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Early prediction of system failures at LANSCE

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Particle accelerators are among the largest and most expensive scientific facilities. Constant monitoring of data from a diverse array of diagnostics is imperative to ensure proper operational parameters—such as beam parameters, power sources, cooling systems, etc. Detecting equipment failure within this data stream is challenging due to the accelerator parameters gradually shifting over time due to diverse user demands, environmental factors, and the feedback control system's operation. At LANSCE, identifying anomalies stemming from deteriorating equipment is a significant issue. To address this, we propose implementing an anomaly detection system based on existing machine learning algorithms. This system will monitor all available data for each accelerator subsystem, establish typical parameter ranges, and determine whether the measured parameters fall beyond those thresholds. This anomaly detection system aims to factor in intrinsic internal correlations among various parameters, which the current Data Watcher warning system fails to consider. We anticipate that this developed warning system will effectively identify ongoing equipment degradation and predict upcoming failures.

Footnotes

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