Going Beyond Machine Learning with Machine Learning
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Hi everyone, I'm Bob and I work as a PhD student in Nijmegen. My research focuses on how machine learning can help the search for new physics. Currently I am investigating a technique called normalising flows, which could be able to parametrise pro so it might not come as a surprise that I personally always like it when I hear some research has used machine learning. Broadening the scope of this incredibly powerful tool, so to say. It is like no other tool able to extract knowledge from data. Knowledge that is easily obscured by high problem dimensionality or complex background noise.

What I like less however is that more often than not, when someone claims to have done machine learning, it boils down to the same old same old. Let's do a short test to see this. Who has worked with machine learning in their research before? Raise your hand. Now keep your hands raised, unless this was exclusively a Boosted Decision Tree. Same, but now for neural networks signal detection (as if it were a neural network).

Machine learning is a whole field of study. I have tracked for the past week the number of papers appearing on arxiv for hep-exp, hep-ph and hep-th. This resulted in *this* graph. Impressive in its own right and I think everyone here will acknowledge the broadness of the subjects covered by our papers. But, for comparison, the arxiv submissions for the machine learning category is up *here*. Wanna know how many of those covered BDTs? 3. What did the others cover? A lot.

The subjects range from the analysis of sequences of data[1] to detection of false positives[2]. And from anomaly detection[3] to solving inverse problems[4] (something I have been working on quite extensively). In other words: there is a whole range of machine learning applications that we have not even tried. Machine learning is more than BDTs in TMVA.

Machine learning is a world of possibilities that high energy physics has just started to get a taste of. This world can be hard to wade through, with all kinds of terminology that is just not part of the physics lingo. But, given the possibilities that the tools provide, I believe it would be a shame if we would be stopped by something as a language. So if you ever want to know how machine learning can help you solve your problems, my door and -- for those who do not want to come all the way to Nijmegen -- my mail, are always open.

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[1] arxiv:1912.03126
[2] arxiv:1912.03673
[3] arxiv:1912.03582
[4] arxiv:1912.04212