ADA Assignment 2

- Sampad Kumar Kar
- MCS202215

0. Imports

In [ ]:

```
# for file handling
import os, sys

# for data manipulation
import pandas as pd
import numpy as np

# for data visualization
import matplotlib.pyplot as plt
import seaborn as sns

# sklearn imports
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score
```

1. Data Loading

In [ ]:

```
# .xlxs sheets converted to .csv file

data_path_1 = os.path.join('data', 'raw', 'Fablink-cleanedup_Fab1001-401.csv')
data_path_2 = os.path.join('data', 'raw', 'Fablink-cleanedup_Fab1002-401.csv')

df1 = pd.read_csv(data_path_1)
df2 = pd.read_csv(data_path_2)
```

2. `df1`

In [ ]:

```
df1.head()
```

Out[ ]:

	source_node	source_port	source_type	operSpeed	destination_node	destination_port	destination_type	octets	la
0	1001	1/1	spine	40G	401	1/49	leaf	864504425592799	859365
1	1001	1/1	spine	40G	401	1/49	leaf	869309684178755	864504
2	1001	1/1	spine	40G	401	1/49	leaf	874373310562711	869309
3	1001	1/1	spine	40G	401	1/49	leaf	879933845908609	87437
4	1001	1/1	spine	40G	401	1/49	leaf	885694021578201	879933

In [ ]:

```
print("The shape of the data is: ", df1.shape)
```

```
The shape of the data is:  (70, 12)
```

In [ ]:

```
df1.columns
```

Out[ ]:

```
Index(['source_node', 'source_port', 'source_type', 'operSpeed',
       'destination_node', 'destination_port', 'destination_type', 'octets',
       'lastOctetval', 'Octet-diff', 'Utilization', 'datetime'],
      dtype='object')
```

In [ ]:

```
# filter out the dataframe to store only the required columns, i.e. 'datetime' and 'Utilization'

df1 = df1[['datetime', 'Utilization']]

# convert the 'datetime' column to datetime format
df1['datetime'] = pd.to_datetime(df1['datetime'])

df1.head()
```

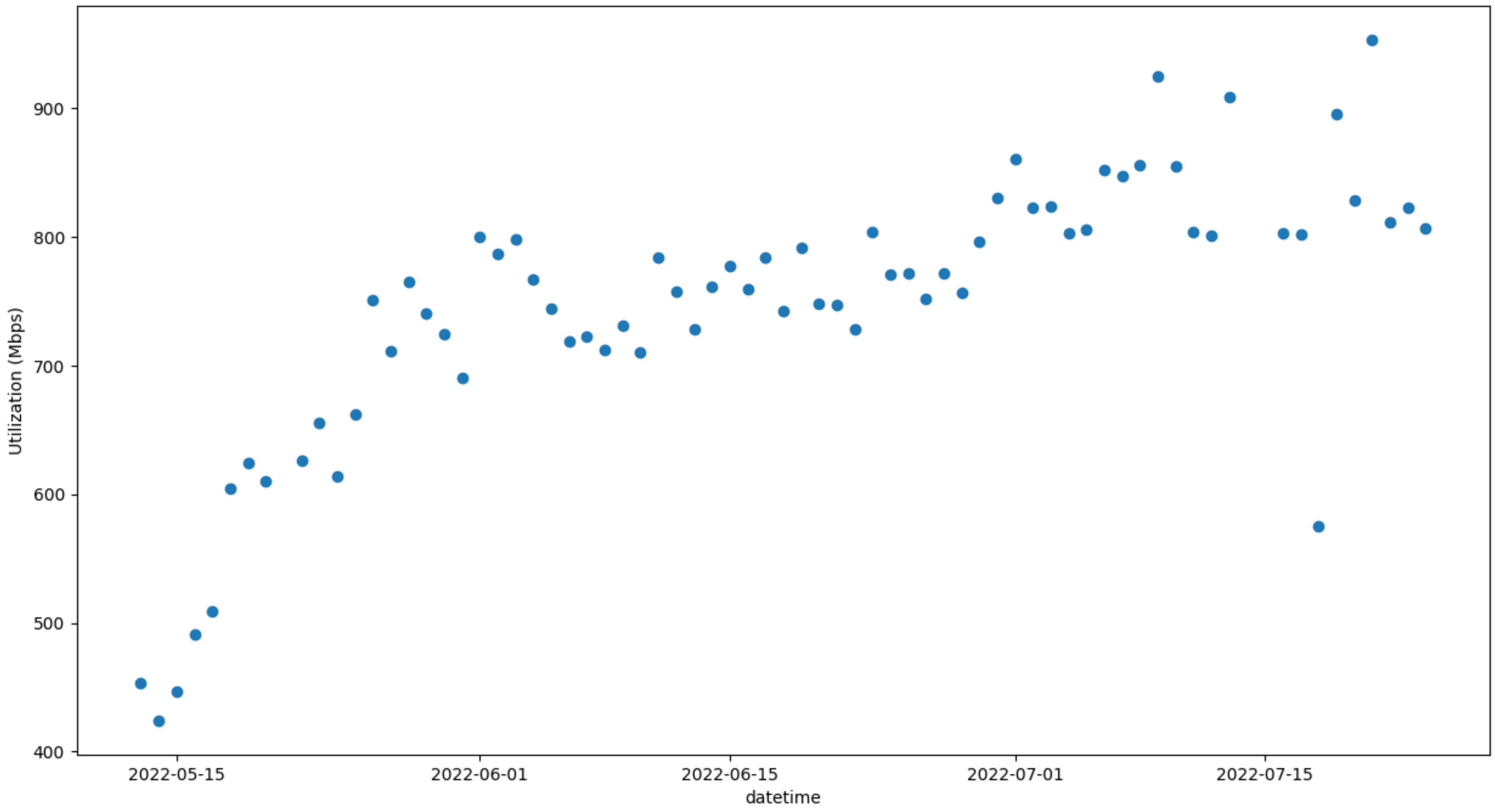
```
/var/folders/xr/w_ff5mfj28v5_lpz552bj4zm0000gn/T/ipykernel_3722/2438006576.py:7: UserWarning: Parsing dates in %
d/%m/%Y format when dayfirst=False (the default) was specified. Pass `dayfirst=True` or specify a format to sile
nce this warning.
  df1['datetime'] = pd.to_datetime(df1['datetime'])
```

Out[ ]:

	datetime	Utilization
0	2022-05-13	453.77
1	2022-05-14	424.32
2	2022-05-15	447.13
3	2022-05-16	491.01
4	2022-05-17	508.64

In [ ]:

```
# we first plot the data in a scatter plot ('Utilization' vs 'datetime') to see the trend

plt.figure(figsize=(15, 8))
plt.scatter(df1['datetime'], df1['Utilization'])
plt.xlabel('datetime')
plt.ylabel('Utilization (Mbps)')
plt.show()
```



The data seems to have a linear trend, `Utilization` seems to be increasing linearly with time. We try to fit a linear regression model to the data by using the current day of the year as independent variable.

2.1 Preprocessing

In [ ]:

```
# add a new column 'doy' to represent the day of the year corresponding to the 'datetime' column

df1['doy'] = df1['datetime'].dt.dayofyear

df1.head()
```

Out[ ]:

	datetime	Utilization	doy
0	2022-05-13	453.77	133
1	2022-05-14	424.32	134
2	2022-05-15	447.13	135
3	2022-05-16	491.01	136
4	2022-05-17	508.64	137

Since, we are fitting a simple Linear Regression Model, scaling is unnecessary. So, we directly move on to fit the model.

2.2 Linear Regression

In [ ]:

```
model_1 = LinearRegression()

# fit the model on the data
model_1.fit(df1[['doy']], df1['Utilization'])
```

Out[ ]:

```
▾ LinearRegression
LinearRegression()
```

In [ ]:

```
# print the coefficients and intercept of the model

print("The coefficient of the model is: ", model_1.coef_.item())
print("The intercept of the model is: ", model_1.intercept_)
```

```
The coefficient of the model is:  3.8781432728837326
The intercept of the model is:  91.85555233725074
```

2.3 Results

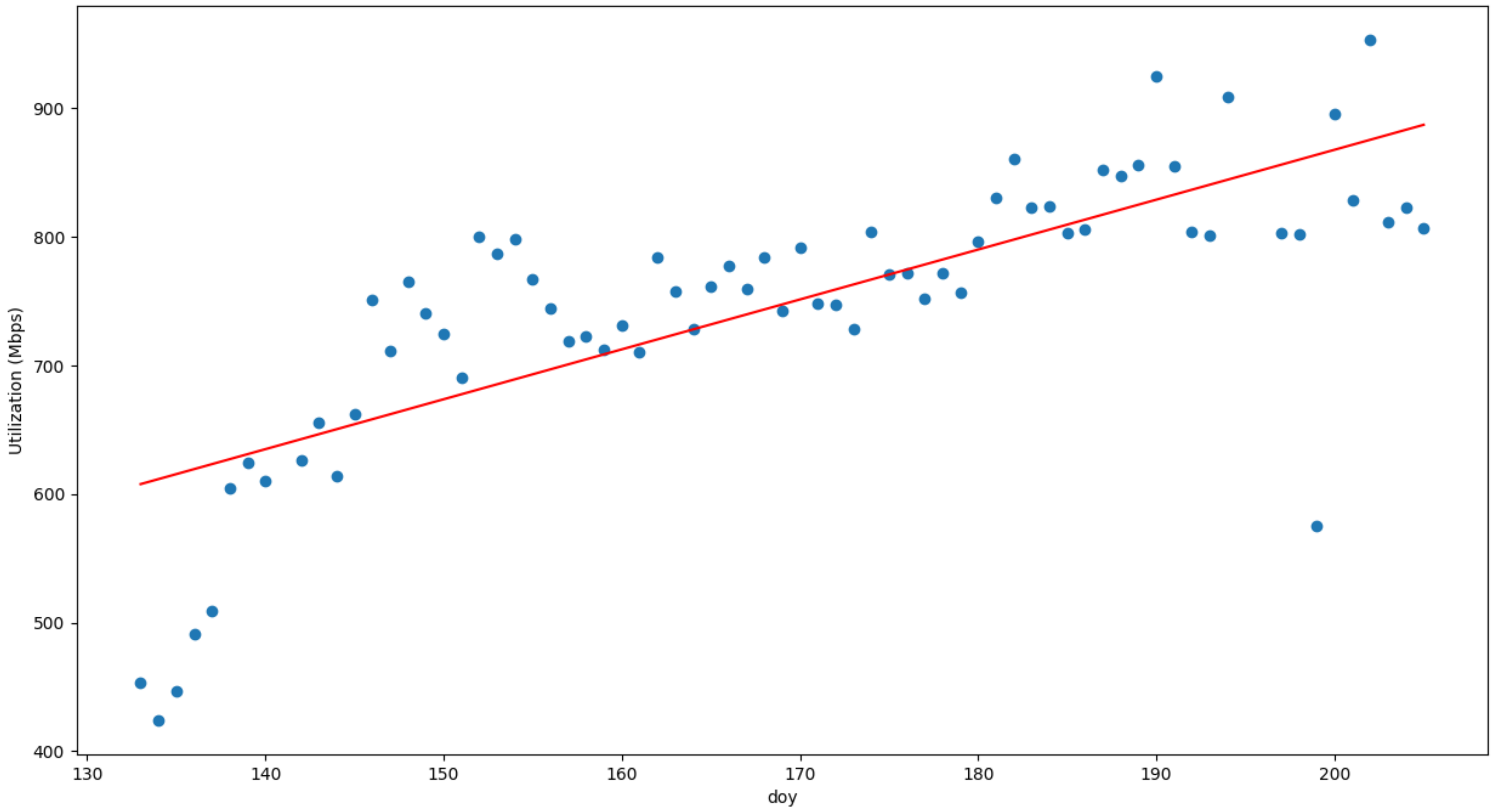
In [ ]:

```
# print the R2 Score, MSE and RMSE of the model

y_true_1 = df1['Utilization']
y_pred_1 = model_1.predict(df1[['doy']])

print("The R2 Score of the model is: ", r2_score(y_true_1, y_pred_1))
print("The MSE of the model is: ", mean_squared_error(y_true_1, y_pred_1))
print("The RMSE of the model is: ", mean_squared_error(y_true_1, y_pred_1, squared=False))
```

```
The R2 Score of the model is:  0.5667070936176999
The MSE of the model is:  4963.4293075154
The RMSE of the model is:  70.45160968718459
```

In [ ]:

```
# plot the scatter plot of the data and the regression line

plt.figure(figsize=(15, 8))
plt.scatter(df1['doy'], df1['Utilization'])
plt.plot(df1['doy'], y_pred_1, color='red')
plt.xlabel('doy')
plt.ylabel('Utilization (Mbps)')
plt.show()
```



3. `df2`

In [ ]:

```
df2.head()
```

Out[ ]:

	source_node	source_port	source_type	operSpeed	destination_node	destination_port	destination_type	octets	
0	1002	1/1	spine	40G	401	1/50	leaf	1294836545844880	128853
1	1002	1/1	spine	40G	401	1/50	leaf	1300783379663990	129483
2	1002	1/1	spine	40G	401	1/50	leaf	1305281270436510	130078
3	1002	1/1	spine	40G	401	1/50	leaf	1310806346359800	13052
4	1002	1/1	spine	40G	401	1/50	leaf	1316036666713580	131080

In [ ]:

```
print("The shape of the data is: ", df2.shape)
```

```
The shape of the data is:  (70, 12)
```

In [ ]:

```
df2.columns
```

Out[ ]:

```
Index(['source_node', 'source_port', 'source_type', 'operSpeed',
       'destination_node', 'destination_port', 'destination_type', 'octets',
       'lastOctetval', 'Octet-diff', 'Utilization', 'datetime'],
      dtype='object')
```

In [ ]:

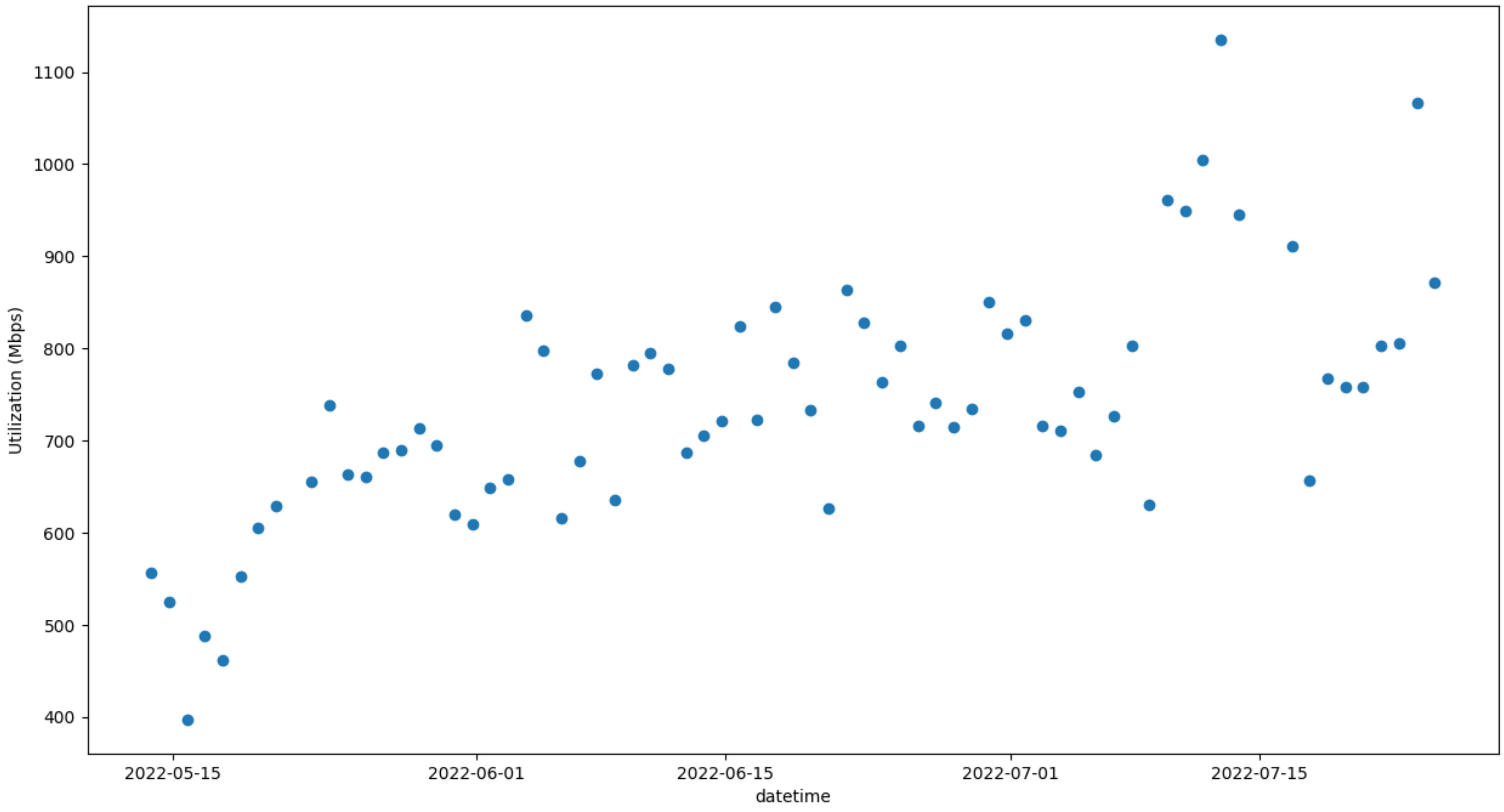
```
# filter out the dataframe to store only the required columns, i.e. 'datetime' and 'Utilization'

df2 = df2[['datetime', 'Utilization']]

# convert the 'datetime' column to datetime format
df2['datetime'] = pd.to_datetime(df2['datetime'])

df2.head()
```

Out[ ]:

	datetime	Utilization
0	2022-05-13 19:07:34	556.48
1	2022-05-14 19:07:27	525.12
2	2022-05-15 19:08:04	397.18
3	2022-05-16 19:08:05	487.88
4	2022-05-17 19:08:27	461.85

In [ ]:

```
# we first plot the data in a scatter plot ('Utilization' vs 'datetime') to see the trend

plt.figure(figsize=(15, 8))
plt.scatter(df2['datetime'], df2['Utilization'])
plt.xlabel('datetime')
plt.ylabel('Utilization (Mbps)')
plt.show()
```



Again, the data seems to have a linear trend, `Utilization` seems to be increasing linearly with time. We try to fit a linear regression model to the data by using the current day of the year as independent variable.

3.1 Preprocessing

In [ ]:

```
# add a new column 'doy' to represent the day of the year corresponding to the 'datetime' column

df2['doy'] = df2['datetime'].dt.dayofyear

df2.head()
```

Out[ ]:

	datetime	Utilization	doy
0	2022-05-13 19:07:34	556.48	133
1	2022-05-14 19:07:27	525.12	134
2	2022-05-15 19:08:04	397.18	135
3	2022-05-16 19:08:05	487.88	136
4	2022-05-17 19:08:27	461.85	137

3.2 Linear Regression

In [ ]:

```
model_2 = LinearRegression()

# fit the model on the data
model_2.fit(df2[['doy']], df2['Utilization'])
```

Out[ ]:

```
▾ LinearRegression
LinearRegression()
```

In [ ]:

```
# print the coefficients and intercept of the model

print("The coefficient of the model is: ", model_2.coef_.item())
print("The intercept of the model is: ", model_2.intercept_)
```

```
The coefficient of the model is:  4.2788890464944185
The intercept of the model is:  16.531497230477157
```

3.3 Results

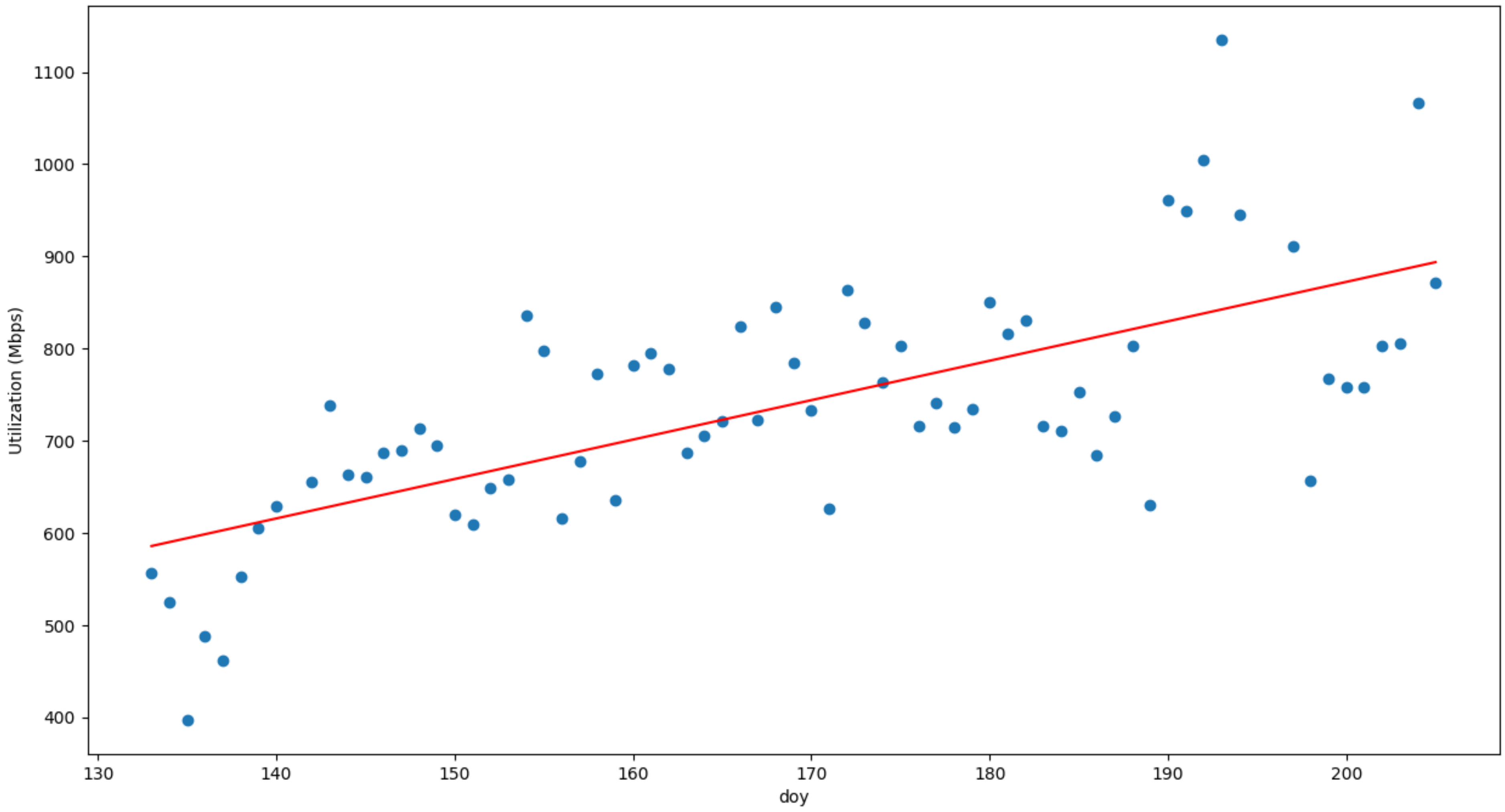
In [ ]:

```
# print the R2 Score, MSE and RMSE of the model

y_true_2 = df2['Utilization']
y_pred_2 = model_2.predict(df2[['doy']])

print("The R2 Score of the model is: ", r2_score(y_true_2, y_pred_2))
print("The MSE of the model is: ", mean_squared_error(y_true_2, y_pred_2))
print("The RMSE of the model is: ", mean_squared_error(y_true_2, y_pred_2, squared=False))
```

```
The R2 Score of the model is:  0.47150640445992176
The MSE of the model is:  8857.790300111858
The RMSE of the model is:  94.11583448130212
```

In [ ]:

```
# plot the scatter plot of the data and the regression line

plt.figure(figsize=(15, 8))
plt.scatter(df2['doy'], df2['Utilization'])
plt.plot(df2['doy'], y_pred_2, color='red')
plt.xlabel('doy')
plt.ylabel('Utilization (Mbps)')
plt.show()
```



In [ ]: