille, France, August-September 2023

Organization of Scientific Contests and Tracks

- Organizer of the SHREC track “Retrieval and Classification of Protein Surfaces Equipped with Physical & Chemical Properties”, 2021.
- Organizer of the SHREC track “Protein-Ligand Binding Site Recognition”, 2022.

Teaching and Advising Activity

At CNR-IMATI

- Advisor of the Internship of Dorian Roger, April-July 2024.

At University of Genova

- Tutor, Elementi di Matematica e Logica, Undergraduate Program in Computer Science, 2011-2012.
- Guest lecturer, Geometric Modeling, Master Program in Computer Science and Mathematics, 2012-2013, 2013-2014, and 2014-2015.
- Assistant tutor for Master Thesis in Mathematics by Beatrice Roticiani, advisor Prof. L. De Floriani, September 2013.
- Lecturer at Mathematics stage for High School students, February 2014.

- Assistant tutor for Master Thesis in Mathematics by Simone Rubino, advisor Prof. L. De Florian, February 2014.
- Tutor for Mathematics and Physics Undergraduate Students, 2013-2014.
- Assistant tutor for Master Thesis in Mathematics by Lisa Chiang, advisors Dr. F. Giannini and Dr. M. Monti, March 2015.
- Teaching assistant, Elementi di Matematica e Logica, Undergraduate Program in Computer Science, 2015-2016.
- Instructor, Topology-Based Data Analysis and Visualization, Ph.D. Program in Computer Science, 2017-2018.
- Instructor, Geometria e Applicazioni della Teoria dei Grafi, Scuola Superiore IANUA-ISSUGE, 2020.
- Instructor, Analisi Matematica I, Undergraduate Program in Electrical Engineering, 2020-2021, 2021-2022, 2022-2023, and 2023-2024.
- Instructor, Topological Data Analysis, Ph.D. Program in Mathematics, 2020-2021.
- Instructor, Matematica Discreta e Applicazioni, Master Program in Mathematics, 2021-2022, 2022-2023.
- Advisor for Bachelor Thesis in Mathematics by Francesca Bertoglio, co-advised with Prof. A. Perego, November 2022.
- Advisor for Bachelor Thesis in Mathematics by Andrea Di Via, co-advised with Prof. M. Penegini, July 2023.
- Advisor for Master Thesis in Mathematics by Isabella Mastroianni, October 2024 (expected).

At Kaiserslautern University of Technology

- Guest lecturer, Computational Geometry, Master Program in Applied Computer Science, 2016-2017.
- Guest lecturer, Visual Analytics, Master Program in Applied Computer Science, 2016-2017.
- Co-advisor for Master Thesis in Computer Science by Jan Stärz, co-advised with Prof. H. Leitte, September 2017.

At Graz University of Technology

- Co-advisor of the Internship of Hugo Manet, April-August 2018.
- Instructor, Knots and 3-Manifolds, Master Program in Mathematics, 2018-2019.

At Polytechnic University of Torino

- Instructor, Computational Linear Algebra for Large Scale Problems, Master Program in Data Science and Engineering and in Mathematical Engineering, 2019-2020.
- Instructor, Top Data Analysis, Ph.D. Program in Pure and Applied Mathematics (joint with University of Torino), 2019-2020.

At University of Torino

- Instructor, Top Data Analysis, Ph.D. Program in Pure and Applied Mathematics (joint with Polytechnic University of Torino), 2019-2020.
- Co-advisor for Master Thesis in Mathematics by Gianluca Zanetti, co-advised with Prof. G. Ruffo and Dr. S. Scaramuccia, April 2022.

May 24, 2024