

Two computing challenges for particle physics : the tracking challenge and event simulation with Generative Adversarial Networks

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Abstract: I will expand on two specific lines of effort to solve the computational challenge at the LHC. (i) LHC experiments need to reconstruct the trajectory of particles from the few precise measurements in the detector. One major process is to « connect the dots », that is associate together the points left by each particle. The complexity of the process is growing exponentially with the LHC luminosity, so that new algorithms are needed. The TrackML challenge is a two phases competition to tackle the issue: 100.000 points to be associated into 10.000 tracks in less than 100 seconds. The first phase (with no speed incentive) has run on Kaggle over the summer, while the second one (with a strong speed incentive) is just starting on Codalab. I will summarize the preliminary findings and perspective. (ii) The growing LHC luminosity also increases the need of very high statistics and accurate event simulations. About 200.000 processor cores world wide are crunching numbers continuously to deliver event simulations, within the current baseline technique (Geant4 like) which is to simulate particles one by one. The recent Generative Adversarial Network technique allows to train an algorithm to generate images similar to an input set, whether celebrity faces, hotel rooms ...or particle showers in a calorimeter or even full LHC events. Once trained, the speed gain is potentially several order of magnitude. I will report on several strategies short-cutting the baseline approach that have now passed the proof of concept stage.

Bio: I am senior scientist at LAL-Orsay. After many years at the forefront of software developments for the ATLAS (CERN) experiment until the Higgs boson discovery in 2012, I was looking for something different. A chance encounter at the cafeteria with a Machine Learning (what was that?) scientist decided it. With Higgs physics always on my mind, I organized the Higgs ML challenge in 2014, and now the tracking ML challenge. I co-coordinate the ATLAS ML forum. I'm keen on both riding and promoting the ML wave in particle physics and science in general.

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