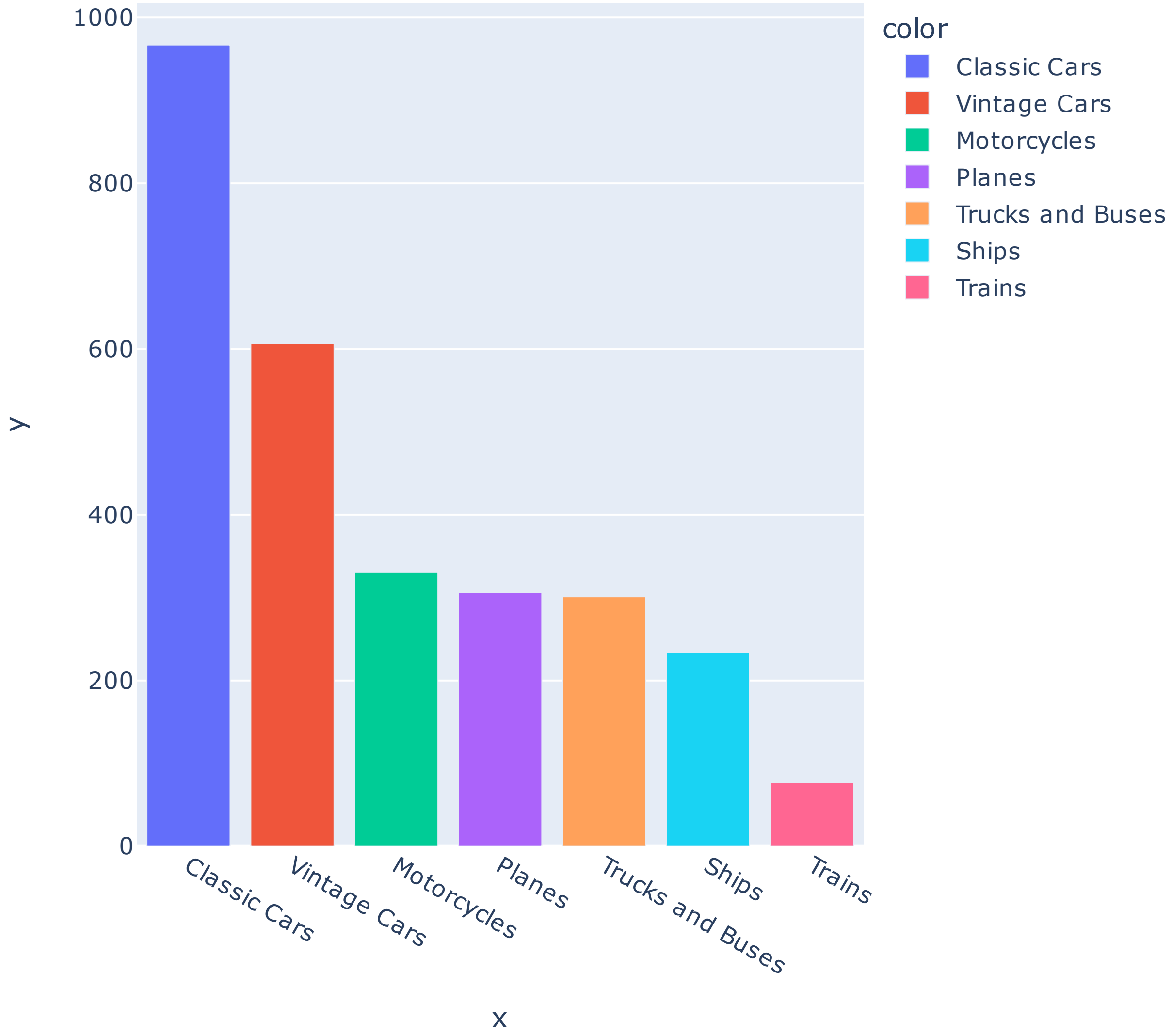
## Drop unbalanced feature

```
df.drop(columns=['STATUS'], axis=1, inplace=True)
```

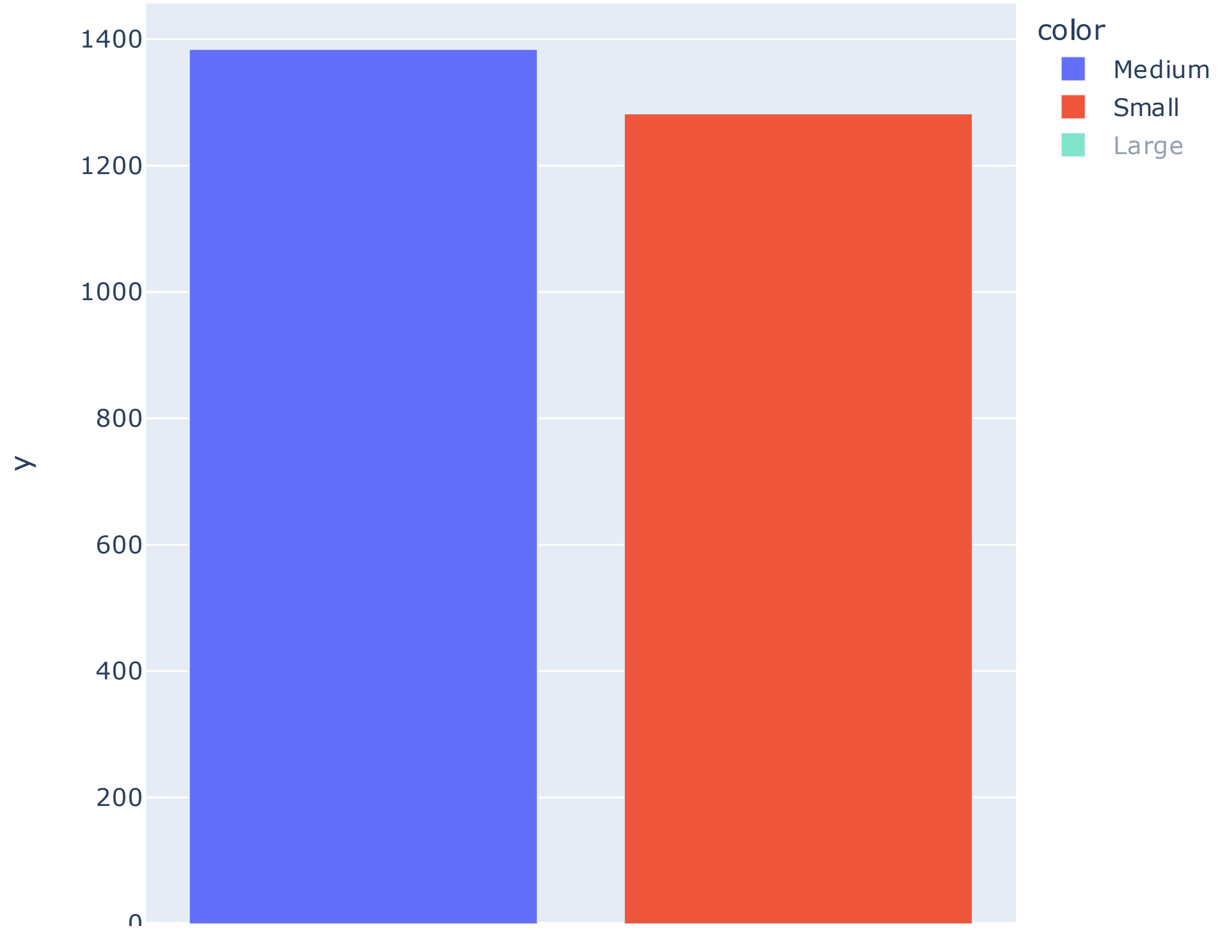
```
print('Columns resume: ', df.shape[1])
```

```
    Columns resume:  13
```

```
barplot_visualization('PRODUCTLINE')
```



```
barplot_visualization('DEALSIZE')
```



## Prepare data

```
def dummies(x):
  dummy = pd.get_dummies(df[x])
  df.drop(columns=x, inplace=True)
  return pd.concat([df, dummy], axis = 1)
```

```
df =  dummies('COUNTRY')
```

```
df =  dummies('PRODUCTLINE')
```

```
df =  dummies('DEALSIZE')
```

```
df.head()
```

|  | QUANTITYORDERED | PRICEEACH | ORDERLINENUMBER | SALES | ORDERDATE | QTR_ID | MONTH_ID |
|---|---|---|---|---|---|---|---|
| **0** | 30 | 95.70 | 2 | 2871.00 | 2003-02-24 | 1 | 2 |
| **1** | 34 | 81.35 | 5 | 2765.90 | 2003-05-07 | 2 | 5 |
| **2** | 41 | 94.74 | 2 | 3884.34 | 2003-07-01 | 3 | 7 |
| **3** | 45 | 83.26 | 6 | 3746.70 | 2003-08-25 | 3 | 8 |
| **4** | 49 | 100.00 | 14 | 5205.27 | 2003-10-10 | 4 | 10 |

```
y = pd.Categorical(df['PRODUCTCODE'])
y
```

```
['S10_1678', 'S10_1678', 'S10_1678', 'S10_1678', 'S10_1678', ..., 'S72_3212',
'S72_3212', 'S72_3212', 'S72_3212', 'S72_3212']
Length: 2823
Categories (109, object): ['S10_1678', 'S10_1949', 'S10_2016', 'S10_4698', ...,
'S700_3962',
                          'S700_4002', 'S72_1253', 'S72_3212']
```

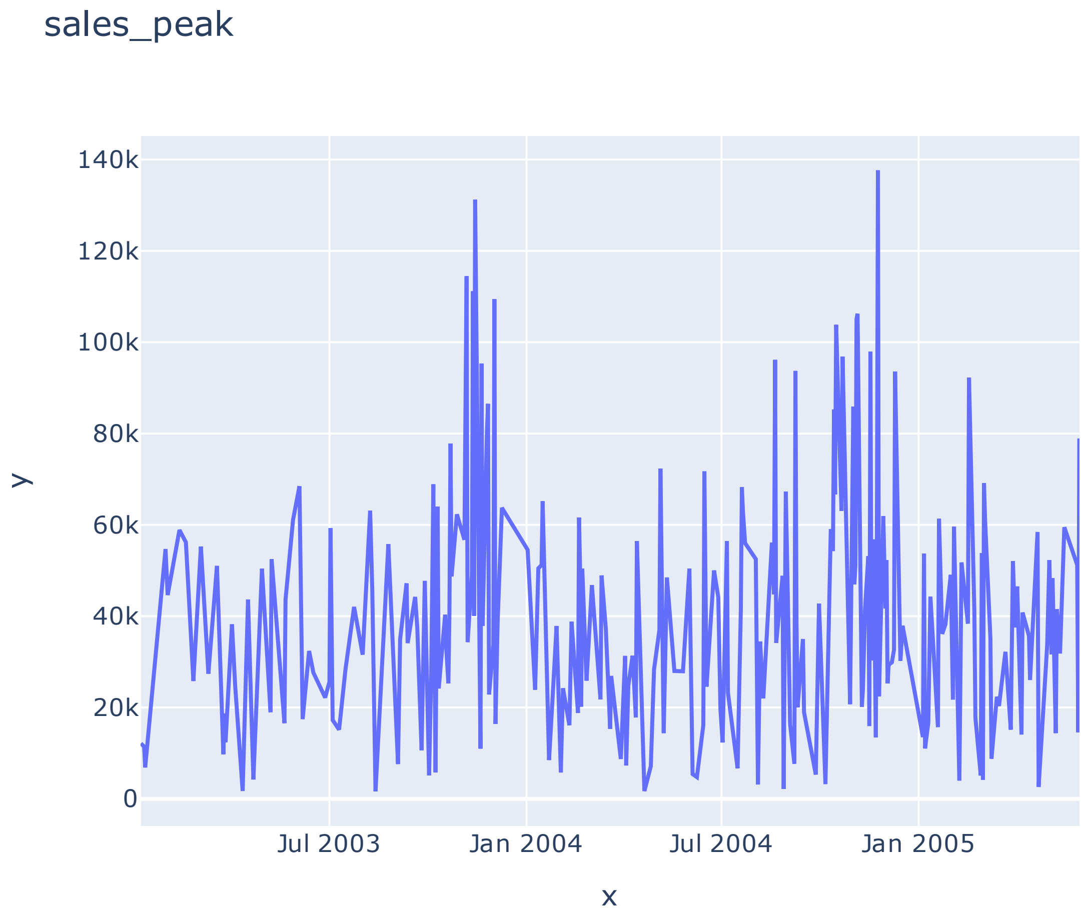
```
df['PRODUCTCODE'] = pd.Categorical(df['PRODUCTCODE']).codes
```

```
df.head()
```

|  | QUANTITYORDERED | PRICEEACH | ORDERLINENUMBER | SALES | ORDERDATE | QTR_ID | MONTH_ID |
|---|---|---|---|---|---|---|---|
| **0** | 30 | 95.70 | 2 | 2871.00 | 2003-02-24 | 1 | 2 |
| **1** | 34 | 81.35 | 5 | 2765.90 | 2003-05-07 | 2 | 5 |
| **2** | 41 | 94.74 | 2 | 3884.34 | 2003-07-01 | 3 | 7 |
| **3** | 45 | 83.26 | 6 | 3746.70 | 2003-08-25 | 3 | 8 |
| **4** | 49 | 100.00 | 14 | 5205.27 | 2003-10-10 | 4 | 10 |

5 rows × 39 columns

```
df_group = df.groupby(by='ORDERDATE').sum()
fig = px.line(x = df_group.index, y = df_group.SALES, title='sales_peak')
fig.show();
```



```
df.drop('ORDERDATE', axis=1, inplace=True)
```

### drop 'ORDERDATE', 'QTR_ID' because we have 'MONTH' etc.

```
df.drop('QTR_ID', axis=1, inplace=True)
```

```
df.shape
```

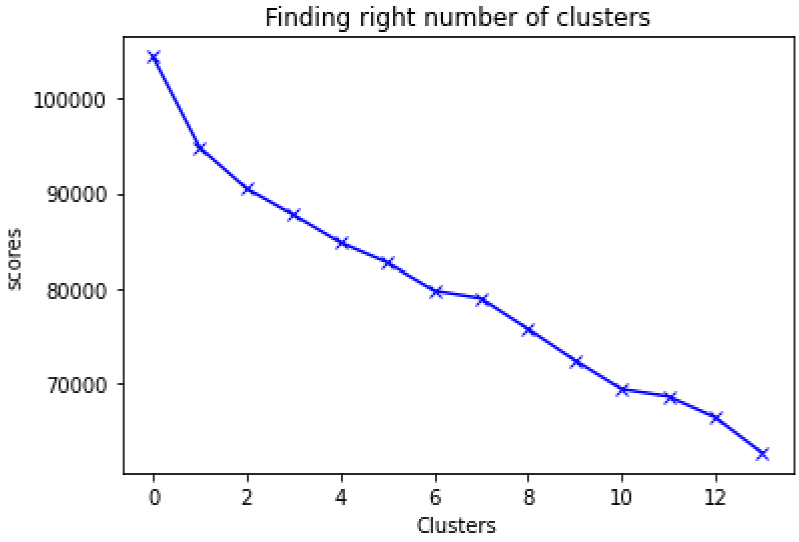
```
(2823, 37)
```

## Use K-MEANS algorithm

```
scaler =  StandardScaler()
df_scaled = scaler.fit_transform(df)
```

```
scores = []
range_values = range(1, 15)
for i in range_values:
  kmeans = KMeans(n_clusters = i)
  kmeans.fit(df_scaled)
  scores.append(kmeans.inertia_)
```

```
plt.plot(scores, 'bx-')
plt.title('Finding right number of clusters')
plt.xlabel('Clusters')
plt.ylabel('scores')
plt.show();
```



## The elbow method

```
kmeans = KMeans(4)
kmeans.fit(df_scaled)

     KMeans(n_clusters=4)
```

```
labels = kmeans.labels_
labels

     array([2, 2, 3, ..., 3, 2, 3], dtype=int32)
```

```
kmeans.cluster_centers_.shape

     (4, 37)
```

```
cluster_centers = pd.DataFrame(data = kmeans.cluster_centers_, columns= [df.columns])
cluster_centers
```

| | QUANTITYORDERED | PRICEEACH | ORDERLINENUMBER | SALES | MONTH_ID | YEAR_ID | MSRP |
|---|---|---|---|---|---|---|---|
| **0** | -0.173920 | -0.039573 | -0.005290 | -0.189818 | 0.073057 | -0.000691 | -0.0723 |
| **1** | 1.245428 | 0.800220 | -0.259579 | 2.573861 | -0.088008 | 0.136857 | 1.4302 |
| **2** | -0.465084 | -0.726204 | 0.039829 | -0.810054 | 0.005971 | -0.001150 | -0.5858 |
| **3** | 0.299596 | 0.574416 | -0.004393 | 0.457362 | -0.004848 | -0.015404 | 0.3740 |

4 rows × 37 columns

## Invert the data

```
cluster_centers = scaler.inverse_transform(cluster_centers)
cluster_centers = pd.DataFrame(data=cluster_centers, columns=[df.columns])
cluster_centers
```

| | QUANTITYORDERED | PRICEEACH | ORDERLINENUMBER | SALES | MONTH_ID | YEAR_ID | MS |
|---|---|---|---|---|---|---|---|
| **0** | 33.398876 | 82.860337 | 6.443820 | 3204.331798 | 7.359551 | 2003.814607 | 9 |
| **1** | 47.222930 | 99.799554 | 5.369427 | 8293.753248 | 6.770701 | 2003.910828 | 15 |
| **2** | 30.563025 | 69.010496 | 6.634454 | 2062.143941 | 7.114286 | 2003.814286 | 7 |
| **3** | 38.010786 | 95.244923 | 6.447612 | 4396.138089 | 7.074730 | 2003.804314 | 11 |

4 rows × 37 columns

```
sales_of_cluster = pd.concat([df, pd.DataFrame({'cluster': labels})], axis=1)
sales_of_cluster.head()
```

|  | QUANTITYORDERED | PRICEEACH | ORDERLINENUMBER | SALES | MONTH_ID | YEAR_ID | MSRP | PROD |
|---|---|---|---|---|---|---|---|---|
| **0** | 30 | 95.70 | 2 | 2871.00 | 2 | 2003 | 95 |  |
| **1** | 34 | 81.35 | 5 | 2765.90 | 5 | 2003 | 95 |  |
| **2** | 41 | 94.74 | 2 | 3884.34 | 7 | 2003 | 95 |  |
| **3** | 45 | 83.26 | 6 | 3746.70 | 8 | 2003 | 95 |  |
| **4** | 49 | 100.00 | 14 | 5205.27 | 10 | 2003 | 95 |  |

5 rows × 38 columns