JACOBO AYALA

AI-First Native · Quantitative Finance · Complex Systems

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LinkedIn · GitHub · Personal Blog

PROFESSIONAL PROFILE

AI-first native Computer Scientist with experience in quantitative finance research, machine learning, and complex systems. I build products end-to-end — from conception and mathematical modeling to production deployment — with a native approach to artificial intelligence as a fundamental working tool. Passionate about the intersection of applied mathematics, quantitative finance, and cutting-edge technology.

EDUCATION

Universidad Nacional de Colombia – Manizales *Jun 2022 – Present*

B.Sc. in Computer Science

- Relevant coursework: Advanced Mathematics, Data Analytics, Machine Learning, Artificial Intelligence, Computational Neuroscience, Numerical Analysis, Complex Systems
- Academic projects in partial differential equations (finite difference methods), genetic algorithms, and cellular automata

Escuela Normal Superior de Caldas *Jan 2012 – 2018*

High School Diploma with emphasis in Education

RESEARCH & CURRENT FOCUS

Portfolio Optimization & Quantitative Finance *2025 – Present*

- Research on advanced portfolio theory: mathematical derivation of the Kelly Criterion from univariate to multivariate formulations
- Critical analysis of fundamental assumptions in portfolio optimization, including the small returns approximation
- Financial derivatives modeling, bond valuation, and quantitative risk management

Complex Systems & Parallel Computing *2024 – Present*

- Social network system developed in CUDA C++ implementing kernels for follower counting, hashtag search, and influence network analysis
- Genetic algorithms for cellular automata rule discovery and Monte Carlo methods for ODE solving

FEATURED PROJECTS

License Plate Detection System *2025*

- Complete end-to-end pipeline: custom YOLO v8 model training, OCR integration, and real-time video processing
- Visualization interface built with Streamlit for security monitoring in Manizales
- Full-stack involvement across all phases: data collection, model training, backend, and frontend

Song Popularity Prediction *2025*

- Python regression model that predicts musical popularity from audio features and metadata
- Source code available on GitHub

Computer Vision with YOLO *2025*

- YOLOv8n model for person detection and counting in aerial video sequences

Ruido Rosa – Music Platform *2024 – Present*

- Full-stack development of a web platform for an emerging music venture, covering design, development, and digital strategy
- Audiovisual content creation: Latin Christmas music videos and promotional material for artists
- Visual identity design and brand strategy

Personal Blog *2024 – Present*

- Publishing reflections on artificial intelligence, mathematics, quantitative finance, and technology
- A space for critical thinking on the intersection of AI and society

TECHNICAL SKILLS

Languages: Python, JavaScript/TypeScript, CUDA C++, SQL, LaTeX

ML / AI: PyTorch, YOLO, Attention Mechanisms, LLM Tokenization, Computer Vision, OCR

Quantitative Finance: Portfolio Optimization, Kelly Criterion, Derivatives Pricing, Risk Management

Frameworks / Tools: Next.js, FastAPI, Streamlit, Firebase, NumPy, Pandas

Numerical Methods: Finite Differences (PDE), Monte Carlo, Genetic Algorithms, Poisson Equations

AI-First Workflow: Native LLM integration in development workflows, AI-assisted rapid prototyping, advanced prompt engineering

CERTIFICATIONS

- Misión TIC 2022 Ruta 2 – Software Development Certificate
- Computer Vision with Python – Platzi
- Business Intelligence: Applications & Opportunities – Platzi

ADDITIONAL INFORMATION

Languages: Spanish (native), English (B2)

Awards: Mejor Supérate 2018 – 11th Grade

Interests: Futsal (Caldas department team), music production, dynamical systems, philosophy of AI