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Data Science for Improving CERN's Accelerator Complex Control Systems

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Data science is about unlocking valuable insights and obtaining deep knowledge out of the data. Its application enables more efficient daily-based operations and more intelligent decision-making processes. CERN has been very successful on developing custom data-driven control and monitoring systems. Several millions of control devices: sensors, front-end equipment, etc., make up these critical-mission services and have lead to a significant investment in terms of data persistency. Exploiting CERN's historical investment on data and evolve the controls and monitoring infrastructures to intelligent, predictive and proactive control and monitoring systems has become an essential task to overcome some the most important challenges to be faced in the coming years. CERN's Engineering, Beams and Information Technology departments have documented this fact. This paper describes how applied data science: classification, clustering, time series forecasting and information discovery techniques, allows us to improve the efficiency of CERN's control and monitoring systems by performing efficient and intelligent predictive maintenance on control equipment, detecting potential anomalies and spotting hidden root causes. Future developments and applications are also discussed.

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