Week 8

- Joshua Burden
- DSC630 Predictive Analytics
- Bellevue University
- Andrew Hua
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In [ ]:

```
import pandas as pd
import matplotlib.pyplot as plt
from datetime import datetime
from sklearn.linear_model import LinearRegression
from sklearn import metrics
```

In [ ]:

```
#Import csv
df = pd.read_csv('us_retail_sales.csv')
df.head()
```

Out[ ]:

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	
0	1992	146925	147223	146805	148032	149010	149800	150761.0	151067.0	152588.0	153521.0	1
1	1993	157555	156266	154752	158979	160605	160127	162816.0	162506.0	163258.0	164685.0	1
2	1994	167518	169649	172766	173106	172329	174241	174781.0	177295.0	178787.0	180561.0	1
3	1995	182413	179488	181013	181686	183536	186081	185431.0	186806.0	187366.0	186565.0	1
4	1996	189135	192266	194029	194744	196205	196136	196187.0	196218.0	198859.0	200509.0	2

In [ ]:

```
#check types
df.dtypes
```

Out[ ]:

```
YEAR      int64
JAN       int64
FEB       int64
MAR       int64
APR       int64
MAY       int64
JUN       int64
JUL     float64
AUG     float64
SEP     float64
OCT     float64
NOV     float64
DEC     float64
dtype: object
```

In [ ]:

```
#check dataframe shape
df.shape
```

Out[ ]:

```
(30, 13)
```

In [ ]:

```
#melt data and change to long df
df2 = pd.melt(df, id_vars='YEAR', value_vars=['JAN', 'FEB', 'MAR',
                                               'APR', 'MAY', 'JUN', 'JUL', 'AUG', 'SEP'
```

In [ ]:

```
#Years to string
df2['YEAR'] = df2['YEAR'].astype(str)
df2['Date']= df2['variable'] + '-01-' + df2['YEAR']

df2['Date'] = pd.to_datetime(df2['Date'])
```

In [ ]:

```
#remove NA and sort by date
df2.dropna(inplace=True)
df2 = df2.sort_values(by=['Date'])
df2
```

Out[ ]:

	YEAR	variable	value	Date
0	1992	JAN	146925.0	1992-01-01
30	1992	FEB	147223.0	1992-02-01
60	1992	MAR	146805.0	1992-03-01
90	1992	APR	148032.0	1992-04-01
120	1992	MAY	149010.0	1992-05-01
...	...	...	...	...
59	2021	FEB	504458.0	2021-02-01
89	2021	MAR	559871.0	2021-03-01
119	2021	APR	562269.0	2021-04-01
149	2021	MAY	548987.0	2021-05-01
179	2021	JUN	550782.0	2021-06-01

354 rows × 4 columns

In [ ]:

```
df.reset_index(inplace = True)
df.head()
```

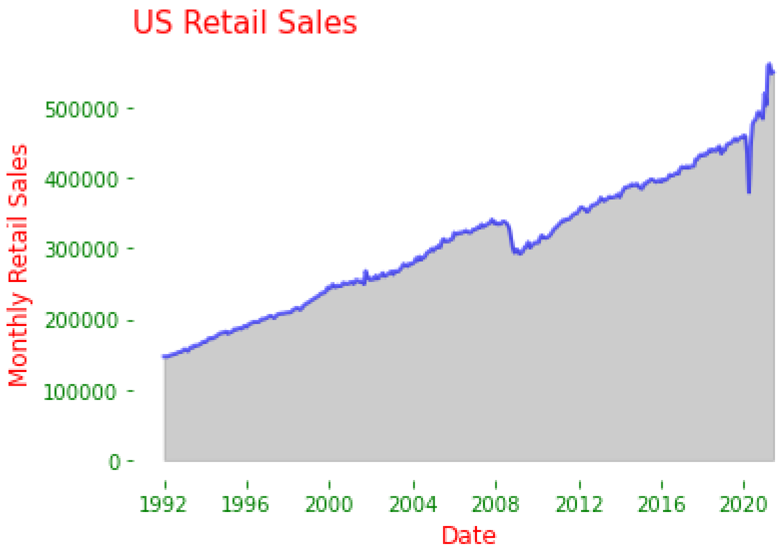
Out[ ]:

	level_0	index	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	!
0	0	0	1992	146925	147223	146805	148032	149010	149800	150761.0	151067.0	15258
1	1	1	1993	157555	156266	154752	158979	160605	160127	162816.0	162506.0	16325
2	2	2	1994	167518	169649	172766	173106	172329	174241	174781.0	177295.0	17878
3	3	3	1995	182413	179488	181013	181686	183536	186081	185431.0	186806.0	18736
4	4	4	1996	189135	192266	194029	194744	196205	196136	196187.0	196218.0	19885

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

In [ ]:

```
# Create an area chart
plt.fill_between(df2['Date'], df2['value'], color="grey", alpha=0.4)
plt.plot(df2['Date'], df2['value'], color="blue", alpha=0.6, linewidth=2)
plt.box(False)
plt.title('US Retail Sales', loc='left', fontsize=15, color='red')
plt.xlabel('Date', fontsize=12, color='red')
plt.ylabel('Monthly Retail Sales', fontsize=12, color='red')
plt.tick_params(axis='x', colors='green')
plt.tick_params(axis='y', colors='green')
plt.show()
```



US Retail sales have been steadily increasing since 1992. As you can see in the chart, small decreases in retail sales were seen during the housing crisis (2008-2009) and at the beggining of the pandemic (2020)

2. 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.

In [ ]:

```
# build a new predictor using a new feature created
df2['O-Date'] = pd.to_datetime(df2['Date'])
df2['O-Date'] = df2['O-Date'].map(datetime.toordinal)
```

In [ ]:

```
#predictor for month
months = dict(JAN=1, FEB=2, MAR=3, APR=4, MAY=5, JUN=6, JUL=7, AUG=8, SEP=9, OCT=10, N
df2['Month'] = df2['variable'].map(months)
```

In [ ]:

```
#build out the training and test models and reshape the data fields
training = df2.iloc[0:341]
test = df2.iloc[342:354]

x_train = training[['O-Date', 'Month']]
```

```
y_train = training['value']
x_test = test[['O-Date', 'Month']]
y_test = test['value']
```

In [ ]:
```
#Create the model
model = LinearRegression()
# Fit the model to the training set
model.fit(x_train, y_train)
```

Out[ ]:
```
LinearRegression()
```

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

In [ ]:
```
# predict the retail sales from last year
test_predictions = model.predict(x_test)
print(test_predictions)
```

```
[449165.16373623 450140.45597197 451115.74820772 452062.40506951
 453037.69730526 453984.35416705 453908.49868608 454883.79092182
 455773.1770357  456748.46927145 457695.12613323 458670.41836898]
```

5. Report the RMSE of the model predictions on the test set.

In [ ]:
```
print('Test RMSE:', metrics.mean_squared_error(y_test, test_predictions, squared=False
```

```
Test RMSE: 66817.27313121158
```

A significant dip and then spike in retail sales might be causing the increased RMSE