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Automated Multi-ERP Unit of Measure Harmonization: A Machine Learning and Reinforcement Learning Approach for Supply Chain Data Consistency

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Abstract

A major enterprise challenge affecting $250 million in configurable materials sales is the inconsistent and error-prone management of Units of Measure (UOM) across three ERP systems. To address this, a unified, intelligent system architecture was developed with a four-stage pipeline that integrates multi-source data acquisition, intelligent harmonization, autonomous decision-making, and production handover. The Knime workflow used eliminates UOM discrepancies between PRE (development/testing), PRD (production), and PRP (production planning) environments while supporting CSV file uploads for companies without SAP ERP. All conversions are validated against NIST standards, ensuring physical compatibility. A key innovation lies in the intelligence layer, which incorporates over 60 features capturing temporal, material, supplier, system, and business variables relevant to UOM accuracy. This machine learning model achieves 85–92% prediction accuracy, while a reinforcement learning component reaches a 94% autonomous resolution rate, reducing human intervention to 6% and dramatically reducing manual workload while maintaining high precision. The final stage produces validated, audit-ready output files containing standardized material data, converted quantities, confidence and risk scores, and recommended actions, enabling seamless import into Logility and automated transfer to production environments. This is the first solution to unify direct ERP integration and manual file processing under a single decision framework, applying identical feature engineering and decision logic regardless of data origin. Operating at enterprise scale, it processes thousands of records per minute with 99.9% reliability, delivering real-time risk assessment and robust compliance support. Ultimately, it transforms fragmented data handling into an automated, intelligent, and highly reliable supply chain data management standard.

Keywords: Automation; Data Harmonization; ERP Integration; Machine Learning; Supply Chain