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A First Application of Collaborative Learning In Particle Physics

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Over the last ten years, the popularity of Machine Learning (ML) has grown exponentially in all scientific fields, included particle physics. Industry has also developed new powerful tools that, imported into academia, could revolutionise research. One recent industry development that has not yet come to the attention of the particle physics community is Collaborative Learning (CL), a framework which allows training the same ML model with different datasets. This work explores the potential of CL, testing the library Colearn with neutrino physics simulation. Colearn, developed by the British Cambridge-based firm Fetch.AI, enables decentralised machine learning tasks. Being a blockchain-mediated CL system, it allows multiple stakeholders to build a shared ML model without needing to rely on a central authority. A generic Liquid Argon Time-Projection Chamber (LArTPC) has been simulated and images produced by fictitious neutrino interactions have been used to produce several datasets. These datasets, called learners, participated successfully in training a Deep Learning (DL) keras model using blockchain technologies in a decentralised way. This test explores the feasability of training a single ML model using different simulation datasets coming from different research groups. In this work, we also discuss a framework that instead makes different ML models competing against each other on the same dataset. The final goal is then to train the most performant ML model across the entire scientific community for a given experiment, either using all of the datasets available or selecting the model which performs best among every model developed in the community.

Significance

At the moment, Collective Learning is unknown to academia and this work represents a first usage of this technology in particle physics.

References

Speaker time zone

Compatible with Europe

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