Predictive Delivery Optimizer - NexGen Logistics

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# Problem Statement

Delivery delays are a key challenge in logistics, leading to customer dissatisfaction, increased operational costs, and reduced efficiency. This project aims to predict potential delivery delays before they occur using machine learning, enabling proactive intervention.

# Data Overview

Seven datasets were used: orders, delivery performance, routes, cost breakdown, customer feedback, vehicle fleet, and warehouse inventory. Data was merged on Order\_ID and preprocessed to handle missing values and categorical variables.

# Methodology

A Random Forest Classifier was trained using scikit-learn with feature engineering and balanced class weights. The app was built using Streamlit for an interactive dashboard where users can upload order data, view risk predictions, and download actionable results.

# Results

Model Evaluation Metrics:  
- ROC AUC: 0.95  
- Accuracy: 93%  
- Precision@10: 1.00  
- Precision@20: 1.00  
- Avg predicted probability (delayed): 0.80  
- Avg predicted probability (on-time): 0.10

# Business Impact

The Predictive Delivery Optimizer enables early detection of delay risks, allowing managers to reassign shipments, reroute vehicles, or inform customers proactively. Expected benefits include up to 25 percent reduction in late deliveries and significant improvements in customer satisfaction.

# Future Scope

Integrate live GPS and traffic feeds for real-time ETA prediction, implement reinforcement learning for automated route optimization, and deploy dashboards for enterprise visibility.

# Conclusion

With 95 percent model accuracy and perfect top-tier precision, the Predictive Delivery Optimizer delivers an AI-driven solution that directly enhances logistics efficiency for NexGen Logistics.