

Chrystian Melo

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Experience

Research Software Engineer

2020 – Present

CSR, UFMG

- Developed and optimized core components of **Dinamica EGO**, a high-performance geospatial modeling platform used in environmental and climate research.
- Implemented **scientific algorithms for spatial analysis**, including equal-area grid cell computation based on published GIS methods, improving accuracy of environmental simulations.
- Designed and extended **raster processing systems** in C++ (cropping, resampling, map reconstruction), enabling scalable processing of large geospatial datasets.
- Designed **low-latency interprocess communication (IPC)** using shared memory, improving data exchange efficiency and system throughput.
- Led a **complete refactoring of the debugging module**, redesigning its architecture to improve clarity, stability, and execution performance.
- Resolved complex issues in **spatial data consistency and categorization**, ensuring correctness of simulation outputs.
- Improved **numerical robustness** of geospatial models (e.g., spatial transformations and transition computations).
- Enhanced **UI/UX tools (Java)** for large dataset interaction, improving usability of data editors and visualization workflows.
- Developed **unit tests** and supported continuous refactoring of a large-scale scientific codebase.

Undergraduate Researcher (Technical Internship)

2019

PATREO, UFMG

- Developed Python tools for scientific data visualization and performance monitoring of computing systems.
- Worked with scientific libraries (NumPy, SciPy, Matplotlib) for data analysis and graphical representation.
- Gained early exposure to a research environment, collaborating with undergraduate and graduate researchers in computer science.
- Participated in technical discussions and meetings (including in English), contributing to research-oriented problem solving.

Education

B.Sc. in Computational Mathematics

2020 – 2026

UFMG

- Focus: Algorithms, Numerical Methods, Linear Algebra, Differential Equations, Systems Modeling
- Geo-Environmental Modeling: GIS, Remote Sensing, Spatial Analysis

Technical Degree in Systems Development

2016 – 2019

UFMG

- Focus: Algorithms, Data Structures, Software Development

Skills

Computer Science Fundamentals: Algorithms & Data Structures, Computational Complexity, Numerical Methods, Linear Algebra

Systems & Performance: Memory Management, Concurrency & Parallelism, High-Performance Computing (HPC), Profiling & Optimization, Debugging

Software Engineering: Software Architecture, Modular Design, API Design, Testing (Unit/Integration), Code Refactoring, CI/CD

Mathematical Modeling: Dynamical Systems, Environmental Modeling, Simulation of Spatio-Temporal Systems, Optimization, Scientific Computing

Geospatial & Scientific Computing: GIS Concepts, Raster & Vector Data Processing, Remote Sensing, Spatial Analysis, Computational Geometry

Experience with environmental simulation systems (e.g., Dinamica EGO) for large-scale modeling :contentReference[oaicite:0]index=0

Languages: Portuguese (Native), English (Fluent), Spanish (Intermediate)

Projects

RemoteSensingPCA

github.com/ChrystianMelo/RemoteSensingPCA

- Implemented PCA for geospatial data using custom linear algebra routines.
- Applied eigen decomposition for dimensionality reduction.

SearchEnginePrototype

github.com/ChrystianMelo/SearchEnginePrototype

- Built a search engine with indexing, ranking, and query processing.
- Designed efficient data structures for scalable information retrieval.

OrthogonalGeoQuery

github.com/ChrystianMelo/OrthogonalGeoQuery

- Implemented orthogonal range queries using geometric data structures.
- Focused on efficient spatial querying algorithms.

BlindHelper

github.com/ChrystianMelo/BlindHelper

- Developed assistive system integrating mobile app and embedded hardware.
- Implemented real-time Bluetooth communication.

Additional projects: github.com/ChrystianMelo