Curriculum Vitae

Guilherme Vituri

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EDUCATION

Doctor of Philosophy – Topological Data Analysis
Universidade Estadual Paulista (Unesp) / Ohio State University (OSU) 2016 — 2020

- I spent six months at the Ohio State University under Facundo Mémoli supervision.
- We generalized the Vietoris-Rips and Cech constructions using "motifs": families of graphs that can be attached to metric spaces (more generally, networks) and generate simplicial complexes. As a corollary, we obtain several clustering methods on graphs.
- The resulting work is "Motivic constructions on graphs and networks with stability results" and can be found here.

Master Degree – Algebraic Topology
Universidade Estadual Paulista (Unesp) 2014 — 2015

- I studied a certain subgroup of the fundamental group, called "Gottlieb group", and proved some results about its properties. The dissertation can be found here.

Bachelor in Mathematics
Universidade Estadual Paulista (Unesp) 2010 — 2013

WORK EXPERIENCE

Head of Intelligence

Argus Solutions Jan 2020 – Present

I founded the area of Data at Argus, and my role was crucial as the company went from a small-sized tech to a multinational. My team now has more than 12 people as diverse as developers, data scientists, engineers and mathematicians. I act as a

manager, code reviewer, project manager, machine learning engineer, DevOps, R/Julia developer and database administrator. I can do a bit of everything.

- We went from hundreds of Excel files to a MariaDB database on AWS. I designed the database, its indexes and applied some normal forms.
- I wrote dozens of R/Julia scripts to read and write data from several sources and created a pipeline of information that ran smoothly
- I automated the generation and mailing of thousands of daily/weekly reports using RMarkdown and Sendgrid, which previously was done by 3 people.
- I created several analytics dashboards using the `shiny` framework, in place of a former Tableau dashboard. I also developed the main platform used by the team to analyze photos/videos.
- We created a machine learning model that predicts if a driver is going to sleep in the next hour, using an ensemble of models with `tidymodels`.
- I created a webserver in Julia using Oxygen.jl to read data from several APIs and write they in our databases. A previous version of this code was written in R and each iteration took almost 4 minutes; it was reduced to 5 seconds in Julia using some paralellism magic.
- I participated in the creation of many computer vision algorithms to detect cellphones, drowsiness, potholes and gestures using `keras` and YOLO.
- I interviewed and hired people, managed the team and developed the abilities we needed to finish our projects.

TOOLS AND SKILLS

R

- `tidyverse`: I use several of these packages everyday; I am "fluent" in `dplyr`, `purrr`, `tidyr`, `stringr`, `tibble` and many others. I prefer to use `echarts4r` instead of `ggplot2`. With `dbplyr`, I can translate many complicated transformations to SQL in a painless way.
- `shiny`: I explored a lot of the `shiny` ecosystem since 2018: from `shinydashboard` to the new `bslib`, using `shinyWidgets` and `toastui`. I can create dashboards, CRUDS, user interfaces, display photos/videos and maps. Async and parallelism are a bit painful but can be done with `future` and `promises`.

- I am also very familiar with `igraph` to manipulate graphs, `leaflet` to plot maps, `httr2` to make gets and posts, `plumber` to create APIs, `reticulate` to interface Python.

- I can create packages, documentation and tests. Unfortunately, my best packages are private but a public example can be found here.

Julia

Coding in Julia is a joy and make R/Python look like unpolished old languages used by barbarians.

- I started learning Julia to write some Topological Data Analysis algorithms and the result was impressive, even with my initial poor skills.

- I am the owner of the JuliaTDA organization which aims to bring the Topological Data Analysis ecosystem to Julia. I wrote the Mapper and Ball Mapper algorithms in Julia and the documentation in Quarto, and later also wrote the ToMATo algorithm.

- Building JuliaTDA, I was able to get familiar with parallelism, code piracy, structs, multiple dispatch, profiling (memory allocations and algorithm efficiency) and plotting tools like Plots and Makie.

- The book "Hands-On Design Patterns and Best Practices with Julia" is my bible, and I am rewriting all my previous code using what I learned there.

- Since I like the tidyverse so much, I am now part of the TidierOrg: a 100% Julia organization inspired by R data tools. I am the main contributor to TidierIteration.jl, a Julia version of R's `purrr`.

- Since I like Quarto so much, I created a package that helps writing Julia documentation with it: QuartoDocBuilder. Its own documentation is written in Quarto!

AWS

- I can create and manage EC2 instances, use S3 to storage and query data, create databases in RDS and create dashboards with metrics.

- I created a facial recognition system of unlabeled drivers using S3 and Rekognition.

- Recently I moved several R/Julia/Python scripts from EC2 to ECS services, providing a reproducible and isolated environment for each code. While doing this, I learned how to create images with Docker, building them with EC2 Image Builder and storing it all in ECR.

Python

- I can read code and port it to another language when necessary; I never had the need to write pure-Python code, but can learn it easily if needed. Using R's `reticulate` and Julia's `PythonCall.jl`, I was able to use many Python packages elsewhere.

Publishing

- I used a lot of `RMarkdown` to generate a wide range of dashboards, reports and analysis. Now I prefer to use Quarto because of its many cool features (sites, blogs and dashboards) and easiness to use with Julia.

- I am writing a book called Topological Data Analysis with Julia while I implement several TDA algorithms in JuliaTDA.

PRESENTATIONS AND WORKSHOPS

- Talk: Topology meets the real world: how geometry can help us analyse finite metric spaces (2023, at the Workshop of Algebraic Topology and Applications).

- Workshop: Topological Data Analysis workshop (2024, at the XXIII Brazilian Topology Meeting).