

Machine Learning–Based Optimization of Officer Assignment and Inspection Time in Vehicle Entry Process

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Abstract

This study presents a machine learning driven approach to optimize officer assignment and minimize inspection time variability in the vehicle entry process. The analysis utilized real operational data including stage-wise inspection times, number of mistakes, and officer-related attributes. Linear Regression and XGBoost models were developed and compared for predicting inspection duration and error probability. The results demonstrated that XGBoost outperformed the linear model with higher accuracy ($R^2 = 0.94$, $RMSE = 0.33$), enabling more reliable forecasting of officer performance. A scheduling optimization algorithm was then implemented to allocate officers to inspection stages while preventing task overlap and minimizing total cycle time. The integrated system enhances process efficiency, reduces inspection delays, and provides a scalable framework for continuous improvement through data analytics and AI.

Keywords

Machine Learning, Optimization, Inspection, Vehicle, Entry Process