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Anomaly detection is something that took a while to be faszinating for me. Maybe this was because it is part of my master thesis or because it seemed like there is nothing to do except for training an autoencoder. Later, after showing that autoencoder anomaly detection is actually not that great (see my Master thesis), I have briefly worked with classical anomaly detection algorithms (IsolationForest, Support vector machines, K neirest neighbour) until I found an anomaly in my autoencoder setup and developed it into my own anomaly detection algorithm, which (at least for master thesis) works better than each of the above (see oneoff networks in my master thesis).

Now having a bit more experience, anomaly detection is one of the most faszinating fields I know: Finding something that you dont know about, without neccesarily having a clear understanding of what it is that you know about seems to be science in its purest form. And from my experience, it is not a field that is suffiently developed, which is really sad, since a great anomaly detection algorithm would be really useful. You could use it to find new physics basically everywhere: From a more particle detector approach (like in my Master thesis) over cosmological dark matter searches and SETI to even weirder approaches (see for example an example from the documentation of grapa that finds non standart model feynman diagramms here)