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, Dall-e, LlamaIndex, Langchain, Retrieval Augmented Generation (RAG), 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-GROUP – UNIVERSITY OF CINCINNATI   **Cincinnati, OH, US**
Graduate Research Assistant | 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

INDEPENDENT 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**
Multiple Entrepreneurial Engagments   **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

Few-Shot Abstractive Summarization for Style Transfer; published at ICNLP 2023
- 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

Vision Language Models Unlocker
- 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: Aug 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*](#)*", 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)**
- *"*[*Electroweak Corrections to the Charm-Top-Quark Contribution to ε*](#)", **Journal of High Energy Physics (JHEP), 10.1007/JHEP12(2022)014**
- *"*[*Rejection Sampling with Autodifferentiation - Case study: Fitting a Hadronization Model*](#)" , **arXiv preprint: 2411.02194 (2024)**
- *"*[*Describing Hadronization via Histories and Observables for Monte-Carlo Event Reweighting*](#)" , **arXiv preprint: 2410.06342 (2024)**

SELECTED TALKS AND PRESENTATIONS

INVITED TALKS (1 HOUR)

- *"Machine Learning Perspective on Scientific Discovery" (tentative title),* **IAIFI - MIT,** Boston US, April 2025
- *"Bridging Physics and AI: ML for Particle Collision Simulation"* – **Google DeepMind**, London, UK, Feb 2025
- *"ML for Physics: Simulating Particle Collisions"* – **CS and Math Seminar, IST Austria**, Vienna, Austria, Jul 2024
- *"Earth Mover's Distance as a Measure for CP-Violation"* – **HEP Seminar, TU Dortmund**, Dortmund, Germany, Aug 2023
- *"MLHAD: A Machine Learning-Based Simulation for Hadronization"* – **Guest Lecturer in Particle Pheno, University of Heidelberg**, Heidelberg, Germany, Jul 2023
- *"MLHAD: A Machine Learning-Based Simulation for Hadronization"* – **Physics and AI Seminar, Deutsches Elektronen Synchrotron (DESY),** Hamburg, Germany, Jul 7, 2023

CONFERENCES AND WORKSHOP TALKS

- *"Data-Driven Reweighting for Monte Carlo Simulations"* – **NeurIPS, Machine Learning for Creativity and Design Workshop 2024**, Vancouver, Canada, Dec 2024
- *"Towards a Data-Driven Model of Hadronization Using Normalizing Flows"* – **DPF-Pheno 2024**, Pittsburgh, USA, May 14, 2024
- *"Hacking Generative Models with Differentiable Network Bending"* – **NeurIPS, Machine Learning for Creativity and Design Workshop 2023**, New Orleans, LA, USA, Dec 2023
- *"Towards Data-Driven Models of Hadronization"* – **NeurIPS, Machine Learning and the Physical Science Workshop 2023**, New Orleans, LA, USA, Dec 2023
- *"Earth Mover's Distance as a Measure for CP-Violation"* – **12th International Conference on the CKM Unitarity Triangle,** Santiago de Compostela, Spain, Sept 2023
- *"Normalizing Flows and Uncertainty Quantification in Hadronization Simulations"* – **Pheno 2023 Symposium, University of Pittsburgh**, Pittsburgh, Pennsylvania, USA, May 8, 2023

- *"Few-Shot Abstractive Summarization for Text Style Transfer"* – **International Conference in Natural Language Processing (ICNLP) 2023**, online
- *"Normalizing Flows for Fragmentation and Hadronization"* – **NeurIPS, Machine Learning and the Physical Science Workshop 2022,** New Orleans, LA, USA, Dec 2022
- *"Modeling Hadronization Using Machine Learning"* – **Pheno 2022 Symposium**, University of Pittsburgh, Pittsburgh, Pennsylvania, USA, May 9, 2022

POSTER PRESENTATIONS
- *"Hacking Generative Models with Differentiable Network Bending"* – **Eastern European Machine Learning (EEML)** Summer School, Novi Sad, Serbia, Jul 16, 2024
- *"ML for Physics: Simulating Particle Collisions"* – **Mediterranean Machine Learning (M2L) Summer School**, Thessaloniki, Greece, Aug 2023
- *"ML for Physics: Simulating Particle Collisions"* – **Machine Learning Summer School on Applications in Science**, Jagiellonian University, Krakow, Poland, Jun 26, 2023
- *"Machine Learning for Hadronization"* – **IAIFI Workshop**, Tufts University, Boston, MA, USA, Aug 2022

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, Qatar Computing Center, 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 in computational physics, and fostering cross-disciplinary dialogue on computational tools and data handling strategies

Visiting Researcher, CERN, Aug 2024
- Conducted research in high-energy physics, collaborating with global experts to advance computational and ML techniques for particle simulations

Visiting Researcher, TU Dortmund, Jul – Sep 2023
- Engaged in interdisciplinary research on ML applications in physics, contributing to ongoing projects in computational particle physics

Co-Organizer, PIKIMO 13 Conference, Nov 2022
- Managed logistics and abstract selection for a high-profile physics conference featuring 15 invited speakers

Student Volunteer, NeurIPS 2022, Dec 2022
- Assisted in organizing one of the largest AI conferences, supporting sessions and fostering networking opportunities

SELECTED HONORS AND AWARDS

- **URC Fellowship** – Recognizing top graduate students for high-impact, faculty-collaborative research
- **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
- **PROMOS Scholarship** – DAAD-funded award for research abroad, supporting thesis work at the University of Cincinnati
- **Deutschlandstipendium (Deutschland Scholarship)** – National scholarship for academic excellence in Germany
- **Abitur Prize of the German Physics Society –** High school award for outstanding achievements in physics