```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sb
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder, StandardScaler
from sklearn import metrics
from sklearn.svm import SVC
from xgboost import XGBRegressor
from sklearn.linear_model import LinearRegression, Lasso, Ridge
from sklearn.ensemble import RandomForestRegressor
from sklearn.metrics import mean_absolute_error as mae

import warnings
warnings.filterwarnings('ignore')
```

```
df = pd.read_csv('/content/train.csv')
display(df.head())
display(df.tail())
```

	date	store	item	sales
0	2013-01-01	1	1	13
1	2013-01-02	1	1	11
2	2013-01-03	1	1	14
3	2013-01-04	1	1	13
4	2013-01-05	1	1	10

	date	store	item	sales
912995	2017-12-27	10	50	63
912996	2017-12-28	10	50	59
912997	2017-12-29	10	50	74
912998	2017-12-30	10	50	62
912999	2017-12-31	10	50	82

```
df.shape
```

```
(913000, 4)
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 913000 entries, 0 to 912999
Data columns (total 4 columns):
 #   Column  Non-Null Count   Dtype 
---  ------  --------------   ----- 
 0   date    913000 non-null  object
 1   store   913000 non-null  int64 
 2   item    913000 non-null  int64 
 3   sales   913000 non-null  int64 
dtypes: int64(3), object(1)
memory usage: 27.9+ MB
```

```
df.describe()
```

	store	item	sales
count	913000.000000	913000.000000	913000.000000
mean	5.500000	25.500000	52.250287
std	2.872283	14.430878	28.801144
min	1.000000	1.000000	0.000000
25%	3.000000	13.000000	30.000000
50%	5.500000	25.500000	47.000000

```
parts = df["date"].str.split("-", n = 3, expand = True)
df["year"]= parts[0].astype('int')
df["month"]= parts[1].astype('int')
df["day"]= parts[2].astype('int')
df.head()
```

	date	store	item	sales	year	month	day
0	2013-01-01	1	1	13	2013	1	1
1	2013-01-02	1	1	11	2013	1	2
2	2013-01-03	1	1	14	2013	1	3
3	2013-01-04	1	1	13	2013	1	4
4	2013-01-05	1	1	10	2013	1	5

```
from datetime import datetime
import calendar

def weekend_or_weekday(year,month,day):

    d = datetime(year,month,day)
    if d.weekday()>4:
        return 1
    else:
        return 0

df['weekend'] = df.apply(lambda x:weekend_or_weekday(x['year'], x['month'], x['day']), axis=1)
df.head()
```

	date	store	item	sales	year	month	day	weekend
0	2013-01-01	1	1	13	2013	1	1	0
1	2013-01-02	1	1	11	2013	1	2	0
2	2013-01-03	1	1	14	2013	1	3	0
3	2013-01-04	1	1	13	2013	1	4	0
4	2013-01-05	1	1	10	2013	1	5	1

```
from datetime import date
import holidays
import pandas as pd

# Create a DataFrame with date column
df = pd.DataFrame({'date': pd.date_range(start='2023-01-01', end='2023-12-31')})

# Define a function to check holidays for a batch of dates
def is_holiday_batch(start_date, end_date):
    india_holidays = holidays.country_holidays('IN')
    df['holidays'] = df['date'].apply(lambda x: 1 if india_holidays.get(x) else 0)

# Process the DataFrame in batches
batch_size = 100
for start in range(0, len(df), batch_size):
```

```
    end = start + batch_size
    is_holiday_batch(df['date'].iloc[start:end], df['date'].iloc[start:end])

df.head()
```

	date	holidays
0	2023-01-01	0
1	2023-01-02	0
2	2023-01-03	0
3	2023-01-04	0
4	2023-01-05	0

```
df['m1'] = np.sin(df['month'] * (2 * np.pi / 12))
df['m2'] = np.cos(df['month'] * (2 * np.pi / 12))
df.head()
```

	date	store	item	sales	year	month	day	weekend	m1	m2
0	2013-01-01	1	1	13	2013	1	1	0	0.5	0.866025
1	2013-01-02	1	1	11	2013	1	2	0	0.5	0.866025
2	2013-01-03	1	1	14	2013	1	3	0	0.5	0.866025
3	2013-01-04	1	1	13	2013	1	4	0	0.5	0.866025
4	2013-01-05	1	1	10	2013	1	5	1	0.5	0.866025

```
def which_day(year, month, day):

    d = datetime(year,month,day)
    return d.weekday()

df['weekday'] = df.apply(lambda x: which_day(x['year'],
                                             x['month'],
                                             x['day']),
                         axis=1)
df.head()
```

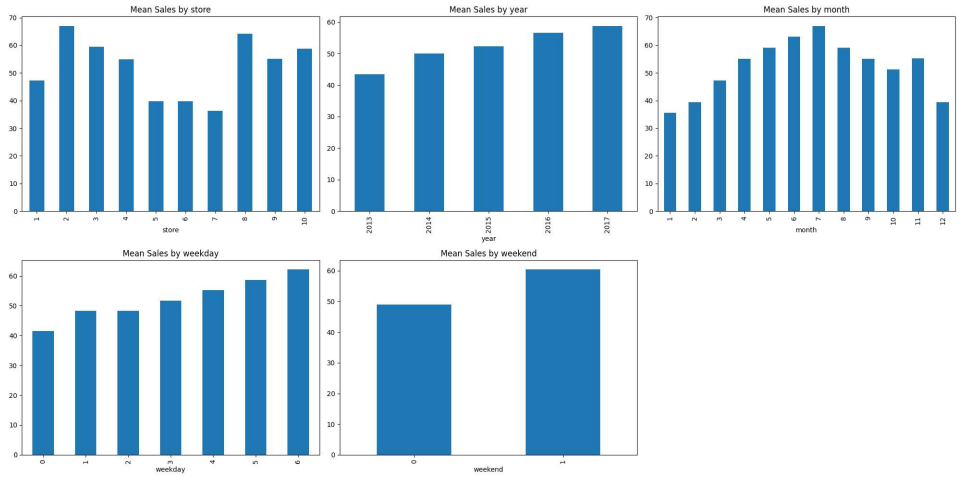
	date	store	item	sales	year	month	day	weekend	m1	m2	weekday
0	2013-01-01	1	1	13	2013	1	1	0	0.5	0.866025	1
1	2013-01-02	1	1	11	2013	1	2	0	0.5	0.866025	2
2	2013-01-03	1	1	14	2013	1	3	0	0.5	0.866025	3
3	2013-01-										

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


df['store'].nunique(), df['item'].nunique()
```

```
(10, 50)
```

```
import matplotlib.pyplot as plt

features = ['store', 'year', 'month', 'weekday', 'weekend']

# Create a grid of subplots
```

```
fig, axes = plt.subplots(2, 3, figsize=(20, 10))

# Flatten the 2D axes array for easier indexing
axes = axes.flatten()

for i, col in enumerate(features):
    if col in df:
        df.groupby(col).mean()['sales'].plot.bar(ax=axes[i])
        axes[i].set_title(f'Mean Sales by {col}')

# Remove any extra empty subplots
for j in range(len(features), 6):
    fig.delaxes(axes[j])

# Adjust layout
plt.tight_layout()

# Show the plot
plt.show()
```

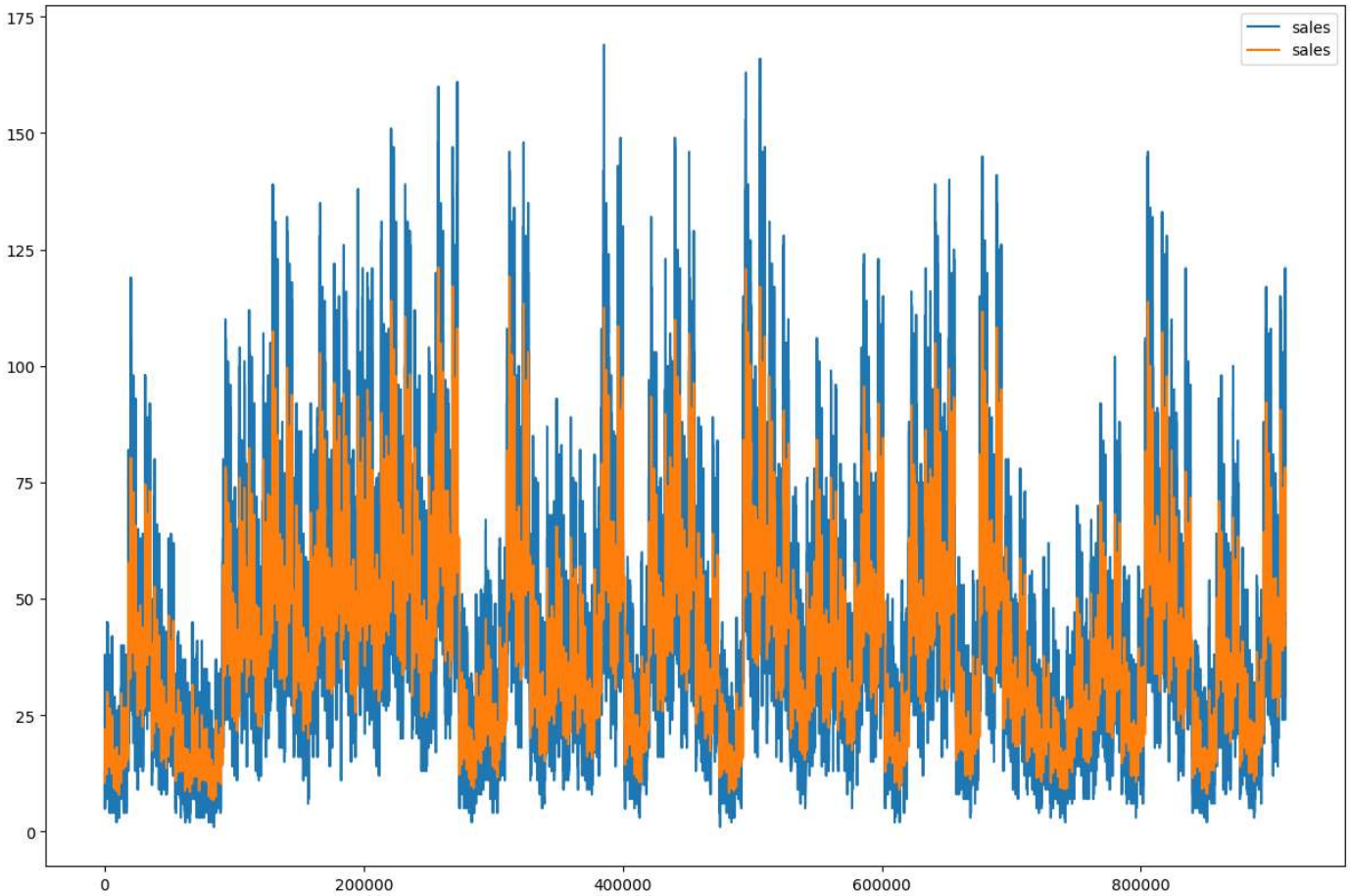



```
plt.figure(figsize=(10,5))
df.groupby('day').mean()['sales'].plot()
plt.show()
```


```
plt.figure(figsize=(10,5))
df.groupby('day').mean()['sales'].plot()
plt.show()
```

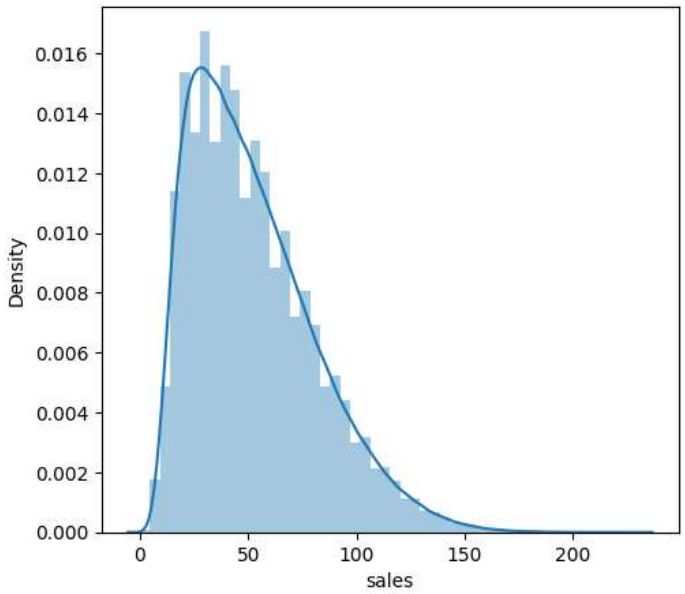


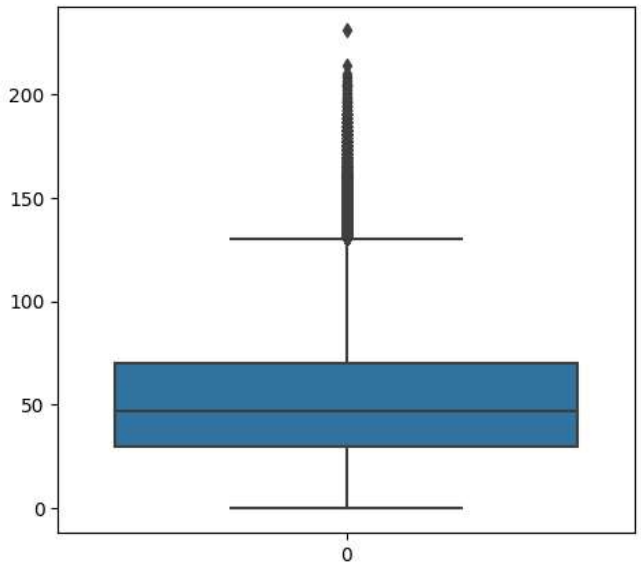
```
plt.figure(figsize=(15, 10))

# Calculating Simple Moving Average
# for a window period of 30 days
window_size = 30
data = df[df['year']==2013]
windows = data['sales'].rolling(window_size)
sma = windows.mean()
sma = sma[window_size - 1:]

data['sales'].plot()
sma.plot()
plt.legend()
plt.show()
```



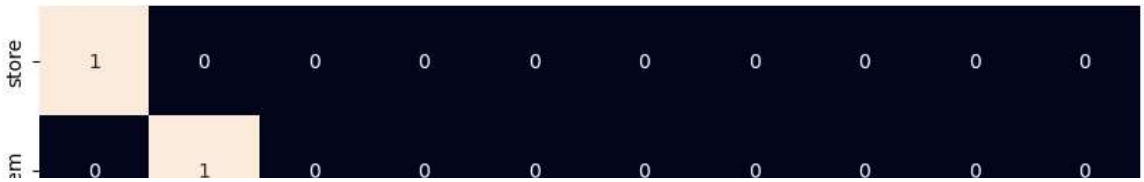

```
plt.subplots(figsize=(12, 5))
plt.subplot(1, 2, 1)
sb.distplot(df['sales'])

plt.subplot(1, 2, 2)
```

```
sb.boxplot(df['sales'])
plt.show()
```






```
plt.figure(figsize=(10, 10))
sb.heatmap(df.corr() > 0.8,
           annot=True,
           cbar=False)
plt.show()
```




```
df = df[df['sales']<140]
```

```
features = df.drop(['sales', 'year'], axis=1)
target = df['sales'].values


X_train, X_val, Y_train, Y_val = train_test_split(features, target,
                                                  test_size = 0.05,
                                                  random_state=22)
X_train.shape, X_val.shape
```

```
((861170, 8), (45325, 8))
```


```
# Normalizing the features for stable and fast training.
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_val = scaler.transform(X_val)
```

```
models = [LinearRegression(), XGBRegressor(), Lasso(), Ridge()]

for i in range(4):
    models[i].fit(X_train, Y_train)

    print(f'{models[i]} : ')

    train_preds = models[i].predict(X_train)
    print('Training Error : ', mae(Y_train, train_preds))

    val_preds = models[i].predict(X_val)
    print('Validation Error : ', mae(Y_val, val_preds))
    print()
```

```
 LinearRegression() :
 Training Error :  20.903004582954193
 Validation Error :  20.971906433303552

 XGBRegressor(base_score=None, booster=None, callbacks=None,
              colsample_bylevel=None, colsample_bynode=None,
              colsample_bytree=None, device=None, early_stopping_rounds=None,
              enable_categorical=False, eval_metric=None, feature_types=None,
              gamma=None, grow_policy=None, importance_type=None,
              interaction_constraints=None, learning_rate=None, max_bin=None,
              max_cat_threshold=None, max_cat_to_onehot=None,
              max_delta_step=None, max_depth=None, max_leaves=None,
              min_child_weight=None, missing=nan, monotone_constraints=None,
              multi_strategy=None, n_estimators=None, n_jobs=None,
              num_parallel_tree=None, random_state=None, ...) :
 Training Error :  6.862874663759986
 Validation Error :  6.88620016190076

 Lasso() :
 Training Error :  21.015028699769758
 Validation Error :  21.071517213774968

 Ridge() :
 Training Error :  20.903004715274434
 Validation Error :  20.97190662414811
```