Optimal Sales Forecast Model Assessment - eCommerce Startup

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Statistics about sales forecast

- 80% of sales orgs DO NOT have a forecast accuracy of greater than 75%.

  - *As per CSO Insights and Gartner*

- 97% of companies that implemented best-in-class forecasting processes achieved quotas, compared to 55% that did not.

  - *As per Aberdeen research*

“My Goal is to identify the preferred sales forecasting model suitable for eCommerce startup with limited historical data.”

Data collection

Public dataset published by Olist on Kaggle.

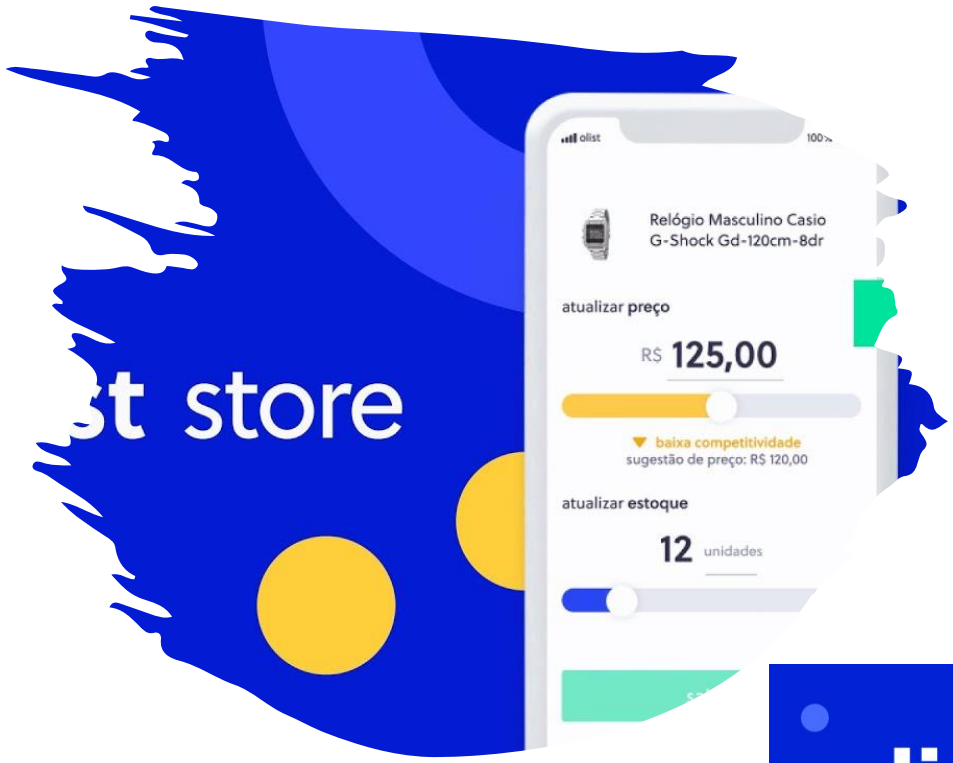
Brazilian Ecommerce platform

Founded in 2015.

Data from 2016 - 2018.

Olist has primarily shared Order transaction data, product data and seller data.

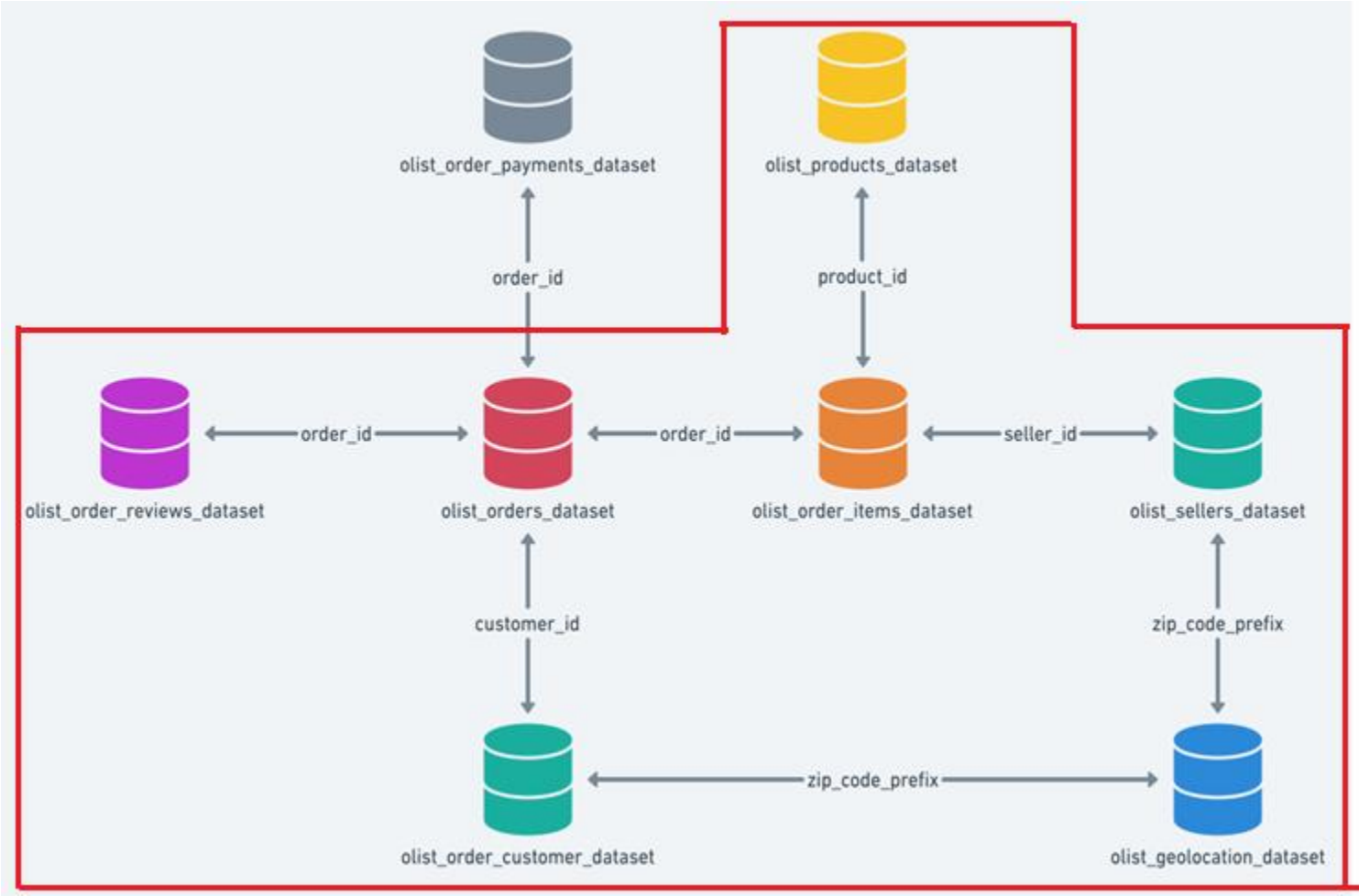
kaggle



olist store

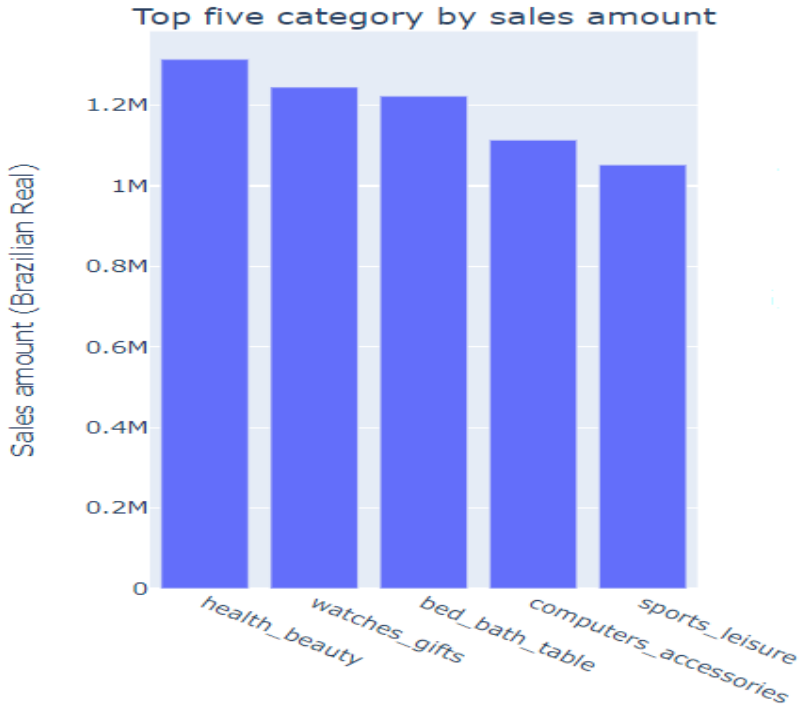
Data Schema

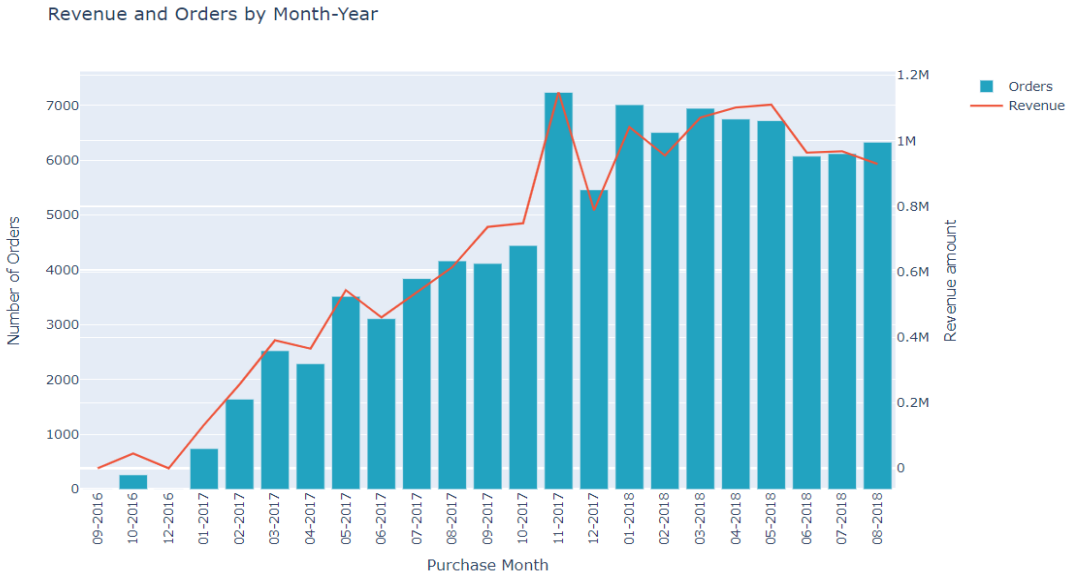
- Joined these csv files to make a master table with 110013 observations with 29 features.
- Removed duplicates and imputed null values.
- After cleaning final data set has all the orders with delivered status.
- Added extra feature ‘holiday’ after scarping it from Brazilian national holiday website.



Data Insights

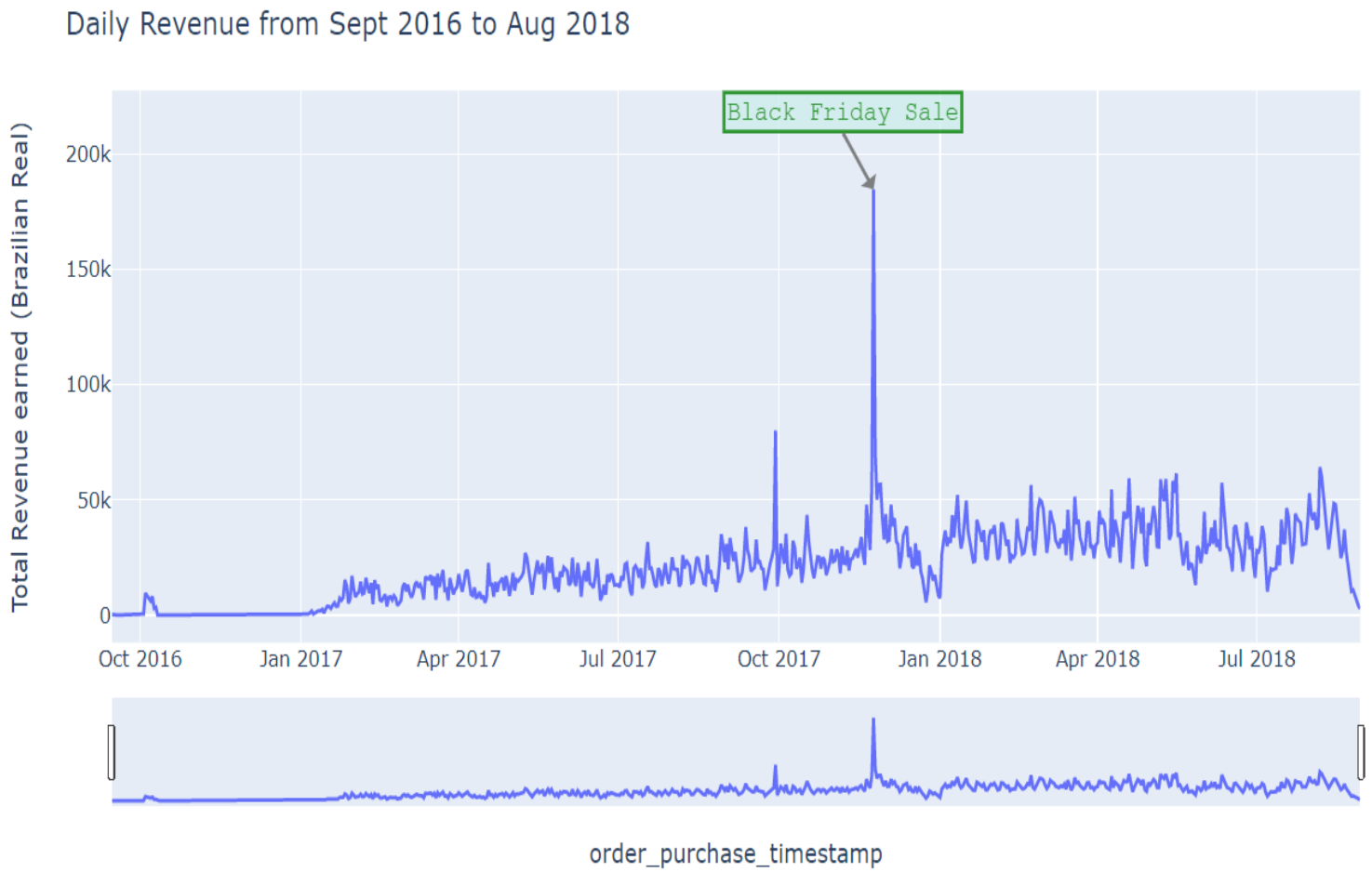
- A total of 96K unique orders.
- Olist platform has 96.79 % as new customers and 3.21% have made repeat purchase..
- A total of 32K different products belonging to 74 categories are sold.
- The overall revenue earned as of Aug 2018 is 14.9 million Brazilian Real (R$).
- There was a highest sale of 184K R$ that was recorded on Black Friday 2017.
- The top five categories are shown here in the bar chart.
- The monthly orders and revenue earned show a growth.





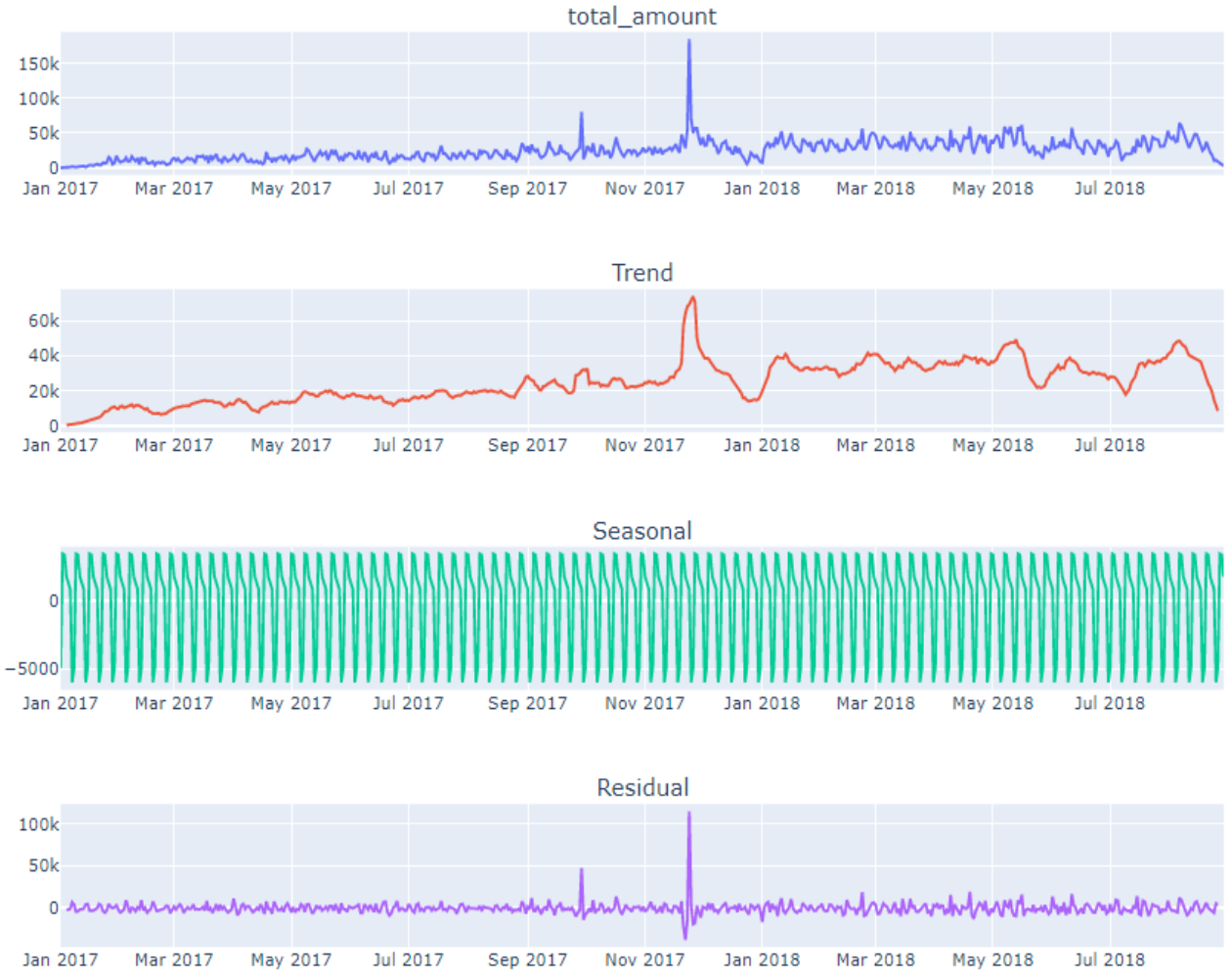
Time Series Data Pre-processing

- Aggregated the Sales amount by date and it reduced the datapoints to two years of data with 606 observations.
- **Target variable: Sales**
- Note: Freight charges were not included as Olist outsourced logistics to third party till 2020.



Time Series Analysis

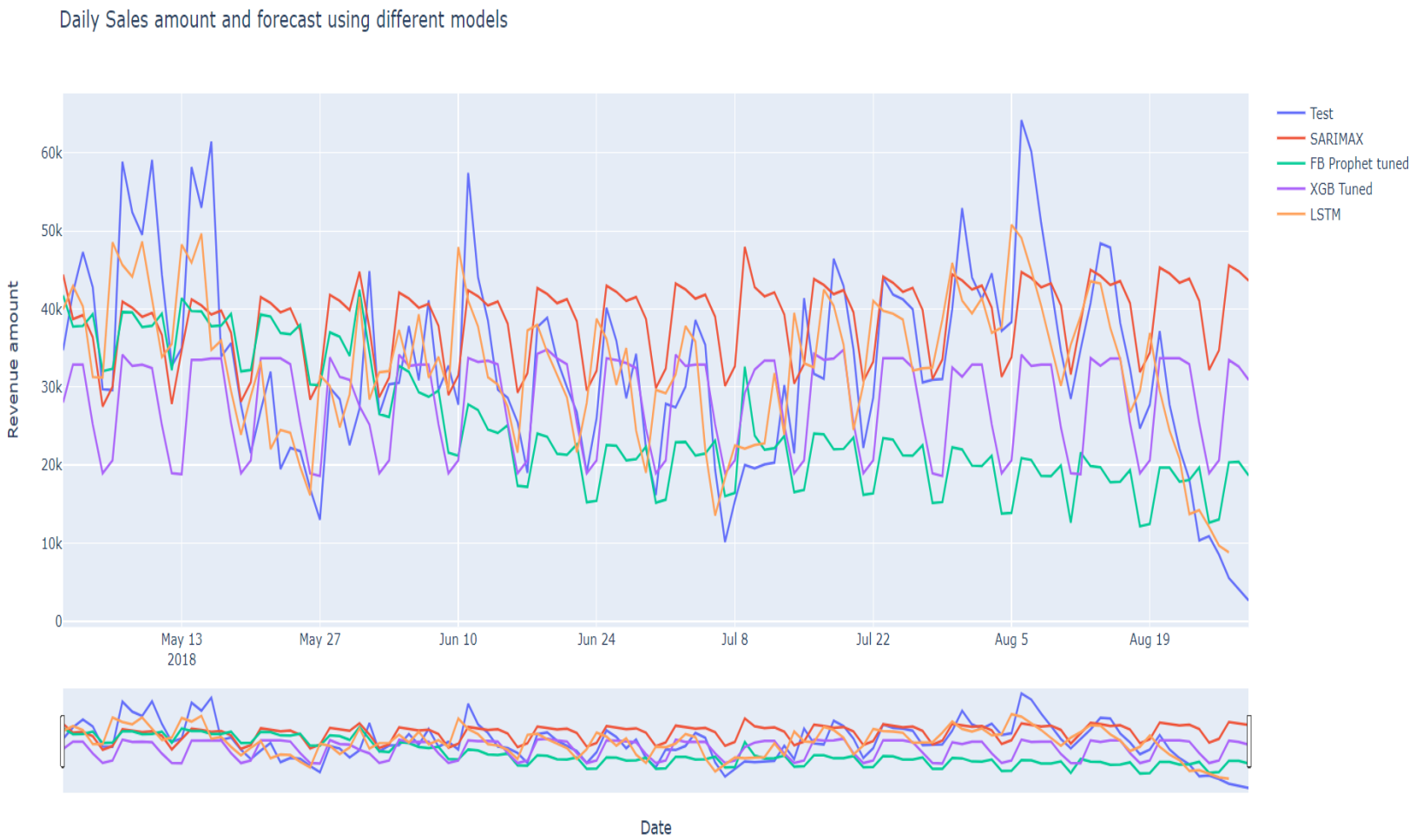
- Observed weekly seasonality.
- Positive Trend.
- There was almost 99% increase in revenue from 2016 to 2017 and 17.4% increase in 2018.
- Huge impact of holidays like Black Friday sale.



Models Applied

Applied four different approaches:

- SARIMAX model including holiday impact.
- Tuned Facebook Prophet including holiday impact.
- Tuned XG boost including holiday impact.
- LSTM one step ahead.
- Using grid search did hyper parameter tuning for each model.



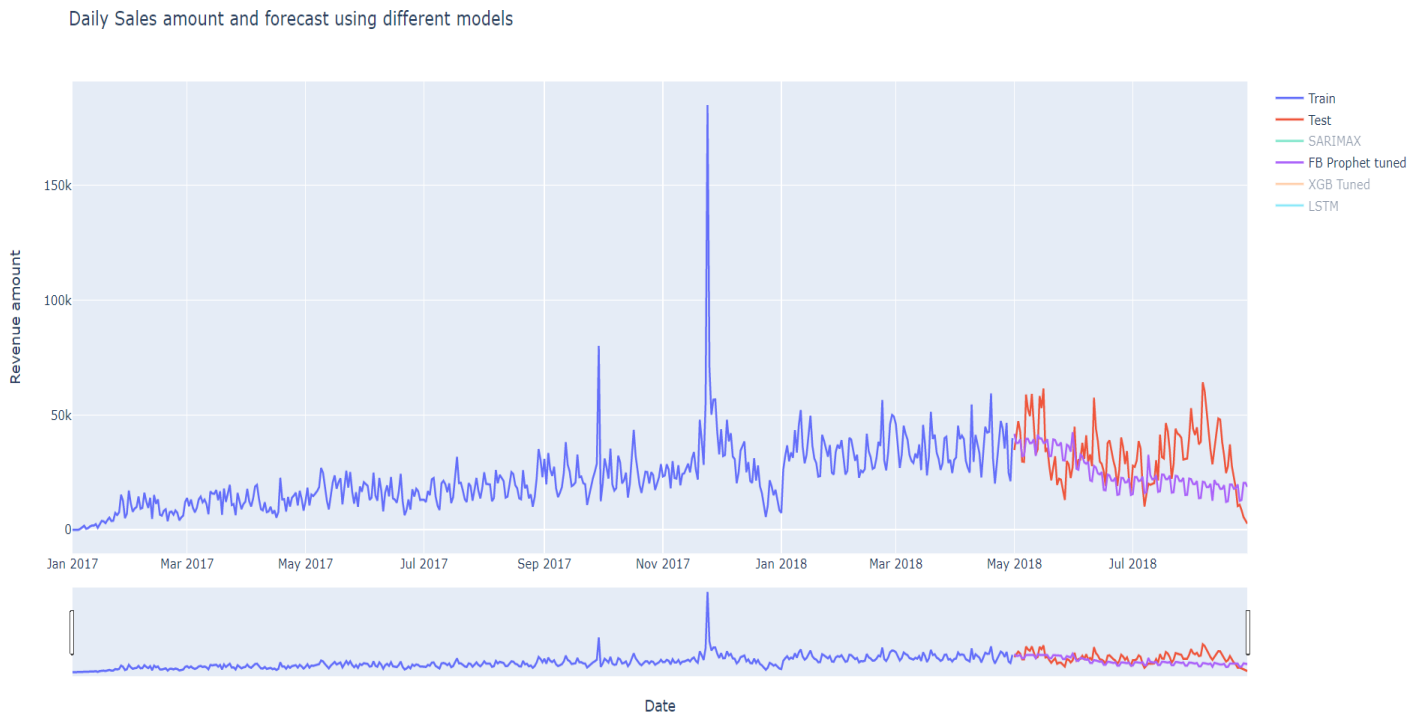
Model Evaluation

- LSTM one step ahead univariate neural network has least MAPE and was trained on limited data. It being a neural network should be fed more data and could be tested further to see actual performance.
- XG Boost next best performance, but it is not able to pick up trend and variations between weeks.
- Choosing tuned FB prophet as final model.

Model	MAPE
SARIMA(1,1,1)(0,1,1)(7)	68.99
SARIMAX(1,1,2)(0,1,1)(7) Including impact of holidays	65.66
Baseline Prophet	71.78
Baseline Prophet with holiday	77.88
Tuned Prophet with holiday	45.38
XGBoost Regression including Holiday	52.18
Tuned XGBoost Regression including Holiday	47.58
LSTM (one step Prediction)	9.37

Facebook Prophet Results

- Going Ahead with FB Prophet.
- Able to pick seasonality, trend and variation within week.
- Gives a MAPE of 51.45% considerable performance.



Parameters of tuned Facebook prophet model					
Growth	**Changepoint_prior_scale**	**Holidays_prior_scale**	**Seasonality_mode**	**Seasonality**	**Seasonality_prior_scale**
Linear	0.4	0.8	Multiplicative	True for yearly, weekly and daily seasonality	10

Summary

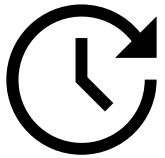
Achieved so far..

Analysed the patterns in time series.

Applied and tested machine learning and neural network forecast models.

Built a baseline forecast model to give business an idea about the future.

Future Scope



External factors can be added like inflation rate, customer satisfaction etc to further improve this model.

Model can be applied to forecast sales for each product category.

Tools used

Thank you!

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