Carlos **Ronchi**

Mathematician

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Education

École Polytechnique Fédérale de Lausanne - EPFL — *Lausanne, VD, Switzerland*

PhD in Molecular Life Sciences — *Sep. 2020 - current*

- Supervisor: Cathrin Brisken
- Fellow of Marie Curie actions (MSCA) - Horizon 2020

University of São Paulo - USP — *São Carlos, SP, Brazil*

M.Sc. in Mathematics — *Aug. 2017 - Nov. 2019*

- Supervisor: Marcio Gameiro
- GPA: 3.83/4.00

Rutgers University — *Piscataway, New Jersey, USA*

Visiting Research Student — *Jan. 2019 - Jun. 2019*

- FAPESP Scholarship.
- Supervisor: Konstantin Mischaikow.

Federal University of Paraná - UFPR — *Curitiba, PR, Brazil*

B.S. in Mathematics — *Apr. 2013 - Jul. 2017*

- Got a scholarship to spend one and a half year in Germany. First six months spent in a german language course. The other one year was spent at RFW-Universität Bonn, Bonn, Germany (Apr. 2015 - Feb. 2016) taking classes.
- GPA: 93.93/100.00

Research Experience

Research assistant at Brisken's lab at School of Life Sciences - EPFL — *Lausanne, Switzerland*

funded by École polytechnique fédérale de Lausanne (EPFL) — *Jan. 2020 - August 2020*

- Studying statistical methods and how they are applied to breast cancer samples. One of the methods is Two-Tier Mapper, a topological tool to study the shape of the data. Developing web-based tools for Two-Tier Mapper.

Master's student — *São Carlos, Brazil*

funded by Fundação de Amparo à Pesquisa do Estado de São Paulo — *Aug. 2017 - Nov. 2020*

- Applied persistent homology to understand the protein structure and predict its stability;
- Combined machine learning and persistent homology to improve the accuracy in image classification problems.

Undergradute researcher — *Curitiba, Brazil*

funded by Programa de Atração de Jovens Talentos (CSF-PAJT) — *Jul. 2016 - Jul. 2017*

- Studied foundations of analysis and multilinear algebra;
- Studied numerical analysis methods for matrix decomposition;
- Studied and implemented both stochastic and conjugate gradient method, SVM, neural networks and logistic regression;
- Applied Convolutional Neural Networks to predict LaTeX characters.

Teaching and Outreach

EPFL — *Lausanne, Switzerland*

PhD Student/Teaching Assistant — *Sep. 2020 - current*

- Started and organize bi-weekly seminars with experts on cancer prevention. The main audience is a group of european researchers and PhD students working under the same Marie Curie grant, a highly prestigious grant awarded by EU.
- Started and organized a monthly bioinformatics journal club for newly started PhD students from the network above.
- Helped students with exercises and concepts in Numerical Analysis, a course with over 150 students.

PET - Educational Project — *Curitiba, Brazil*

Core Member, funded by national government — *Aug. 2013 - Jul. 2014, Mar. - Jun. 2016*

- Developed teaching resources to teach high leve mathematics to 100 high school students during one week. The topics were:
  - Number Theory and Criptograhy;
  - Euclidean and Non-Euclidean geometries.
- Organized an one week long academic session for math students, with courses and invited lectures.

Teaching Assistant - Analytic Geometry — *Curitiba, Brazil*

Federal University of Paraná — *Mar. 2016 - Jun. 2016*

- Organized weekly meetings with students to help them and solve problems in Analytic Geometry.

Skills

Programming Languages Julia, Python, LaTeX, R, MATLAB
Portuguese (Native), English (excellent command), German (very good command), French (basic communication)

Projects

ttmap

https://ttmap.epfl.ch

- Website with a user friendly interface to use Two-Tier Mapper, a topological tool to analyse RNA-Seq data. The source code can be found here: `https://github.com/chronchi/ttmap-app`
- Developed a R package with a more user-friendly interface. (to be released)

ProteinPersistent.jl

https://github.com/chronchi/ProteinPersistent.jl

- Package that provides an interface for some functions of BioPython. It also calculates the persistent homology of a protein using the python package ripser.

HSP.jl

https://github.com/chronchi/HSP.jl

- Julia implementation of a package to calculate the optimal Hansen Solubility Parameters.

MapperMDS.jl

https://github.com/chronchi/MapperMDS.jl

- Mapper is an algorithm from topological data analysis that helps visualize high dimensional data. This is an implementation in Julia that particularly accepts a distance matrix as input.

PersistenceImage.jl

https://github.com/chronchi/PersistenceImage.jl

- Persistence image is a vectorization method for persistence diagrams. This is an implementation of the algorithm in Julia.

perscode

https://github.com/chronchi/perscode

- Perscode is a vectorization method for persistence diagrams. This is an implementation of the algorithm in python.

3dPD

https://github.com/chronchi/3dPD

- Visualization tool for optimal cycles (w.r.t. number of edges) and persistence diagrams of three-dimensional datasets.

Honors & Awards

2010	**Bronze medal**, National Astronomy Olympiad	*Curitiba, Brazil*
2011	**Bronze medal**, National Astronomy Olympiad	*Curitiba, Brazil*
2018	**Best Poster Presentation**, 8th Workshop of Thesis and Dissertations at ICMC - USP	*São Carlos, Brazil*

Events

Sep. 2021	**Basel Computational Biology Conference - BC2**, Estrogen signature and gene coexpression network for breast cancer stratification and survival analysis	*Basel, Switzerland*
Oct. 2019	**XII Regional Topology Meeting**, A topological approach to protein stability	*Águas de Lindóia, Brazil*
May 2019	**Geometric Data Analysis**, Persistent homology and the protein folding problem	*Chicago, USA*
Apr. 2019	**Data Driven Dynamics: Algebraic Topology, Combinatorics and Analysis**, Persistent homology and the protein folding problem	*Montreal, Canada*
Aug. 2018	**8th Workshop of Thesis and Dissertations of ICMC**, Optimal cycles and applications in machine learning	*São Carlos, Brazil*
Aug. 2018	**XXI Brazilian Topology Meeting**, Optimal cycles and applications in machine learning	*Niteroi, Brazil*
Aug. 2018	**TRIPODS Summer Bootcamp: Topology and machine learning**, Optimal cycles and applications in machine learning	*Providence, USA*
Nov. 2016	**Jornada de Matemática, Matemática Aplicada e Educação Matemática**	*Curitiba, Brazil*
Oct. 2015	**Automatic sequences, Number Theory, Aperiodic Order**	*Delft, The Netherlands*
Oct. 2015	**Panorama of Mathematics**	*Bonn, Germany*