

ALEJANDRO JACKSON

Quantum Software Engineering | MSc Candidate, Sorbonne Université

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EDUCATION

Sorbonne Université - M.S. Quantum Information Paris, France | Expected June 2027

Coursework: Basic Quantum Physics for CS, Quantum Physics for CS, Quantum Circuits & Query Complexity, Shannon Theory (Information Theory) **Spring 2027:** Quantum Algorithms, Quantum Information Theory.

Brown University - ScB Computer Science (Software Principles & Design Pathways)

Providence, RI | May 2025

Coursework: Graduate Software Engineering, Designing Humanity Centered Technology, UI/UX, Design & Analysis of Algorithms, Responsible CS in Practice, Logic for Systems, Machine Learning.

QUANTUM & TECHNICAL SKILLS

Quantum & Numerical Computing: Python (NumPy, SciPy), Linear Algebra, Matplotlib, Statistical Modeling, Statevector simulation, Noise modeling (amplitude/phase damping), Benchmarking (mean $\pm$ std, fixed seeds), Qiskit Runtime, Quantum Compilation, Quantum Simulation, Quantum-Classical Hybrid, Quantum Machine Learning

Systems & Performance: MPI, OpenMP, SIMD, AVX2, Grid5000, Profiling, Memory scaling analysis

Technical: Software Requirements/Specifications Documents, High-Level Architecture Diagrams, AWS, Git/GitHub

Programming: React, TypeScript, TailwindCSS, Node.js, Spark, Next.js, Postgres, System Design, Data Storage, Java, JavaScript, Python, CSS

FEATURED PROJECTS

Details and repos: alejandrjackson.vercel.app

Generative Quantum ML: IQP Circuits & Anti-Concentration | JAX, PennyLane, Qiskit, Python

Feb 2026 - May 2026

Trained IQP circuits via MMD² loss across 4 circuit families and 6 target datasets, extending Xanadu AI's scaling GQML paper (arXiv:2503.02934); team project (with 2 collaborators) supervised by Hela Mhiri, Sorbonne Université.

- Showed MMD² $\neq$ learned distribution shape: at $\sigma=9$ (MMD²=0.0010), target/learned anti-concentration (scaled second moment) gap remained 73.0, exposing a blind spot in scalar-loss-only training diagnostics.
- Owned anti-concentration and per-order marginal-agreement diagnostics, decomposing spectral bandwidth effects across 3 σ values to isolate which Z-word orders MMD² training actually learns.
- Built Qiskit Aer cross-validation layer (statevector/shot/noise) and ran Grid5000 scaling experiments (n up to 20+, 512 nodes) validating classical training claims against real quantum execution modes.
- Formally modeled IQP generator-graph structure in Forge (relational model finder) to encode degree constraints and anti-concentration threshold predicates for automated circuit-family search.

Feb 2026

Quantum Algorithm & Simulation Benchmark Suite | Python, Qiskit, NumPy, pytest

- Measured gradient variance scaling via parameter-shift rule on IQP circuits (n=4–12 qubits, d=2–10, K=20 trials): tied parameters yield positive log-variance slope (+0.26 – +0.33); untied exhibit barren plateau (–0.24 – –0.35).
- Benchmarked shot-noise tradeoffs: mapped Pareto frontier of accuracy (mean_abs_error) vs runtime; identified shot threshold for <1e-2 error.
- Config-driven, deterministic seeds, CI-tested; all results trace to trial-level logs and publication-style plots.

Nov – Dec 2025

Distributed Meet-in-the-Middle Attack | C/MPI/OpenMP/AVX2, Grid'5000

Hybrid distributed MITM attack combining MPI, OpenMP, and AVX2 SIMD (8-way vectorized Speck64/128) achieving 171x speedup on 512 MPI ranks.

- Achieved 171x speedup (33.5% efficiency) at n=36 and 120x at n=40 via distributed dictionary sharding, OpenMP threading, and 8-way AVX2 vectorization.
- Enabled n=40 by introducing a 9-pass time-memory tradeoff under 60% RAM cap; analyzed scaling bottlenecks (dict_probe + communication).

SOFTWARE ENGINEERING EXPERIENCE

Kyron Medical, Director of Technical Engineering (Part-Time, Concurrent with MSc)

Aug 2025 - Feb 2026

- Most senior engineer across 13 production subdomains (11 HIPAA-regulated clients); architected HIPAA-compliant infrastructure (DB design, API layer, access control, encryption) supporting 103 API endpoints.
- Built ML-based Denial Intelligence pipeline analyzing >\$5M in claims data; deployed voice-AI automation across 4 call workflows (eligibility, claim-status, prior auth, appeal follow-up).
- Designed blue/green deployment architecture for zero-downtime releases across 11 client subdomains.

Nov 2024 - Aug 2025

Kyron Medical, Technical Consultant

- Delivered full-stack systems and infrastructure automation for early-stage healthcare platform.
- Built QA/QC operations pipelines standardizing deployment validation across 11 client environments.
- Implemented secure database schema and foundational API layer supporting HIPAA-compliant workflows spanning 23 database tables and FHIR R4-compliant data exchange.
- Led infrastructure setup across 11 clients enabling first deployment within 1 day of client sign-on.

Providence, RI | Oct 2024 – May 2025

Brown University, Head Teaching Assistant

Head TA for CS0320 – Intro to Software Engineering

- Led and mentored a team of 11 TAs supporting ~130 students in a semester-long full-stack engineering course.
- Defined grading rubrics and architectural standards enforcing testing, modularity, and production-quality code across 6 multi-week assignments.
- Conducted twice-weekly code reviews (checkpoint + final) and held 2 hrs/week of office hours debugging TypeScript/React projects.
- Acted as technical lead between professor and staff, aligning evaluation standards and resolving escalated technical issues.

HONORS & LANGUAGES

Hispanic Scholarship Fund Scholar, 2021 **Languages:** English (Native) · Spanish (advanced) · French (B1+)