Charbel Isaias Chavez Zavala

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Education

Monterrey's Institute of Technology (GPA: 3.8 / 4.0) Querétaro, MX
BS in Computer Science, Minor in Advanced AI — Academic Talent Scholarship *Expected Jul 2027*

Relevant Coursework: Data Structures · Advanced Algorithms · Object-Oriented Programming · Software Engineering · Project Management · Calculus

Experience

Research Student – Quantum Neural Networks Monterrey's Institute of Technology
Hybrid Classical-Quantum Architecture Research *Mar 2026 – Present*

- Designing and implementing the **hybrid classical-quantum architecture** for a benchmark, integrating classical embeddings with variational quantum layers.
- Building **reproducible experimentation pipelines** for NLP tasks (IMDB, AG News) and computer vision tasks (MNIST, Fashion-MNIST).
- Automating experiment execution and managing **version control** for the team's shared repository.
- Collaborating on a **multifactorial experimental protocol** evaluating variables such as qubit count, encoding strategy, and circuit depth.

Projects

HopIt – AI-Powered Platformer Level Builder | *AI Systems & LLMs* Spring 2026

- Built an end-to-end pipeline transforming user drawings into structured **JSON representations**, enabling real-time game reconstruction for **HackPrinceton 2026**.
- Integrated **Gemini API** for multimodal reasoning to interpret drawings and generate feedback on playability, difficulty, and level design quality.
- Framed level design as an **AI-driven iterative refinement problem**, combining structured representations with LLM outputs; awarded **Best Rookie Track** and **1st Runner-Up – Best Use of AI + Hardware**.

VQC Implementation | *Quantum Machine Learning* Spring 2026

- Designed a **2-qubit parameterized quantum circuit** with RY–RZ–CNOT ansatz trained via the parameter-shift rule.
- Benchmarked against SVM-RBF baseline; achieved **91.2% test accuracy** with near-identical AUC (0.9868 vs 0.9871).
- Analyzed **loss landscape, quantum kernel geometry, and barren plateau theory** to explain the performance gap.

Diana – Exoplanet Detection Web App | *Machine Learning Engineer* Oct 2025

- Trained and evaluated **LightGBM models** on **15,000+ Kepler and TESS samples** for exoplanet detection.
- Built a **FastAPI backend** and **React frontend** for real-time inference and visualization.
- Achieved **2nd place at NASA Space Apps Challenge 2025** (local event).

Multi-Agent Fire Rescue Simulation | *Agent-Based Modeling* Summer 2025

- Developed a **multi-agent system** using **Python and Mesa**, achieving a **27% win rate across 100+ simulations**.
- Implemented autonomous agents with **dynamic role assignment** and **Dijkstra-based pathfinding**.
- Built real-time visualization using **Flask and WebSockets**.

Technical Skills

Languages: Python, JavaScript, TypeScript, C++
Frameworks: Next.js, Node.js, Express
Libraries: NumPy, Pandas, Matplotlib, PennyLane, Qiskit, TensorFlow, Scikit-Learn
Databases: PostgreSQL, Prisma ORM, MySQL
Tools: Git, GitHub, AWS, OCI, GCP, Postman
Core: Quantum Machine Learning · Machine Learning · AI · API Development · Data Structures · Algorithms
Languages: English (C1), Spanish (Native)