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Online image-based beam-dump anomaly detection

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The CERN SPS Beam Dump System (SBDS) disposes the beam in the SPS at end of cycled operation or in case of machine malfunctioning, with its kicker magnets deviating the beam to an absorber block and diluting the particle density. This is a critical system, as its malfunctioning can lead to absorber block degradation, unwanted activation of the surroundings or even damage to the vacuum chamber. We develop an online anomaly detection system for the SBDS based on real-time images of a beam screen device. Crucially, the model must accurately classify these images despite being trained on an unlabelled dataset and one in which anomalous samples are uncommon. We show this can be achieved with a convolutional autoencoder and by leveraging the quality of its reconstructions. This work improves the safety of operating the SPS and contributes towards the goal of automating the operation of particle accelerators.

Primary Keyword

anomaly detection

Secondary Keyword

Tertiary Keyword

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