Raphaël Tinarrage

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Largo do Machado, Rio de Janeiro, Brazil

Academic Positions

Since 2021   **Post-doc**, FGV EMAp, Rio de Janeiro
Theory and applications of Topological Data Analysis

Education

2017-2020   **Graduate degree (PhD)**, Inria Saclay and Laboratoire de Mathématiques d'Orsay, France
Thesis: Topological inference from measures and vector bundles
Advisors: Frédéric Chazal and Marc Glisse
Manuscript: `https://raphaeltinarrage.github.io/files/Tinarrage_Dissertation.pdf`
Reports: `https://raphaeltinarrage.github.io/files/Reports_Dissertation.pdf`

2016–2017   **Graduate degree (MSc)**, École Normale Supérieure Paris-Saclay, France
M2R mathematics for life sciences

2015–2016   **Graduate degree (MSc)**, École Normale Supérieure Paris-Saclay, France
M2 Preparation to the Agregation degree. Accepted, national rank 68th

2014–2015   **Graduate degree (MSc)**, Paris-Saclay University, Orsay, France
M1 Fundamental and applied mathematics, Magistère de mathématiques 2nd year

2013–2014   **Undergraduate degree**, Paris-Saclay University, Orsay, France
L3 Fundamental and applied mathematics, Magistère de mathématiques 1st year

Research

Google Scholar: `https://scholar.google.com/citations?user=bkIa2aYAAAAJ&hl=en`

01/2024   **Train-Free Segmentation in MRI with Cubical Persistent Homology**, with Anton François
Preprint. arXiv: `https://arxiv.org/abs/2401.01160`

06/2023   **LieDetect: Detection of representation orbits of compact Lie groups from point clouds**, with Henrique Ennes
Preprint. arXiv: `https://arxiv.org/abs/2309.03086`

04/2023   **TDANetVis: Suggesting temporal resolutions for graph visualization using zigzag PH**, with Jorge Poco, Agma J. M. Traina, Jean Roberto Ponciano and Cláudio Linhares
Preprint. arXiv: `https://arxiv.org/abs/2304.03828`

04/2023   **Recovering the homology of immersed manifolds**
Published in Discrete and Computational Geometry (`https://link.springer.com/article/10.1007/s00454-022-00409-5`)

09/2022   **O impacto da Súmula Vinculante 26 na diminuição de demanda similar no STF: uma análise quantitativa por modelos de ML**, with Beatriz S. Chagas and Carla M. Damian
Conference article at XI Encontro Internacional do CONPEDI (`http://site.conpedi.org.br/publicacoes/129by0v5/gg2as8tl/0d71WWx2sWUgr61q.pdf`)

09/2022   **Progressão de regime em crimes hediondos no Supremo Tribunal Federal: uma análise empírica pela Súmula Vinculante 26**, with Ana Clara M. Jaccoud and Pedro B. de Oliveira
Conference article at XI Encontro Internacional do CONPEDI (`http://site.conpedi.org.br/publicacoes/129by0v5/502849so/6o53sVpwaxV5352U.pdf`)

09/2022   **Simplicial approximation to CW complexes in practice**
Preprint. arXiv: `https://arxiv.org/abs/2112.07573`

03/2022   **Computing persistent Stiefel-Whitney classes of line bundles**
Published in Journal of Applied and Computational Topology (`https://link.springer.com/article/10.1007/s41468-021-00080-4`)

06/2020 **DTM-based filtrations**, with Hirokazu Anai, Frédéric Chazal, Marc Glisse, Yuichi Ike, Hiroya Inakoshi and Yuhei Umeda
Published in Symposium Abel proceedings (`https://link.springer.com/chapter/10.1007/978-3-030-43408-3_2`) and SoCG conference 2019 (`https://drops.dagstuhl.de/opus/volltexte/2019/10462/`)

My work has led to the creation of the package *velour*, written in Python, which is available on
GitHub: `https://github.com/raphaeltinarrage/velour`
PyPI: `https://pypi.org/project/velour/`

Ongoing projects

Since 2022 **Bayesian inference on phylogenetic trees**, with Rodrigo Alves and Luiz Max F. de Carvalho
Study of the geometry of the space of metric trees, in order to define Markov chains for Bayesian inference

Since 2021 **Empirical analysis of biding precedent efficiency in the Brazilian Supreme Court via similar case matching**, with Henrique Hennes, Jorge Poco, Jean Roberto Ponciano and Lucas Resck
A comparison of NLP models in the context of Brazilian High Court's Common Law's measures, and an empirical legal study of their efficiency

Since 2021 **Evolução dos processos legais relativos à progressão do regime por crimes hediondos**, with Henrique Hennes, Jorge Poco, Jean Roberto Ponciano, Lucas Resck, Beatriz Sabdin Chagas, Carla Marcondes Damian, Ana Clara Macedo Jaccoud and Pedro Burlini de Oliveira
Completed project, currently being written.
A legal study of the modalities of prison regime progression for shameful crime convicts in Brazil, through a analysis Brazilian Supreme Court's Binding Precedent 26

Posters

06/2022 **Algebraic Topology: Methods, Computation and Science**, University of Oxford
Simplicial approximation to CW-complexes in practice
Poster: `https://raphaeltinarrage.github.io/files/Poster_ATMCS_2022.pdf`

06/2018 **Algebraic Topology: Methods, Computation and Science**, IST Austria
DTM-filtrations
Poster: `https://raphaeltinarrage.github.io/files/Poster_ATMCS.pdf`

Advisorship

Since 2021 **Data Analysis of Symmetries**, FGV EMAp, Rio de Janeiro
MSc student: Henrique Hennes
Adaptation of tools from Lie geometry to Data Analysis

Since 2021 **Machine Learning and Súmulas Vinculantes**, FGV EMAp, Rio de Janeiro
Undergraduate students: Beatriz S. Chagas, Ana C. M. Jaccoud, Carla M. Damian and Pedro B. de Oliveira
Development of Data Analysis techniques for Brazilian legal documents.

Teaching

2023 **General and Combinatorial Topology**, FGV EMAp, Rio de Janeiro
Summer course for undergraduate and master's students
Course website: `https://raphaeltinarrage.github.io/EMApTopology.html`
Notes: `https://raphaeltinarrage.github.io/files/EMApTopology/SummerCourseTopology.pdf`

2021 **Topological Data Analysis with Persistent Homology**, FGV EMAp, Rio de Janeiro
Summer course for undergraduate and master's students
Course website: `https://raphaeltinarrage.github.io/EMAp.html`
Course notes: `https://raphaeltinarrage.github.io/files/EMAp/SummerCourseTDA.pdf`
Videos: `https://www.youtube.com/playlist?list=PL_FkltNTtklB221BEq6zwb_FX5bIr7dvx`

2017-2020 **Statistical interpretation of data**, *UE M331, L3 MINT*, Université Paris-Saclay, Orsay
Assistant professor, for undergraduate students

2017-2020 **Modelisation project**, *UE M326, L3 MINT*, Université Paris-Saclay, Orsay
Assistant professor, for undergraduate students

2017-2019 **Ordinary differential equations**, *UE M257, L2 BC*, Université Paris-Saclay, Orsay
Assistant professor, for undergraduate students
Notes: `https://raphaeltinarrage.github.io/M257.html`

2017-2020 **Organization of atelier MATh.en.JEANS**, Collège Alain Fournier, Orsay
Popularization of mathematics in middle school
Notes: `https://raphaeltinarrage.github.io/MEJ.html`

Talks

10/2023 **International School on Dynamical Systems & Applications**, Online
An introduction to Topological Data Analysis IV: Python tutorial
Notebook: `https://raphaeltinarrage.github.io/files/Tutorial_DSA.zip`
Video: `https://www.youtube.com/watch?v=xXGaz6AvAKY`

10/2023 **International School on Dynamical Systems & Applications**, Online
An introduction to Topological Data Analysis III: Persistent Homology
Slides: `https://raphaeltinarrage.github.io/files/Slides_DSA_III.pdf`
Video: `https://www.youtube.com/watch?v=ONJooSU3w1k`

09/2023 **International School on Dynamical Systems & Applications**, Online
An introduction to Topological Data Analysis II: Homological inference
Slides: `https://raphaeltinarrage.github.io/files/Slides_DSA_II.pdf`
Video: `https://www.youtube.com/watch?v=Ts_xbpzoX3s`

09/2023 **International School on Dynamical Systems & Applications**, Online
An introduction to Topological Data Analysis I: Topological invariants
Slides: `https://raphaeltinarrage.github.io/files/Slides_DSA_I.pdf`
Video: `https://www.youtube.com/watch?v=Tr2xbhTyRLY`

01/2023 **Summer School on Data Science**, FGV EMAp
TDA Minicourse III: Persistent Homology
Slides: `https://raphaeltinarrage.github.io/files/Slides_SSDS_III.pdf`
Video: `https://www.youtube.com/watch?v=fjvXZFGhgrg`

01/2023 **Summer School on Data Science**, FGV EMAp
TDA Minicourse II: Homological inference
Slides: `https://raphaeltinarrage.github.io/files/Slides_SSDS_II.pdf`
Video: `https://www.youtube.com/watch?v=OEC7zzQpCNk`

01/2023 **Summer School on Data Science**, FGV EMAp
TDA Minicourse I: From Topology to Data Analysis
Slides: `https://raphaeltinarrage.github.io/files/Slides_SSDS_I.pdf`
Video: `https://www.youtube.com/watch?v=bvDzJF9j8Cc`

01/2023 **Workshop On Legal Digital Intelligence**, FGV EMAp
TDA and Súmulas Vinculantes
Slides: `https://raphaeltinarrage.github.io/files/Slides_LDA2023.pdf`

11/2022 **ICMC Seminário**, USP, São Carlos
Análise Topológica de Dados e suas aplicações
Slides: `https://raphaeltinarrage.github.io/files/Slides_ICMCII2022.pdf`
Video: `https://www.youtube.com/watch?v=qsHPO2WrRzY`

11/2022 **ICMC Seminário**, USP, São Carlos
TDA para escolha de resolução temporal na visualização de grafos
Slides: `https://raphaeltinarrage.github.io/files/Slides_ICMCI2022.pdf`

09/2022 **XI Encontro Internacional do CONPEDI**, Santiago, Chile
O impacto da Súmula Vinculante 26 na diminuição de demanda similar no STF

09/2022 **XI Encontro Internacional do CONPEDI**, Santiago, Chile
Progressão de regime em crimes hediondos no Supremo Tribunal Federal

04/2021 **SoCG - Minisymposium on Computational Topology**, online
Simplicial approximation to CW-complexes in practice
Slides: `https://raphaeltinarrage.github.io/files/Slides_SoCG2021.pdf`
Video: `https://www.youtube.com/watch?v=PaKkzcMZC70`

04/2021 **EMAp Seminário**, FGV EMAp, online
Topological inference in Topological Data Analysis II: Persistence barcodes
Slides: `https://raphaeltinarrage.github.io/files/Slides_EMApII2021.pdf`
Video: `https://www.youtube.com/watch?v=HfkuIqxhjGY`

04/2021 **EMAp Seminário**, FGV EMAp, online
Topological inference in Topological Data Analysis I: Topology in datasets
Slides: `https://raphaeltinarrage.github.io/files/Slides_EMApI2021.pdf`
Video: `https://www.youtube.com/watch?v=fqeazsBn3RE`

12/2020 **Modelling, Analysis and Scientific Computing**, UMPA Lyon, online
Introduction to Persistent Homology
Slides: `https://raphaeltinarrage.github.io/files/Slides_UMPA2020.pdf`

12/2020 **Applied Algebraic Topology Network**, online
Persistent Stiefel-Whitney classes
Slides: `https://raphaeltinarrage.github.io/files/Slides_AATRN2020.pdf`
Video: `https://www.youtube.com/watch?v=xnQdGRvWenw`

11/2020 **Applied Topology Seminar**, EPFL Lausanne, online
Persistent Stiefel-Whitney classes
Slides: `https://raphaeltinarrage.github.io/files/Slides_EPFL2020.pdf`
Video: `https://www.youtube.com/watch?v=-AGpfIo8RsA`

10/2020 **Thesis defense**, Laboratoire de Mathématiques d'Orsay
Topological inference from measures and vector bundles
Slides: `https://raphaeltinarrage.github.io/files/Slides_Dissertation.pdf`
Video: `https://youtu.be/kHGv8BfeHho`

06/2020 **Symposium on Computational Geometry**, Young Researchers Forum, online
Recovering the homology of immersed manifolds
Slides: `https://raphaeltinarrage.github.io/files/Slides_SoCG2020.pdf`
Video: `https://www.youtube.com/watch?v=mXRjvwJJ8m8`

05/2020 **Séminaire des doctorants**, Laboratoire de Mathématiques d'Orsay, online
Introduction to Persistent Homology
Slides: `https://raphaeltinarrage.github.io/files/Slides_seminaire_informel.pdf`
Video: `https://www.youtube.com/watch?v=uDba3kV3Sf0`

03/2020 **Datashape Seminar**, Inria Saclay
Introduction to characteristic classes
Notes: `https://raphaeltinarrage.github.io/files/Notes_Datashape2020.pdf`

10/2019 **Datashape Seminar**, Inria Saclay, Orsay
Recovering the homology of immersed manifolds
Slides: `https://raphaeltinarrage.github.io/files/Slides_Datashape2019.pdf`

04/2019 **Symposium on Computational Geometry**, Portland, Oregon
DTM-based filtrations
Slides: `https://raphaeltinarrage.github.io/files/Slides_SoCG2019.pdf`

04/2019 **Séminaire de l'équipe Topologie-Dynamique**, Laboratoire de Mathématiques d'Orsay
DTM-filtrations

02/2019 **Séminaire des doctorants**, LAMFA Amiens, France
Introduction to Persistent Homology

12/2018 **Séminaire des doctorants**, IMJ-PRG Jussieu, France
Introduction to Persistent Homology

12/2018 **Séminaire des doctorants**, Laboratoire de Mathématiques d'Orsay
Introduction to Persistent Homology

11/2018 **Datashape Seminar**, Inria Saclay
DTM-filtrations

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