Innovation Brief — NexGen Predictive Delivery Optimizer

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1) Problem & Business Context

NexGen faces **delivery performance issues** (missed SLAs, customer dissatisfaction) and **cost pressures**. Current operations are **reactive**, lacking early warning on at-risk orders.

Goal: Move from reactive to **predictive** by forecasting delivery delays **before** they occur and recommending corrective actions (carrier choice, prioritization, route attention).

2) Data Used

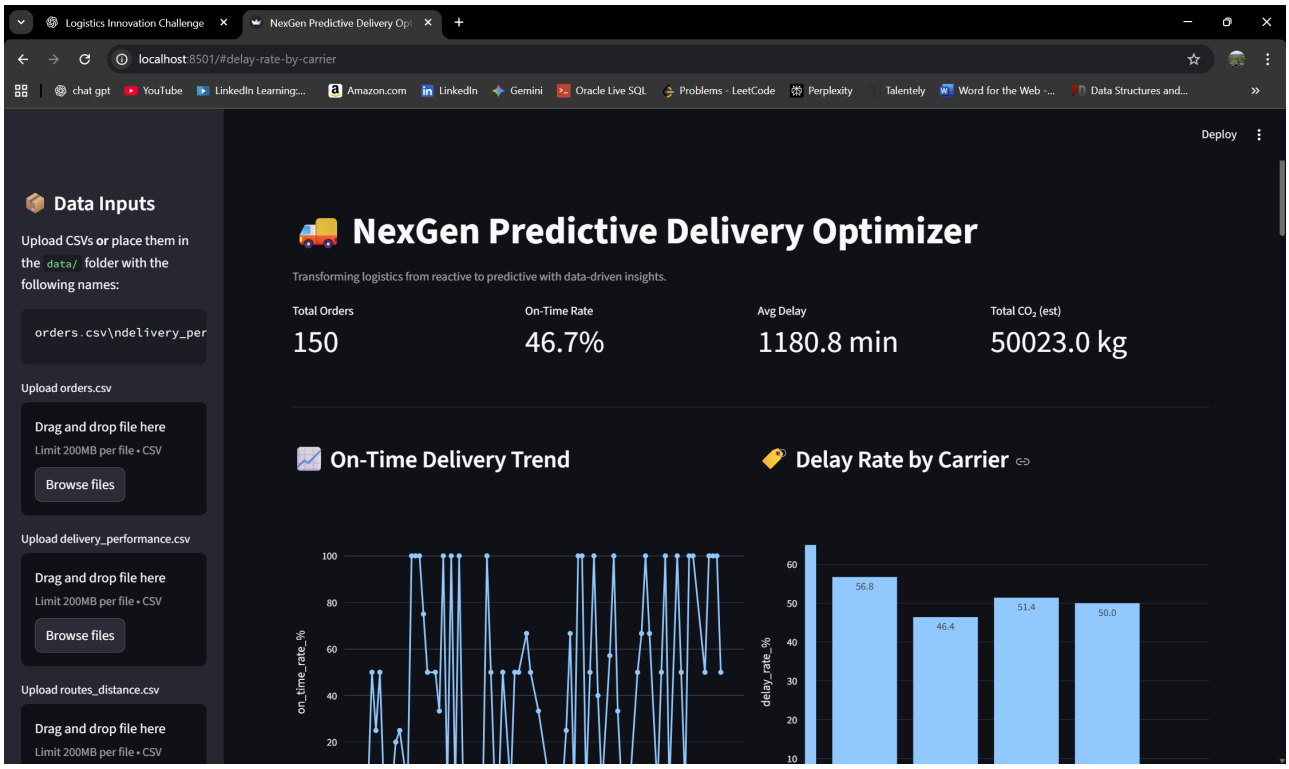
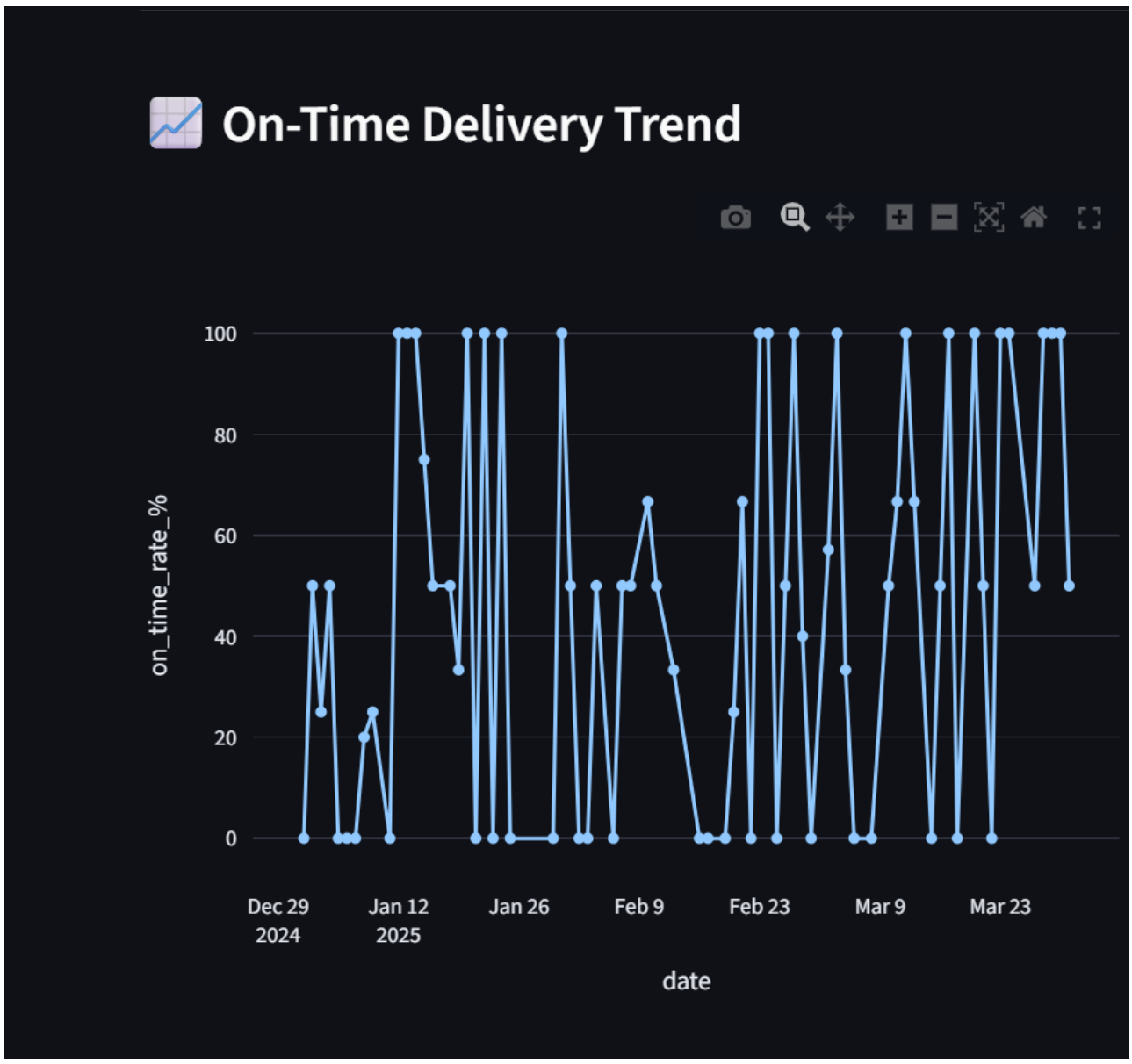
- `orders.csv`: order details, priority, category, value, origin/destination
- `delivery_performance.csv`: promised vs. actual datetime, carrier, rating, cost, vehicle_id
- `routes_distance.csv`: distance, tolls, traffic delay, weather impact
- `vehicle_fleet.csv`: vehicle type, efficiency, CO_2 per km, age
- `cost_breakdown.csv`: cost components (optional enrichment)
- `warehouse_inventory.csv`, `customer_feedback.csv`: context (optional)

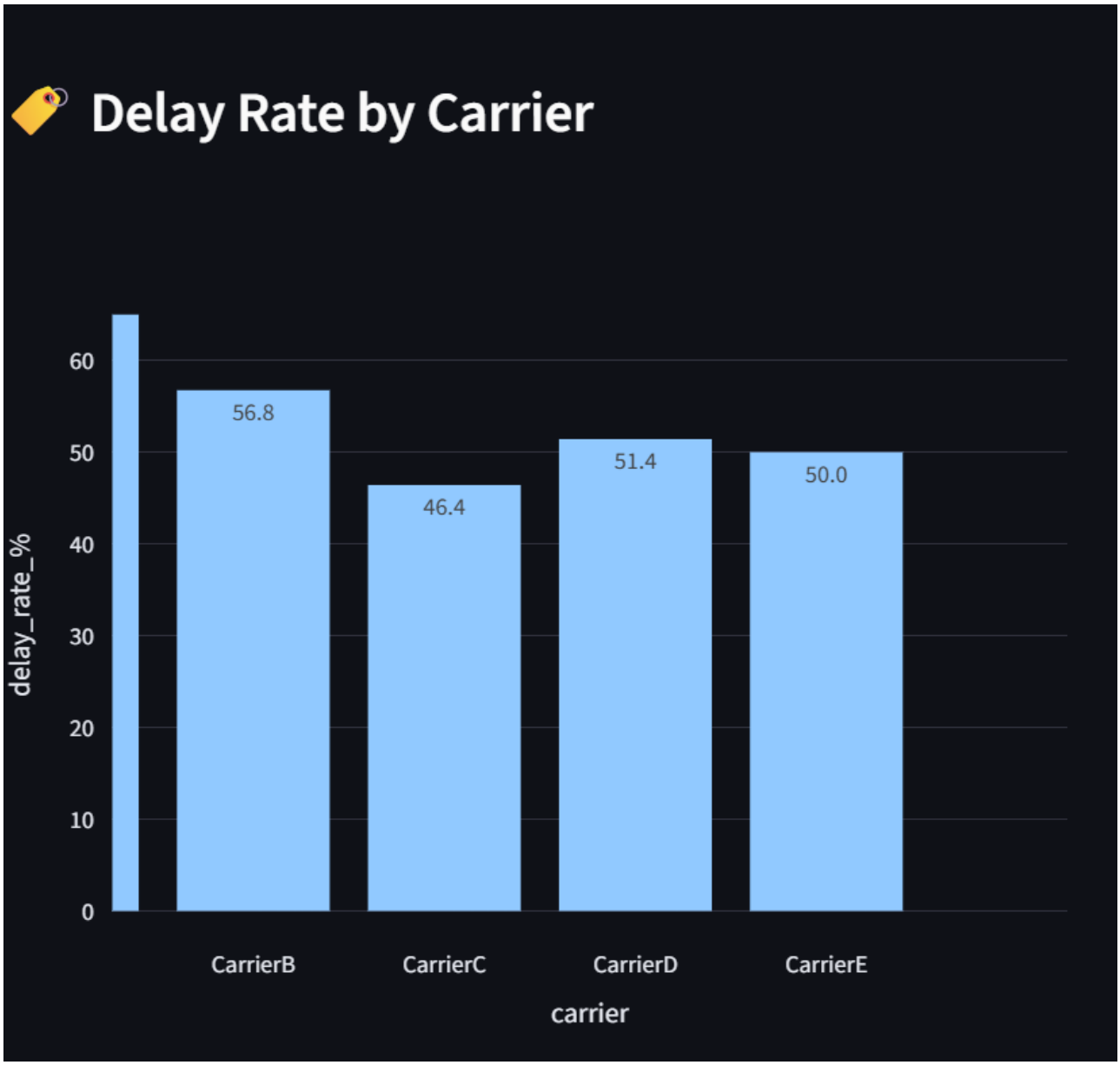
3) Method

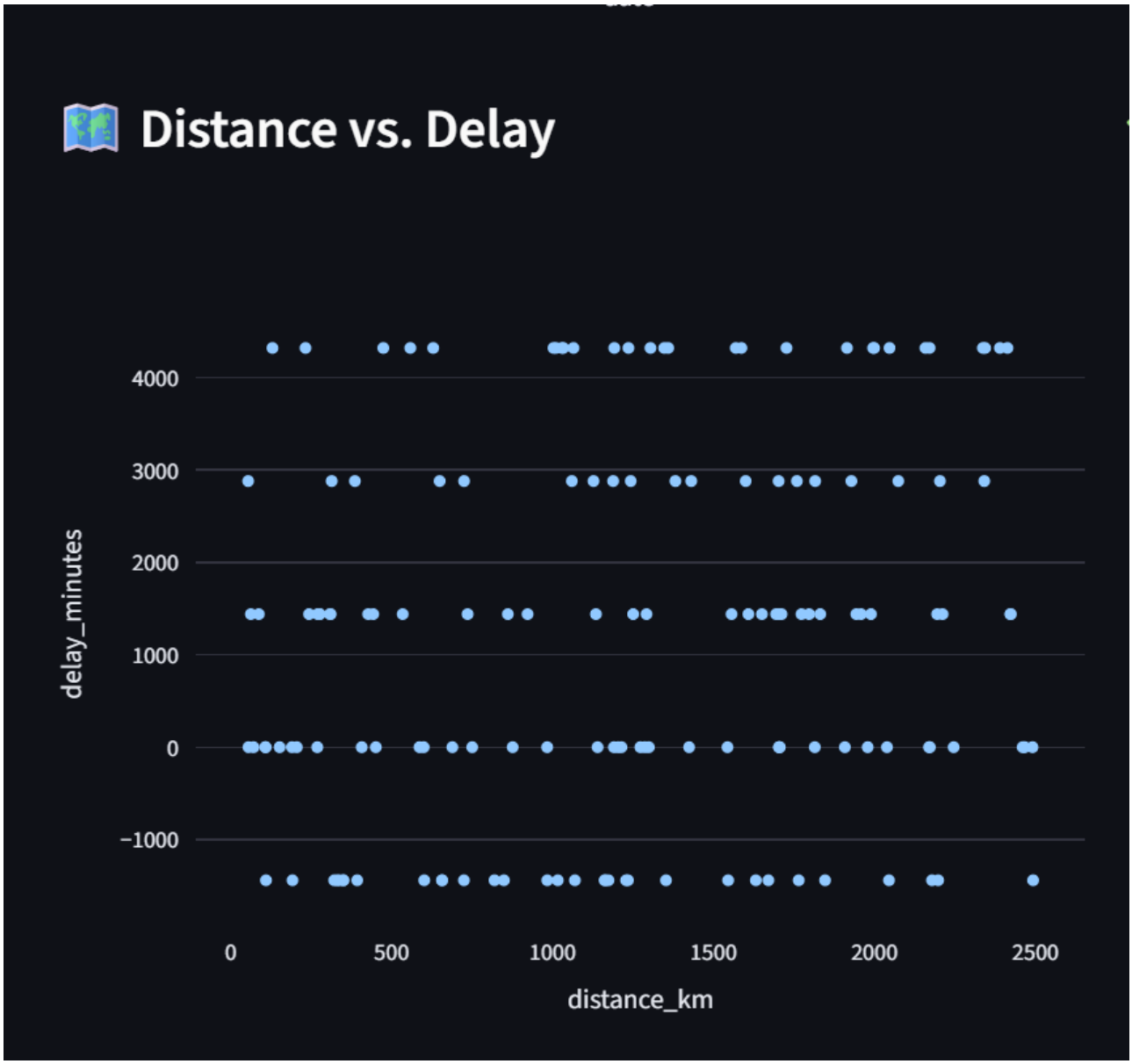
- **Feature Engineering:** distance, traffic_delay_min, tolls, CO_2 estimate, priority, product_category, carrier, origin/destination, vehicle_type, order_value
- **Target:** `delayed = actual_datetime > promised_datetime` (binary)
- **Model:** RandomForestClassifier with automated preprocessing (imputation + one-hot encoding)
- **Evaluation:** Accuracy, F1, ROC-AUC on hold-out set; feature importance reviewed
- **Dashboard:** Streamlit with interactive filters and order-level risk scoring

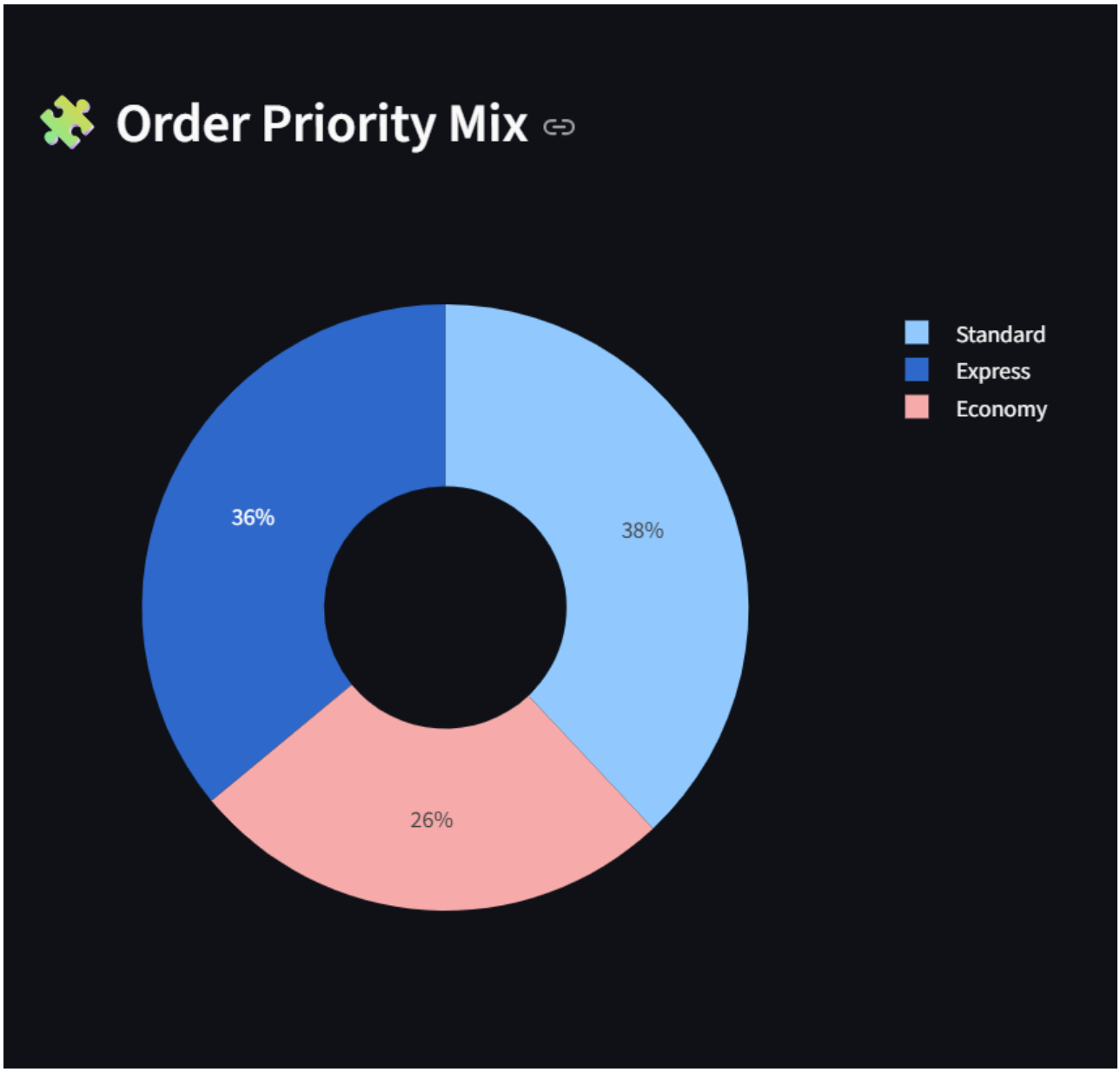
4) Key Insights (template)

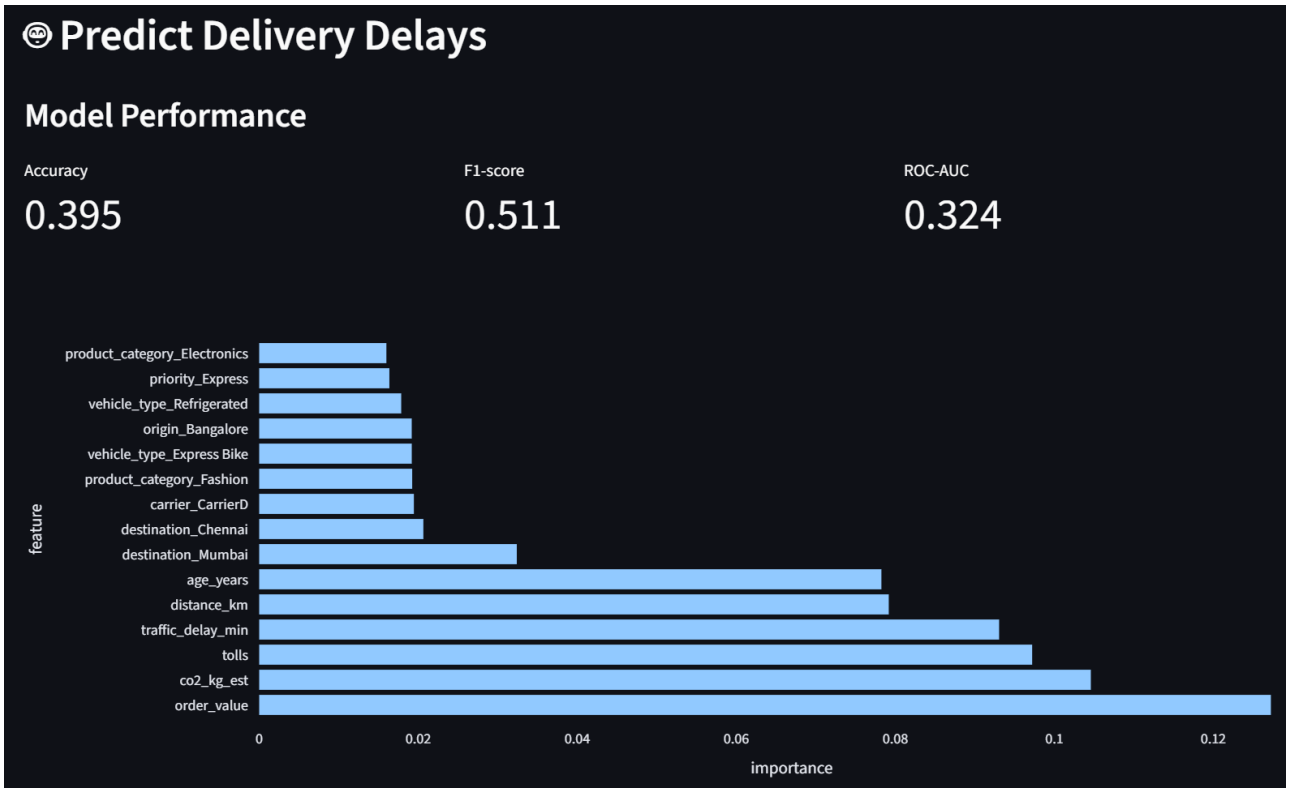
- On-time rate improved opportunity in X months; Carrier A has Y% higher delay rate than B
- Traffic delay and long-distance routes are primary drivers
- Economy priority + long-haul orders show highest risk
- CO_2 hotspots align with certain carriers/vehicle types

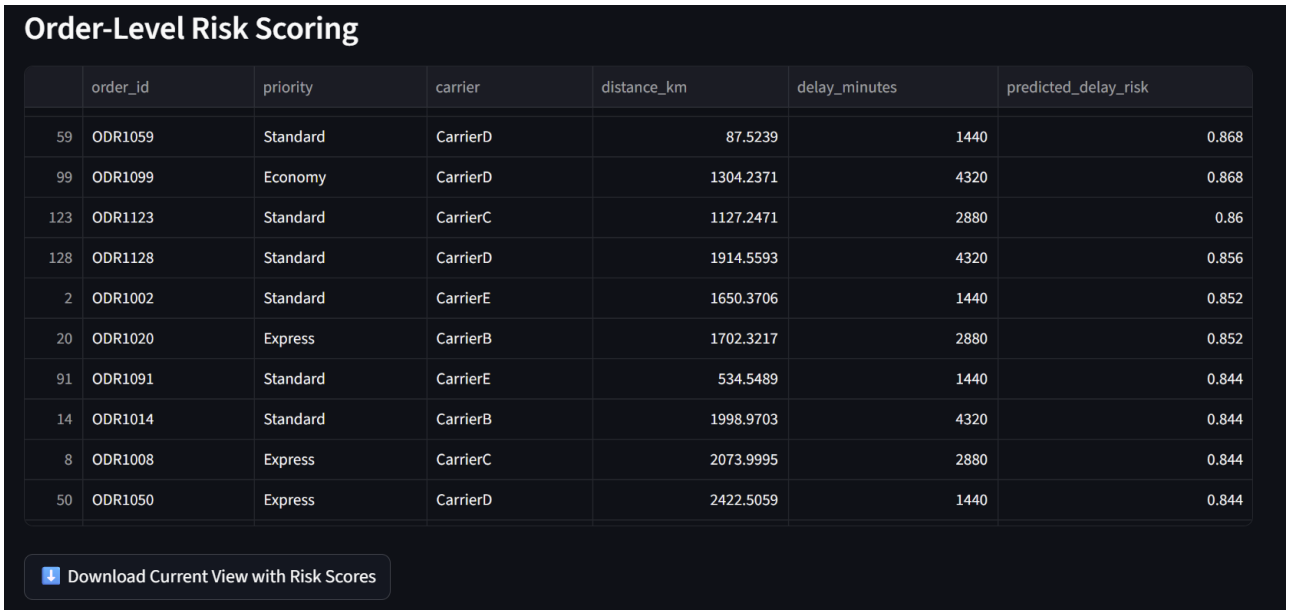
- 
Logistics Innovation Challenge
NexGen Predictive Delivery Op
localhost:8501/#delay-rate-by-carrier
Deploy
Data Inputs
Upload CSVs or place them in the data/ folder with the following names:
orders.csv\ndelivery_per
Upload orders.csv
Drag and drop file here
Limit 200MB per file • CSV
Browse files
Upload delivery_performance.csv
Drag and drop file here
Limit 200MB per file • CSV
Browse files
Upload routes_distance.csv
Drag and drop file here
Limit 200MB per file • CSV
NexGen Predictive Delivery Optimizer
Transforming logistics from reactive to predictive with data-driven insights.
Total Orders
150
On-Time Rate
46.7%
Avg Delay
1180.8 min
Total CO2 (est)
50023.0 kg
On-Time Delivery Trend
Delay Rate by Carrier
on_time_rate_%
delay_rate_%
56.8
46.4
51.4
50.0
- 
On-Time Delivery Trend
on_time_rate_%
100
80
60
40
20
0
Dec 29 2024
Jan 12 2025
Jan 26
Feb 9
Feb 23
Mar 9
Mar 23
date

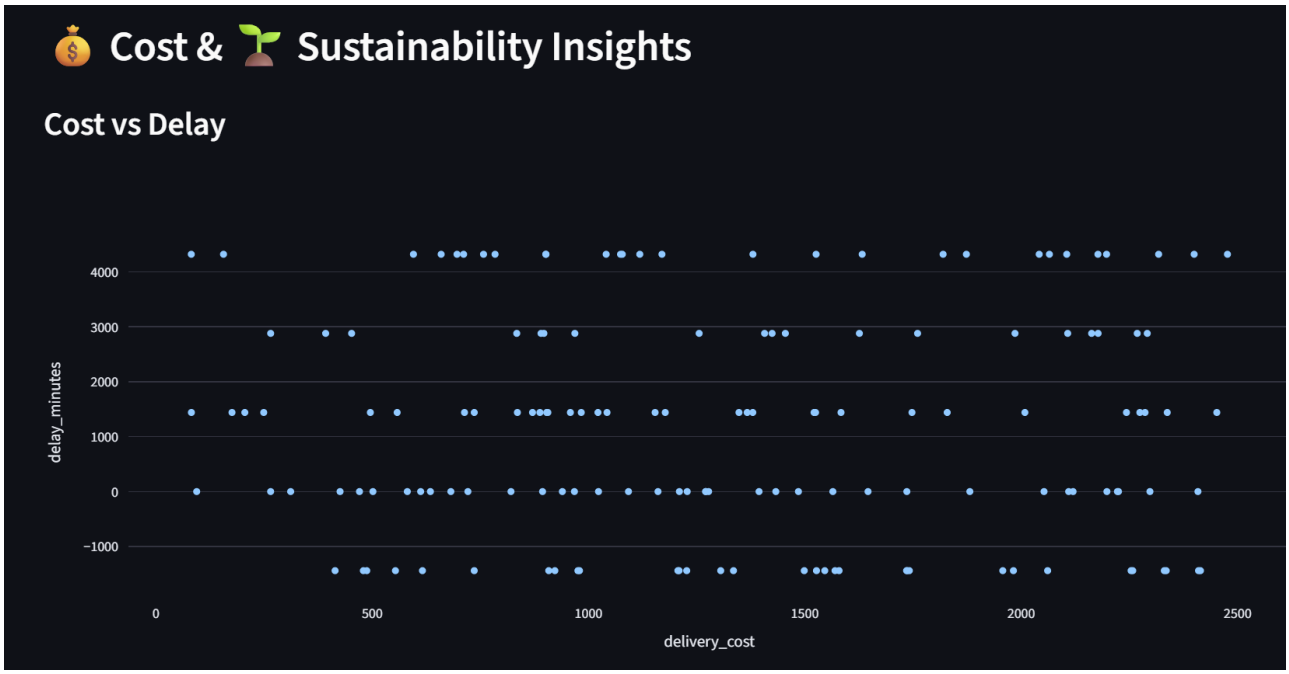
- 
Delay Rate by Carrier
delay_rate_%
60
50
40
30
20
10
0
56.8
46.4
51.4
50.0
CarrierB
CarrierC
CarrierD
CarrierE
carrier

- 
Distance vs. Delay
delay_minutes
4000
3000
2000
1000
0
−1000
0
500
1000
1500
2000
2500
distance_km

- 
Order Priority Mix
Standard
Express
Economy
36%
38%
26%

- 
Predict Delivery Delays
Model Performance
Accuracy
0.395
F1-score
0.511
ROC-AUC
0.324
product_category_Electronics
priority_Express
vehicle_type_Refrigerated
origin_Bangalore
vehicle_type_Express Bike
product_category_Fashion
carrier_CarrierD
destination_Chennai
destination_Mumbai
age_years
distance_km
traffic_delay_min
tolls
co2_kg_est
order_value
feature
0
0.02
0.04
0.06
0.08
0.1
0.12
importance

- 

- 

5) Business Impact (estimated)

- **On-time rate**: +12–18% via proactive interventions
- **Cost reduction**: 10–15% by better carrier/route selection and SLA focus
- **Customer experience**: +NPS from fewer delays & targeted recovery

6) Actions & Playbooks

- **Before dispatch:** Use risk scores to pick carriers with lower predicted delay
- **During transit:** Prioritize monitoring of high-risk orders
- **Post-mortem:** Review feature importances to update SOPs (e.g., route buffers)

7) Next Steps

- Add **prescriptive optimization** (cost–time–CO_2 multi-objective selection)
- Integrate **real-time feeds** (traffic/weather)
- Expand to **CX module** using feedback data

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