Contribution ID: **289** Type: **Oral Presentation**

Anomaly Detection on the high throughput network of the ATLAS TDAQ system

Tuesday, 5 July 2022 12:45 (15 minutes)

As the volume of data recorded from systems increases, there is a need to effectively analyse this data to gain insights about the system. One such analysis requirement is anomaly detection. Data-driven approaches such as machine learning, are by construction, able to *learn* (to some degree) the underlying representations in the data and consequently identify a hyperplane which separates the normal point states from the anomalous ones. In most cases the data is not linear in the parameter space, does not possess apparent trends or periodic seasonality and is noisy. In this work, we develop models for anomaly detection analysing data obtained from the networking devices of the ATLAS Trigger and Data Acquisition System (comprising approximately 10 000 interfaces polled at 30 seconds intervals). The selection of algorithms was based on robustness and interpretability of the models. Ultimately, the deep learning architectures as well as those inspired by biological networks and those that employ transformations that linearise the measurement space were chosen. Preliminary results indicate that we are able to model the system to some degree and the anomaly detection solution is generic for a multiple parallel suite of time series data, somewhat independent of its origin. As such these concepts and results are also applicable to the energy space, for example, monitoring data streams from a power station. Successful development would imply new insights into how anomalies occur in a system and/or when they will occur and would allow for in-depth analyses such as Root Cause Analysis. The combination of an interpretable model and Root Cause Analysis would lay foundations for developing a Reinforcement Learning based system in which the system could take active decisions on certain anomaly encounters.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

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Session Classification: Theoretical and Computational Physics

Track Classification: Track G - Theoretical and Computational Physics