Matheus Luís Bernardi

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Personal Profile

Mathematician and Software Developer with a passion for understanding how things work and using mathematical insights to tackle both everyday challenges and complex problems. Excited about automating processes to help developers focus on code, creating efficiencies across projects. Continuously learning and expanding knowledge, especially in web development, to build innovative and impactful solutions.

Education

University of Campinas   *Campinas, SP*
Bachelor of Science in Applied Mathematics   *Feb 2016 - Aug 2020*

- **Core Studies:** Rigorous coursework in calculus, linear algebra, probability, and statistics, with a focus on mathematical modeling, numerical analysis, and differential equations.
- **Skills Gained:** Proficiency in mathematical programming (e.g., MATLAB, Python), analytical problem-solving, quantitative reasoning, and critical thinking.

Work Experience

CNPEM   *Campinas, SP*
Senior Technological Development Analyst   *Feb 2019 - Present*

- Scientific Computing Intern (2019): Joined the Scientific Computing group at LNLS, focusing on image processing and reconstruction algorithms. Developed foundational programming skills in Python and CUDA while enhancing mathematical expertise.
- Full-Time Employee (2020): Promoted to a full-time role in the Scientific Computing group. Continued to advance image processing projects and initiated web development efforts, transitioning desktop applications to modern web platforms. Advocated for software development best practices, including continuous integration, code reviews, and thorough documentation.
- Control Software Group Transition (2023): Transitioned to the Control Software group, concentrating on developing state-of-the-art web applications for accelerator control and processing interfaces. Currently focused on implementing modern web technologies and best practices to establish high standards for web applications within the accelerator community.Additionally, I am migrating the current architecture of the infrastructure and deployment processes to a more automated framework, building a CI/CD-focused structure. This transition aims to streamline development, allowing developers to concentrate on coding while enhancing maintenance and facilitating code updates.

Software Projects

Pianno

github.com/cnpem/pianno

- Developed a web-based drawing application to streamline the Pimega detector alignment process, enabling users to visually annotate and adjust detector positions in real-time for enhanced accuracy and efficiency. The application features an intuitive user interface for easy drawing, manipulation, and saving of alignment diagrams. The alignment problem was challenging to solve mathematically across all systems in a generic way, but by allowing a few targeted annotations, the application significantly accelerated the process, making it more easily solvable.
- Technologies Used: React, Next.js, Pixi.js, Node.js, Docker

DeepSirius UI

github.com/cnpem/deepsirius-ui

- Developed a web interface for a deep learning-based workflow management tool designed for segmentation analysis of tomographic image data. This interface allows users to create and manage deep learning pipelines seamlessly, with a focus on user-centric design to ensure accessibility for scientists and researchers.
- Technologies Used: React, Next.js, Auth.js, Prisma, tRPC, Node.js, PostgreSQL, Docker, Python, Flask.

Sophys Web

github.com/cnpem/sophys-web

- A suite of web applications and resources for the Sirius Ophyd and bluesky Utilities (SOphYS) project, designed to provide a control layer abstraction for hardware devices and streamline experiment orchestration.
- Technologies Used: React, Next.js, Auth.js, Turborepo, tRPC, Node.js, Docker, Python, Kafka, ReactQuery, ShadcnUI

Other Notable Projects

Scientific Computing Group - LNLS

- Fourier Shell Correlation: Implemented an imaging resolution assessment algorithm for tomographic images, optimized for GPU processing.
- Fan Beam Backprojection Algorithm: Developed an innovative algorithm for tomographic image reconstruction in fan beam geometries.
- X-ray Phase Contrast: Implemented a Fresnel propagator and applied the Newton method for phase retrieval within the Fresnel regime.
- Annotat3D: migrated an Interactive Segmentation tool written in PyQt to a React based web application.

Skills

Languages	Python, C/C++, CUDA, HTML/CSS, JavaScript, TypeScript, Matlab, SQL
Miscellaneous	Linux, Git, Shell, Docker/Singularity, CI/CD, Kubernetes
Web Frameworks	React, Next.js, Astro, Node.js, Deno, Bun, FastAPI, Flask

Publications

JOURNAL ARTICLES

Alternative fan-beam backprojection and adjoint operators
  Patricio Guerrero, Matheus Bernardi, Eduardo Miqueles
  Journal of Inverse and Ill-posed Problems pp. 921–935. 2023

Annotat3D: A Modern Web Application for Interactive Segmentation of Volumetric Images at Sirius/LNLS
  Allan Pinto, Gabriel Borin, Bruno Carlos, Matheus L. Bernardi, Matheus F. Sarmento, Alan Z. Peixinho, Thiago V. Spina, Eduardo X. Miqueles
  Synchrotron Radiation News pp. 36–43. Taylor & Francis, 2022

RemoteVis: An Efficient Library for Remote Visualization of Large Volumes Using NVIDIA Index
  Thiago Spina, Dawood Alnajjar, Matheus Bernardi, Fernando Furusato, Alexander Kuhn, Eduardo Miqueles, Marc Nienhaus, Alan Peixinho
  JACoW FRBL05. 2022

Languages

Portuguese	Native
English	Advanced
Japanese	N4