Institut für Kernphysik

ROBUST DATA SCIENCE

Master Thesis

Designing Human-AI Collaborative Workflows for Advanced Image Analysis in Physics

Project Overview:
This Masters Project analyzes about one million diffraction images from the Linac Coherent Light Source (LCLS) at the Stanford Linear Accelerator Center (SLAC).

Challenges:
Major challenges include learning from limited training data, ensuring broad experimental applicability, and avoiding introducing bias into the analysis.

Methods:
Your task shall be to develop a cutting-edge human-AI collaboration workflow. This involves training AI models on small expert-annotated datasets, using explainable AI to uncover biases, and leveraging active learning for iterative refinement with human feedback. You shall also explore self-supervised learning to uncover hidden patterns, enabling potentially completely new insights into complex scientific data.

Interdisciplinarity:
This Masters Project is an interdisciplinary collaboration of the Robust Data Science Group (Prof. Muma) with the Laboratory Astrophysics Group (Prof. Kuschel).

Prerequisites:

- Strong foundation in machine learning and AI: Essential for developing and refining the complex algorithms required.
- Programming skills: Proficiency in Python is crucial for implementing the pipeline efficiently.
- Motivation and Interest: A high level of enthusiasm for developing and applying advanced methods and working with real physics data is key to success in this project.

How to Apply?
Please send an E-Mail to michael.muma@tu-darmstadt.de with your CV and transcript.