Sri_Lankan_TourismForecastModel_Prophet

October 16, 2024

[1]:
```python
import pandas as pd

df = pd.read_csv('https://raw.githubusercontent.com/dev-achintha/
 ↪Sri_Lanka-Tourism_Forcasting_Model/prophet/dataset/
 ↪2014-2024-monthly-tourist-arrivals-sl-csv.csv')
df = df.drop(columns=['PercentageChange'], errors='ignore')
df['ds'] = pd.to_datetime(df['Year'].astype(str) + '-' + df['Month'],␣
 ↪format='%Y-%B')
df.rename(columns={'Arrivals': 'y'}, inplace=True)
df = df[['ds', 'y']]
df.head()
```

[1]:
```
          ds       y
0 2014-01-01  146575
1 2014-02-01  141878
2 2014-03-01  133048
3 2014-04-01  112631
4 2014-05-01   90046
```

[2]:
```python
# Split data into train and test sets
train = df[:-24]
test = df[-24:]
```

[3]:
```python
#prophet
from prophet import Prophet

model_prophet = Prophet(yearly_seasonality=True, weekly_seasonality=True,␣
 ↪daily_seasonality=False,
                        changepoint_prior_scale=0.1, n_changepoints=30)
model_prophet.add_seasonality(name='monthly', period=30.5, fourier_order=5)
# changepoints = ['2019-04-21', '2020-03-01', '2022-03-22', '2023-02-25']
#     # 2019-04-21 Easter Bombings
#     # 2020-03-01 Covid19 Pandemic
#     # 2022-03-22 Dollar rate increses
#     # 2023-02-25 Dollar rate decreases
# model = Prophet(changepoints=changepoints)
```

```
model_prophet.fit(train)

future_prophet = model_prophet.make_future_dataframe(periods=24, freq='ME')
forecast_prophet = model_prophet.predict(future_prophet)
```

```
06:00:26 - cmdstanpy - INFO - Chain [1] start processing
06:00:26 - cmdstanpy - INFO - Chain [1] done processing
```

[4]:
```
# SARIMA
from statsmodels.tsa.statespace.sarimax import SARIMAX

model_sarima = SARIMAX(train['y'], order=(1, 1, 1), seasonal_order=(1, 1, 1,␣
 ↪12))
results_sarima = model_sarima.fit()
forecast_sarima = results_sarima.forecast(steps=24)
```

```
RUNNING THE L-BFGS-B CODE

           * * *

Machine precision = 2.220D-16
 N =            5     M =           10

At X0         0 variables are exactly at the bounds

At iterate    0    f=  1.02766D+01    |proj g|=  1.24216D-01

At iterate    5    f=  1.02438D+01    |proj g|=  5.17627D-02

At iterate   10    f=  1.02372D+01    |proj g|=  1.26834D-03

At iterate   15    f=  1.02372D+01    |proj g|=  4.09548D-05

           * * *

Tit   = total number of iterations
Tnf   = total number of function evaluations
Tnint = total number of segments explored during Cauchy searches
Skip  = number of BFGS updates skipped
Nact  = number of active bounds at final generalized Cauchy point
Projg = norm of the final projected gradient
F     = final function value

           * * *

   N    Tit     Tnf  Tnint  Skip  Nact     Projg        F
    5     17     20      1     0     0   1.564D-05   1.024D+01
```

```
 F =   10.237194792619087

CONVERGENCE: REL_REDUCTION_OF_F_<=_FACTR*EPSMCH

 This problem is unconstrained.
```

[5]:
```python
# LSTM Model
from sklearn.preprocessing import MinMaxScaler
import numpy as np
from keras.models import Sequential
from keras.layers import LSTM, Dense

scaler = MinMaxScaler()
scaled_data = scaler.fit_transform(df[['y']])

def create_sequences(data, seq_length):
    sequences = []
    for i in range(len(data) - seq_length):
        sequences.append(data[i:i+seq_length])
    return np.array(sequences)

seq_length = 12
X = create_sequences(scaled_data[:-1], seq_length)
y = scaled_data[seq_length:-1]  # Adjust y to have the same number of samples␣
 ↪as X

model_lstm = Sequential([
    LSTM(50, activation='relu', input_shape=(seq_length, 1)),
    Dense(1)
])
model_lstm.compile(optimizer='adam', loss='mse')
model_lstm.fit(X, y, epochs=100, batch_size=32, verbose=0)

last_sequence = scaled_data[-seq_length:]
forecast_lstm = []

for _ in range(24):
    next_pred = model_lstm.predict(last_sequence.reshape(1, seq_length, 1))
    forecast_lstm.append(next_pred[0, 0])
    last_sequence = np.roll(last_sequence, -1)
    last_sequence[-1] = next_pred

forecast_lstm = scaler.inverse_transform(np.array(forecast_lstm).reshape(-1, 1))
```

```
2024-10-16 06:00:37.674733: I external/local_xla/xla/tsl/cuda/cudart_stub.cc:32]
Could not find cuda drivers on your machine, GPU will not be used.
2024-10-16 06:00:37.678098: I external/local_xla/xla/tsl/cuda/cudart_stub.cc:32]
Could not find cuda drivers on your machine, GPU will not be used.
```

```
2024-10-16 06:00:37.687433: E
external/local_xla/xla/stream_executor/cuda/cuda_fft.cc:485] Unable to register
cuFFT factory: Attempting to register factory for plugin cuFFT when one has
already been registered
2024-10-16 06:00:37.701333: E
external/local_xla/xla/stream_executor/cuda/cuda_dnn.cc:8454] Unable to register
cuDNN factory: Attempting to register factory for plugin cuDNN when one has
already been registered
2024-10-16 06:00:37.705542: E
external/local_xla/xla/stream_executor/cuda/cuda_blas.cc:1452] Unable to
register cuBLAS factory: Attempting to register factory for plugin cuBLAS when
one has already been registered
2024-10-16 06:00:37.719201: I tensorflow/core/platform/cpu_feature_guard.cc:210]
This TensorFlow binary is optimized to use available CPU instructions in
performance-critical operations.
To enable the following instructions: AVX2 FMA, in other operations, rebuild
TensorFlow with the appropriate compiler flags.
2024-10-16 06:00:38.945013: W
tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38] TF-TRT Warning: Could not
find TensorRT
/usr/local/python/3.12.1/lib/python3.12/site-
packages/keras/src/layers/rnn/rnn.py:204: UserWarning: Do not pass an
`input_shape`/`input_dim` argument to a layer. When using Sequential models,
prefer using an `Input(shape)` object as the first layer in the model instead.
  super().__init__(**kwargs)

1/1             0s 107ms/step
1/1             0s 12ms/step
1/1             0s 12ms/step
1/1             0s 12ms/step
1/1             0s 14ms/step
1/1             0s 13ms/step
1/1             0s 13ms/step
1/1             0s 12ms/step
1/1             0s 12ms/step
1/1             0s 12ms/step
1/1             0s 12ms/step
1/1             0s 15ms/step
1/1             0s 12ms/step
1/1             0s 12ms/step
1/1             0s 12ms/step
1/1             0s 19ms/step
1/1             0s 22ms/step
1/1             0s 19ms/step
1/1             0s 14ms/step
1/1             0s 12ms/step
1/1             0s 12ms/step
1/1             0s 21ms/step
```

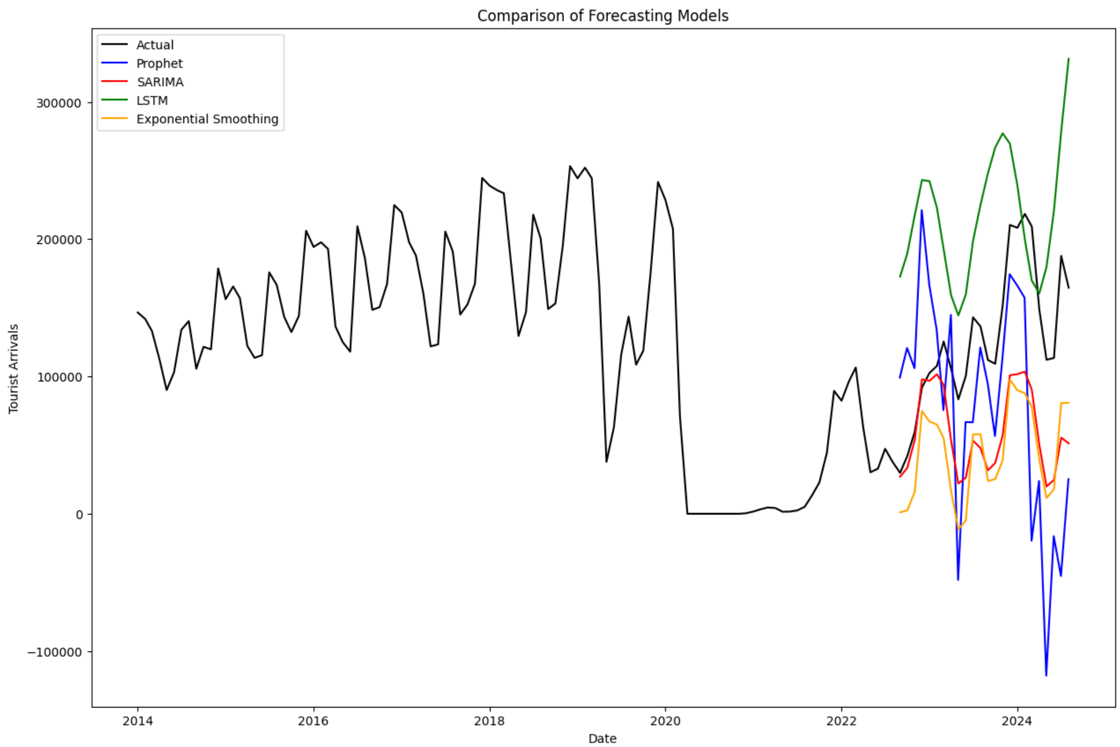
```
1/1                0s 31ms/step
1/1                0s 20ms/step
```

[10]:

```python
import warnings
from statsmodels.tsa.holtwinters import ExponentialSmoothing
from statsmodels.tools.sm_exceptions import ConvergenceWarning

# Suppress the ConvergenceWarning
warnings.filterwarnings("ignore", category=ConvergenceWarning)

# Define and fit the Exponential Smoothing model
model_es = ExponentialSmoothing(train['y'], seasonal_periods=12, trend='add',␣
  ↪seasonal='add')
results_es = model_es.fit(optimized=True, remove_bias=True)

# Forecast using the fitted model
forecast_es = results_es.forecast(24)
```

[11]:

```python
# Plotting
from matplotlib import pyplot as plt

plt.figure(figsize=(15, 10))
plt.plot(df['ds'], df['y'], label='Actual', color='black')
plt.plot(forecast_prophet['ds'][-24:], forecast_prophet['yhat'][-24:],␣
  ↪label='Prophet', color='blue')
plt.plot(test['ds'], forecast_sarima, label='SARIMA', color='red')
plt.plot(test['ds'], forecast_lstm, label='LSTM', color='green')
plt.plot(test['ds'], forecast_es, label='Exponential Smoothing', color='orange')
plt.title('Comparison of Forecasting Models')
plt.xlabel('Date')
plt.ylabel('Tourist Arrivals')
plt.legend()
plt.show()
```



[12]:
```python
# Calculate MAE for each model
from sklearn.metrics import mean_absolute_error


mae_prophet = mean_absolute_error(test['y'], forecast_prophet['yhat'][-24:])
mae_sarima = mean_absolute_error(test['y'], forecast_sarima)
mae_lstm = mean_absolute_error(test['y'], forecast_lstm)
mae_es = mean_absolute_error(test['y'], forecast_es)

print(f"MAE Prophet: {mae_prophet}")
print(f"MAE SARIMA: {mae_sarima}")
print(f"MAE LSTM: {mae_lstm}")
print(f"MAE Exponential Smoothing: {mae_es}")
```

```
MAE Prophet: 87229.15375560976
MAE SARIMA: 68969.09074247057
MAE LSTM: 93762.59440104167
MAE Exponential Smoothing: 83541.2909200419
```

[ ]:
```python
# !sudo apt-get update
# !sudo apt-get install -y pandoc texlive-xetex texlive-fonts-recommended
 ↪texlive-plain-generic
# %pip install jupyter_core jupyter platformdirs pypandoc
```

```
!jupyter nbconvert --to pdf /workspaces/
↪Sri_Lanka-Tourism_Forcasting_Model_SARIMA/notebooks/
↪Sri_Lankan_TourismForecastModel_Prophet.ipynb
```