DHL Delivery Delay Analysis– Case Study

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1. Executive Summary

This case study presents an analysis of delivery delays experienced by DHL between January and May 2025. By applying data science techniques, the project aimed to uncover patterns and drivers of delays, build a predictive model to identify at-risk deliveries in advance, and offer actionable recommendations to enhance delivery performance. The outcome is a set of insights and tools that support more informed operational decisions and improved customer satisfaction.

2. Business Objective

The primary goal of this project was to investigate the root causes of delayed deliveries and to provide DHL with data-driven recommendations. These insights are intended to reduce the frequency of late deliveries, optimize route planning and vehicle usage, and ultimately help DHL maintain its reputation for reliable and timely service.

3. Dataset Overview

The dataset used in this analysis contained over 10,000 individual delivery records. Each record included variables such as delivery distance, package volume, time window for delivery, actual delivery time, vehicle type used, weather conditions, and traffic levels. These diverse attributes allowed for a comprehensive view of the factors affecting delivery performance.

4. Exploratory Data Insights

Initial analysis revealed that approximately 21 percent of deliveries were delayed. The most frequent delays occurred during the late afternoon, particularly between 4 PM and 6 PM. Further analysis showed that rainy weather and high traffic conditions were strongly correlated with increased delays. Additionally, Route R21 and deliveries involving vans appeared to have consistently higher delay rates compared to other segments.

5. Feature Engineering & Modeling

To enable more precise analysis and prediction, we created several engineered features. These included the extraction of the delivery hour from timestamps, binary flags to indicate delays, rolling averages for distance and delivery time, and a calculated risk score for each delivery. A classification model, specifically a Random Forest, was developed using these features. The

model achieved high accuracy and provided interpretable results that could be integrated into DHL's decision-making processes.

6. Key Findings

The findings of this study highlight the importance of delivery timing, with evening deliveries being notably more prone to delays. Certain routes, particularly Route R21, consistently exhibited underperformance. The machine learning model demonstrated the ability to accurately flag high-risk deliveries in advance, providing DHL with an opportunity to intervene proactively before issues arise.

7. Business Recommendations

Based on the insights gained, we recommend optimizing delivery scheduling to avoid peak traffic periods, especially during late afternoons. Deliveries on high-risk routes should be equipped with real-time traffic alerts, and drivers assigned to these routes may benefit from targeted coaching or reassignment. Additionally, DHL may consider revising its service level agreements (SLAs) for time windows that are frequently impacted by weather or traffic disruptions, allowing for more realistic delivery expectations.

8. Implementation Plan

To test the effectiveness of these recommendations, we propose a pilot program focusing on Route R21 and Route R03. The pilot would run for four weeks and involve enhanced scheduling and the use of traffic-aware navigation tools. During the trial, key performance indicators such as on-time delivery rate, customer feedback, and average delivery time will be monitored closely. Following the pilot, results will be evaluated, and a broader rollout can be planned if improvements are observed.

9. Conclusion

This case study illustrates how a data-driven approach can empower DHL to better understand and address the challenges of delayed deliveries. Through predictive modeling and analytical insights, DHL can shift from reactive management to proactive planning, ultimately improving operational efficiency and customer satisfaction. The tools and recommendations provided here serve as a foundation for strategic enhancement in logistics and last-mile delivery performance.