

Predicting Shipping Prices Using Machine Learning

Zachary J. Fuller

Northwest Missouri State University, Maryville MO 64468, USA
s553830@nwmissouri.edu and zachfuller1@gmail.com

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1 Introduction

This project will cover the domain of logistics. I currently work for a freight auditing company, so my knowledge of the industry will be helpful in this analysis. Additionally, I am hopeful that what I learn from this study can be applied to the work I do in my professional life. My data will likely come from Kaggle, as I have found a couple of decent data sources on there already. Google's Dataset search engine will also be helpful. If any data I find has tracking numbers associated with it, then UPS, FedEx, or the associated carrier's website should also provide some valuable data about the package. I would like to do some predictive analytics using previously shipped packages as a training set. Specifically, predicting the cost to ship a package based on multiple factors like weight, destination, origin, and distance traveled could likely be accomplished using a regression model. I feel that this could be useful as carriers pricing policies are not very transparent unless you are well versed in logistics, so having a pricing estimator could empower small business owners and online sellers to choose the best shipping option for their needs. The steps I will follow to complete this project are:

1. I will first locate my dataset.
2. Then, I will clean the dataset using the python packages Pandas and NumPy, removing any drastic outliers if needed and deciding how to handle missing values.
3. Then, I will use SciKitLearn to separate the data into a train and test set.
4. I will evaluate the results. If needed, I will retrain and test the data, repeating steps 2 and 3.
5. After training and testing is complete, I will use a python plotting package, likely Plotly (my preferred choice) or Matplotlib to display the results.
6. Finally, I will write the report, making sure to examine any possible errors.

The key components of my approach will be finding the right data sources, making sure the data is cleaned in a way so as not skew results, and most importantly, the training and testing process. This will likely be done using multiple linear regression, so making sure that the data is trained correctly is key finding the best fit to account for each independent variable.

2 Methodology

3 Data Collection

My main data source was found on Kaggle [1]. I have also found some supplementary data on Data World [3] [2]. that can help to provide some general context for my data domain of shipping and logistics in general. The data is found in a few CSV files. I did not have to use any data scraping techniques, as my main data source and the supplementary data sources are made available for easy download through each of their host sites. From the "Shipping Optimization Challenge" dataset on Kaggle, I will use the sendtimestamp, sourcecountry, destinationcountry, freightcost, grossweight, and shipmentcharges fields. The dataset has thousands of columns, so I will likely need to fill in some null values. Additionally, I may slice off the timestamps and only use dates, as it appears that a lot of this data involves international shipping, and the timestamp may be less important and take up space/time. Finally, I will need to convert the country fields, as they are simply abbreviations at the moment. I will likely read the CSVs into a pandas dataframe in a Jupyter notebook, merge the necessary tables and fields together, and then perform this cleaning.

4 Data Processing/Cleaning

Curating the data means that we clean and manipulate the data as needed, with the desired result being a more concise and complete dataset for further analysis. In the case of my dataset, I viewed the data in a Jupyter Notebook using a pandas data frame. My data was in 2 files with the same structure, so I had to concatenate the 2 files. After examining the number of unique values and any missing values in the data frame, I determined which columns provided useful insight and which ones were bulk that could be dropped. I also had to recreate some of the columns that were stored as hard to understand abbreviations so that they could be more easily understood by myself and any observers of my final project.

I used the python packages pandas to create and manipulate my data in the form of a data frame. I used different pandas methods like dropna to drop missing columns, drop to drop unnecessary columns, unique to view the unique values in each column, concat to combine my 2 data sets, isnull and any to find columns with missing values, and map to create a new column based on given values in already existing columns. I also used the python package plotly, specifically the module plotly express, as this is my preferred plotting package. The plotly.express function "histogram" was used to view the distribution of my data.

The only column that was missing data was called "shipping time". About 19.7 percent of the values in this column were null. I figured that this would be a very important independent variable in my later model, and I didn't want to feed any poorly imputed data into my model, so I dropped all of these rows that

had missing values in this column. The data science phrase "garbage in, garbage out" was a guiding principle in this decision.

After cleaning the data, I was left with 5114 records/rows and 10 columns/attributes.

Below are some important descriptions of the attributes that I kept in my dataset:

- shipment id: This was a unique ID given to each shipment in the original data set. I debated whether or not to keep this in or simply refer to individual records with the data frame's index, but I ultimately decided that it may be useful to have this ID for further reference in the future. [1]
- freight cost: The cost/kg of the shipment. [1]
- gross weight: The weight in kg of the shipment. [1]
- shipment charges: This one was confusing to me at first, but looking back through the documentation on Kaggle, I learned that this is the minimum amount that a company would charge for a specific shipment. I may not end up using this in my final analysis, but I figured I would keep it in here just in case I do. [1]
- total cost: This was a field I calculated by multiplying the freight cost by the gross weight, as the freight cost is the charge per kg. This will be the dependent variable that I want to predict.
- shipment mode: The way the product is shipped, either by air or ocean. [1]
- shipping company: One of 3 anonymous shipping companies used. The shipment charges field values are based on this field's value. [1]
- shipping time: Time in days that it took the shipment to reach it's destination. [1]
- sender: The origin country. This was originally stored in a field called source country with a 2-letter abbreviation as a value, so I calculated this field using the map function to make it easier to understand. However, all of the values here are "Great Britain," so I may end up dropping this field.
- receiver: The destination country. This was originally stored in a field called destination country with a 2-letter abbreviation as a value, so I calculated this field using the map function to make it easier to understand.

My independent variables will be gross weight, shipment mode, shipping time, and receiver. Other possible independent variables may be shipment charges, shipping company, and freight cost, although these will likely be unnecessary. My dependent variables that I am trying to predict is the total cost field.

5 Results and Analysis

6 Limitations

7 Conclusions

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