Machine Learning Project

Black Friday Sales Prediction

Group 7 - DSAI K65 - HUST

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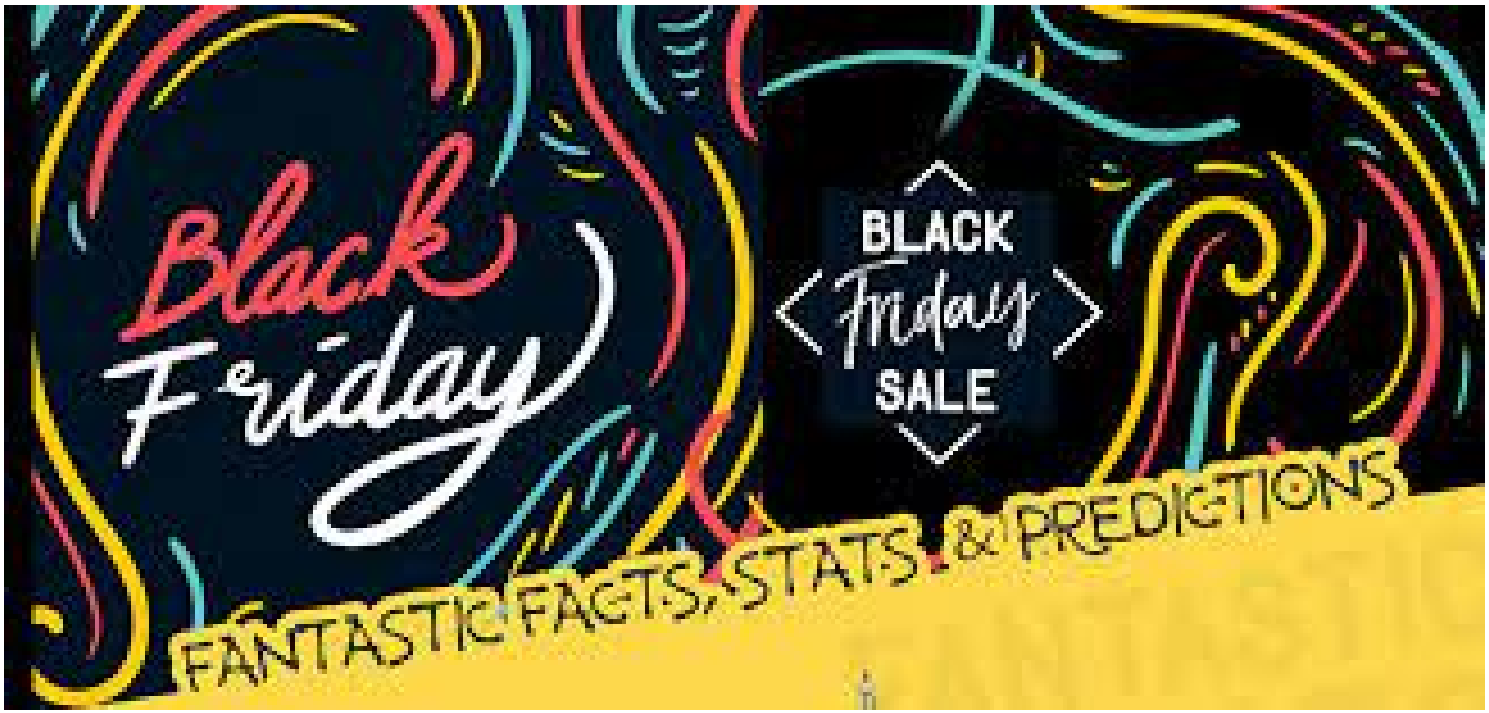
Introduction



- Black Friday : hottest business day
- Analyze the data from the previous sales and predict the purchase amount

Datasets

Two different data sets: training set and test set.

Training set:

- 550068 rows of data.
- 11 categorical features: **customer profile** and **product detail**.
- *Purchase* is a continuous target label.

User_ID	1000001
Product_ID	P00248942
Gender	F
Age	0-17
Occupation	10
City_Category	A
Stay_In_Current_City_Years	2
Marital_Status	0
Product_Category_1	1
Product_Category_2	6.0
Product_Category_3	14.0
Purchase	15200

Problems

Problem statement

- Given the dataset, the retail company wants to understand customer purchase behaviour against various products given previous month sales
- Create personalized offer for customers against different products

Our goals

- Build a model to predict the purchase amount

SOLUTIONS

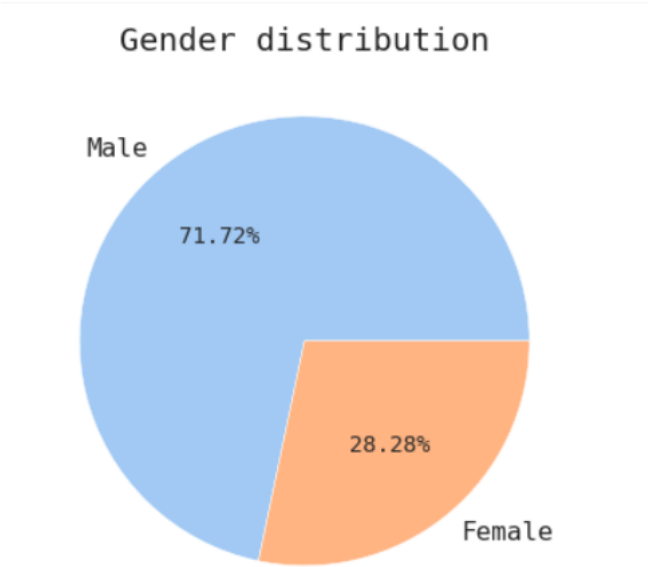
Some tools/libraries

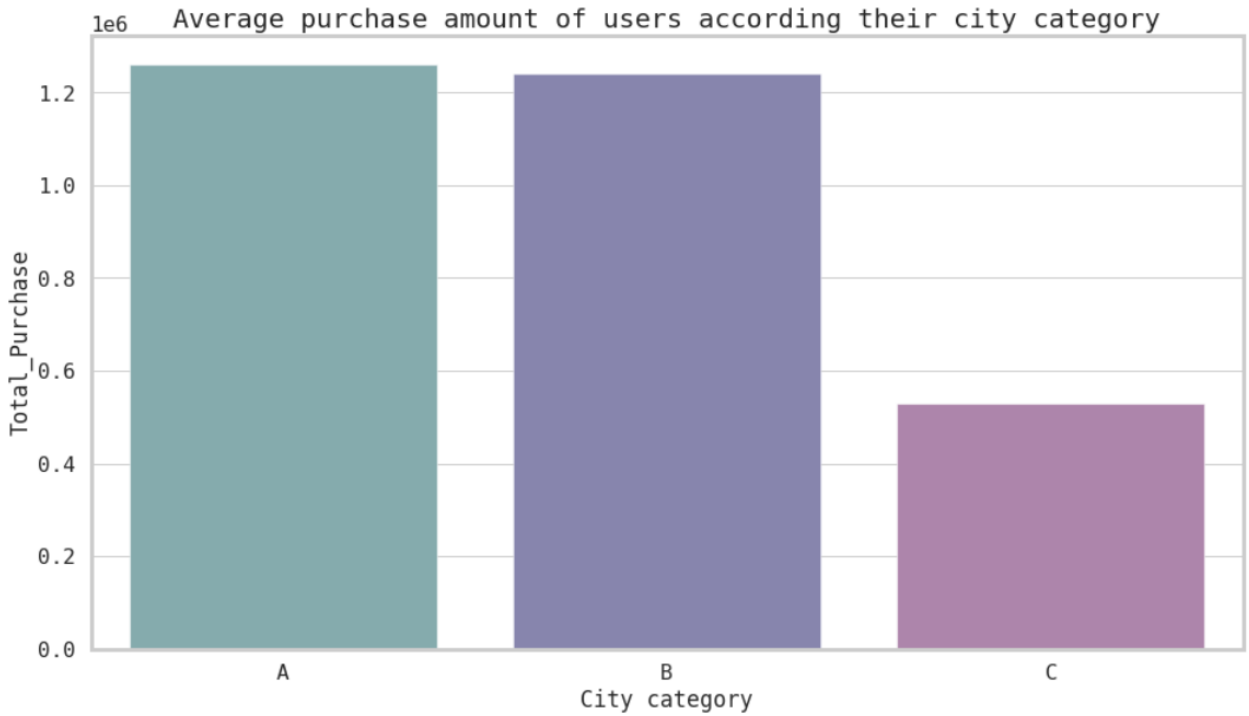
Approach

Our solution follows 4 steps:

- Explore and find the data patterns
- Choose the metrics to score our model
- Choose a baseline model to set a benchmark
- Compare the results of each model and find the best model

Data Exploration





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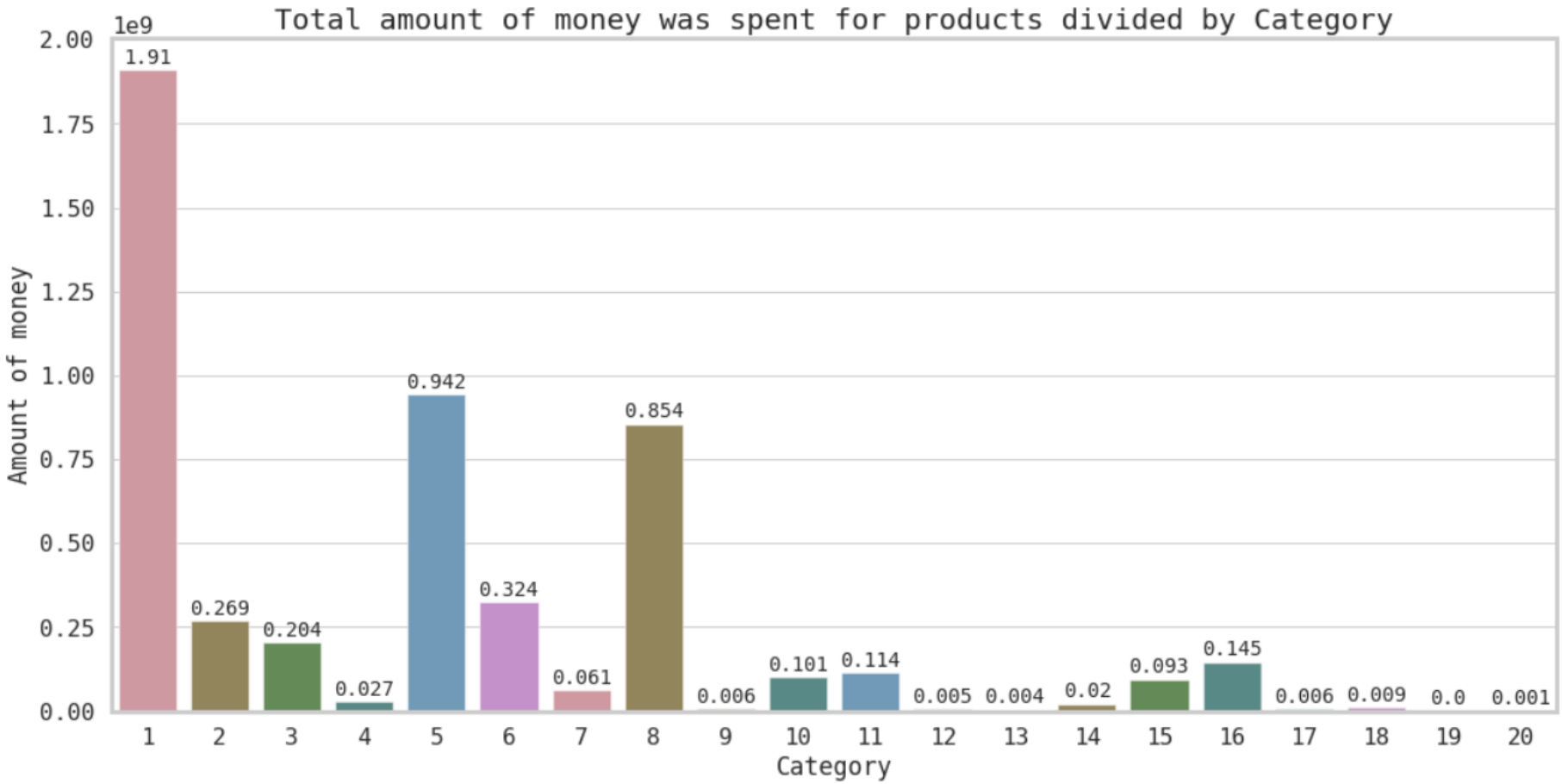
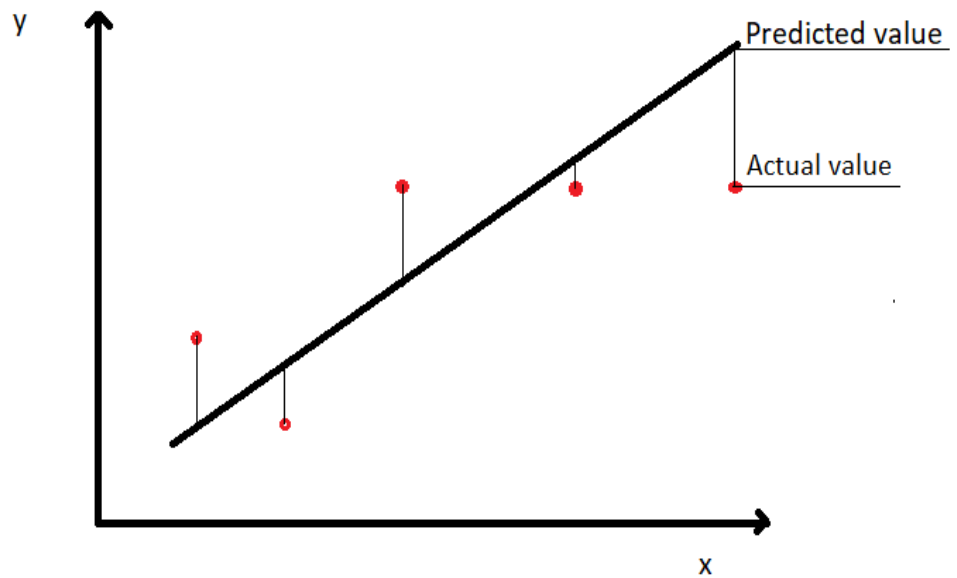


Metrics

Root Mean Square Error

$$RMSE = \sqrt{\frac{\sum_i^N ||y_i - \hat{y}_i||^2}{N}}$$

- y_i : i^{th} actual value
- $\hat{y}_i$: i^{th} predicted value
- N : number of instances



The models

- Simple Regression - a baseline model
  - Ordinary Least Square Linear Regression (OLS)
  - Polynomial Regression
- Decision Tree
- Ensemble Learning
  - Random Forest
  - XGBoost
- K-Nearest Neighbors (KNN)
- Collaborative Filtering

RESULTS

Result comparison

Results of different models

	Model	RMSE_mean	Training time(s)	Prediction time(s)	Parameters	Evaluation technique
0	OLS Linear Regression	4614.7	0.172	0.015		5-fold cross-validation
1	Polynomial Regression	4163.05	15.318	0.068	degree = 3	5-fold cross-validation
2	Decision Tree	2733.33	2.879	0.038	max_depth = 15, min_sample_leaf = 20	5-fold cross-validation
3	Random Forest	2738.68	71.483	4.137	n_estimators= 100, min_samples_split= 5, max_features= sqrt	5-fold cross-validation
4	XGBoost	2618.79	84.291	1.143	n_estimators= 200, min_samples_split= 9, subsample = 0.8	5-fold cross-validation
5	K-Nearest Neighbors	2995.14	0.395	1530.0	k = 15	Hold-old (2:1)
6	Collaborative Filtering	4311.77	67.713	338.071		Hold-out (2:1)

Difficulties and limitations

Difficulties

- Do not have common knowledge about the problem
- Do not find the effective way to preprocess the data

Limitations

- Limited hardware resources
- Limited knowledge about theoretical properties of some models (Random Forest)

Conclusion

Summary

- The best model for this problem is XGBoost
- To successful in solving a problem, having great insight about the dataset is crucial
- Finding proper models and suitable set of hyper-parameters for them is really important

Possible extensions

- Understanding the dataset and investigate in more appropriate preprocessing techniques
- Attempting algorithms such as LightGBM and CatBoost

Colab