# RODRIGO GOMES DE ARAÚJO

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## EDUCATION

**Master's in Computer Science**                                            *Sep 2025 – Present (Expected 2027)*
Faculdade de Ciências da Universidade do Porto (FCUP)
*Focus: Distributed Systems and Reliable Computing*

**Bachelor's in Computer Science and Engineering**                                   *Sep 2022 – Jul 2025*
Faculdade de Engenharia da Universidade do Porto (FEUP)

## PROJECTS

**Black Hole Light Simulation** — Rust — Raylib — Computational Physics                      *2025*

- Independently developed a **real-time 2D simulation** of **gravitational lensing** around a Schwarzschild black hole, combining **computational physics** with graphics programming.
- Implemented **null geodesic integration** using **4th-order Runge–Kutta method**, ensuring numerical stability and physical accuracy while maintaining 60 FPS rendering performance.
- Validated simulation against **theoretical predictions** through reference orbit analysis; applied **memory optimization techniques** to handle complex light path calculations efficiently.

**Distributed Systems Suite (Rust): Total Order, Gossip Convergence, Token Ring** — Rust — gRPC (Tonic) — TCP — Fault Tolerance                                                                    *2025–2026*

- Built three distributed systems in Rust for a Distributed Systems course: **totally-ordered multicast** with **Lamport logical clocks**, **push-pull gossip** with **exponential anti-entropy**, and a **token ring** implementing **mutual exclusion** via token passing.
- Implemented **gRPC-based peer communication** (Tonic) for ordered multicast and token ring services, and a **TCP-based RPC protocol** for gossip-based state synchronization; automated multi-node runs with scripts and Docker Compose.
- Ensured correctness properties: **total order delivery** via timestamp-based hold-back rules, **network-wide convergence** to the average state through push-pull averaging, and **exclusive access** to a shared calculator service while holding the token.
- Added resilience/security features: **timestamp abuse protections** (reject reuse/backdating/far-future drift) and **fault tolerance** in token passing via automatic rerouting to skip failed peers and recover ring continuity.

**Parallel All-Pairs Shortest Path Solver** — **C** — **MPI** — High-Performance Computing — Dynamic Programming    *2025*

- Designed and implemented **parallel Floyd-Warshall** using **MPI** with 2D Cartesian process topology, achieving efficient distribution of computation across multiple nodes for All-Pairs Shortest Path (APSP) problem.
- Developed **hybrid communication strategy** combining **Fox's algorithm** matrix distribution with **non-blocking MPI_Ibcast** operations, optimizing data movement patterns and reducing synchronization overhead.

**MINIX Retro Game: Custom Drivers + Space Invaders Clone** — C — MINIX                      *2025*

- Built a **Space Invaders-style game** on **MINIX** in **C**, showcasing low-level systems programming end-to-end.
- Implemented custom drivers: **graphics with triple buffering**, **mouse input**, and **clock/RTC** for timing and gameplay control.

## ACHIEVEMENTS & AWARDS

**2nd Place – IEEE RetroJam Game Development Competition** — IEEE UP Student Branch — Rust         *2025*

- Collaborated in a team to design, implement, and deliver a complete **2D built-from-scratch game** within **48-hour deadline** in **Rust**, demonstrating **rapid prototyping**, time management, and **teamwork under pressure**.

**Academic Merit Awards** — Escola Secundária Carlos Amarante                              *2020–2022*

- Recognized for outstanding academic performance in science and technology disciplines throughout high school.

**World 4th Place – RoboCup Rescue Superteam** — RoboCup Leipzig, Germany                      *2016*

- Represented Portugal internationally in **autonomous robotics** competition, developing **navigation algorithms** and **autonomous systems** for **rescue** scenarios.

**National 1st Place – Robotics Championship (CoSpace Rescue)** — Portugal                      *2016*

**National 4th Place – Canguru Matemático Sem Fronteiras** — Portugal                         *2016*

## TECHNICAL SKILLS

**Programming Languages:** Rust, C, C++, Java, Python, SQL
**Technologies & Tools:** TCP/IP, Git, Linux, Tokio/Tonic, Docker, Portainer, PostgreSQL, MPI, OpenMP, TLS
**Skills:** Systems Programming, Algorithm Design & Optimization, High-Performance Computing, Computer Networks, Telecommunications, Distributed Systems, Reliable Computing