Carlos **Ronchi**

Mathematician · Computational biologist

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Summary

Mathematician doing a PhD in molecular life sciences at EPFL in Switzerland. Developed machine learning algorithms for biomarker discovery with transcriptomics data in breast cancer. Experienced in transcriptomic analysis, including bulk RNA-seq, microarray and single-cell RNA-seq. Generated reports and pipelines using reproducible standards, such as quarto markdown and docker. Learned and implemented biostatistical pipelines to analyse growth measurements data. Love to communicate and perform interdisciplinary work.

Worked with deep learning and artificial intelligence in problems related to protein stability and computer vision. Besides the mentioned interests, huge fan of sports, specially table tennis and soccer. Always thinking what is the best approach to solve a problem.

Education

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

PhD in Molecular Life Sciences — *Sep. 2020 - expected August 2024*

- 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.Sc. 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

PhD student at EPFL
Lausanne, Switzerland

funded by MSCA - Horizon 2020 — *Sep. 2020 - Current*

- Developed algorithms using bulk RNA-seq and microarray to better understand breast cancer and improve diagnosis.
- Developed several R packages for biostatistics and bioinformatic analysis in the lab.
- Used Bayesian Inference in novel ways to extract insights from data generated in the lab and elsewhere.
- Analysed multiple transcriptomics dataset, including Bulk RNA-seq, scRNA-seq, microarray, CHiP-seq.
- Developed several analysis pipelines for transcriptomics data that is shared in the group and used by non-bioinformaticians as well.
- Experienced in communicating with biologists through talks and also by writing reproducible reports using quarto.

Research intern at AstraZeneca
Cambridge, UK

funded by MSCA - Horizon 2020 — *Nov. 2022 - Nov. 2022*

- Academic placement to learn and understand the research process in pharmaceutical companies. Presented my research for over 70 people at both the bioscience and bioinformatics department.

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 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/Research outreach and supervision *Sep. 2020 - Now*

- Proposed and supervised a lab immersion project for a master's student. The student worked weekly on the lab in a project involving the tool TTMap.
- Participated in more than 5 conferences, going from biostatistics and bioinformatics to public outreach.

EPFL *Lausanne, Switzerland*

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

- Teaching assistant of genomics and bioinformatics for over 100 students in 2022 and 2023. Organized exercise sessions and students projects for the final assignments. Supervised more 10 students in the final project where they had to reproduce figures from several papers.
- 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 of analytic geometry for over 20 students in a semester

Skills

Programming and HPC R, python, Julia, LaTeX, bash, SQL, docker, Slurm

Languages Portuguese (Native), English (excellent command), German (good command), French (good command)

Papers

2023

- Ronchi, C., & Haider, S., & Brisken C. **EMBER creates a unified space for independent breast cancer transcriptomic datasets enabling precision oncology** *In review.*
- Ronchi, C., & Ambrosini G. & Brisken C. **biogrowleR: Extracting insights from growth measurement data**. *In preparation.*
- Ronchi, C., & Brisken, C. (2023). **Targeting the Progesterone Receptor in Breast Cancer: Mind the Short Form!** In Clinical Cancer Research (pp. OF1–OF2). American Association for Cancer Research (AACR). https://doi.org/10.1158/1078-0432.ccr-22-3374

Projects

ember

https://chronchi.github.io/ember/

- An R package that implements the method described in the accompanying paper (In review).
- Integration of bulk RNA-seq and microarray datasets for individual samples. Suitable for biomarker discovery and cross dataset comparison.

biogrowleR

https://upbri.gitlab.io/biogrowleR/

- An R package that provides tutorials and auxiliary functions on how to analyse growth measurement data.
- Package was taught in workshops and has been used by other life scientist.

ttmap

https://gitlab.com/upbri/ttmap

- R package implementing Two-Tier Mapper, a topological tool to analyse RNA-Seq data.
- Developed a R package with a more user-friendly interface and API.
- Supervised a master's student that added tests and a shiny app interface to the package.

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.

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 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.

3dPD

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

- Visualization tool for optimal cycles (w.r.t. number of edges) and persistence diagrams of three-dimensional datasets. Developed as part of my master thesis.

HSP.jl

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

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

Events

Feb. 2024	**Perspectives on cancer prevention**, Talk: EMBER creates a unified space for independent breast cancer transcriptomic datasets enabling precision oncology	*Lausanne, Switzerland*
Jun. 2023	**International workshop on cancer prevention**, Transcriptomic based molecular landscape provides a framework for precision medicine in breast cancer	*Ghent, Belgium*
Jul. 2023	**Science and policy summer schoool**, Organized by EPFL and ETH PhD students	*Beatenberg, Switzerland*
Feb. 2023	**World Cancer Day**, Could algorithms and computers help us with cancer prevention?	*Lausanne, Switzerland*
Nov. 2022	**Talks at AstraZeneca**, Understanding hormone signaling and its risks on estrogen receptor-positive breast cancer	*Cambridge, UK*
Oct. 2022	**II Congreso Internacional de Topología y Afines**, TDA in action: using two-tier mapper to understand breast cancer	*Lima, Peru*
Aug. 2022	**43rd Annual Conference of the International Society for Clinical Biostatistics**	*Newcastle, UK*
Jun. 2022	**Open Science Summer School**, @EPFL, organized by EPFL and ETH PhD students	*Lausanne, Switzerland*
Jun. 2022	**International workshop on cancer prevention**, Understanding hormone signaling and its risk on estrogen receptor-positive breast cancer	*Pollone, Italy*
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*

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*