

Capstone Project - 2

Retail Sales Prediction

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Problem Statement

1. Rossmann operates over 3000 drug stores in 7 European countries.
2. Provided with historical sales data for 1,115 Rossmann stores. The sales are influenced by many parameters and task is to forecast the "Sales" for 6 weeks in advance.



Data Summary

We have two datasets. Rossman store data is for years 2013, 2014 and 2015 with 10,17,209 observations on 9 variables. Stores data with 1115 observations on 10 variables. Some important features are:-

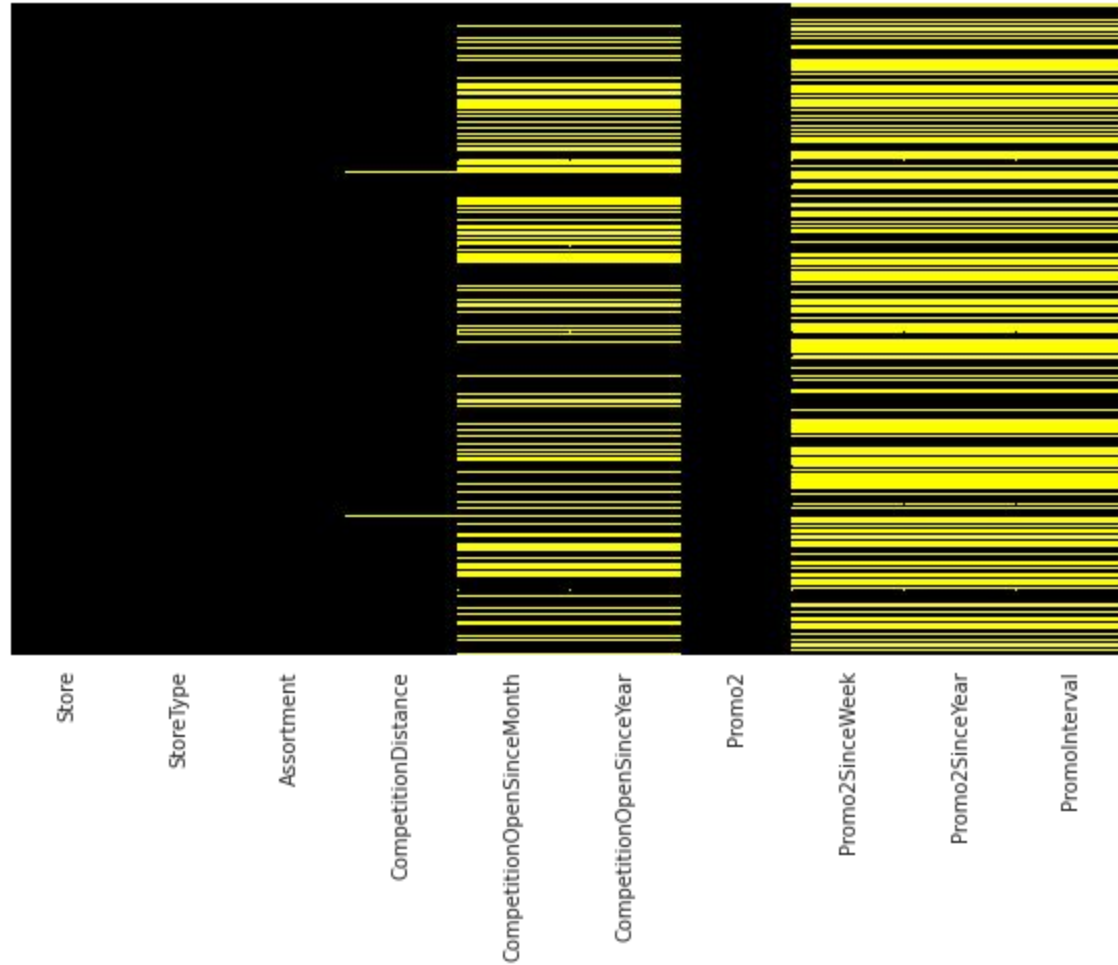
1. **Customer** : - The number of customers on a given day in a store.
2. **Date** :- Showing dates for observations.
3. **State Holiday** :- Indicating a state holiday.
4. **Store Type** : Differentiate between 4 different store models (a,b,c,d).
5. **Assortment** : Describes an assortment level i.e a : basic, b : extra and c : extended.
6. **Competition Distance** : Distance in meters to the nearest competition store.
7. **Promo** :- Indicates whether a store is running a promo on that day.

Data Preprocessing

Columns having >30% null values are dropped.

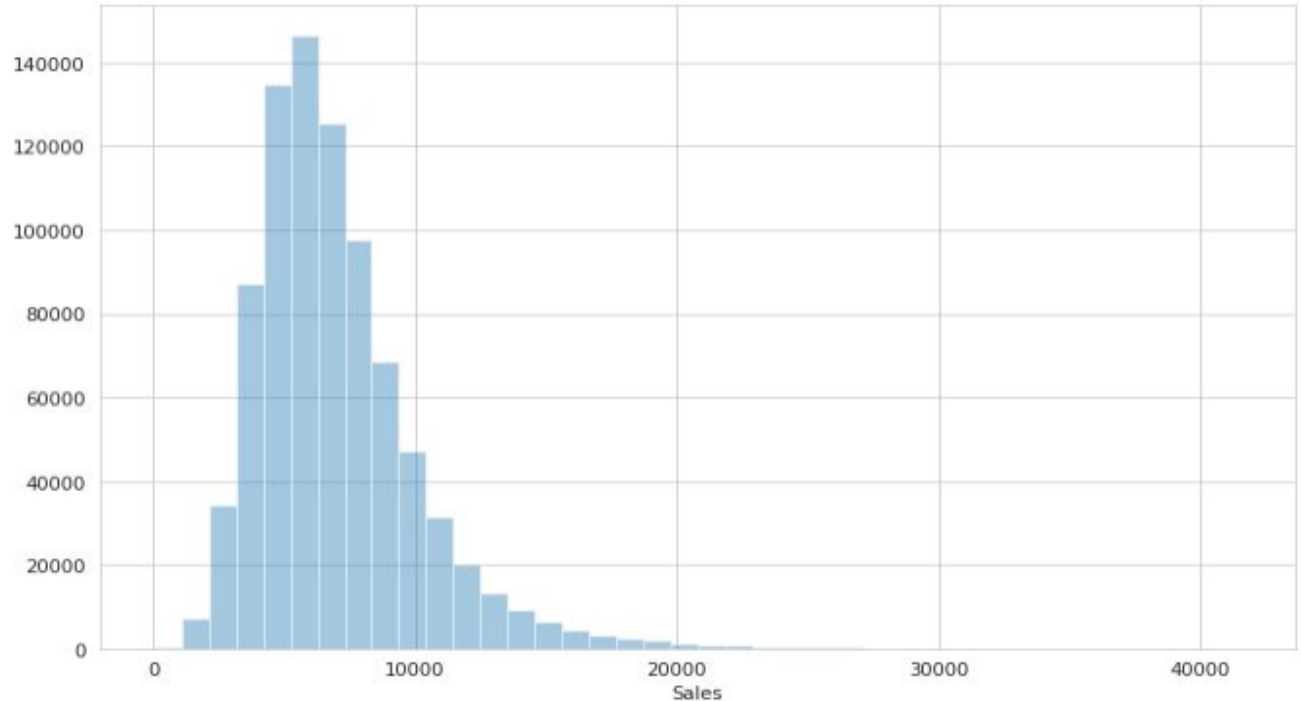
Null values in 'Competition Distance' are imputed with median of feature.

Removing those stores observations that are temporarily closed (~ 17.3K) & stores generating zero sales.



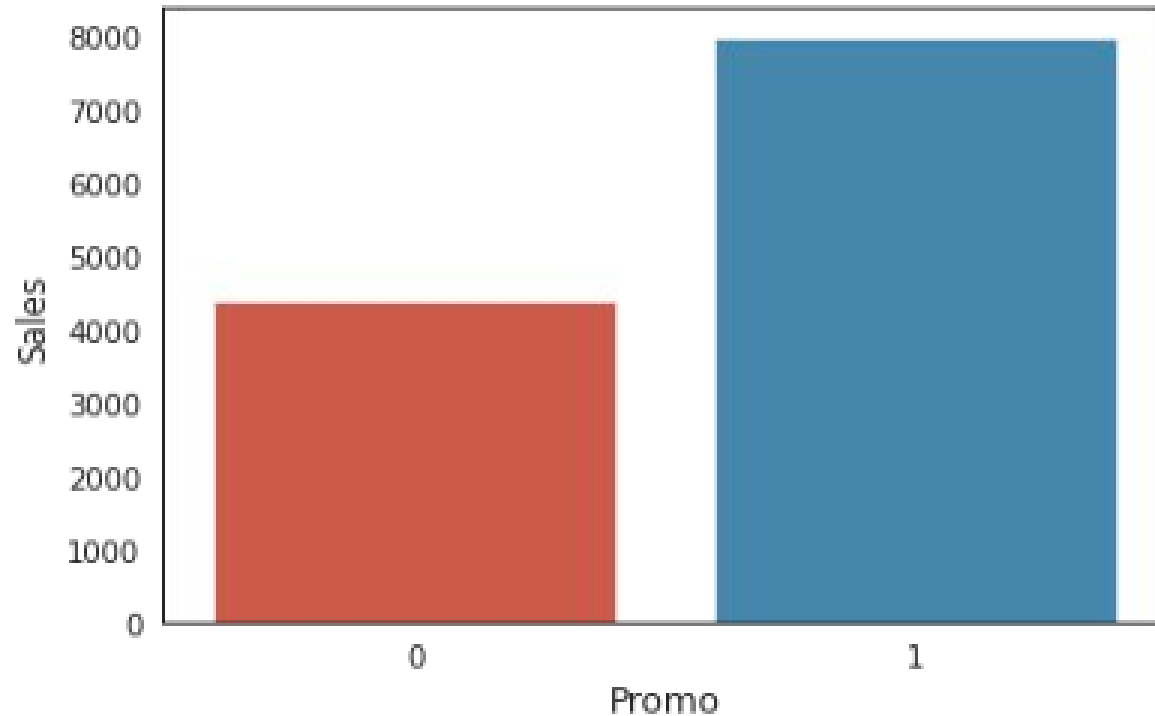
Exploratory Data Analysis

Sales are normally distributed with slightly right tail skewed.



EDA (contd..)

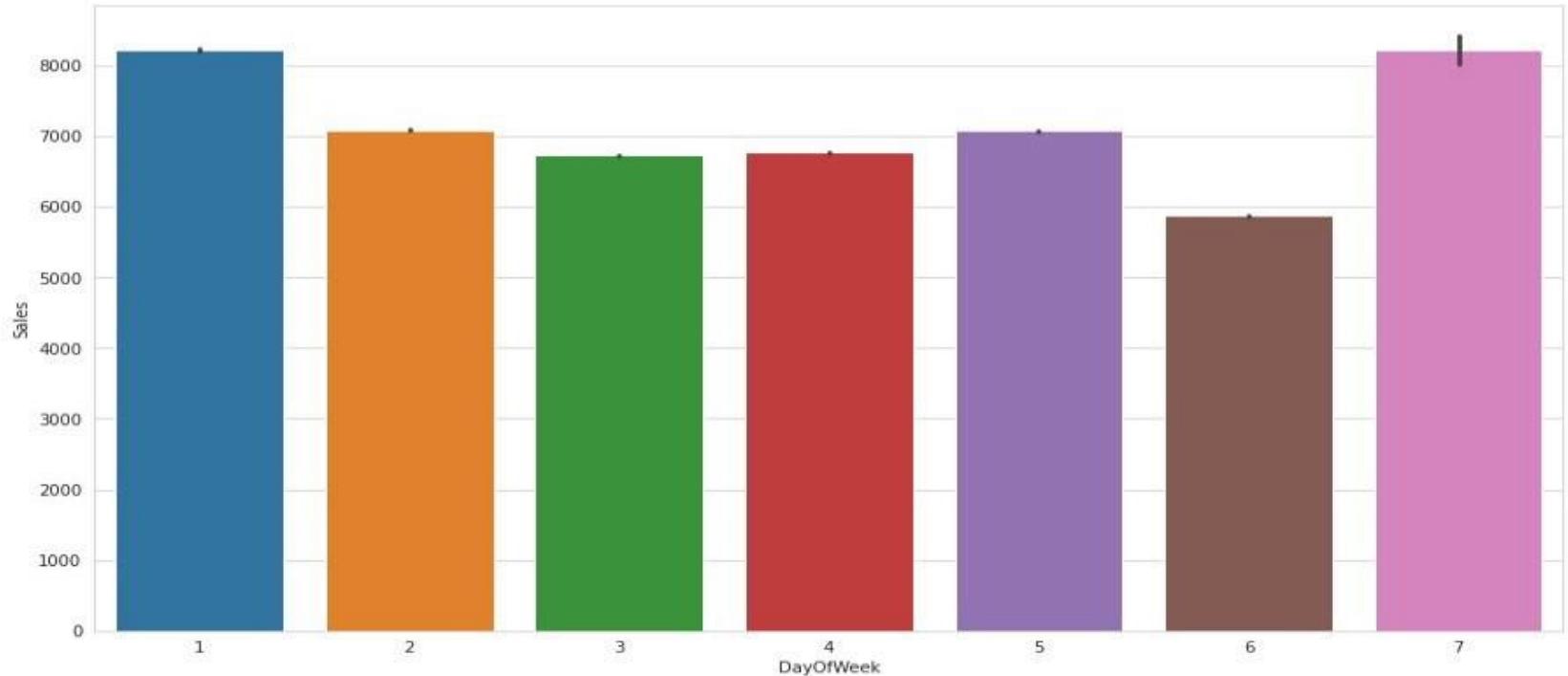
Impact of Promo on sales: Sales Are nearly doubled High When Promo is Running



EDA (contd..)

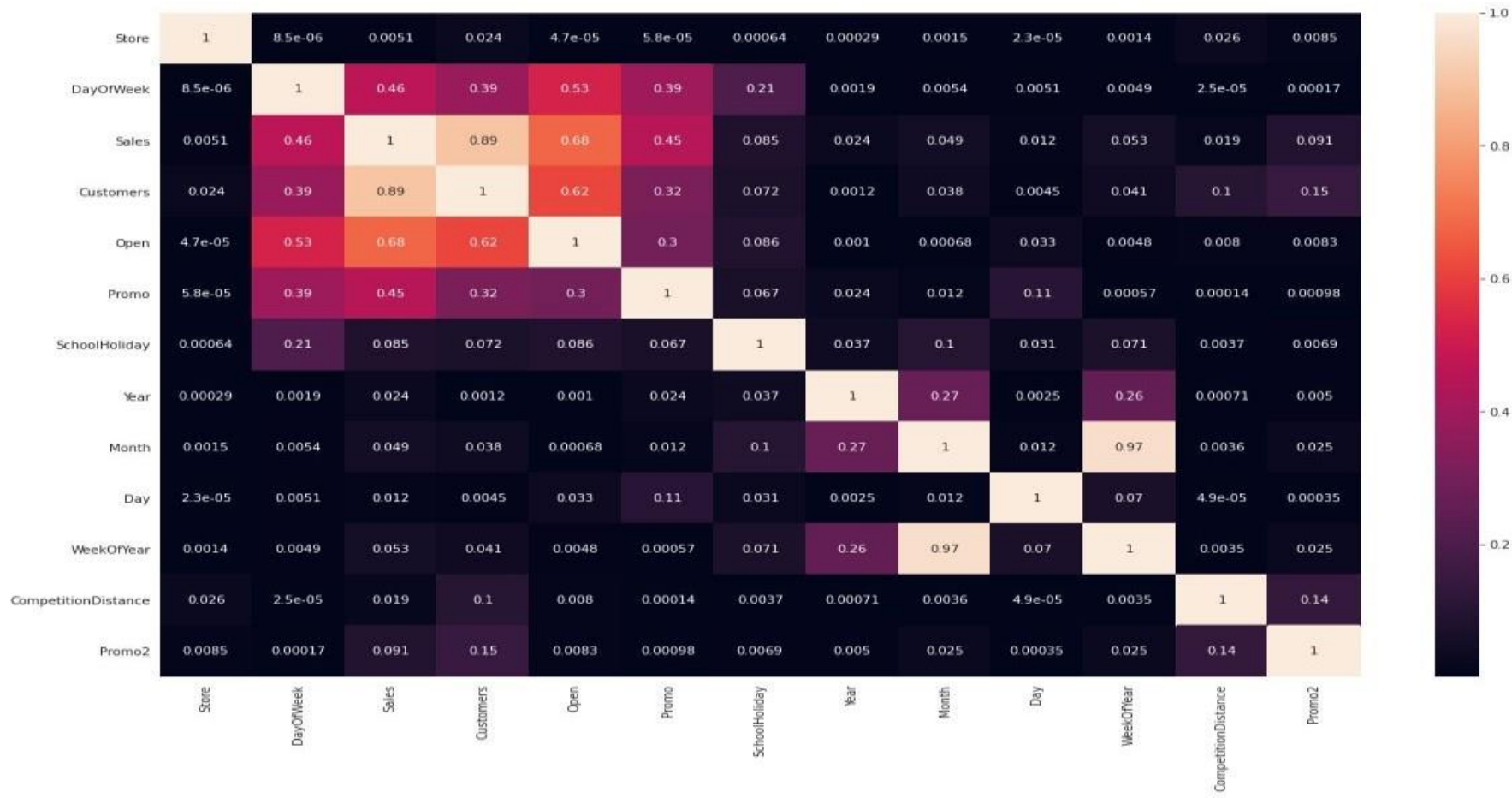
Day Wise trends in Sales:

As we can see that in the graph given below that Stores mainly closed on Sunday



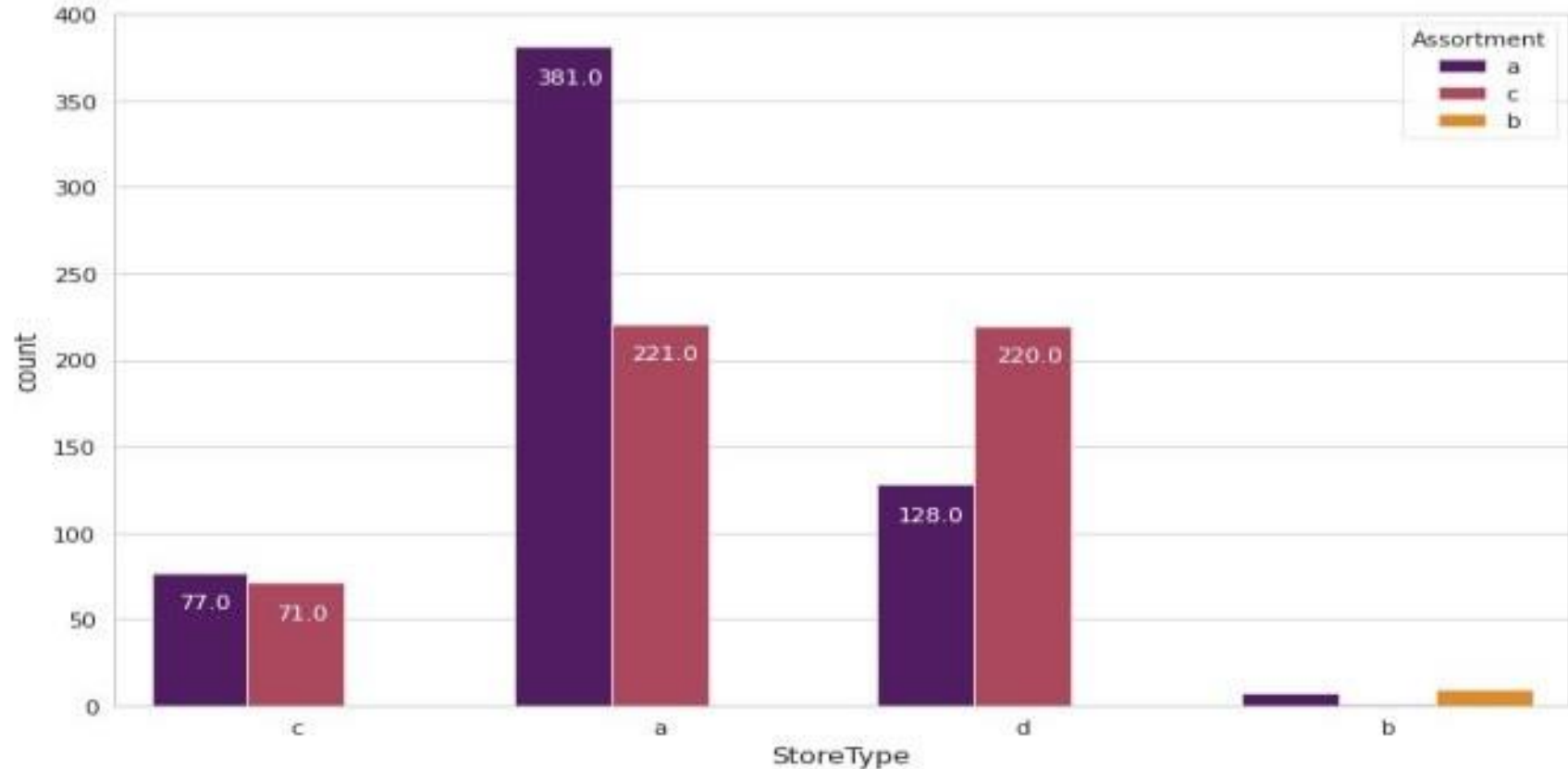
EDA (contd..)

Heatmap for merged dataset



EDA (contd..)

Analysis of Store Types with their respective assortment.

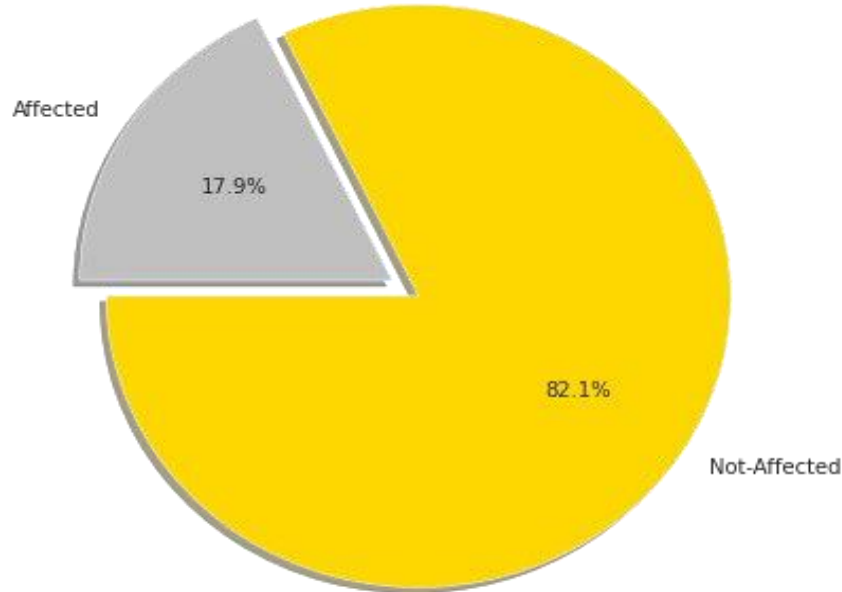


EDA (contd..)

School and State holidays effect on sales

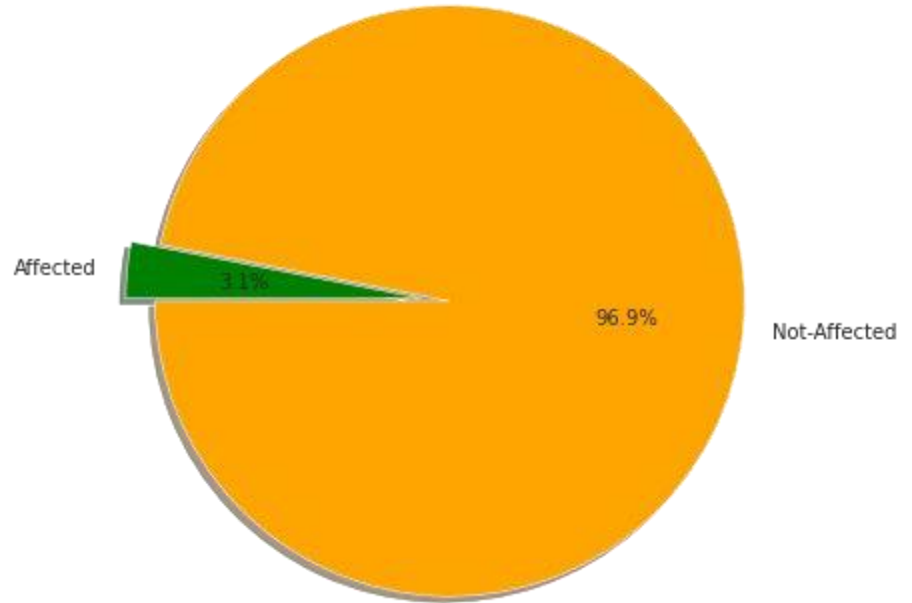
As we can see in the Piechart Sales affected by School Holiday is 18% and Mainly Sales aren't affected by School Holiday

Sales Affected by Schoolholiday or Not ?



As we can see in the Piechart Sales affected by State Holiday is only 3% means Sales aren't affected by State Holiday

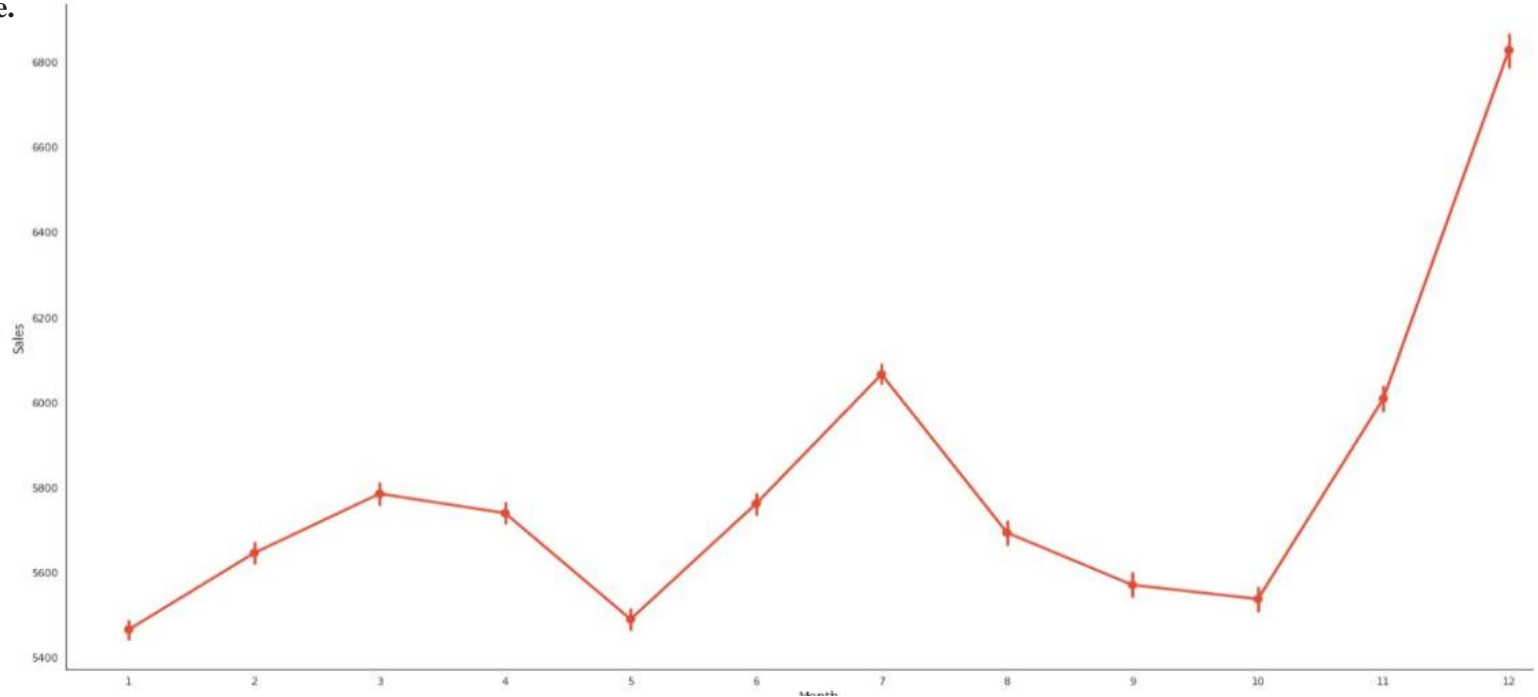
Sales Affected by State holiday or Not ?



EDA (contd..)

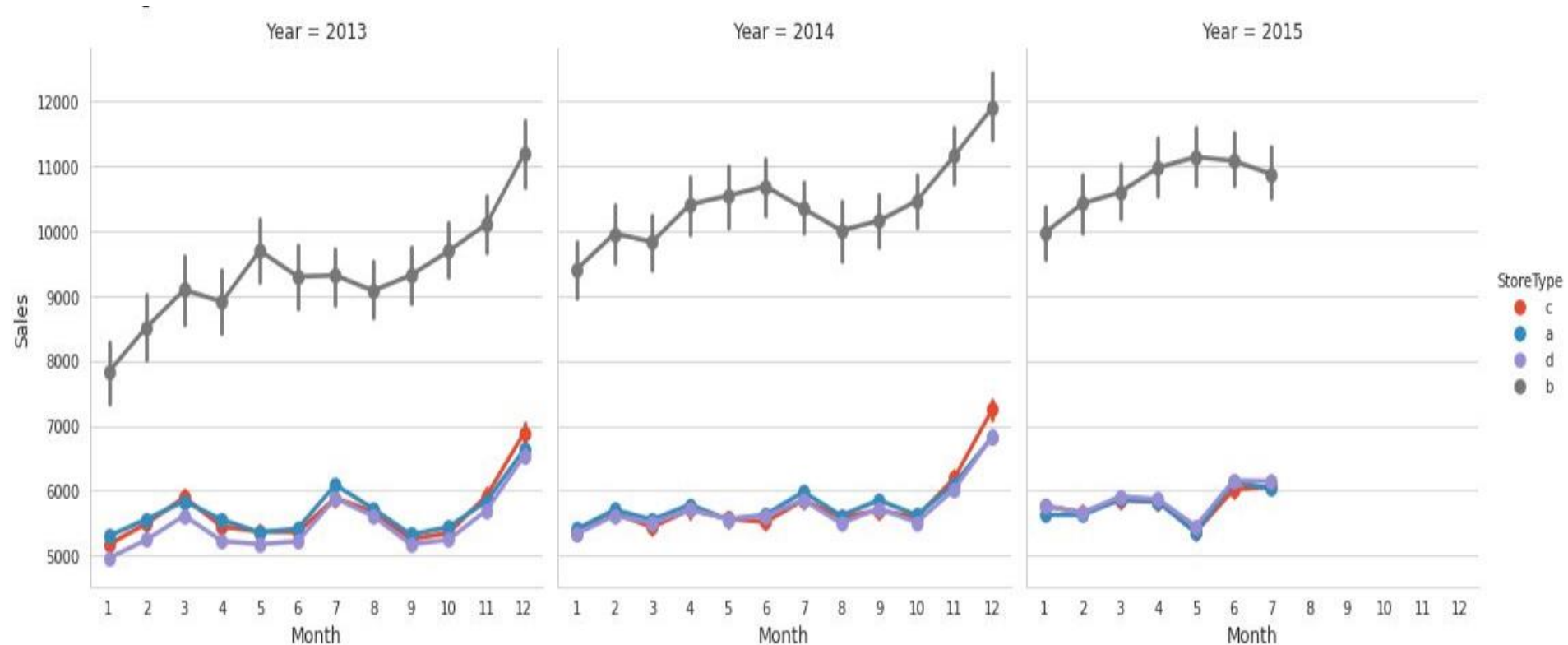
Monthly trends in Sales:

As We can see that In the month of November and Specially in December Sales is increasing Rapidly every year on the christmas eve.



EDA (contd..)

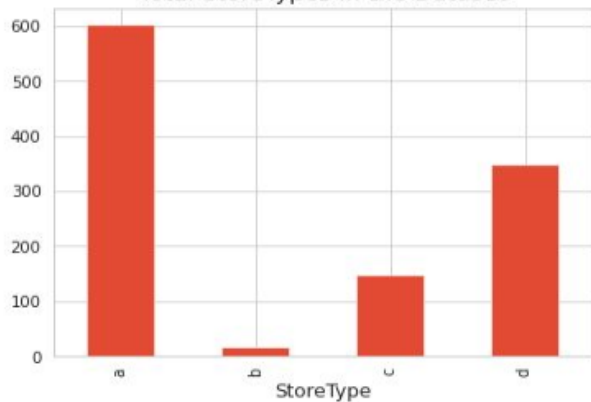
Yearly Distribution of Sales according to store types



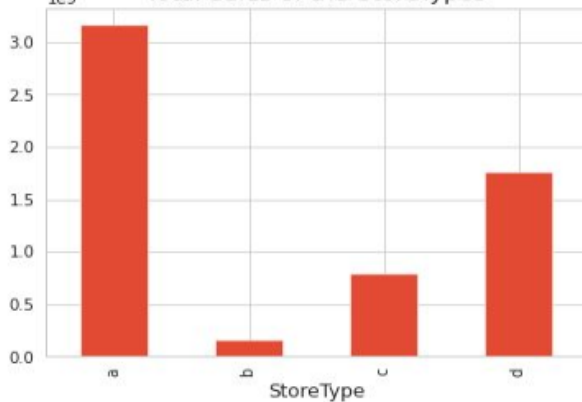
EDA (contd..)

Store Types and average sales/customer/spending relation

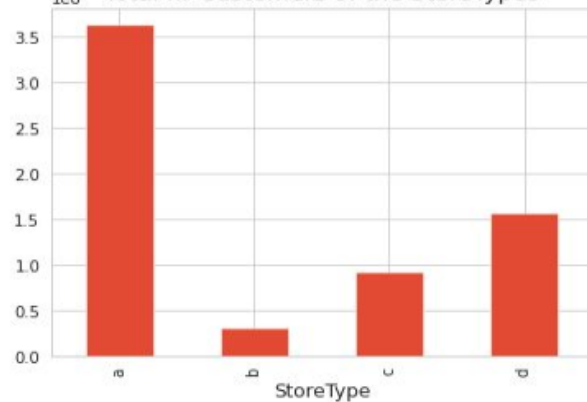
Total StoreTypes in the Dataset



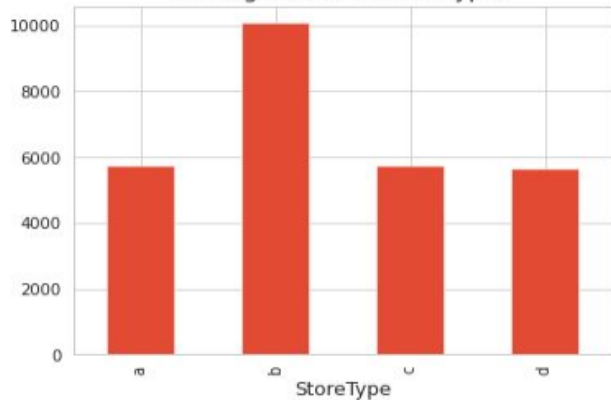
Total Sales of the StoreTypes



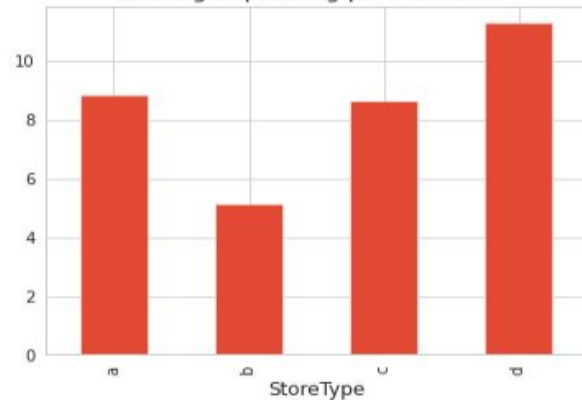
Total nr Customers of the StoreTypes



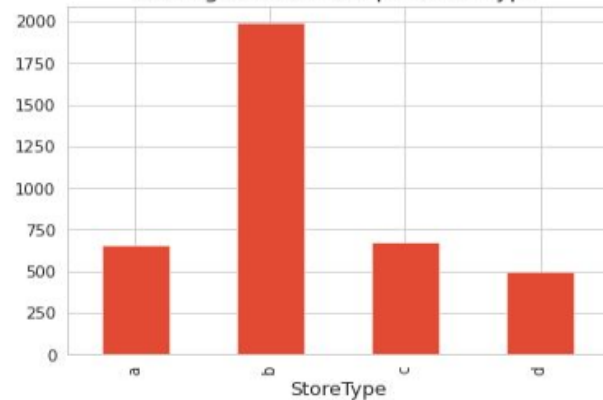
Average Sales of StoreTypes



Average Spending per Customer

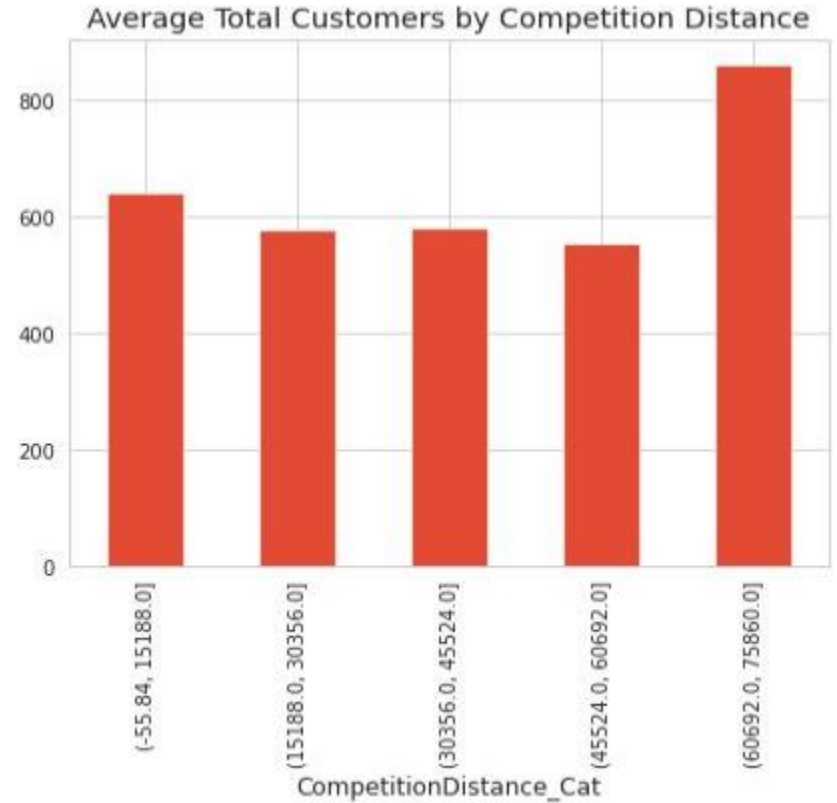
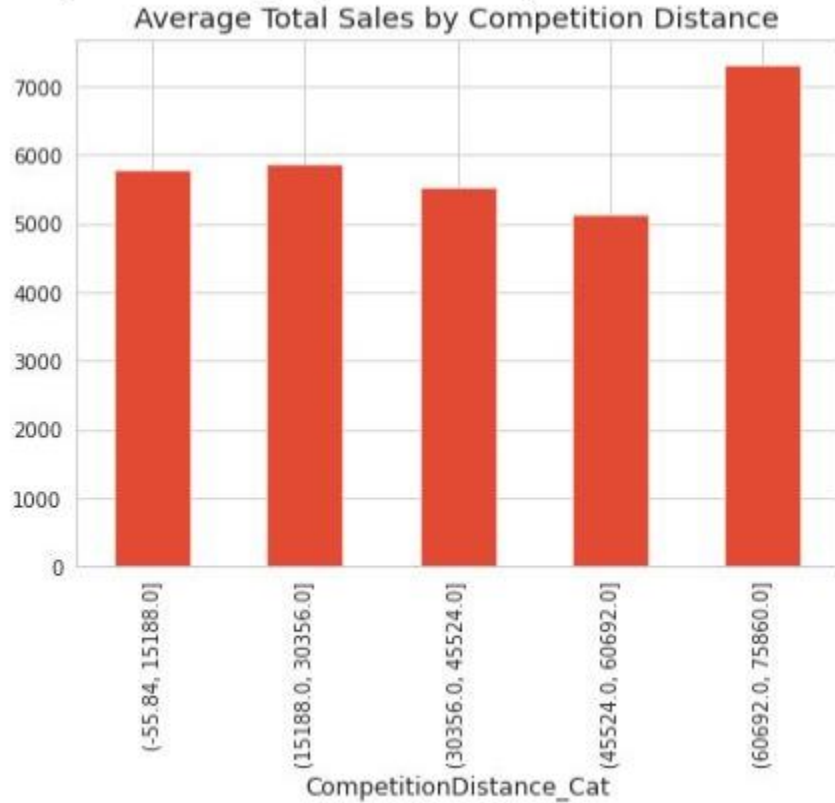


Average Customers per StoreType



EDA (contd..)

Impact of Competition Distance on Sales and Customers



EDA (summary)

1. Sales are highly correlated to customers.
2. Stores opened on 'State Holiday' makes a good amount of sales.
3. There is no such significant difference in sales on 'School Holidays'.
4. Even though store type 'b' has very less number of stores but these are outperforming other store types in terms of sales and avg customers.
5. Sales are consistent for the second quarter of the year but it starts increasing in the last quarter.

Feature Engineering

1. **Extracting week, month, year from Date and adding them in dataset.**
2. **Merging both dataset.**
3. **One hot encoding for Storetype, Assortment.**
4. **Splitting dataset into Training and Test set and applying MinMaxScaler for scaling dataset.**

Models Implemented

1. Linear Regression (Baseline Model)
2. Lasso Regression
3. Decision Tree Regression
4. Decision Tree Regression (with hyperparameters)
5. K-Nearest Neighbors Regression
6. Random Forest Regressor

Model Evaluation

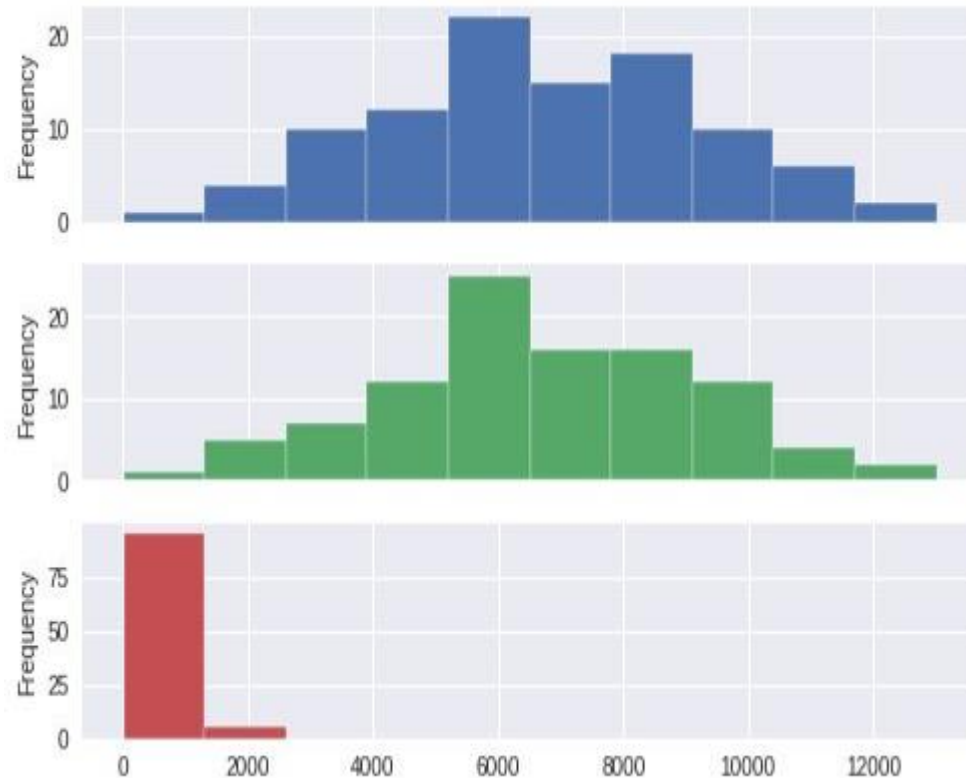
<u>MODEL</u>	<u>TRAINING SCORE</u>	<u>TESTING SCORE</u>
Linear Regression	0.780750	0.782392
Lasso Regression	0.780731	0.780769
Decision Tree Regression	0.99996	0.915942
Decision Tree Regression (with hyperparameters)	0.963506	0.935417
K-Nearest Neighbors Regression	0.73722	0.71665
Random Forest Regressor	0.993783	0.956520

Insights from Random Forest Regressor

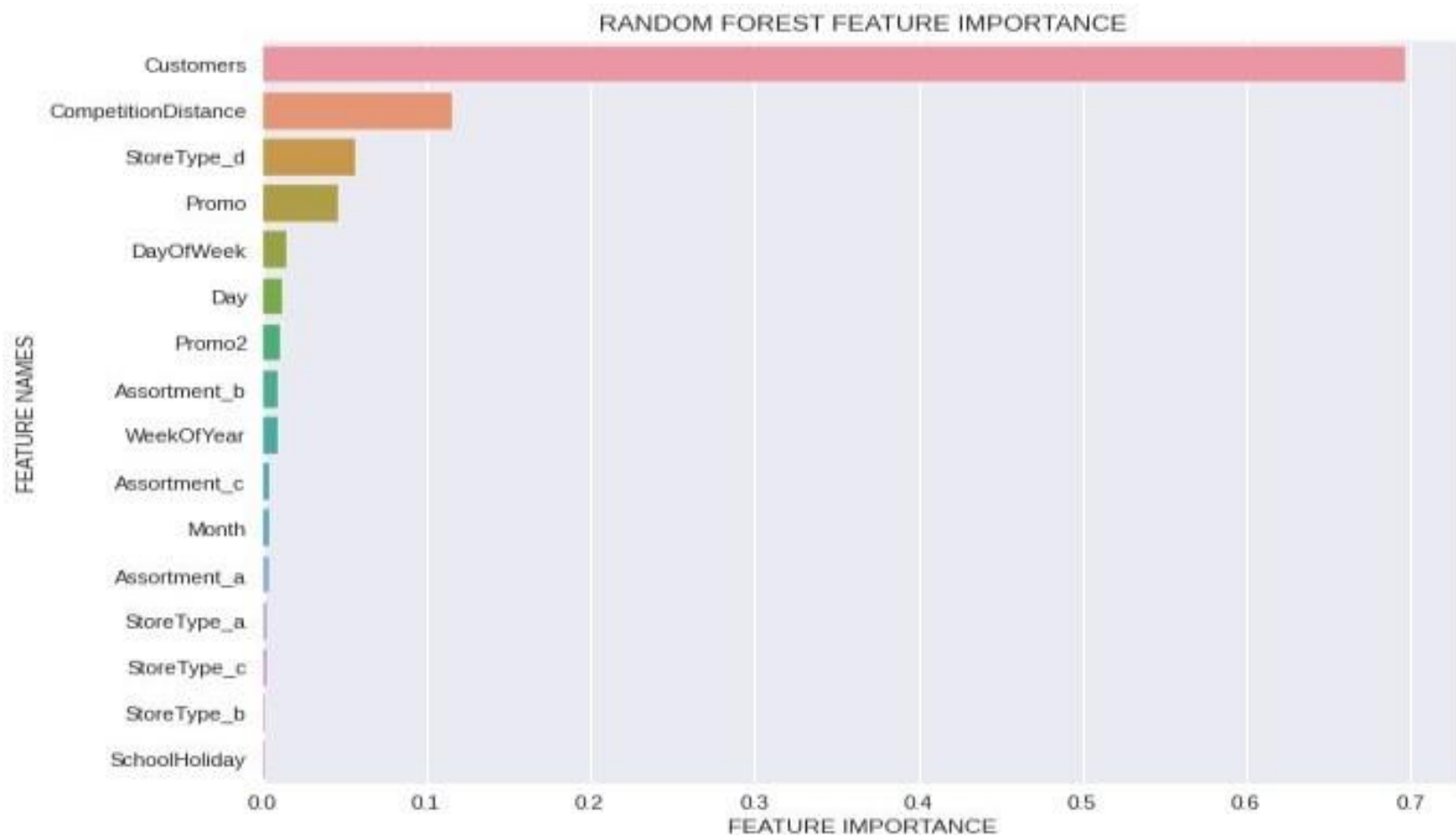
Predictions from random forest model are very close to actual values in our X dataset as we have good score. The figure shows actual values, predicted & the difference between them respectively.

Since this is Sales prediction MAE is a good metric.

We're getting Mean Absolute Error ~ \$ 380
And MAPE of 5.65%



Feature Importance



Conclusion

Our model shows that Customers, Competition distance, Store type are some of the most important features in our sales prediction. We need to focus on these aspects to maximize our profits for the next 6 weeks.

Thank you

