

ABSTRACT

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Title : MLOps Integration for Monitoring, Drift Detection, and Adaptive Retraining in Gas Sensor-Based Machine Learning Production Systems

Machine learning models deployed in sensor-based production systems are prone to performance degradation due to dynamic changes in data distribution, commonly referred to as data drift. Without structured monitoring and model update mechanisms, prediction reliability may deteriorate over time. This study proposes an integrated Machine Learning Operations (MLOps) approach for monitoring, drift detection, and adaptive model retraining in production machine learning environments. Experiments are conducted using the Gas Sensor Array Drift Dataset from the UCI Machine Learning Repository, processed in batch-based streams to simulate real-world operational conditions. Data drift is identified using the Population Stability Index (PSI) and Kullback–Leibler Divergence (KL), which serve as triggers for adaptive retraining. Experimental results indicate that adaptive retraining consistently maintains more stable model performance compared to no-retraining and periodic retraining strategies, while enabling a reproducible and well-managed machine learning lifecycle.

Kata kunci: *Adaptive Retraining, Data Drift Detection, Gas Sensor Data, Machine Learning Operations (MLOps), Production Machine Learning*