
# Exploratory Data Analysis

## Final Project (Retail Forecasting)

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Gao Mo

# Team

- Group Name: Lone Wolf
- Name: Gao Mo
- Email: david113mo@gmail.com
- Country: United States
- College: Carnegie Mellon University
- Specialization: Data Science

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# Agenda

Problem Statement

Data Cleaning & Transformation

EDA

EDA Summary

Model Recommendation

# Problem Statement

- A Company that sells many kinds of products requires us to replace the in-house software designed to predict retailing with an AI/ML driven method. The models that we implement should take seasonality and other additional factors into account.

# Data Cleaning & Transformation

## String to integer for future use

```
1 data['Price Discount (%)'] = data['Price Discount (%)'].apply(lambda x: int(x[:-1]))
2 data.head()
```

| | Product | date | Sales | Price Discount (%) | In-Store Promo | Catalogue Promo | Store End Promo | Google_Mobility | Covid_Flag | V_DAY | EASTER | CHRISTMAS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | SKU1 | 2/5/2017 | 27750 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 |
| 1 | SKU1 | 2/12/2017 | 29023 | 0 | 1 | 0 | 1 | 0.0 | 0 | 1 | 0 | 0 |
| 2 | SKU1 | 2/19/2017 | 45630 | 17 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 |
| 3 | SKU1 | 2/26/2017 | 26789 | 0 | 1 | 0 | 1 | 0.0 | 0 | 0 | 0 | 0 |
| 4 | SKU1 | 3/5/2017 | 41999 | 17 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 |

## Make all data types consistent

```
1 data['Google_Mobility'] = data['Google_Mobility'].apply(lambda x: int(x))
2 data.head()
```

| | Product | date | Sales | Price Discount (%) | In-Store Promo | Catalogue Promo | Store End Promo | Google_Mobility | Covid_Flag | V_DAY | EASTER | CHRISTMAS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | SKU1 | 2/5/2017 | 27750 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | SKU1 | 2/12/2017 | 29023 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 2 | SKU1 | 2/19/2017 | 45630 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | SKU1 | 2/26/2017 | 26789 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 4 | SKU1 | 3/5/2017 | 41999 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

# Data Cleaning & Transformation

## Data column engineering

```
1 from dateutil import parser
2 data.date = data.date.apply(lambda x: parser.parse(x))
3 data.head()
```

| | Product | date | Sales | Price Discount (%) | In-Store Promo | Catalogue Promo | Store End Promo | Google_Mobility | Covid_Flag | V_DAY | EASTER | CHRISTMAS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | SKU1 | 2017-02-05 | 27750 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **1** | SKU1 | 2017-02-12 | 29023 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| **2** | SKU1 | 2017-02-19 | 45630 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **3** | SKU1 | 2017-02-26 | 26789 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **4** | SKU1 | 2017-03-05 | 41999 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

# Data Cleaning & Transformation

## Handling Outliers

### Approach 1: log tranformation

```
data.Sales = data.Sales.apply(lambda x:  math.log(x) if x!=0 else x)
data.head()
```

| | Product | date | Sales | Price Discount (%) | In-Store Promo | Catalogue Promo | Store End Promo | Google_Mobility | Covid_Flag | V_DAY | EASTER | CHRISTMAS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | SKU1 | 2017-02-05 | 10.230991 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **1** | SKU1 | 2017-02-12 | 10.275844 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| **2** | SKU1 | 2017-02-19 | 10.728321 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **3** | SKU1 | 2017-02-26 | 10.195747 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **4** | SKU1 | 2017-03-05 | 10.645401 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

# Data Cleaning & Transformation

**Approach 2: Drop them**

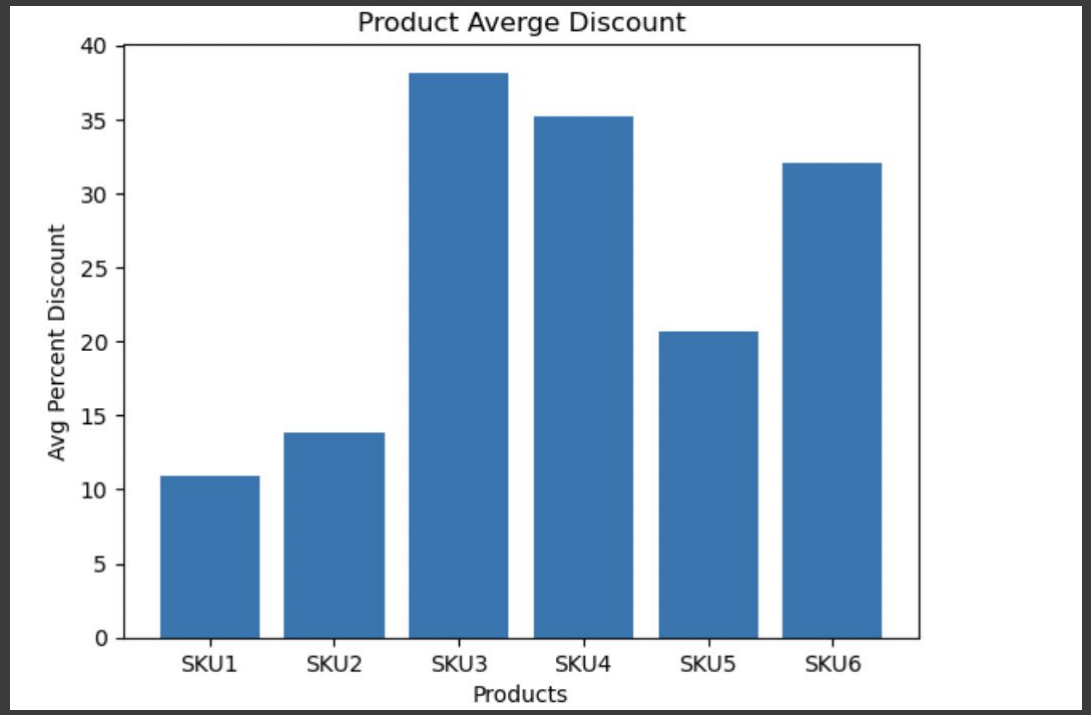
```
1 data = pd.read_csv('forecasting.csv')
2 mean_sales = data.Sales.describe().mean()
3 std_sales = data.Sales.describe().std()
4 outliers = mean_sales + 1.5*std_sales
5 outliers
```

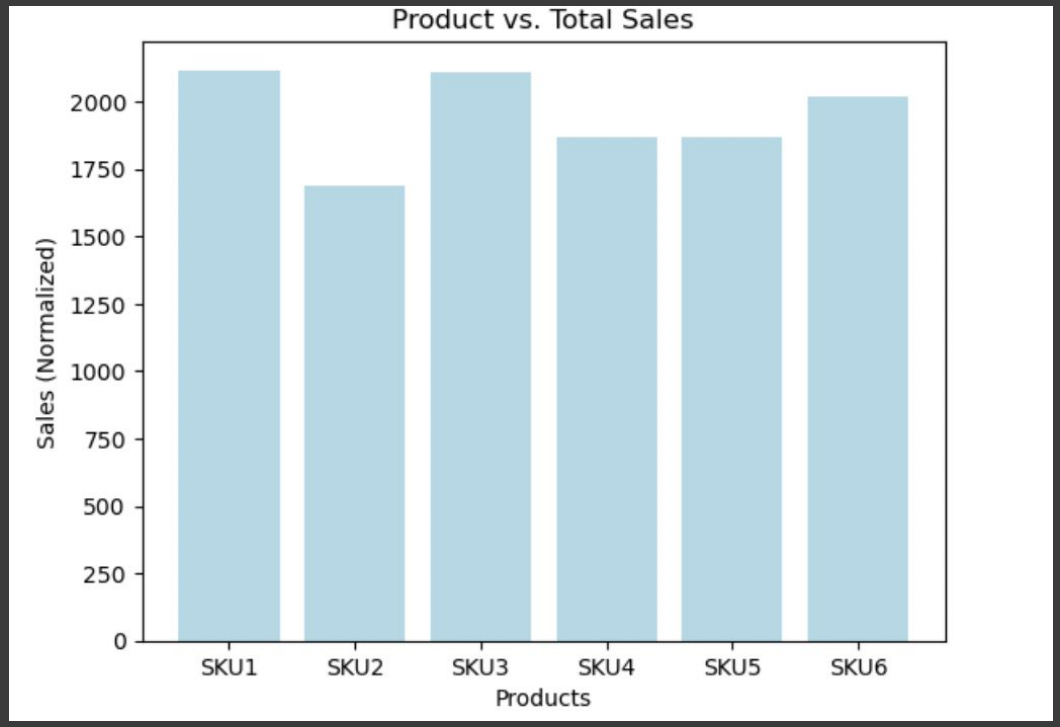
```
197383.3855213944
```

```
1 data = data[data.Sales <= outliers]
2 data
```

| | Product | date | Sales | Price Discount (%) | In-Store Promo | Catalogue Promo | Store End Promo | Google_Mobility | Covid_Flag | V_DAY | EASTER | CHRISTMAS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | SKU1 | 2/5/2017 | 27750 | 0% | 0 | 0 | 0 | 0.00 | 0 | 0 | 0 | 0 |
| **1** | SKU1 | 2/12/2017 | 29023 | 0% | 1 | 0 | 1 | 0.00 | 0 | 1 | 0 | 0 |
| **2** | SKU1 | 2/19/2017 | 45630 | 17% | 0 | 0 | 0 | 0.00 | 0 | 0 | 0 | 0 |
| **3** | SKU1 | 2/26/2017 | 26789 | 0% | 1 | 0 | 1 | 0.00 | 0 | 0 | 0 | 0 |
| **4** | SKU1 | 3/5/2017 | 41999 | 17% | 0 | 0 | 0 | 0.00 | 0 | 0 | 0 | 0 |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| **1213** | SKU6 | 10/18/2020 | 96619 | 54% | 0 | 1 | 0 | -7.56 | 1 | 0 | 0 | 0 |
| **1214** | SKU6 | 10/25/2020 | 115798 | 52% | 0 | 1 | 0 | -8.39 | 1 | 0 | 0 | 0 |
| **1215** | SKU6 | 11/1/2020 | 152186 | 54% | 1 | 0 | 1 | -7.43 | 1 | 0 | 0 | 0 |
| **1216** | SKU6 | 11/8/2020 | 26445 | 44% | 1 | 0 | 1 | -5.95 | 1 | 0 | 0 | 0 |
| **1217** | SKU6 | 11/15/2020 | 26414 | 44% | 0 | 0 | 0 | -7.20 | 1 | 0 | 0 | 0 |

# EDA

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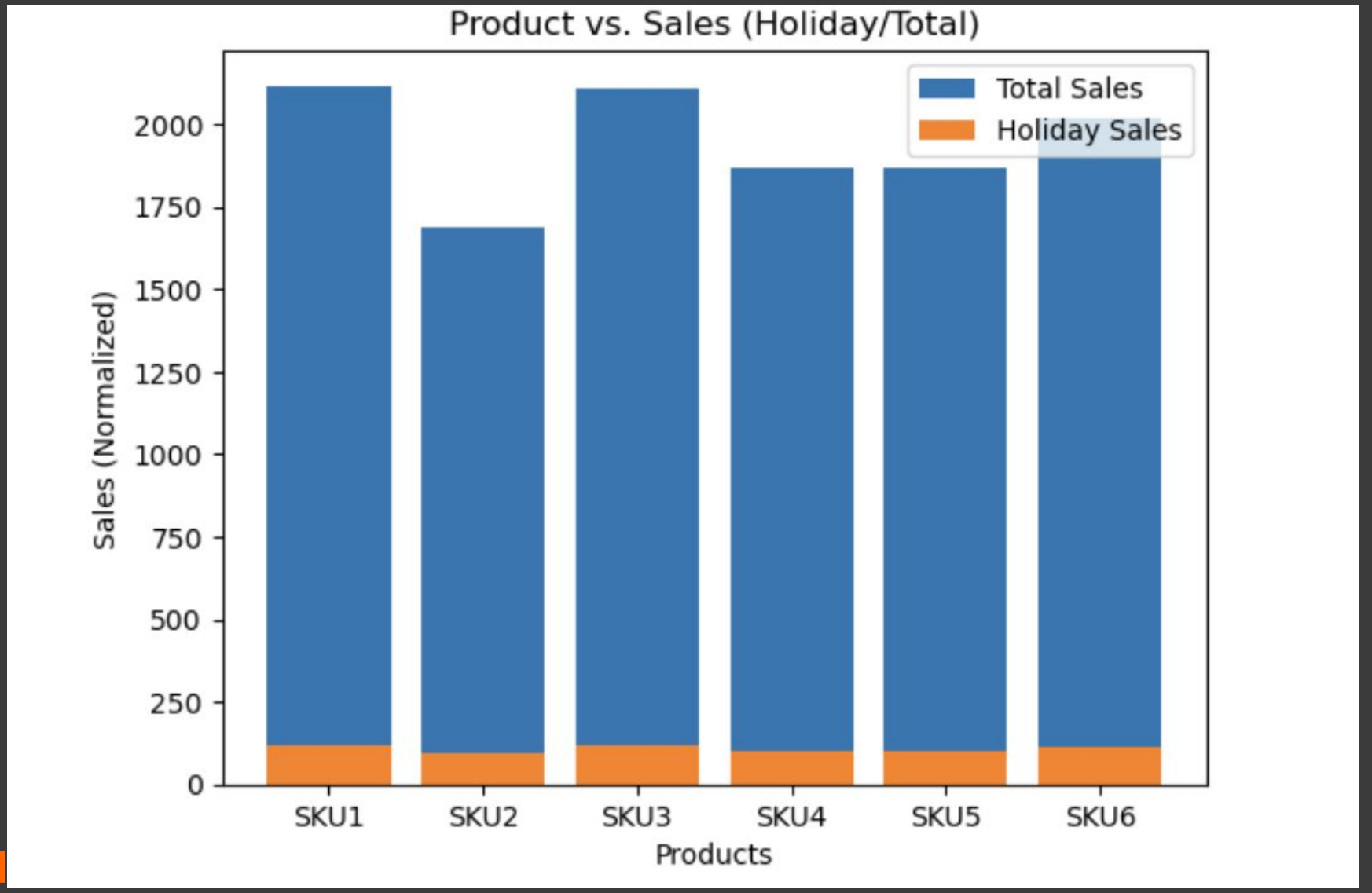
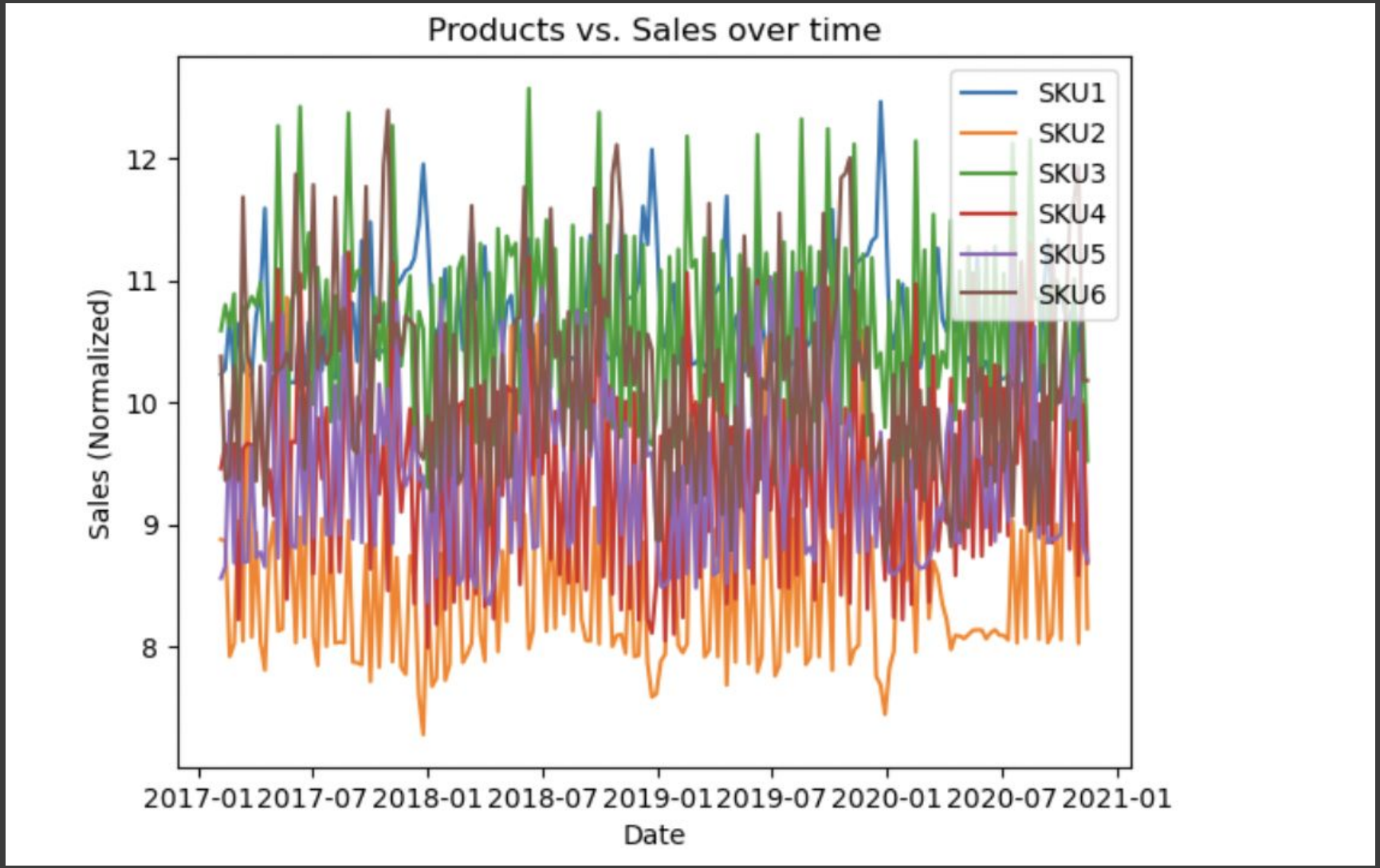
# EDA



# EDA



# EDA Summary

- Products vary in the average amount of discount percentage due to seasonality & holidays
- Products vary a little in terms of sales made during specific holidays and seasonality, which shows that the total sales are not too influenced by seasonality and discount
- Product sales vary a lot over time

# Model Recommendation

- Random Forest
- LSTM
- GRU
- XGBoost

# Thank You