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📖 README

Smart Supply Chain: Delivery Delay Prediction & Supplier Segmentation

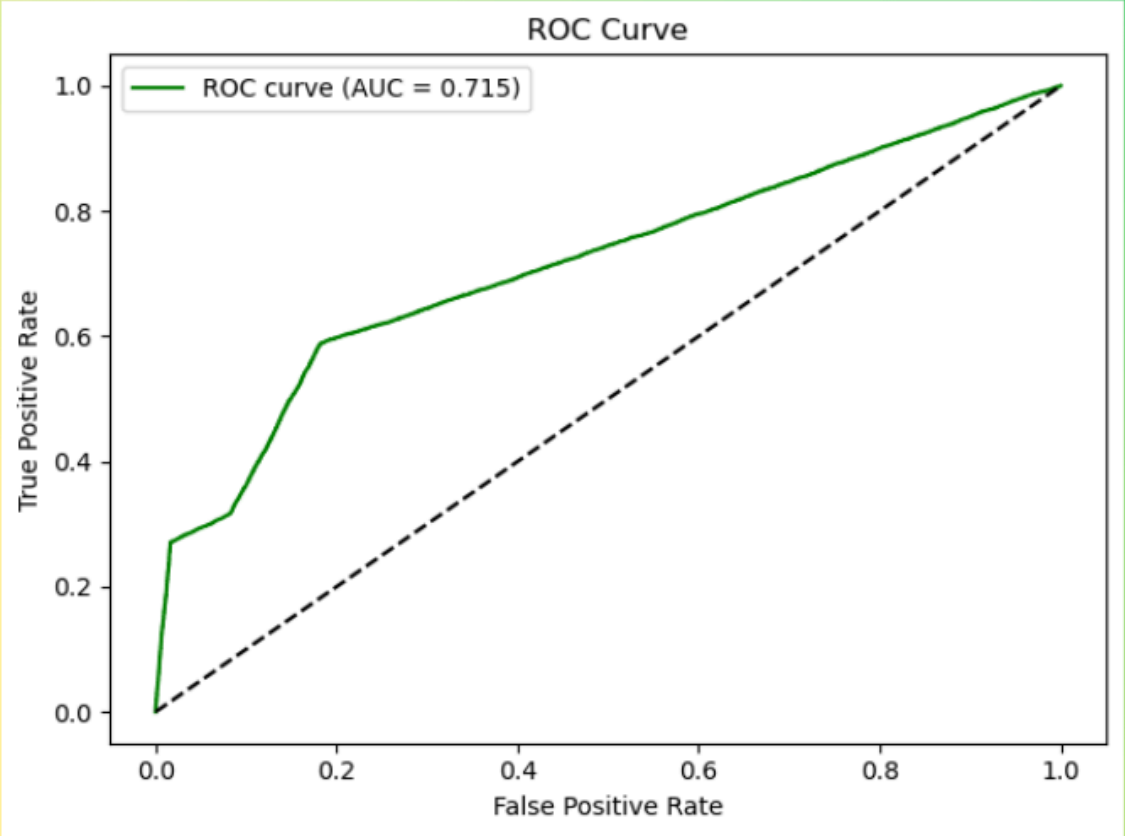
Project Overview

Machine learning solution for supply chain optimization using DataCo's 180K+ order dataset. Implements logistic regression for delivery delay prediction and multi-class classification for supplier reliability assessment.

Technical Summary

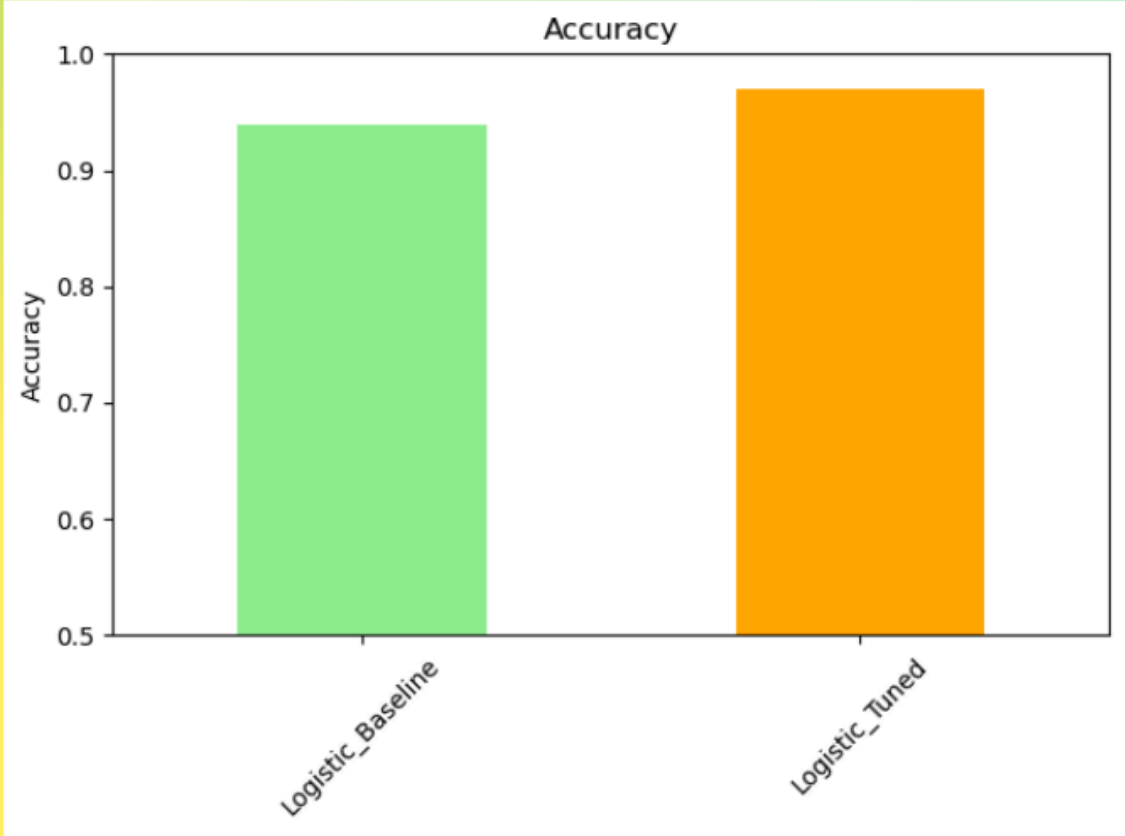
Problem 1: Delivery Delay Prediction (Binary Classification)

- Target:** Late delivery risk
- Features:** Shipping mode, customer segment, market, scheduled days, order metrics
- Model:** Tuned Logistic Regression
- Performance:** ROC-AUC 0.756, F1-Score 0.743
- Key Insight:** Same Day shipping shows 30% delay risk vs 70% for Standard Class



Problem 2: Supplier Reliability Classification (Multi-class Classification)

- Target: Reliability tiers
- Features: Late shipment rate, lead time variability, order volume, profitability
- Model: Multinomial Logistic Regression
- Performance: Macro F1-Score 0.890, Accuracy 0.895
- Key Insight: Late shipment rate and lead time performance are primary differentiators



Results & Visualizations

- ROC Curve Analysis: Binary classification achieves strong discriminative power (AUC > 0.75)
- Confusion Matrix: High precision for both on-time and late delivery predictions
- Feature Importance: Shipping mode and geographic location emerge as critical factors
- Supplier Segmentation: Clear separation between reliability tiers across performance metrics

Implementation

- Scikit-learn pipeline with StandardScaler preprocessing
- GridSearchCV hyperparameter optimization
- Real-time prediction capability for new customer demand



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