Internship: M2 (or final year engineering school)
Advanced Deep Learning for charged particle tracking at the LHC at CERN

The Large Hadron Collider (LHC) at CERN [1], where the Higgs boson was discovered, will undergo a major upgrade in 2029, pushing further the limits of our understanding of particle physics. This new phase requires the creation of faster algorithms, in particular for the tracking of charged particles.

The Laboratoire des 2 Infinis (L2IT) [2] is a young laboratory created in 2020 in Toulouse to conduct research in fundamental physics with new numerical methods including Artificial Intelligence techniques. The L2IT team plays a major role in the GNN4ITk project [3-5], an international collaboration that builds a new generation algorithm based on Graph Neural Networks (GNNs), for the tracking of charged particle in the future inner tracker of ATLAS [6], one the flagship experiments at the LHC.

We are offering an internship opportunity for students pursuing a Master's degree or in their final year of an engineering school program to join our ML R&D team. This internship will focus on exploring Transformers-based fitting to improve the quality of the track candidates produced by the GNN4ITk pipeline.

You are a AI / Machine Learning Master's student or a Computer Science or Fundamental Physics Master's student with a strong background in Machine Learning, this offer might be interesting for you! You will have the opportunity to enhance your knowledge and skills in advanced AI models and techniques while contributing to our R&D efforts in a highly stimulating and dynamic research environment as part of a major international scientific collaboration.

Key words: Geometric Deep Learning, Graph Neural Networks, Transformers, Inference Engineering

Required Skills:

- Strong knowledge and skills in AI / ML concepts and techniques
- Proficiency in Python and its scientific/data science packages (e.g. Numpy, Pandas)
- Experience of a least one project in PyTorch would be a plus
- Proficiency in navigating Linux environments
- Autonomy and creativity
- English language proficiency at a B2 level or highers

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[1] CERN, url: https://home.cern/
[2] Laboratoire des 2 Infinis (L2IT), url : https://www.l2it.in2p3.fr
[3] X. Ju et al., Physics Performance of the ATLAS GNN4ITk Track Reconstruction Chain, Proceedings of CHEP 2023
[4] S. Caillou et al., Novel fully-heterogeneous GNN designs for track reconstruction at the HL-LHC, Proceedings of CHEP 2023
[5] H. Torres et al., Physics Performance of the ATLAS GNN4ITk Track Reconstruction Chain, Proceedings of Connecting The Dots (CTD 2023)
[6] ATLAS experiment, url: https://atlas.cern