

Research interests

of Simon Kluettermann (PhD applicant)

Past research: After a [bachelor thesis](#) about using machine learning to improve the AMS detector analysis, I wrote my [masters thesis \(Deep learning for new physics mining at the LHC\)](#) about a modification of a paper called [QCDorWhat](#). Their idea was to use machine learning (namely anomaly detection) to unsupervisedly detect LHC jets that are not (only) the product of standard model interactions. My initial task, was to apply graph machine learning to the same task and see if this improves the quality. And even though this was by no means trivial, it became clear that their initial approach is flawed for this to have any big effects: To find anomalous jets, they used a technique based on autoencoders. Sadly their desired goal of finding any anomalous events was only tested on limited anomalies, which resulted in them being great at finding this anomaly, but sadly not very good at every other one. After I found this, my master thesis kind of pivoted, making me focus more on generality than on quality. Even though I had to use other algorithms than autoencoders to make this work, my final models were quite general, and able to detect nearly any anomaly (there is a nice comparison plot at the end of my [abstract](#)).

Future interests: My future interests are strongly influenced by my thesis. On the machine learning side, this means that I have a strong interest in understanding my models on a deeper level (and a slight bias to thinking that machine learning models are less powerful and complicated than they seem), while on a scientific level I think it is sad, that good anomaly detection is a bit neglected, as there are few fields where it could not be applied. Dark Matter searches are a prime example of a field that could profit from good anomaly detection. Instead of searching for expected signs, anomaly detection can search for anything unexplainable. This can make it hard to differentiate between sources of these anomalies, but also allows you to make connections that could not be done by a human. On a more philosophical level I am fascinated by this idea. The concept of things that cannot be found by a human biases, but could be found by a machine. Finally some other things that I was/am interested in, you find in my [github](#) and I would also not like just to do things that I am already familiar with.

Referees

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