Jorge Enciso

Machine Learning Engineer and Machine Learning Performance Engineer

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Education

Colegio Japonés Paraguayo   Asunción, Paraguay
High School Diploma, Natural Sciences Track, GPA [10/10], Valedictorian   Graduation Date Thesis [Nov 2023]

- Relevant Coursework: Advanced Mathematics, Physics, Mechatronics

- Honors Thesis: *"Niche Modeling with Deep Learning"*

    - Created an automated training pipeline to reconstruct species' spatial distributions from historical occurrence data.

    - Developed and benchmarked Machine Learning and Deep Learning models for generalized distribution estimation (Neural Networks, Logistic Regression, Naive Bayes, SVM, Random Forest)

    - Three step pseudo-absence generation with unsupervised methods (One-Class SVM, K-means Clustering) [5] implemented from scratch, random and radius based sampling.

Research Experience

Multi-modal modelling for Geophysical Forecasting   Polars, Pandas, Pytorch
MHD-informed Multi-Modal Networks for Geomagnetic Forecasting   October 2023 – May 2024

- Developed Deep Learning architectures for long-term Solar Wind forecasting.
- Engineered Bahdanau-based architectures for satellite time series fusion.
- Integrated MHD constraints as a physics informed cost function.
- Created the concept of "Encoder Forcing", a technique to enforce the calibration of the input data throughout the training process.
- Achieved 96% accuracy, 86% recall, and 93% precision, competing with state-of-the-art.

Computer Vision for Astronomic instrumentation   OpenCV, Scikit-Image, Pytorch
CorKit: A Framework for LASCO Coronagraph Calibration   March 2024 – July 2024

- Developed an alternative pipeline for automated image preprocessing and calibration of solar coronagraph data.
- Implemented the original pipeline [3] from scratch with modern programming languages with extended linear algebra support (Python, C++).
- Created a Multi-Layered UNet-Like Partial Convolutional Neural Network architecture from the foundational Partial CNN work [2] from scratch.
- Increased the reliability of coronagraph scientific products with contextual image inpainting.

Statistical Mechanics informed Neural Networks   NVIDIA Modulus, Pytorch, Polars, Pandas
Vlasov-Maxwell informed Operator Learning for Solar Wind Modeling   October 2024 – Ongoing

- Modeled solar wind's electron's anisotropic behavior using physics-informed machine learning.
- Implemented Deep Neural Networks, Recurrent Neural Networks, and Neural Operators to replicate electron's probability density function.
- Unveiled reliable data-driven distributions for an obscure area in Plasma Physics.

Machine Learning for Celestial Mechanics   NVIDIA Modulus, Pytorch, Numpy
PINNs for Celestial Mechanics: The Family of N-body problems   December 2024 – Ongoing

- Modeled gravitational interactions between celestial bodies with Physics informed Neural Networks [4].
- Enforced hamiltonian constraints of the N-Free body problem and its variations (Euler, Lagrange) using Lagrangian optimization and symplectic integrators.
- Presented PINNs as an alternative to reliably study celestial mechanics without overly complex numerical methods.

Specialized Projects

LighTorch – Deep Learning Framework Lightning, Pytorch, Optuna, CUDA C++
Personal ML Framework Project 2024 – Ongoing

- Wrapper over the Pytorch Lightning and plain Pytorch backends.
- Abstractions for supervised, self-supervised, and adversarial training.
- Multi-Objective optimization for Hyperparameter tuning with Optuna.
- More than 20 modules extending novel architectures, including the Partial Convolutions [2], Fourier Layers (including deconvolutions) [8], among others.
- Implemented additional architectures from scratch: Rotary Positional Encoding [7]; RMS Norm [9]; GLU Variants [6]; Multi Query Attention, Grouped Query Attention & Multi Head Attention [1].
- In progress: Low level optimizations for non-standard modules.

Fusion – IO-Aware Kernelized Training Compiler CUDA, C++, Pytorch
In Development 2024 - Ongoing

- Design a programming language syntactically parallel as a machine learning standard.
- Create a new version of the forward-backward standard that exploits IO operation latency.
- Features include stream-aware optimization, prefetching graphs for latency hiding, and compatibility with state-of-the-art frameworks.

Fourier is All You Need & Fourier Variational Autoencoders CUDA, C++, Pytorch
Machine Learning Architecture 2024

- Exploited mathematical properties of the Fourier Transform to accelerate Convolutional Neural Networks.
- Investigated the properties of the Fourier space in training scenarios.
- Designed UNet-Like variations for the Fourier Layer case [8] (implemented from scratch).
- Created a Fourier Layer alternative for UNet-Like autoencoders: Fourier Deconvolutional Layer.

Miscellaneous Projects

Rapid Eye Movement Detection Pytorch, Pandas, Numpy, Scikit-Learn
Sleeping stages classification 2023

- Implemented Recurrent Neural Networks to classify sleeping stages.
- Achieved state-of-the-art classification with 97% F1 Score (Residual GRU model).
- Deep Recurrent Neural Networks and Attention-based architectures.

SADI A.I. Pytorch, OpenCV
Security AI 2023

- Developed foundational models to classify and recognize threats.
- Trained state-of-the-art Computer Vision models (YOLO, YOLO-NAS).
- Real-Time face detection, threat detection, face recognition, and individual detection.

Sketcher A.I. Pytorch, OpenCV
Art AI 2023

- Created foundational pipeline to create sketches from images.
- Implemented state-of-the-art style-transfer mechanisms.

Awards & Recognitions

- Silver Medal – National Math Olympiad (8th/9th Division), Paraguay, 2020
- Bronze Medal – National Math Olympiad (10th/11th/12th Division), Paraguay, 2021
- Gold Medal – Regional Physics Olympiad (Advanced Level), Paraguay, 2022
- Silver Medal – National Physics Olympiad (Intermediate Level), Paraguay, 2022
- National Delegate – Ibero-American Physics Olympiad, 2022
- Honorable Mention – NASA Space Apps Challenge Paraguay, 2023
- 2nd Place in Technology – Marie Curie National Science Fair, 2023
- 2nd Place - 1st National Stratospheric Platforms Contest, 2023

Experience

DDS.py   Asuncion, Paraguay   July 2023 – December 2024

- Taught foundational programming (Python) and ML concepts to high school students.
- Developed and maintained an alternative learning roadmap on GitHub.
- An introductory to advance course on deep learning, and an introduction to ML performance engineering.

Mechatronics Teacher   Asuncion, Paraguay   March 2024 – November 2024

- General purpose programming (C++, Python) lectures for High School students.
- Taught Networking (OSI Model, TCP/UDP communication), Astronomy software design patterns (NASA Software Engineering book), serial protocols (USB, I^2C, etc).
- Taught programming paradigms: Object Oriented Programming (OOP) and Functional programming.

Physics Teacher   Asuncion, Paraguay   March 2023 – November 2024

- Taught lectures on classical mechanics and electromagnetism for physics olympiads.

Oym Systems Group S.A.   Asuncion, Paraguay
ML & Devops Engineer - Research Team   July 2024 – Ongoing

- Develop cloud infrastructure pipelines for ERP software scalability.
- Created LLM pipelines with Retrieval Augmented Generation (RAG) and Low Rank Adaptation (LoRA) for fine-tuning.
- Refactoring monolithic architectures into dockerized microservices.
- Implemented Kubernetes Operators for horizontal and vertical scalability.
- Proposed Continuous Integration and Deployment Git operations.

Tigo - Telecel - Milicom   Asuncion, Paraguay
Machine Learning Engineer & AI Specialist   June 2025 – Ongoing

- Finetuned 8B quantized LLMs on consumer-grade hardware for QLoRA PEFT finetuning for test case generation.
- Implemented brokers (for LangGraph) for Model Context Protocol (MCP).
- Implemented RAG retrievers (code, chat, text) as tooling for Agentic workflows.
- Develop cloud infrastructure pipelines for monitoring, security, and deployment of Agentic LLMs.
- Worked as a consultant for industry level AI applications.

Certifications

- **Stanford University: Machine Learning**

- **IBM AI Engineernig**

- **Jovian: Zero to GANs with Pytorch**

- **Duoling English Test**

Skills

Languages: Spanish (Native), English (Fluent), Japanese (Basic)
Programming: C++, CUDA C++, PTX ISA, Python, Rust, Bash, Lua, Nix
Scientific: Deep Learning, Numerical Optimization, Compiler Design, Geospatial ML, Remote Sensing, Data Fusion
ML Tools: CuDNN, CUDA Toolkit, Tensor RT, Triton, PyTorch, Lightning, NVIDIA Modulus, Scikit-learn, Transformers, LangChain, LangGraph, vLLM, NVIDIA NeMo
Data Tools: Pandas, Polars, Matplotlib, Seaborn, PySpark, cudf, SQL, Milvus
Devops & MLops: Docker, Istio (Service mesh), Nginx, Helm, Kubernetes, Argo CD, NVIDIA NIM, Prometheus, Grafana, Tensorboard, Hydra

References

[1] Joshua Ainslie, James Lee-Thorp, Michiel de Jong, Yury Zemlyanskiy, Federico Lebrón, and Sumit Sanghai. Gqa: Training generalized multi-query transformer models from multi-head checkpoints, 2023.

[2] Guilin Liu, Fitsum A. Reda, Kevin J. Shih, Ting-Chun Wang, Andrew Tao, and Bryan Catanzaro. Image inpainting for irregular holes using partial convolutions, 2018.

[3] J. Morrill, C. Korendyke, G. Brueckner, F. Giovane, Russell Howard, M. Koomen, Dyson Moses, S. Plunkett, Angelos Vourlidas, E. Esfandiari, Nathan Rich, Dennis Wang, A. Thernisien, Philippe Lamy, Antoine Llebaria, D. Biesecker, D. Michels, Qinghai Gong, and M. Andrews. Calibration of the soho/lasco c3 white light coronagraph. *Solar Physics*, 233:331–372, 02 2006.

[4] M. Raissi, P. Perdikaris, and G.E. Karniadakis. Physics-informed neural networks: A deep learning framework for solving forward and inverse problems involving nonlinear partial differential equations. *Journal of Computational Physics*, 378:686–707, 2019.

[5] Senait D. Senay, Susan P. Worner, and Takayoshi Ikeda. Novel three-step pseudo-absence selection technique for improved species distribution modelling. *PLOS ONE*, 8(8):1–16, 08 2013.

[6] Noam Shazeer. Glu variants improve transformer, 2020.

[7] Jianlin Su, Yu Lu, Shengfeng Pan, Ahmed Murtadha, Bo Wen, and Yunfeng Liu. Roformer: Enhanced transformer with rotary position embedding, 2023.

[8] Jakub Zak, Anna Korzynska, Antonina Pater, and Lukasz Roszkowiak. Fourier transform layer: A proof of work in different training scenarios. *Applied Soft Computing*, 145:110607, 2023.

[9] Biao Zhang and Rico Sennrich. Root mean square layer normalization, 2019.