Ahmed Youssef

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SKILLS

Programming Languages/Systems: Python, C++, SQL, Spark, Git, Docker, Linux, Bash scripting
Frameworks & Libraries: PyTorch, TensorFlow, JAX, HuggingFace, NumPy, Pandas, Scikit-Learn, OpenCV
Technologies & Tools: Large-Scale ML Training, LLM Fine-Tuning & Inference, High-Performance Computing (HPC), Parallel & Distributed Systems
Research & Engineering Expertise: Generative AI (VAEs, Normalizing Flows, Diffusion Models), AI Explainability, Model Optimization, Reinforcement Learning
Soft Skills: Research Leadership, Technical Writing, Multilingual (English, German, Arabic)

PROFESSIONAL EXPERIENCE

HEP-THEORY UNIVERSITY OF CINCINNATI – HEP THEORY GROUP **Cincinnati, OH, US**
Research Scientist & ML Engineer **Jan 2020 -Present**

- Led ML-driven simulations for scientific computing, leveraging generative AI for large-scale data modeling
- Designed a Monte Carlo reweighting framework that improved simulation accuracy and computational speed 3-4×
- Developed scalable parallel computing infrastructure, optimizing AI-driven particle collision simulations impacting 10,000+ researchers
- Built scalable ML systems for exploratory AI research and automation in scientific simulations

DEEP LEARNING & AI RESEARCHER **Jan 2022 -Present**

- Designed scalable LLM fine-tuning & inference pipelines, improving model efficiency for multimodal applications
- Developed AI explainability techniques for Vision-Language Models (VLMs) and LLMs, enhancing interpretability and robustness.
- Engineered model compression and optimization techniques to reduce compute costs while maintaining accuracy
- Researched multimodal learning, representation learning, and robustness in generative models

UC CENTER FOR ENTREPRENEURSHIP **Cincinnati, OH, US**
Machine Learning & AI Product Engineer **Jan 2023 -Present**

- Developed an AI-driven quality control system, integrating computer vision & ML for automated defect detection
- Secured $7,500 in startup funding through pitching, advancing AI-driven industrial automation
- Led the deployment of scalable AI solutions, focusing on edge computing and real-time ML inference
- Drove innovation and growth by exploring new AI applications for manufacturing and supply chain industries

PROJECTS

Scalable LLM Fine-Tuning & Model Optimization

- Engineered efficient training infrastructure for LLM fine-tuning, optimizing parallelism and memory utilization
- Applied retrieval-augmented generation (RAG) techniques to enhance model generalization
- Implemented reinforcement learning-based tuning for task-specific LLM adaptation

AI Explainability for Multimodal Models

- Developed explainability techniques for LLMs & VLMs, improving interpretability in generative models
- Evaluated using the Google DeepMind Perception Test, ensuring trustworthiness & model robustness

EDUCATION

UNIVERSITY OF CINCINNATI — **Cincinnati, OH**
Ph.D. Candidate in Particle Physics (Focus in Machine Learning) — **Expected Grad: May 2025**

RUHR UNIVERSITY OF BOCHUM — **Bochum, Germany**
Bachelor of Science in Physics — **Sep 2016 - Sep 2019**

SELECTED PUBLICATIONS

NOTE: Authors in papers marked with (*) are listed alphabetically, as per field convention

- **"*Data-Driven Reweighting for Monte Carlo Simulations",* accepted at ML4PS workshop, **NeurIPS 2024**
- ***"Towards data driven models of hadronization", ML4PS workshop, **NeurIPS 2023**
- "Hacking Generative Models with Differentiable Network Bending", ML4CD workshop**, NeurIPS 2023**
- "Few-Shot Abstractive Summarization for Text Style Transfer", **ICNLP 2023**
- "Normalizing Flows for Fragmentation and Hadronization", ML4PS workshop, **NeurIPS 2022**
- **"Towards a data-driven model of hadronization using normalizing flows", **SciPost Phys. 17, 045 (2024)**
- **"Earth Mover's Distance as a measure for CP-violation", **JHEP, 10.1007/JHEP06(2023)098**
- **"Modeling Hadronization using Machine Learning", ***SciPost Phys. 14, 027 (2023)***
- **"Reweighting Monte Carlo Predictions and Automated Fragmentation Variations in Pythia 8", **SciPost Phys. 16, 134 (2024)**
- *" Describing Hadronization via Histories and Observables for Monte-Carlo Event Reweighting" , **arXiv preprint: 2410.06342 (2024)**

SELECTED TALKS AND PRESENTATIONS

- *"Bridging Physics and AI: ML for Particle Collision Simulation",* **Google DeepMind,** London UK, Feb 2025
- *"Data-Driven Reweighting for Monte Carlo Simulations",* **ML4PS, NeurIPS 2024**
- "*Hacking Generative Models with Differentiable Network bending*"**, ML4CD, NeurIPS 2023**,
- "Towards data-driven models of *Hadronization",* **ML4PS, NeurIPS 2023**
- "*ML for Physics: Simulating Particle Collisions",* **CS and Math seminar**, **IST Austria**, Jul 2024
- "*Earth Mover's Distance as a measure for CP-violation*", **12th international Conference on the CKM Unitarity Triangle**, Santiago de Compostela, Spain, Sept 2023
- *"Few-Shot Abstractive Summarization for Text Style Transfer",* **ICNLP 2023**
- *"Normalizing Flows for Fragmentation and Hadronization",* **ML4PS, NeurIPS 2022,**
- **"***MLHAD: A Machine Learning based Simulation for Hadronization*", **Guest Lecturer in Particle Pheno, University Heidelberg,** Heidelberg, Germany Jul 2023

SELECTED RESEARCH COMMUNITY INVOLVEMENT

Core Organizer, Muslim in ML Affinity Workshop, NeurIPS 2024
- Spearheaded a workshop for 160 participants, coordinating speakers from OpenAI, Carnegie Mellon, MIT, and managing logistics, and maintained communication with the affinity chairs

Reviewer, ML and Physical Science Workshop, NeurIPS 2024
- Reviewed research submissions, shaping the ML & Physics research landscape

Convener, Computing, Analysis Tool, and Data Handling Session, Pheno 2024
- Led the session, overseeing abstract selection on ML applications in computational physics, and fostering cross-disciplinary dialogue on computational tools and data handling strategies

SELECTED HONORS AND AWARDS

- **URC Fellowship** – Top 10% research innovation recognition for research excellence in ML and AI
- **GSG Research Fellowship** – Awarded for contributions to computational physics & A.
- **Lab2Market Fellowship** – Secured $5000 in funding for ML-driven innovation
- **Pheno Travel Award (3× recipient)** – Recognized for research excellence in ML & HEP