

Chapter 7

Smart Freight Estimation Using Artificial Intelligence for Sustainable City Logistics

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ABSTRACT

In this chapter, a novel machine learning based framework, RouteEdge for predicting accurate shipment cost in logistics is presented. The model improves on the previous work, by integrating spatial fuel price data, and using shipment parameters like distance, delivery time and region specific costs to take into account non

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linear dependencies in real world logistics scenarios, and captures it using Random Forest, Gradient Boosting, and XGBoost. KDTree is used for spatial diesel pricing, the system also provides interactive Streamlit based interface of user inputs and shows predicted prognosis in real time. Finally, we have tested Gradient Boosting through robust analysis and it turned out to be the most accurate model with an R^2 of 97.70%. The RouteEdge product gives you data driven insights that help you plan out logistics and optimize the associated cost in a more scalable way.

INTRODUCTION

In modern logistics, it is a hard-to-solve problem to estimate the freight costs, which depend on the constantly varying variables such as distance, urgency of delivery, fuel prices, and even geography of the region. Cost forecasting is accomplished by the use of outdated processes which involve either the utilization of fixed rate charts or averages which are not dynamic in a real time particularly in a big and complicated nation such as India. The result of this inaccuracy is a poor planning, increases in costs, and poor decision making in the supply chains. This is made worse by the fact that these businesses have to compute the costs of shipping to multiple locations, which have fluctuating prices of fuel and time-frames.

This chapter suggests the use of RouteEdge, a machine learning framework that is used to predict the freight bills by respectively fueling the price data and the parameters of the trip spatially. Through the integration of models, such as Random Forest, Gradient Boosting and XGBoost with spatial mapping methods, such as KDTree, RouteEdge can capture non-linear relationships between the delivery distance and time with the diesel prices of the region, which have convoluted forms of interaction. This results in accuracy in the cost forecast and better logistics planning. The flexibility on the input to be provided and the visualization that RouteEdge provides empower.

Freight cost estimation has become the bane of the modern transportation and logistics industry due to increasing volatility in the cost of fuels, their increasing cost of operation, and the increasing strain on the accurate and timely pricing decisions in the industry. In large geographically dispersed countries such as India, the prices of fuel are changing widely among the regions and over time and this is making fixed rate card and average rate system less and less reliable. The issue is also improved by the fact that the logistics processes are now highly digitalized and the managers and planners require clear and data-driven resources that can assist in making decisions regarding the route's choice, budgeting, and quotes.

The chapter makes RouteEdge a timely resolution to these issues. Compared to the conventional freight calculators or completely predictive machine learning

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