Rodriguez_Felipe_DSC630_Week_8_Code

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```
[1]: # Ignores warnings
     import warnings
     warnings.filterwarnings('ignore')
```

```
[2]: import pandas as pd
     import matplotlib.pyplot as plt
```

```
[3]: df = pd.read_csv("us_retail_sales.csv")
```

```
[4]: df.head()
```

```
[4]:    YEAR     JAN     FEB     MAR     APR     MAY     JUN       JUL       AUG  \
     0  1992  146925  147223  146805  148032  149010  149800  150761.0  151067.0
     1  1993  157555  156266  154752  158979  160605  160127  162816.0  162506.0
     2  1994  167518  169649  172766  173106  172329  174241  174781.0  177295.0
     3  1995  182413  179488  181013  181686  183536  186081  185431.0  186806.0
     4  1996  189135  192266  194029  194744  196205  196136  196187.0  196218.0

             SEP       OCT       NOV       DEC
     0  152588.0  153521.0  153583.0  155614.0
     1  163258.0  164685.0  166594.0  168161.0
     2  178787.0  180561.0  180703.0  181524.0
     3  187366.0  186565.0  189055.0  190774.0
     4  198859.0  200509.0  200174.0  201284.0
```

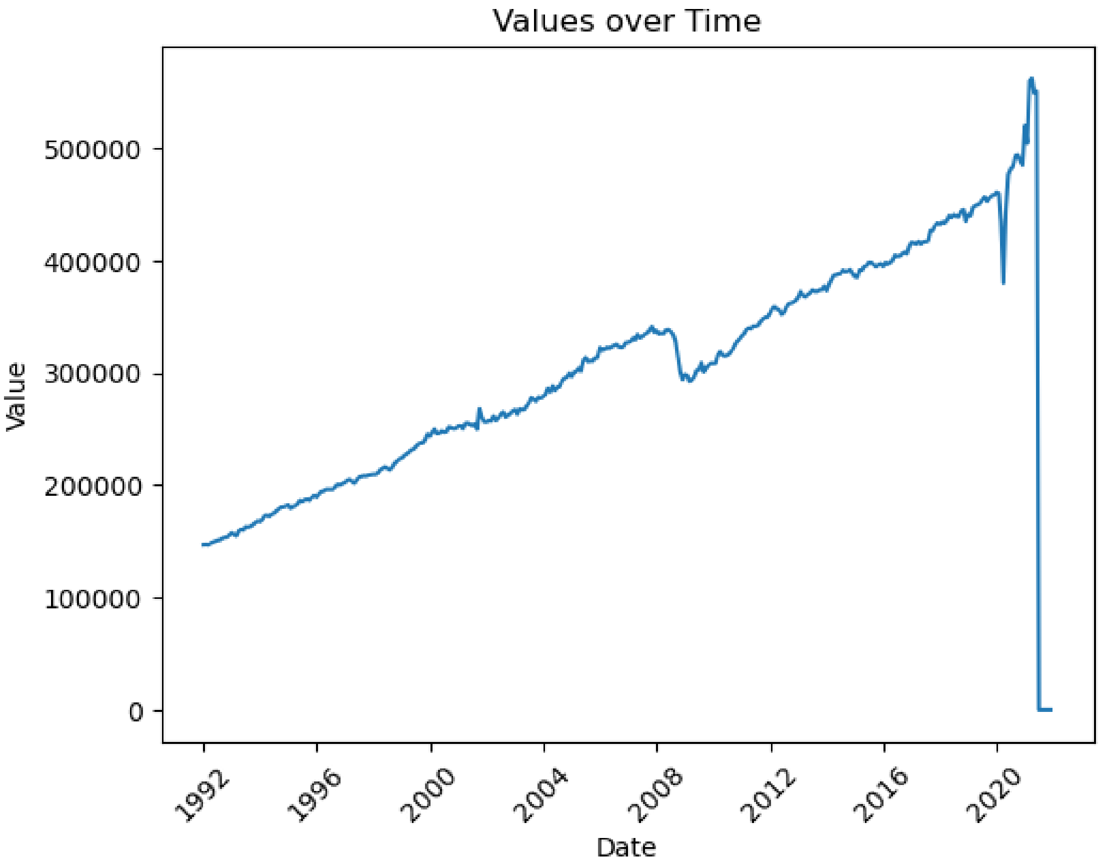
```
[5]: df = df.fillna(0)
```

Plot the data with proper labeling and make some observations on the graph.

```
[6]: # Reshape the dataframe to have a single 'Month' column and a 'Value' column
     df = df.melt(id_vars='YEAR', var_name='Month', value_name='Value')

     # Combine the 'YEAR' and 'Month' columns to create a 'Date' column
     df['Date'] = pd.to_datetime(df['YEAR'].astype(str) + '-' + df['Month'],␣
      ↪format='%Y-%b')

     # Sort the dataframe by the 'Date' column
     df = df.sort_values('Date')
```

[7]:

```python
# Plot the values over time
plt.plot(df['Date'], df['Value'])

# Set the x-axis label
plt.xlabel('Date')

# Set the y-axis label
plt.ylabel('Value')

# Set the title of the plot
plt.title('Values over Time')

# Rotate the x-axis labels for better visibility
plt.xticks(rotation=45)

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



The values over time see a steady increase with two dips in 2008 and 2020. The data drops to 0 at the end because any null values were filled with 0. After the dip in 2008, a sharp increase occurs.

Split this data into a training and test set. Use the last year of data (July 2020 – June 2021) of data as your test set and the rest as your training set.

[8]:
```
# Set the initial date to split
start_date = pd.to_datetime('2020-07-01')
```

[9]:
```
# Split the data into two sets
test = df[(df['Date'] >= start_date)]
train = df[(df['Date'] < start_date)]
```

[10]:
```
from time import strptime
```

[11]:
```
# Create the month in number format
test['month_number'] = [strptime(str(x), '%b').tm_mon for x in test['Month']]
train['month_number'] = [strptime(str(x), '%b').tm_mon for x in train['Month']]
```

[12]:
```
# drop columns not needed
test = test.drop(columns=['Date', 'Month'])
train = train.drop(columns=['Date', 'Month'])
```

Use the training set to build a predictive model for the monthly retail sales.

[13]:
```
from sklearn.model_selection import train_test_split
```

[14]:
```
# Separate the target from the features
feature = train.drop('Value', axis=1)
target = train['Value']

#Split the data into training and test
feature_train, feature_test, target_train, target_test =␣
 ↪train_test_split(feature, target)
```

[15]:
```
from sklearn.linear_model import LinearRegression
```

[16]:
```
# Creates linear regression
linear_regression = LinearRegression()
```

[17]:
```
# Fits the model using test data
lr_model = linear_regression.fit(feature_train, target_train)
```

Use the model to predict the monthly retail sales on the last year of data.

[18]:
```
target_predicted = linear_regression.predict(feature_test)
target_predicted
```

[18]:
```
array([403257.99499721, 173322.76589053, 269281.59897819, 331419.30618268,
       326436.50562564, 177254.58343472, 252238.7262846 , 186955.56504477,
       240965.01765687, 214485.78285725, 372582.32314939, 355539.4504558 ,
       378873.23122007, 429737.22979684, 152348.07565276, 306248.1788967 ,
       169126.32884234, 366813.15908352, 362881.34153934, 404044.35850605,
       200588.364199  , 374941.4136759 , 409548.9030679 , 323291.0515903 ,
       272427.05301354, 369958.61311886, 334564.76021802, 316735.52401559,
       315162.79699792, 198229.27367249, 178040.94694355, 172536.4023817 ,
       353966.72343813, 362094.9780305 , 156279.89319694, 273999.78003121,
       193511.09261947, 224973.12797613, 291829.01623364, 425019.04874382,
       170699.05586001, 279768.94409708, 157066.25670578, 228904.94552032,
       270854.32599587, 285273.48865893, 211862.07282672, 231264.03604682,
       242537.74467454, 257221.52684163, 190101.01908011, 329846.579165  ,
       221563.05443677, 354753.08694696, 303889.0883702 , 286059.85216776,
       194297.45612831, 390146.9398478 , 358684.90449114, 225759.49148497,
       332992.03320035, 356325.81396463, 321718.32457262, 265085.16192999,
       338496.5777622 , 443370.02895107, 267708.87196052, 351607.63291162,
       195870.18314598, 301529.99784369, 199802.00069016, 320931.96106379,
       425805.41225266, 312017.34296258, 263512.43491232, 322504.68808146,
       220776.69092794, 244110.47169222, 219990.3274191 , 344265.74182807,
       350821.26940278, 386215.12230362, 445993.7389816 , 230477.67253799,
       448352.82950811, 404830.72201489])
```

Report t**he RMSE of the model predictions on the test set.**

[19]:

```
# Calculates R2
r_sqaured = lr_model.score(feature_test, target_test)
print("R2 Value is:", r_sqaured)
```

```
R2 Value is: 0.9752390325112489
```