Iván Jaen Márquez

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Education

University of Wisconsin – Madison — Madison, WI, United States
Ph.D in Computer Sciences. Research focus: Machine Learning. — Aug 2022 – Ongoing

Centro de Investigacion en Matematicas, CIMAT — Guanajuato, GTO, Mexico
M.S. in Computer Science and Industrial Mathematics — Jul 2016
Thesis: *"A Univariate Boltzmann based Estimation of Distribution Algorithm Using the Natural Gradient for Updating the Parameters"* (in English)
Awarded Full scholarship for Master studies (CONACYT) and "*Beca Mixta*" for a six-months research stay in the UK.

Tecnologico Nacional de Mexico campus Veracruz — Veracruz, VER, Mexico
B.S. in Computer Systems Engineering — Jul 2014
Thesis: *"Object Tracking via Particle Filters and Stochastic Algorithms"* (in Spanish)
Awarded "*Mención honorífica*" (Distinction) on final oral defense and highest GPA in the department's graduating class.

Awards

- Computer Science Summer Research Assistantship, UW-Madison CS Dept. — Summer 2023
- Fulbright-Garcia Robles Fellowship — Aug 2022 – Aug 2025
- Best undergraduate thesis in Computer Science in Mexico (nationwide annual contest) — Oct 2014
  Asociacion Nacional de Instituciones de Educacion en Tecnologias de Informacion (ANIEI)

Research Experience

UW-Madison - Independent Studies - Machine Learning and Optimization Group — Madison, WI
Graduate student, advised by Prof. Grigoris Chrystos — Summer 2024

- Worked with modern deep learning architectures (ResNets, CNN, ViT, MoE) analyzing and quantifying inductive biases such as spectral, low-rank embedding and simplicity bias.

UW-Madison - Computer Science Summer Research Assistantship — Madison, WI
Graduate student, advised by Prof. Stephen Wright — Summer 2023

- Worked with block-coordinate descent methods for tackling the Multi-Task/Multi-modal Non-negative Matrix Factorization (NMF) problem. This formulation was applied to cell clustering (RNA-seq, ATAC-seq data).

Robert Gordon University - Computational Intelligence Group — Aberdeen, UK
Visiting Graduate student, advised by Prof. John McCall — Jan – Jul 2015

- Worked with the formal mathematical approach of Estimation of Distribution Algorithms and explored connections with existing state-of-the-art global optimization methods (Covariance Matrix Adaptation, CMA-ES).

CIMAT - Masters Research Thesis — Guanajuato, Mexico
Graduate student, advised by Prof. Arturo Hernandez-Aguirre — Jun – Dec 2014

- Worked with Optimization and Machine Learning methods from the perspective of Information Geometry. Proposed a practical approach by minimizing the KL-divergence of the probability densities w.r.t. the Boltzmann distribution.

CIMAT - Undergraduate Researcher — Guanajuato, Mexico
Undergraduate student — Aug 2012 – Jul 2013

- Worked with the particle filter for target estimation and tracking. Proposed an approach to combine population based meta-heuristics with the particle filter method to improve state estimation for video object tracking.

Mexican Academy of Sciences - National Summer Research Program — Guanajuato, Mexico
Undergraduate student — Jun – Jul 2012

- Attended short courses at CIMAT on Machine Learning, Pattern Recognition, Image processing and Robotics.

Relevant Class Projects

CS 744: Big Data Systems - Memory Efficient Low-Rank Systems for Large Vision/Language Models

- We explore the utility of multiple low-rank methods for training. We then apply these methods across task domains. Our primary motivation is that this reduces memory cost, as a form of compression.
  https://github.com/ivanjaenm/Low-Rank-training-GaloLTE

CS 826: Theoretical Foundations of Large-Scale ML - Quantifying modern inductive biases for deep learning.

- I performed 1) a review of simplicity biases, identifying their notions of "simple", main assumptions and investigating potential interrelationships. Additionally, 2) experimentally quantify these biases across MLPs under different settings. https://github.com/ivanjaenm/QuantifyingBiases

CS 839: Foundation Models - Multimodal Geometry of Truth.

- Using various multimodal models, ranging from small ones the recent LLaMA 3.3-70B, we explore truth representations across different modalities. Results indicate that linear structure does not necessarily emerge in all truth statements. https://github.com/ivanjaenm/multimodal-geometry-of-truth

Graduate Coursework

- **CS/Engineering/Math at UW-Madison**:
  - Math 521: Analysis I
  - CS 524: Intro to Optimization
  - CS 525: Linear Optimization
  - CS 726: Nonlinear Optimization
  - ECE 532: Matrix Methods in ML
  - CS 744: Big Data Systems
  - CS 760: Machine Learning
  - CS 839: Foundation Models
  - CS 784: Foundations of Data Management
  - ECE 826: Theoretical Foundations of Large-scale ML

Teaching Experience

Lecturer:

UNAM - Faculty of Sciences - Mathematics Dept. — Mexico City
- **Genetic Algorithms**: Spring 2018 & Spring 2019

Graduate Teaching Assistant:

CIMAT - Computer Science Dept. — Guanajuato, Mexico
- **Algorithms and programming (C++)**: Fall 2015

University of Wisconsin–Madison - Computer Sciences Dept. — Madison, USA
- **CS 320: Data Science Programming II (Python)**: Fall '22, '23, Spring '22, '23
- **CS 400: Programming III (Java)**: Fall '24
- **CS 544: Intro to Big Data Systems**: Spring '25

Publications

- ***Mario Ivan Jaen-Marquez***, Arturo Hernandez-Aguirre, Rafael Rivera-Lopez,"Object tracking via bio-inspired optimization algorithms" (in Spanish), Talk at *XXIV Escuela Nacional de Optimización y Análisis Numérico, (ENOAN 2014)*, Guanajuato, Mexico.
- ***Mario Ivan Jaen-Marquez***, Arturo Hernandez-Aguirre,"A parallel numerical integration method based on the Particle Swarm Optimization algorithm" (in Spanish), Talk at *5th. International Supercomputing Conference in Mexico (ISUM 2014)*, Baja California, Mexico.

Technical Skills Summary

- **Programming languages**: C/C++, Python, Julia, Java, Matlab
- **Frameworks/Tools**: PyTorch, Lightning, Docker, PySpark, Scikit-learn, Hydra, Condor/CHTC, Git, Bash, LaTeX
- **Languages**: English (Fluent), Spanish (Native)

Work Experience

Microsoft - Azure — Remote
Data and Applied Scientist — Nov 2020 - Jul 2022
- Applied Statistical Learning and experimentation techniques to get better analytics on Azure products
- Proposed and implemented a k-way merge algorithm to integrate data quality streams from distributed systems.

BBVA bank - Global Markets — Mexico City
Quant Developer — Dec 2015 – Oct 2020
- Productionized a wide range of pricing/risk computational models for the front office trading platform.
- Researched and developed algorithmic trading strategies: optimization for portfolio compression (delta hedging)

Service and Leadership

Mentor for Incoming CS PhD students at UW-Madison — Fall 2023, Madison, WI
Delta Research Mentor Program — Summer 2023, Madison, WI
Fulbright Pre-Academic Program — Summer 2022, Syracuse, NY