time-series-analysis

February 2, 2024

```
[1]: import pandas as pd
     import numpy as np
     import matplotlib.pyplot as plt
```

```
[2]: df = pd.read_csv("/content/Data.csv")
     df.head()
```

```
[2]:          Date      State                                       Disease  \
     0  31-07-2019  Telangana                                         Fever
     1  31-07-2019  Telangana           continuous abdominal cramp Problems
     2  31-07-2019  Telangana  G.28. SWELLINGS LUMPS BUMPS ON OR UNDER SKIN
     3  31-07-2019  Telangana                                    Drowsiness
     4  31-07-2019  Telangana                                         Cough

        Disease_Count
     0              5
     1              1
     2              1
     3              1
     4              1
```

```
[3]: # Convert 'date' column to datetime format
     df['Date'] = pd.to_datetime(df['Date'])
```

```
<ipython-input-3-b3df9d66c702>:2: UserWarning: Parsing dates in DD/MM/YYYY
format when dayfirst=False (the default) was specified. This may lead to
inconsistently parsed dates! Specify a format to ensure consistent parsing.
  df['Date'] = pd.to_datetime(df['Date'])
```

```
[4]: # Set 'date' column as index
     df.set_index('Date', inplace=True)
```

```
[5]: from statsmodels.tsa.seasonal import seasonal_decompose
     from statsmodels.tsa.statespace.sarimax import SARIMAX
```

```
[7]: # Resample the data to ensure a consistent frequency (daily) and aggregate by␣
       ↪sum
```

```
df_resampled = df.resample('D').sum()
```

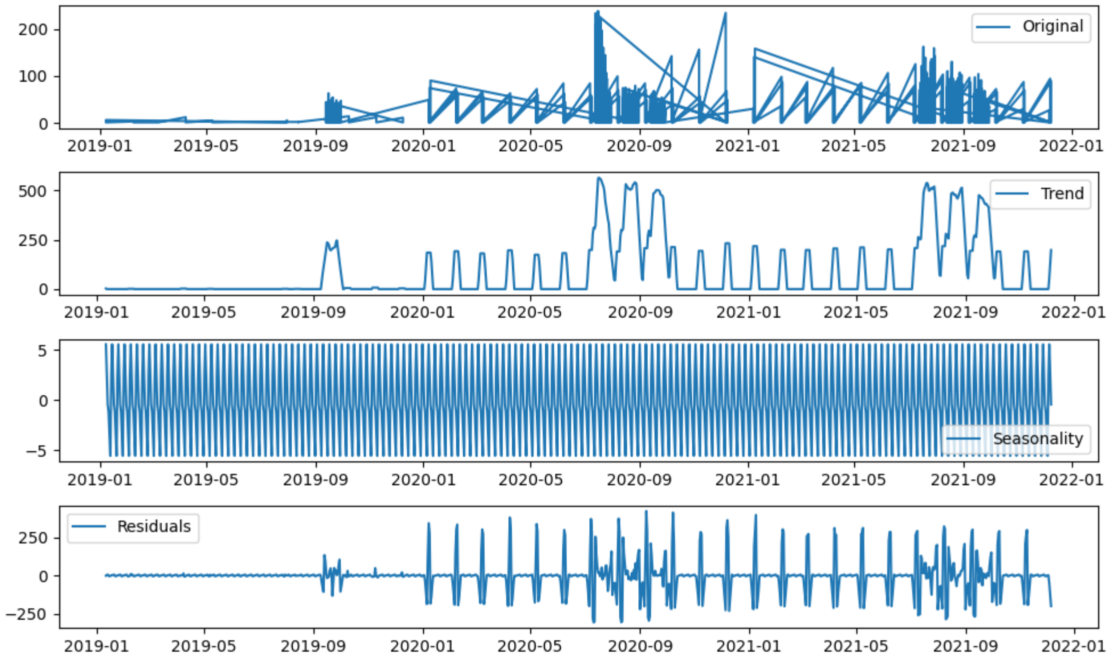
```
<ipython-input-7-d5ba24283056>:2: FutureWarning: The default value of
numeric_only in DataFrameGroupBy.sum is deprecated. In a future version,
numeric_only will default to False. Either specify numeric_only or select only
columns which should be valid for the function.
  df_resampled = df.resample('D').sum()
```

[8]:

```
# Perform time series decomposition
decomposition = seasonal_decompose(df_resampled['Disease_Count'], model='additive')
trend = decomposition.trend
seasonal = decomposition.seasonal
residual = decomposition.resid
```

[9]:

```
# Plot the decomposed components
plt.figure(figsize=(10, 6))
plt.subplot(411)
plt.plot(df['Disease_Count'], label='Original')
plt.legend(loc='best')
plt.subplot(412)
plt.plot(trend, label='Trend')
plt.legend(loc='best')
plt.subplot(413)
plt.plot(seasonal, label='Seasonality')
plt.legend(loc='best')
plt.subplot(414)
plt.plot(residual, label='Residuals')
plt.legend(loc='best')
plt.tight_layout()
```



[14]:
```
# Fit a SARIMA(1,1,1)(1,1,1,12) model
model = SARIMAX(df_resampled['Disease_Count'], order=(1, 1, 1),␣
  ↪seasonal_order=(1, 1, 1, 12))
results = model.fit()
```

```
/usr/local/lib/python3.10/dist-
packages/statsmodels/tsa/statespace/sarimax.py:966: UserWarning: Non-stationary
starting autoregressive parameters found. Using zeros as starting parameters.
  warn('Non-stationary starting autoregressive parameters'
/usr/local/lib/python3.10/dist-
packages/statsmodels/tsa/statespace/sarimax.py:978: UserWarning: Non-invertible
starting MA parameters found. Using zeros as starting parameters.
  warn('Non-invertible starting MA parameters found.'
```

[15]:
```
# Print model summary
print(results.summary())
```

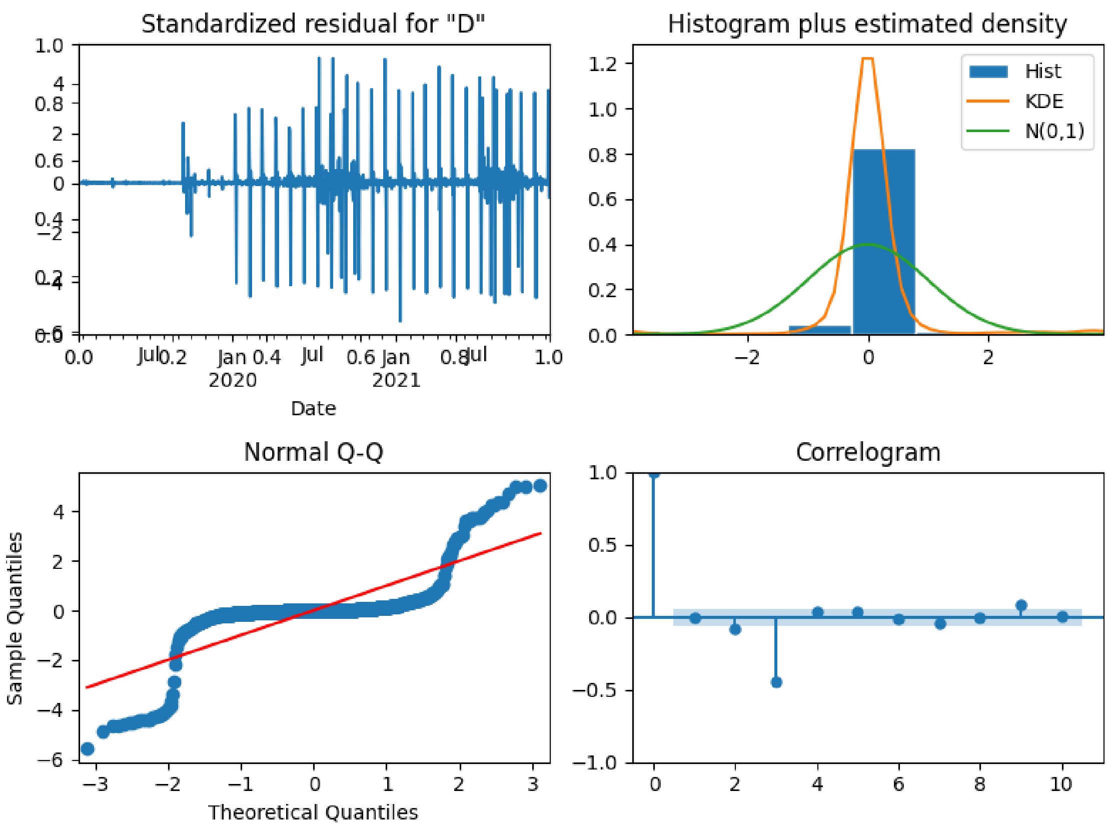
```
                                     SARIMAX Results
================================================================================
==========
Dep. Variable:                      Disease_Count   No. Observations:
1067
Model:             SARIMAX(1, 1, 1)x(1, 1, 1, 12)   Log Likelihood
-6477.301
Date:                            Fri, 02 Feb 2024   AIC
12964.601
```

```
Time:                                    15:00:15   BIC
12989.403
Sample:                                01-08-2019   HQIC
12974.004
                                     - 12-09-2021
Covariance Type:                              opg
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
ar.L1         -0.0410      0.384     -0.107      0.915      -0.793       0.711
ma.L1          0.1423      0.371      0.383      0.702      -0.586       0.870
ar.S.L12      -0.0533      0.032     -1.648      0.099      -0.117       0.010
ma.S.L12      -0.9998      1.348     -0.741      0.458      -3.643       1.643
sigma2       1.21e+04   1.62e+04      0.746      0.456   -1.97e+04    4.39e+04
================================================================================
===
Ljung-Box (L1) (Q):                   0.01   Jarque-Bera (JB):
8012.85
Prob(Q):                              0.93   Prob(JB):
0.00
Heteroskedasticity (H):              34.60   Skew:
-0.56
Prob(H) (two-sided):                  0.00   Kurtosis:
16.46
================================================================================
===

Warnings:
[1] Covariance matrix calculated using the outer product of gradients (complex-
step).
```

[29]:

```python
# Plot the model diagnostics
plt.figure(figsize=(8, 6))
plt.subplot(2, 2, 1)
results.plot_diagnostics(fig=plt.gcf())
plt.tight_layout()
```

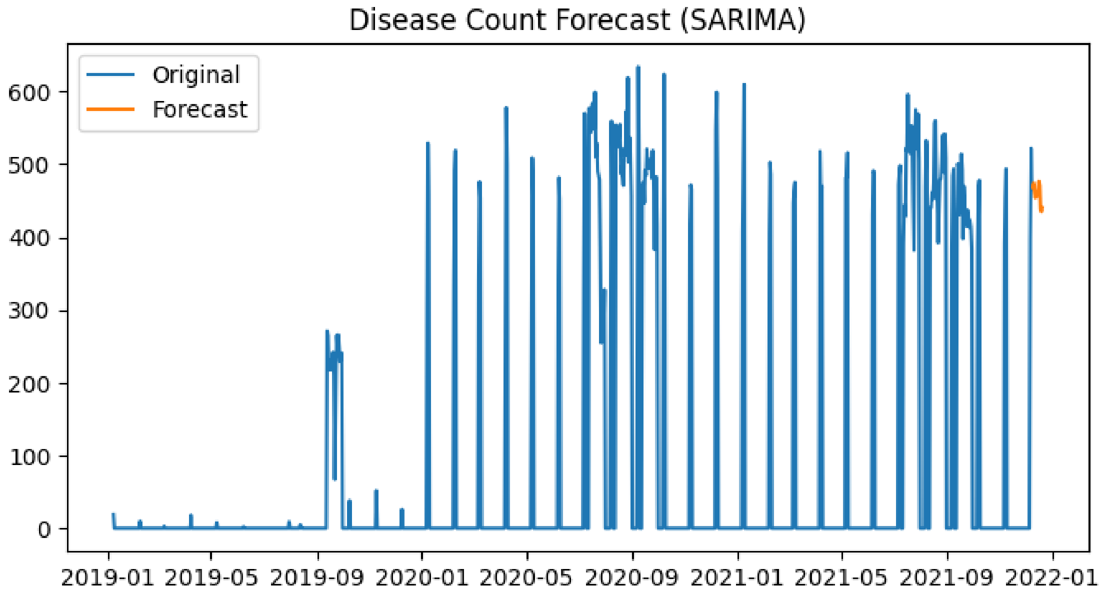


[18]:

```
# Forecast future values
forecast = results.forecast(steps=12)  # Change 'steps' for desired forecast␣
 ↪horizon
```

[30]:

```
# Plot the original data and forecast
plt.figure(figsize=(8, 4))
plt.plot(df_resampled.index, df_resampled['Disease_Count'], label='Original')
plt.plot(forecast.index, forecast, label='Forecast')
plt.legend(loc='best')
plt.title('Disease Count Forecast (SARIMA)')
plt.show()
```


Disease Count Forecast (SARIMA)
Original
Forecast
600
500
400
300
200
100
0
2019-01
2019-05
2019-09
2020-01
2020-05
2020-09
2021-01
2021-05
2021-09
2022-01