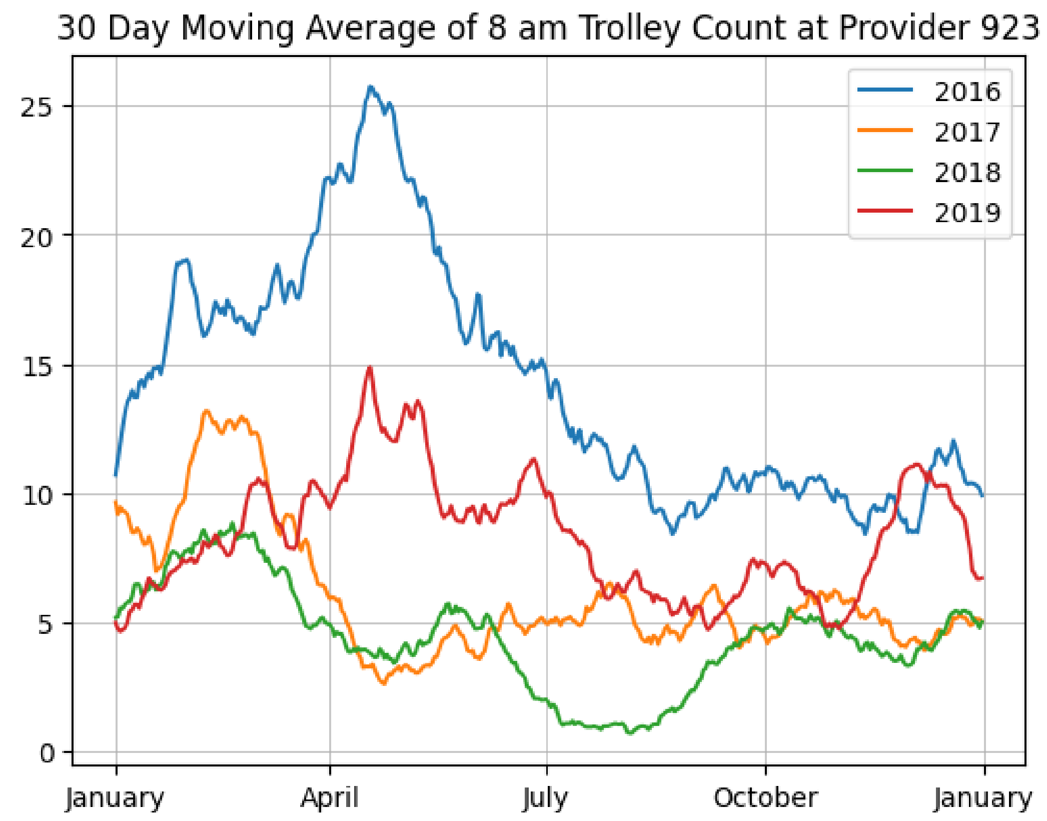
Time Series Data

December 21, 2024

[1]:
```python
import pandas as pd
import warnings
import os
import sklearn
import matplotlib.pyplot as plt
from sklearn.preprocessing import MinMaxScaler, StandardScaler
from sklearn.ensemble import RandomForestRegressor
warnings.filterwarnings('ignore')
from sklearn.model_selection import train_test_split

os.chdir('C:/Users/C10381149/OneDrive - Technological University Dublin/
 ↪Documents/Python/Datasets/')

t=pd.read_csv('TrolleyGAR.csv')
t.columns=['provider','date','total8am','total8pm','total2pm']
t=t.drop(columns=['total8pm','total2pm'])
t.date=pd.to_datetime(t.date, format='%d/%m/%Y')

t923=t.query("provider==923 and date < '2020-01-01'")[
['date','total8am']].reset_index(drop=True)

t923['30DMA']=0
for i in range(len(t923)):
    date_i = t923.loc[i, 'date']
    last_30_days = pd.date_range(end=date_i, periods=30)
    moving_average_i = t923[t923.date.isin(last_30_days)].total8am.mean()
    t923.loc[i, '30DMA'] = moving_average_i

t923=t923.sort_values('date').reset_index(drop=True)

plotDF=t923.dropna()
plotDF['year']=plotDF.date.dt.year
plotDF['month']=plotDF.date.dt.month
plotDF['day']=plotDF.date.dt.day
plotDF['chart_date']=plotDF.date.dt.strftime('2019-%m-%d')
plotDF.loc[(plotDF.month==2) & (plotDF.day==29),'chart_date'] = ''
plotDF['chart_date']=pd.to_datetime(plotDF.chart_date)
```

```
plotDF=plotDF.query("year > 2015").pivot(
    index='chart_date', columns='year', values='30DMA').dropna()

fig, ax = plt.subplots()
ax.plot(plotDF)
ax.legend(labels=['2016','2017','2018','2019'])
ax.set_title('30 Day Moving Average of 8 am Trolley Count at Provider 923')
xticks=pd.
 ↪to_datetime(['2019-01-01','2019-04-01','2019-07-01','2019-10-01','2020-01-01'])
xlabs=['January','April','July','October','January']
ax.set_xticks(ticks=xticks, labels=xlabs)
ax.set_xlabel('')
ax.grid(linewidth=.5)
plt.show()
```



[2]:
```
b=t923.query("date < '2019-01-01'")
newCols=['lag_'+str(i)+'d' for i in range(1,31)]
for c in newCols:
    b[c] = 0

for i in range(len(b)):
    date_i=b.loc[i, 'date']
    for j in range(1,31):
        date_i_minus_j=date_i - pd.Timedelta(j,'d')
        if date_i_minus_j in list(b.date):
            lagged_value=float(b[b.date == date_i_minus_j]['30DMA'])
            colName='lag_'+str(j)+'d'
            b.loc[i, colName] = lagged_value

b['year']=b.date.dt.year
b['month']=b.date.dt.month
b['day']=b.date.dt.day
b['day_of_week']=b.date.dt.day_of_week
features=newCols+['day_of_week','month']
X=pd.get_dummies(b[features],columns=['day_of_week','month'],drop_first=True,␣
  ↪dtype=int)
y = b['30DMA']
X_train, X_test, y_train, y_test = train_test_split(X, y, random_state=0)
forest=RandomForestRegressor(n_estimators=10, random_state=2).fit(X_train,␣
  ↪y_train)
print("Training score: {:.3f}".format(forest.score(X_train,y_train)))
print("Test score: {:.3f}".format(forest.score(X_test,y_test)))
```

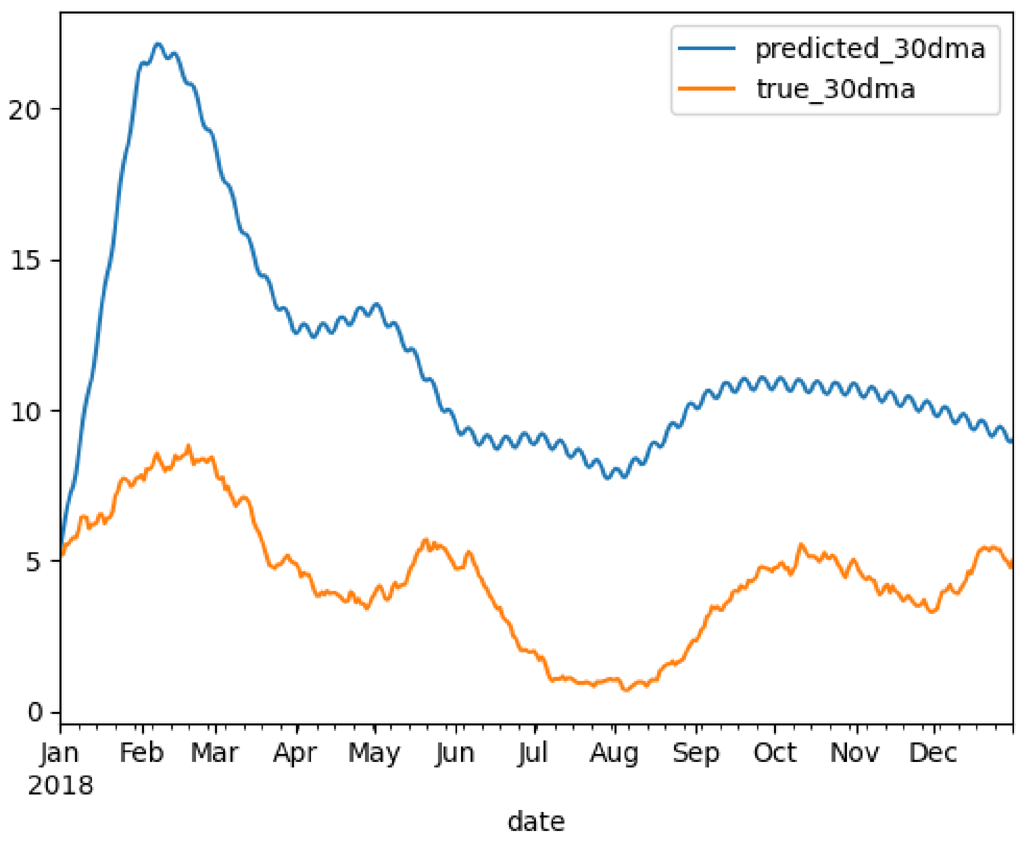
```
Training score: 0.998
Test score: 0.997
```

[7]:
```
from sklearn.linear_model import LinearRegression
lm=LinearRegression().fit(X_train,y_train)
print("Training score: {:.3f}".format(lm.score(X_train,y_train)))
print("Test score: {:.3f}".format(lm.score(X_test,y_test)))
```

```
Training score: 0.992
Test score: 0.993
```

[9]:
```
predicted_df=b.query("date < '2018-01-01'")[['date','30DMA']]
true_df=b.query("date < '2019-01-01'")[['date','30DMA']]
```

[10]:
```
while predicted_df.date.max() < pd.to_datetime('2019-01-01'):
    next_date=predicted_df.date.max() + pd.Timedelta(1,'d')
    X_new=pd.DataFrame({'date':[next_date]})
    dow=X_new.date.dt.day_of_week.values[0]
    mth=X_new.date.dt.month.values[0]
    for c in list(X.columns):
        X_new[c] = 0
    if dow != 0:
        X_new.loc[0, 'day_of_week_'+str(dow)] = 1
    if mth != 1:
        X_new.loc[0, 'month_'+str(mth)] = 1
    date_i=X_new.loc[0, 'date']

    for j in range(1,31):
        date_i_minus_j=date_i - pd.Timedelta(j,'d')
        if date_i_minus_j in list(predicted_df.date):
            lagged_value=float(predicted_df[predicted_df.date ==␣
 ↪date_i_minus_j]['30DMA'])
            colName='lag_'+str(j)+'d'
            X_new.loc[0, colName] = lagged_value

    X_new=X_new.drop(columns='date')

    predicted_df=pd.concat(
        [predicted_df,
         pd.DataFrame(
             {'date':[next_date],
              '30DMA':float(lm.predict(X_new))
             }
         )
        ]
    )

    predicted_df=predicted_df.reset_index(drop=True)

pdf=pd.merge(
    left=predicted_df.rename(columns={'30DMA':
 ↪'predicted_30dma'})[['date','predicted_30dma']],
    right=true_df.query("date >= '2018-01-01'").rename(
        columns={'30DMA':'true_30dma'})[['date','true_30dma']],
    on='date')

pdf.plot(x='date')
plt.show()
```



predicted_30dma
true_30dma
20
15
10
5
0
Jan
2018
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
date