Business Analytics Using Forecasting

Forecasting the demand of trailers for the efficiency of usage and to offer the customized service

Team Number : 3

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2.Executive summary

In this project, our data source is the stakeholders who are Jouyu's family business. It is kind of transport industry. The business model is to transport customers' excavators to the destination they require through the trailers whom the stakeholders own. However, since the stakeholders are used to manually record the trips that customers require, they predict the next demand only based on their experience. Without the assistant of technology, stakeholders are unable to anticipate the demand of trailers in the future accurately.

Based on these business problems that the stakeholders meet, we set two forecasting goals. One is to forecast the trend of small and large trailers. We will use the data of monthly trips to estimate the demand of different types of trailers. The other one is to forecast the trend of monthly demand for two types of customers. The reason is that we attempt to find out the biggest potential demand in this industry so that we can offer some customized service. In addition, our goal is prospective, because we add data month by month. As for time series, we have four time series, including customers (company, and individual) and excavators (small, and large). Overall, our purpose is to forecast the demand in 2015.

When it comes to the data, we totally receive 3682 data from the stakeholders. The interval of data is 4 years, from 2011 to 2014. The data columns include date, customer types (company, and individual), and trailer types (small, and large). In order to know the situation of data, we visualize the data through tableau. The data are divided into 2 groups. One plot is for customers (company vs individual), and the other is for excavators (small vs large). It is found that there is a trend but no seasonality. Additionally, after partitioning the data, we have 3 years for training period (2011/1~2013/12) and 1 year for validation (2014/1~2014/12).

After partition, we try to analyze the data through naïve, and holt-winters. Nevertheless, the results perform not well. Therefore, we opt for moving average, exponential smoothing and neural network to rerun our data. Simultaneously, we use neural network to get forecasting value of year 2015. The error rate is regarded as benchmark. It is found that the error rate of neural network is smaller than that of moving average and exponential smoothing. Hence, we decide to choose neural network to predict the demand in 2015, and the charts of results are attached on item 6 and 7.

In conclusion, according to the prediction that we get, we only can recommend Jouyu's family that they may negotiate with the customers about the short-term contract. From the stakeholders' perspective, they can keep the valued customers. For the customers, they can get some discount. Through this way, stakeholder can build the strong relationship with customers.

3. Problem description (business goal and forecasting goal)

- **Stakeholder**

Our stakeholder is Jouyu's family business. We attempt to help them improve their strategy towards transport industry. The tools used in this company are trailers, and their business model is to transport customers' excavators to destination through the trailers.

- **Challenge**

Since the original data is recorded manually, stakeholder can not predict the demand in the future. It is risky that the stakeholder does not realize the demand of excavator industry only based on their experience.

- **Forecasting goal**

Goal 1 : Forecast the trend of small and large trailers

In order to meet the customers' demand, we will use the monthly trips data to estimate the demand of different types of trailers.

Goal 2 : The trend of monthly demand for two types of customers

It can help us to find out the biggest potential demand in this industry, and then we can offer some customized service. Our goal is prospective, because we add data month by month. Moreover, we have four time series, including customer (company, individual) and excavators (small, large).

4. Data description

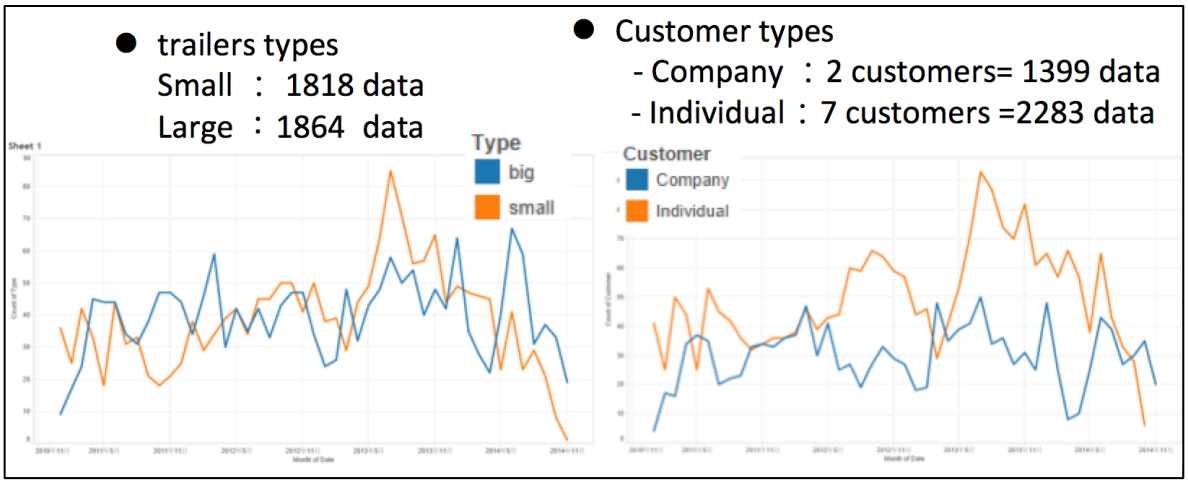
Our data source is from Jouyu's family business. After the proposal report, we keep updating the data until 2014. Our data interval totally is 4 years, from 2011 to 2014. The data columns include date, customer types, and trailer types. After doing data partition, we have 3 year for training period and 1 year for validation. Eventually, our purpose is to forecast the demand in 2015.

5. Brief data preparation details (how your data were created from the raw data) and key charts.

Brief description of available data

- All data：3682 data
- There are **"Date"**, **"customer types"** , **"trailer types"**
- Time period ：4 year (2011/1~2014/11)
- Training period : 2011/1~2013/12 (3 year)
- Validation period：2014/1~2014/12(1 year)
- Forecasting : 2015/1 ~2015/12

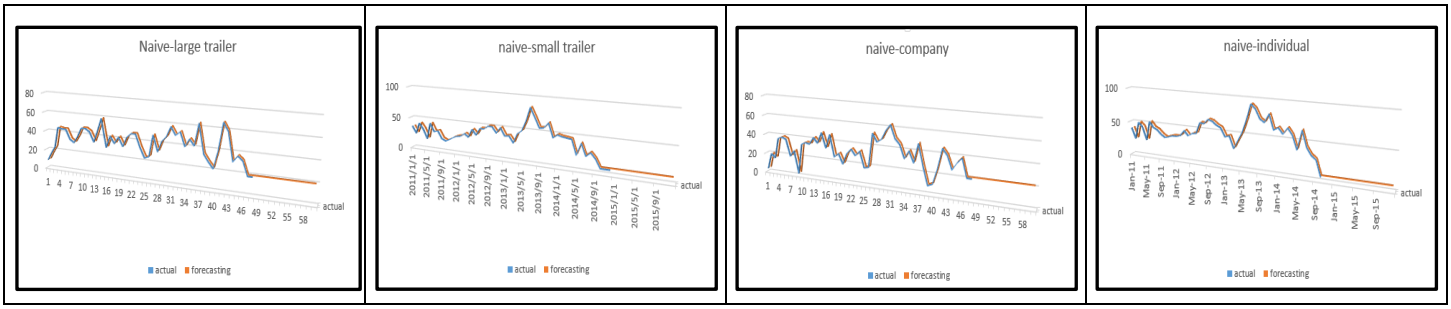
Firstly, we use tableau to visualize our data. The first plot is for Goal1. Next, we separate the trailer into small and large. The column is date, and the row is trailer type. Similarly, we draw another plots for customer. After running the autocorrelations method, we found out that our data has trend but no seasonality.



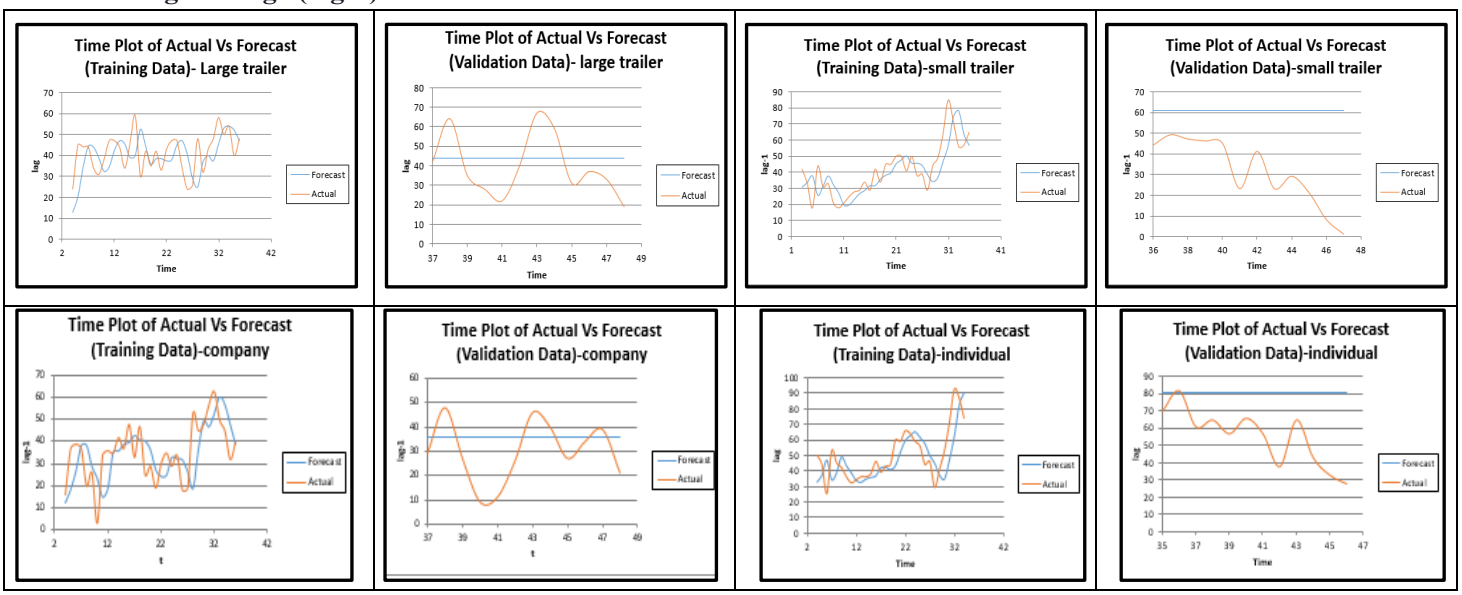
6. Forecasting solution:

We choose MA (lag-1), exponential smoothing (lag-1) and NN (lag-1), and use NN to get 2015 forecasting value.

- **Naïve**

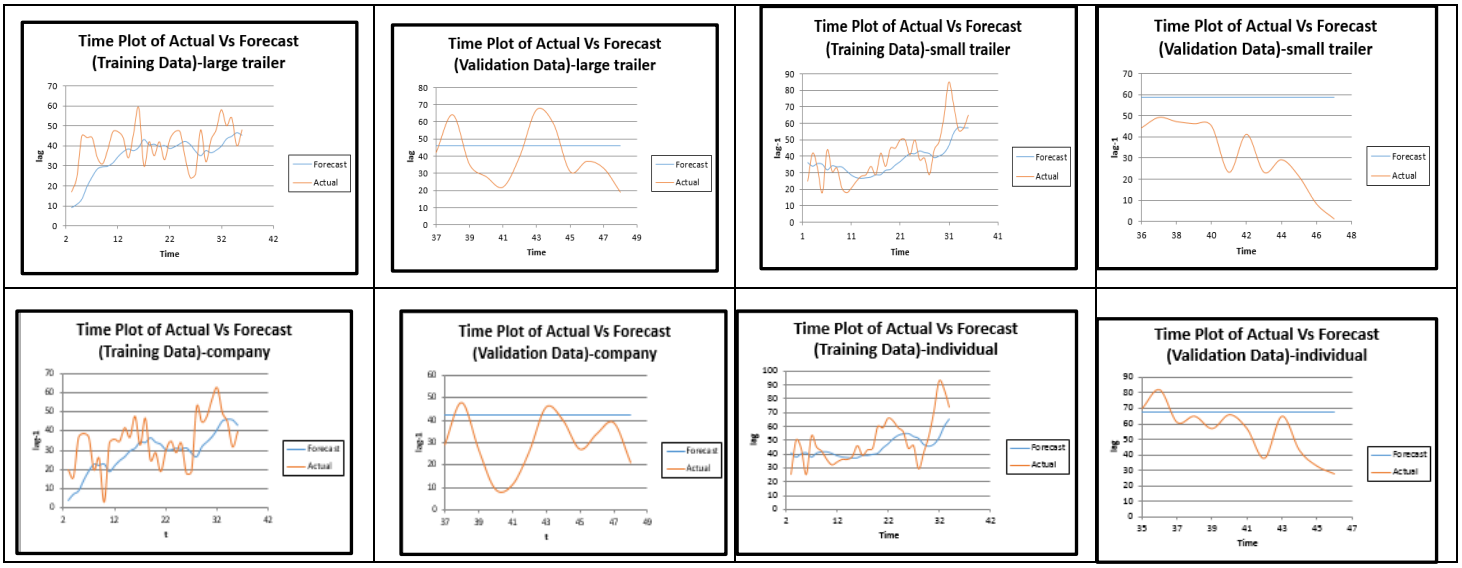


- **Moving Average (lag-1)**



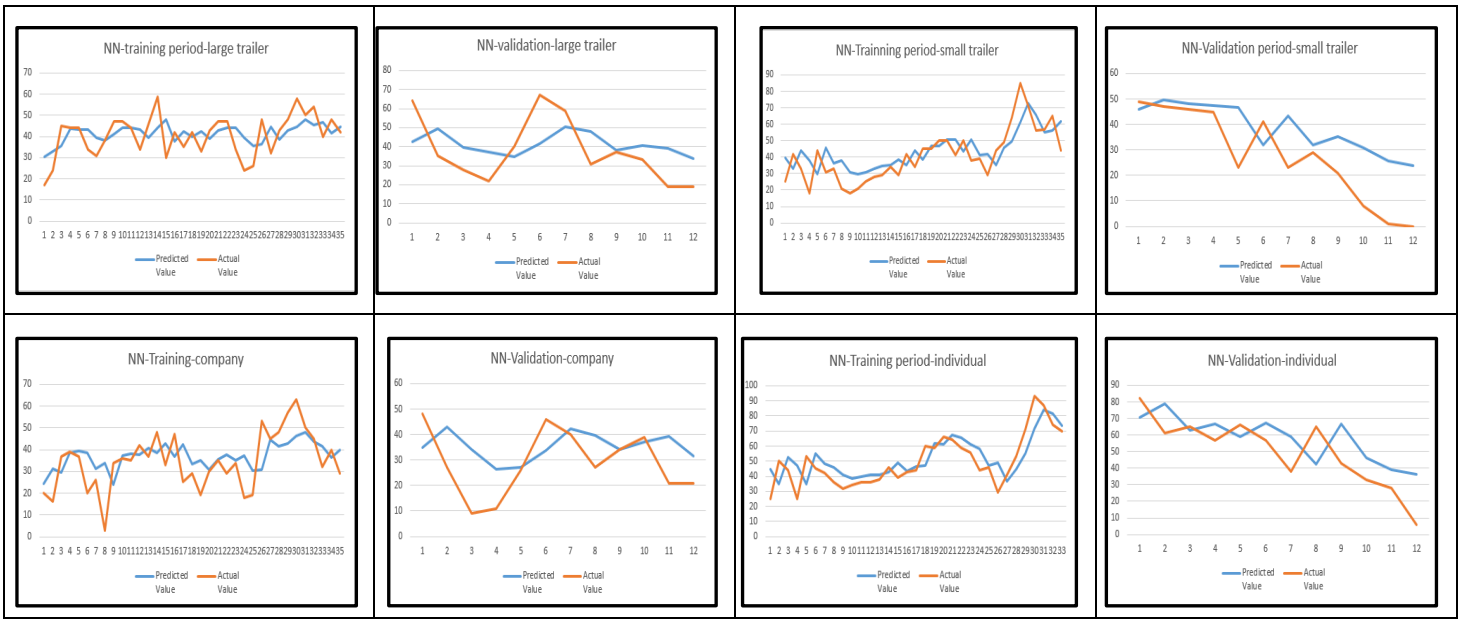
		MAPE	MAD		MAPE	MAD
Large trailer	Training period	22.197	8.5	Validation period	42.866	13.917
Small trailer		21.878	8.288		625.301	29.583
Company		48.159	9.788		66.523	11.083
Individual		19.326	9.258		60.950	25.333

- **Exponential smoothing (lag-1)**



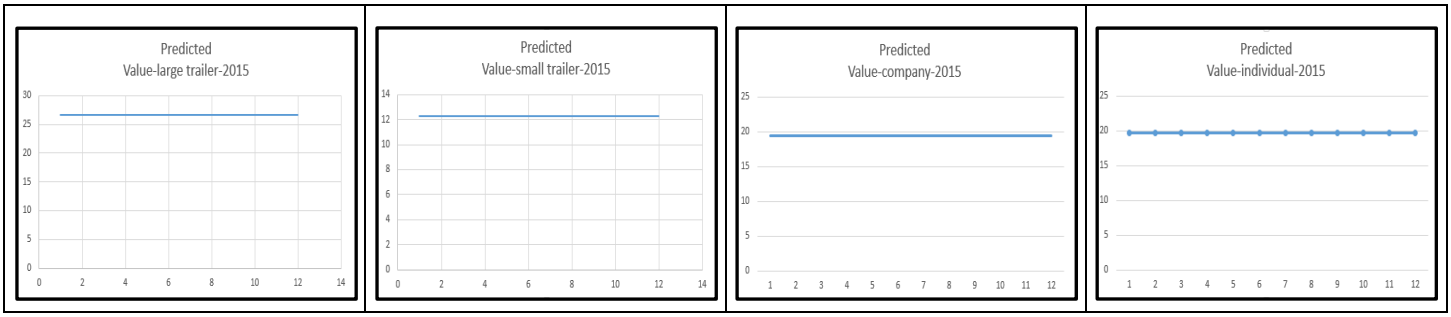
		MAPE	MAD		MAPE	MAD
Large trailer	Training period	26.096	10.062	Validation period	46.742	14.835
Small trailer		23.043	8.670		597.549	27.249
Company		52.749	11.665		87.743	14.370
Individual		21.474	10.409		37.832	14.740

- **Neural Network (lag-1)**



		RMS	AVG		RMS	AVG
Large trailer	Training period	6.056	-0.942	Validation period	10.710	-3.46
Small trailer		6.974	0.858		30.283	-38.617
Company		7.972	-2.378		9.258	-6.178
Individual		7.55	-2.177		11.944	-7.86

7. Time plot of series with future forecasts (Year 2015)



8. Conclusion and operational recommendations

In conclusion, in the beginning, we intend to recommend the stakeholders to use the forecasting results to realize the potential decline and do the preparation in advance. However, after the forecasting, it is found that there is no seasonality in our data. Our forecasting line is just a straight line. We only can recommend Jouyu's family that they may negotiate with the customers about the short-term contract. From the stakeholders' perspective, they can keep the valued customers. For the customers, they can get some discount. Through this way, stakeholder can build the strong relationship with customers.