Alex Eduardo Sanchez

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Education

Florida International University Expected December 2027
M.S. in Artificial Intelligence, GPA: **4.00**/4.00 *Miami, FL*
Coursework: Graduate Artificial Intelligence, Data Analysis I, Analysis of Algorithms

Florida International University Aug 2023 – May 2026
B.S. in Computer Science, Minor in Mathematics, GPA: **3.91**/4.00 *Miami, FL*
Honors & Awards: Deans List (8x), FIU Presidential Scholarship, Florida Academic Scholarship, OURS Scholarship
Coursework: Data Structures & Algorithms, Software Engineering, Linear Algebra, Theory of Algorithms, Graph Theory, Calculus I-III, Operating Systems Principles, Computer Architecture

Experience

Undergraduate Researcher Jul 2025 – Present
Florida International University – MLSysX *Miami, FL*
- Designed and built **EMAS (Evolving Multi-Agent System)**, a novel multi-agent framework where LLM-backed software engineering agents dynamically evolve their roles mid-task based on self-reflection signals, outperforming static team baselines by **66.7% on SWE-Bench-Lite**
- Engineered a **Merkle-chained role governance ledger** that enforces role exclusivity across agents via hash-verified evolution commits, eliminating role convergence and preserving team diversity
- Authored an abstract accepted for oral presentation at **NCUR 2026** and **URFIU 2026**, advised by Prof. Yanzhao Wu

AI/ML Research Intern Jun 2025 – Aug 2025
UChicago Data Science Institute *Chicago, IL*
- Pioneered an Active Simulation-Based Inference (Active SBI) framework to optimize instrument design for astrophysical experiments, integrating simulation generation, posterior inference, and acquisition policy learning
- Achieved **70% higher posterior accuracy** over baseline by engineering a neural posterior estimator using PyTorch and the sbi library for astrophysical instrument design
- Scaled experiments to **100k+ simulations** across **four distributed H100 GPUs**, ensuring large-scale performance evaluation and allowing reproducibility

Projects

Latent Diffusion Model in JAX | *JAX, Huggingface, WandB*
- Implemented a **Latent Diffusion Model from scratch** in **JAX/Flax NNX**, building a full **DDPM scheduler** (linear beta schedule, forward/reverse diffusion process) and a **conditional UNet** with cross-attention, timestep embeddings, and **Classifier-Free Guidance (CFG)**
- Conditioned generation via a frozen **CLIP** text encoder (768-dim embeddings) and a frozen **VAE** latent space, compressing **256x256** images into **32x32x4** latents for efficient diffusion training
- Trained on **120k MS-COCO** image-caption pairs for **30 epochs**, demonstrating emergent semantic structure across diverse text prompts, validated via **WandB** loss curves and generation samples

Hybrid Neuro-Symbolic Theorem Prover | *PyTorch, Lean4, Huggingface Transformers*
- Architected a **multi-agent neuro-symbolic framework** that integrates LLMs with the Lean 4 formal verification engine, decoupling high-level strategy synthesis from symbolic tactic execution to eliminate model hallucinations and **ensure 100% logical consistency**
- Engineered an automated feedback pipeline between the Lean 4 compiler and PyTorch inference, utilizing real-time error signals to prune invalid proof branches and iteratively refine candidate tactics (***n = 5-10***) per search state
- Optimized proof-tree exploration by implementing a search controller driven by neuro-symbolic heuristics and **Depth-First Search (DFS)**, achieving end-to-end strategy generation and formal verification for benchmark theorems in **under 30 seconds**

Leadership & Activities

AI Guild Lead | *INIT* December 2025 – Present
- Leading the **INIT AI Guild** across **4+** university chapters, delivering a graduate-level deep learning curriculum **3x/week**, covering transformers, diffusion models, RLHF, and multimodality
- Mentoring **35+ students** across in-person and remote sessions, translating research papers into working code (CLIP, GPT-2, DDPM) and guiding members through original implementations
- Extended the curriculum into a public deep learning series on YouTube, publishing theory and implementation walkthroughs

Technical Skills

Languages: Python, C, Java, JavaScript, TypeScript, SQL, HTML/CSS
ML/AI: PyTorch, JAX, Flax, HuggingFace, OpenCV, WandB, sbi
Infrastructure/Tools: Docker, MongoDB, MySQL, REST APIs, Git, FastAPI, Agile
Frameworks/Libraries: NumPy, Pandas, Matplotlib, Streamlit, React Native