CDCS
CENTER FOR DATA AND COMPUTING
IN NATURAL SCIENCES

OPENING SYMPOSIUM 2022

Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

DESY.

TUHH

Contribution ID: **26** Type: **Oral**

Dynamic clustering for anomaly detection and diagnosis

Thursday 28 April 2022 11:00 (40 minutes)

Monitoring is a key element in guaranteeing the state of health of a system, all the more important when the system is critical, autonomous, and/or operating remotely. Anomaly detection and diagnosis are two main aspects. While model-based approaches have been around for a long time, they have been challenged in recent years by data-based approaches which proceed with an exploration of historical data to infer, by learning, a model.

Most systems are subject to multiple variations because they operate in evolving environments and may suffer ageing or unexpected situations. Evolving environments and dynamicity challenge machine learning researchers with nonstationary data flows where the concepts being tracked can change over time. In this regard, dynamic clustering algorithms have been developed to be able to perform state tracking and online anomaly detection in such contexts.

In this talk, I will present the principles of a dynamic clustering approach to track evolving environments that uses a two-stages distance-based and density-based clustering algorithm. I will explain how these principles can be used to develop an online method of double anomaly detection adapted to the requirements of on-board operation. The objective is to design a software protection component for space electronics against radiation faults, a project that we are carrying out in partnership with the French Space Agency CNES.

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Session Classification: CDL4 (Controls of Accelerators)

Track Classification: CDL4 (Control of Accelerators)