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Anomaly Detection for Predictive Maintenance in Data Centers Using Variational Autoencoders

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Anomaly detection is a critical component of predictive maintenance in data centers, where early identification of abnormal patterns in system behavior can prevent failures and reduce operational costs. This work explores the application of Variational Autoencoders (VAEs) for unsupervised anomaly detection in data collected from data center infrastructure. VAEs are probabilistic generative models that learn latent representations of data, enabling the identification of deviations from normal operational patterns.

Our approach leverages information from data centers to train a VAE on normal operating conditions. Once trained, the VAE identifies anomalies as inputs with high reconstruction errors or low likelihood in the learned latent space. The results suggest that VAE-based anomaly detection has potential to provide a robust solution for monitoring complex data center environments, with advantages over traditional threshold-based and supervised methods. Additionally, the integration of this technique with predictive maintenance workflows is discussed, highlighting its potential to enhance failure prediction accuracy and operational reliability. This study underscores the value of VAEs in advancing the automation and intelligence of predictive maintenance systems.

Primary author: LORUSSO, Marco (University of Bologna and INFN)

Presenter: LORUSSO, Marco (University of Bologna and INFN)

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