IJCLab
Irène Joliot-Curie
Laboratoire de Physique des 2 Infinis

INTERNSHIP PROPOSAL

Fair Universe : Validation of « uncertainty-aware » Machine Learning algorithms for Higgs boson measurement at the LHC

Level (L3, M1, M2)	L3/M1
For M2, can be followed with PhD? (indicate the title of the PhD)	
Period / length of the internship (indicate the year)	Any duration, any time of the year
Supervisor	David Rousseau
Team/Service	ATLAS
Pole	PHE
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Pre-requisite

This internship is open to students currently in L3 (Bachelor) or M1 (master) level studies in Physics or in Computer Science (in this case, with a significant AI component), or in engineering school. Gap year engineering school 6-month internship is also possible.

Exceptionally, due to Paris 2024 Olympic Games the internship cannot take place in July or August 2024, and for June or Sep 2024 only students with secured accommodation in Paris area can be considered

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Description of the internship

There has been a surge of Machine Learning/Artificial Intelligence techniques in particle physics in recent years. However, it appears that a major roadblock delaying a wider adoption is the handling of uncertainties.

Fair Universe https://fair-universe.lbl.gov is a collaboration Berkeley / U Washington / U Paris Saclay (IJCLab) which aims at developing a major Machine Learning competition and benchmark on the measurement of Higgs to tautau cross-section at the Large Hadron Collider. There are two major innovations: 1) the algorithms developed should be robust against a set of representative systematic uncertainties 2) participants are expected to provide a Confidence Interval. Their goal is to minimize the size of the Confidence Interval while maintaining its statistical coverage at 68%.

The intern will participate to the finalization of the competition platform, with in depth analysis of various “uncertainty-aware” algorithms.

It is expected that the intern would be proficient with python/numpy/matplotlib ; hands-on experience with Machine Learning algorithms would be a plus.

Description of the team/service

The internship will take place in the PHE-ATLAS team at IJCLab. The PHE-ATLAS team is a founding group of the ATLAS collaboration with major contributions to the liquid argon calorimeter, inner detector and software, as well as Higgs Physics. David Rousseau https://users.ijclab.in2p3.fr/david-rousseau/en/home/ has been developing AI techniques for HEP, in particular generative models for calorimeter simulation, advanced tracking algorithms and, lately, uncertainty aware algorithms.

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