

RUAN FELIPE DA SILVA E SOUSA

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EDUCATION

Federal University of Rio de Janeiro (UFRJ)

Institute of Mathematics

B.Sc. in Applied Mathematics

Concentration: Scientific Computing

March 2019 – March 2024

Federal University of Rio de Janeiro (UFRJ)

Systems and Computing Engineering Program – PESC March 2024 – Present (defense expected December 2026)

M.Sc. in Systems and Computing Engineering

Thesis: *Trajectory of Modern Generative Models: From Normalizing Flows to Flow Matching*, viewed through the unifying lens of Optimal Transport.

Advisor: Prof. Adriano Maurício de Almeida Cortês, D.Sc.

Fundação Getulio Vargas (FGV)

School of Applied Mathematics – EMap

Ph.D. in Applied Mathematics

Research on stochastic optimization for power systems: coupling between the official NEWAVE and DECOMP models used by the Brazilian system operator (ONS), and SDDP/EDDP variants addressing dimensionality and cut selection.

Advisor: Prof. Bernardo Freitas Paulo da Costa

August 2025 – Present (defense expected December 2028)

EXPERIENCE

Pluma Finance

Founding Engineer

February 2026 – April 2026

- Personal-finance fintech (budgets, accounts, bank sync, insights); as one of the first engineers, built a large part of the product (full-stack).
- Designed and implemented an autonomous platform of AI agents for end-to-end software development cycle automation (from ticket to merged PR), composed of specialized agents (*implementer*, *reviewer*, *fixer*, *custodian*) cooperating across iterative rounds.
- Multi-model cross-review (Claude + Gemini) to reduce single-model blind spots. Guardrails: containerized validation with memory caps, least-privilege permission policies, automatic escalation.
- Dynamic context construction, RAG, and type-aware AST mapping (ts-morph) to guide agents across a large-scale codebase.
- Transaction pipeline for a personal-finance fintech: webhook handling (Pluggy), deduplication, multi-provider data normalization, recurring-transaction detection, credit card engine modeling.
- PostgreSQL query and index optimization, sync pipelines with circuit breaker, performance work on hot query paths.
- Cross-functional Product Owner role for part of the tenure: planned, specced, and shipped features end-to-end from user feedback; triaged tickets between support and engineering; curated *Featurebase* (feedback platform & public roadmap).

LabMA UFRJ – Applied Mathematics Laboratory

Consultant

March 2025 – Present

- Lead data-centric projects, defining scope and managing the analysis lifecycle on an Oracle database with over 1 billion records.

- Manage a data science team focused on Python systems for cleaning and processing large data volumes (~3TB).
- Oversee ETL processes: data loading, strategic indexing, and SQL query optimization.
- Develop automated data-quality reports using Python, Pandas, and Borb.
- Contribute to the development of biometric (life) tables, generating insights on population dynamics.
- Academic writing of technical notes; research on mathematical methods for computational statistics.
- **Lab-wide organizational restructuring:** introduced code best-practices culture (versioning, modularity, efficiency); redefined hierarchy and workflow under *agile squads* logic; instituted quality assurance discipline.
- **Multi-engine analytical migration:** led benchmark comparing PostgreSQL, Hydra columnar, ClickHouse, and DuckDB for the biometric-tables pipeline; implemented multi-year ingestion on pgduckdb and the MR3 rig.
- Mentor students and junior researchers.

NACAD UFRJ – High-Performance Computing Center

March 2024 – March 2025

Research Assistant (Scholarship)

- Conducted research in machine learning and AI: developed a diffusion-based super-resolution generative model for physical imagery, used to enhance the output of a reduced-order fluid dynamics model. Published at [CILAMCE 2024](#).
- Refactored and rebuilt the reduced-order model: converted from a Jupyter notebook into a complete Python module with Git versioning, documentation, and safe configuration loading.
- Extended the super-resolution model to general reduced-order fluid-dynamics predictions; published as **lead author** at [IEEE FUSION 2025](#).

Bee Datascience Consulting

February 2024 – November 2024

Software Developer (Contractor)

- Developed and deployed a portfolio-generation system based on non-linear optimization of a target metric for financial-market trading, in Python with Git versioning.
- Integrated the strategy into an automated trading system.
- Additional details under NDA.

Undergraduate Research – LabMA UFRJ

February 2023 – February 2024

Undergraduate Research Fellow

- Research and maintenance of the BR-EMS biometric-table calculation systems used by Brazilian insurance companies, advised by Prof. Milton Ramirez.
- Developed and managed a team building a Python data-cleaning system for insurance-company submissions.
- Built an automated data-quality reporting system in Python using the Borb library.
- Optimized and maintained the Oracle database where data from multiple insurers is processed for biometric-table analysis.

Undergraduate Research – Institute of Mathematics, UFRJ

March 2022 – January 2023

Undergraduate Research Fellow

- Research and implementation of stochastic optimization methods in Julia, in partnership with ONS. Studied models for the Brazilian hydrothermal dispatch problem, advised by Prof. Bernardo Freitas Paulo da Costa.
- Implemented a stochastic optimization model, generated plots and reports, and explored model results in Julia, with Git versioning and documentation discipline.
- Built Docker images of the project for reproducibility.

SELECTED PROJECTS

llm-chunking

End-to-end RAG over a document corpus

github.com/Rfelip/llm-chunking

- RAG pipeline over web content: extracts and *chunks* any URL, builds *embeddings* and indexes them in a vector store (FAISS), with dynamic cosine-similarity retrieval and grounded answer generation.
- Conversational interface via a Telegram bot (custom API, *api/bot* split); fully local and containerized with Docker.

citation-xray

github.com/Rfelip/citation-xray

Academic citation-verification CLI

- Scans *markdown* notes and verifies each citation against arXiv, Crossref (DOI), and OpenAlex (author-year), flagging unmatched references for review — guards against source hallucination.
- Pure Python (*stdlib*, zero dependencies); `--strict` (CI / git-hook), `--offline`, and `--json` modes; own test suite.

sparring

github.com/Rfelip/sparring

Native desktop spaced-repetition app (FSRS)

- *Flashcard* app with FSRS scheduling and KaTeX math; native GTK + WebKit2 shell serving the frontend via an in-process HTTP server, no external server.
- YAML cards compiled by a custom build pipeline; in-app card CRUD over a Python↔JS JSON *bridge*; Tauri packaging (rpm/deb).

db_orchestrator

github.com/Rfelip/db_orchestrator

Unified multi-database SQL execution API

- One API + YAML-manifest workflow to run SQL across Oracle, PostgreSQL, and pgduckdb; reusable Python library handling transactions, retries, execution-plan capture, and notifications (Discord/Telegram).

PUBLICATIONS

R. F. S. Sousa, R. M. Velho, N. L. de Matos, A. M. A. Cortês, G. F. Barros, A. L. G. A. Coutinho. *Data-Driven Diffusion-Based Super-Resolution for Improvement of Reduced-Order Model Predictions in Fluid Dynamics*. 2025 28th International Conference on Information Fusion (FUSION). Lead author. [\[IEEE Xplore / DOI\]](#)

A. Cortês, R. F. da Silva e Sousa, R. M. Velho, G. F. Barros, F. A. Rochinha, A. L. G. A. Coutinho. *Improving accuracy of parametric surrogate model for turbidity currents using diffusion-based super-resolution*. CILAMCE 2024 – XLV Iberian-Latin-American Congress on Computational Methods in Engineering. [\[DOI\]](#)

B. F. P. da Costa, A. O. Calixto, R. F. S. Sousa, R. T. Figueiredo, D. D. J. Penna, L. S. Khenayfis, A. M. R. Oliveira. *Boundary Conditions for Hydrothermal Operation Planning Problems: The Infinite Horizon Approach*. CNMAC 2024 – Brazilian National Congress on Computational and Applied Mathematics. [\[DOI\]](#)

B. F. P. da Costa, A. Calixto, R. T. Figueiredo, D. D. Penna, R. F. da Silva e Sousa, et al. *Periodic-Horizon Stochastic Optimization*. Technical report, 2022.

Research group of the 9th Workshop on Mathematical Solutions for Industrial Problems (CeMEAI – USP). *Energy planning and environmental constraints: impact of multiple water uses on the electric-energy business*. Technical report, 2023. [\[Cambridge MIIR\]](#)

ACADEMIC EVENTS

XLV CILAMCE – Iberian-Latin-American Congress on Computational Methods in Engineering November 2024
Maceió/AL

- Presented the diffusion-based super-resolution work derived from research at NACAD/UFRJ.

XLIII CNMAC – Brazilian National Congress on Computational and Applied Mathematics September 2024
Florianópolis/SC

- Presented work on boundary conditions for the hydrothermal operation-planning problem.

1st Workshop Mathematics in Industry

January 2024

Fundação Getulio Vargas (FGV)

- Participated in the research group on Daily Energy Operation Planning (Brazilian thermal/hydro dispatch).
- Developed a toy model of the problem; implemented alternative models reducing the *beyond-the-horizon* cost in Julia using JuMP.jl.

9th Workshop on Mathematical Solutions for Industrial Problems

February 2023

CeMEAI – USP

- Participated in the research group on *Energy planning and environmental constraints — impact of multiple water uses on the electric-energy business*.
- Implemented a model of the São Francisco River Basin operation in Julia using SDDP.jl, plus water-use constraints.

TECHNICAL SKILLS

Languages	Python (7 yrs), TypeScript (advanced, full-stack), Julia (6 yrs), SQL (advanced – Oracle, PostgreSQL, DuckDB), C (basic)
AI Engineering	Multi-agent pipelines (implementer/reviewer/fixer/custodian), end-to-end RAG (chunking, embeddings, vector stores – FAISS), AST mapping (ts-morph), multi-model cross-review (Claude/Gemini), guardrails, dynamic context construction
Data Science & ML	Modern generative models (Normalizing Flows, Continuous Flows, Score-based / Diffusion, Flow Matching); image processing (incl. OCR); information retrieval / text mining; traditional ML; deep neural networks
Optimization	Linear and integer programming, stochastic optimization (SDDP, EDDP), optimal control, decomposition methods, finance (options, hedging)
Databases	Dimensional modeling, query and index optimization, execution-plan analysis, multi-engine benchmarks (PostgreSQL, Hydra, ClickHouse, DuckDB, Oracle)
Web Development	React, tRPC, Supabase, Zustand, Next.js
Scientific Computing	Parallel programming (CPU/GPU), basic CFD, numerical methods for ODEs/PDEs
Tools	Linux (terminal), Docker, Git/GitHub, LaTeX, MPI, OpenMP, Excel, MS Office, ts-morph, <i>tasknotes</i>
Libraries	PyTorch, JuMP, Pandas, Seaborn, Matplotlib, Plots.jl, Borb, NumPy, SciPy
Soft skills	Team leadership and management; quality-and-clean-code culture; agile methodology; project presentations; problem solving; event organization; initiative
Languages (spoken)	Portuguese (native) English – Fluent (speak, write, read) – Duolingo C1 (140/160)