Performance Evaluation of AI Models for Monitoring Automotive Component Traceability Data

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**Abstract.** In the era of Industry 4.0 and smart manufacturing, ensuring the accu- rate traceability of automotive electronic components has become a central chal- lenge for maintaining quality, compliance, and operational efficiency. This study conducts a comparative evaluation of three unsupervised artificial intelligence models Isolation Forest, One-Class Support Vector Machine (SVM), and Auto- encoder for anomaly detection within IoT-enabled traceability systems. To this end, a simulated production environment was developed to replicate an automo- tive upstream supply chain, integrating IoT technologies such as RFID sensors, barcode readers, and real-time tracking systems. To mimic realistic industrial dis- ruptions, controlled anomalies including sequence breaks, duplicate scans, and batch misallocations were systematically injected into the dataset. Experimental results demonstrate that the Autoencoder achieves the highest recall rate (85%), making it particularly suitable for contexts requiring exhaustive anomaly detec- tion, while the Isolation Forest delivers the highest precision (85%), minimizing false positives in high-throughput environments. These findings underscore the trade-offs between sensitivity and accuracy, providing actionable insights into selecting the most appropriate model based on industrial priorities, and paving the way for the deployment of AI-driven monitoring solutions in real-world IoT- based traceability systems.

**Keywords:** Traceability, Automotive Supply Chain, Internet of Things (IoT), Artificial Intelligence (AI).