In [ ]:

```
import os
import numpy as np
import pandas as pd
import tensorflow as tf
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_absolute_error, mean_squared_error
from sklearn.preprocessing import MinMaxScaler

data = pd.read_csv('state_consumption.csv')


# Split data into features and target
X = data[['Goa', 'Gujarat', 'Maharashtra', 'DNH', 'Rajasthan']]
data['total_electricity_consumption'] = data['Goa'] + data['Gujarat'] + \
    data['Maharashtra'] + data['DNH'] + data['Rajasthan']
y = data['total_electricity_consumption']

data
# Normalize the data using Min-Max scaling
scaler = MinMaxScaler()
X_scaled = scaler.fit_transform(X)

# Reshape the data for LSTM input (samples, time steps, features)
X_reshaped = X_scaled.reshape((X_scaled.shape[0], 1, X_scaled.shape[1]))

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(
    X_reshaped, y, test_size=0.2, random_state=42)

model_filename = "my_table_model_lstm.h5"
if os.path.exists(model_filename):
    # Load the existing LSTM model
    model = tf.keras.models.load_model(model_filename)
    print("Existing LSTM model loaded.")
else:
    model = tf.keras.Sequential([
        tf.keras.layers.LSTM(64, activation='relu', input_shape=(1, 5)),
        tf.keras.layers.Dense(32, activation='relu'),
        tf.keras.layers.Dense(1)  # No activation function for regression
    ])
    model.compile(optimizer='adam', loss='mean_squared_error', metrics=['mae'])
    print("New LSTM model created.")

# Check if model needs retraining
if not os.path.exists(model_filename):
    # Train the new LSTM model
    model.fit(X_train, y_train, epochs=500, validation_data=(X_test, y_test))
else:
    # Retrain the existing LSTM model
    model.fit(X_train, y_train, epochs=100, validation_data=(X_test, y_test))

model.save(model_filename)
print("LSTM Model saved.")
```

```python
# Use the model to predict electricity consumption for the last 5 rows
X_test_last_5 = X_reshaped[-5:]
y_true_last_5 = y.tail(5)

# Predict using the LSTM model
y_pred_last_5 = model.predict(X_test_last_5)

for i in range(5):
    print(f"True Consumption: {y_true_last_5.iloc[i]} kWh")
    print(f"Predicted Consumption: {y_pred_last_5[i][0]} kWh")
    print()

# Evaluate the model
mae_lstm = mean_absolute_error(y_true_last_5, y_pred_last_5)
mse_lstm = mean_squared_error(y_true_last_5, y_pred_last_5)
rmse_lstm = np.sqrt(mse_lstm)

print(f"LSTM Mean Absolute Error (MAE): {mae_lstm:.2f}")
print(f"LSTM Mean Squared Error (MSE): {mse_lstm:.2f}")
print(f"LSTM Root Mean Squared Error (RMSE): {rmse_lstm:.2f}")
```

```
Existing LSTM model loaded.
Epoch 1/100
12/12 [==============================] - 1s 21ms/step - loss: 18.6577 - mae: 2.8217
- val_loss: 15.9691 - val_mae: 2.5472
Epoch 2/100
12/12 [==============================] - 0s 7ms/step - loss: 19.3610 - mae: 2.9771 -
val_loss: 17.8889 - val_mae: 2.7607
Epoch 3/100
12/12 [==============================] - 0s 5ms/step - loss: 19.1864 - mae: 2.8690 -
val_loss: 19.3940 - val_mae: 2.9764
Epoch 4/100
12/12 [==============================] - 0s 6ms/step - loss: 18.5523 - mae: 2.8324 -
val_loss: 17.3530 - val_mae: 2.6959
Epoch 5/100
12/12 [==============================] - 0s 5ms/step - loss: 17.9866 - mae: 2.7258 -
val_loss: 16.8238 - val_mae: 2.6248
Epoch 6/100
12/12 [==============================] - 0s 5ms/step - loss: 17.5991 - mae: 2.7138 -
val_loss: 18.2553 - val_mae: 2.8258
Epoch 7/100
12/12 [==============================] - 0s 6ms/step - loss: 18.0587 - mae: 2.7712 -
val_loss: 18.6691 - val_mae: 2.9001
Epoch 8/100
12/12 [==============================] - 0s 6ms/step - loss: 17.7318 - mae: 2.7379 -
val_loss: 15.9028 - val_mae: 2.5354
Epoch 9/100
12/12 [==============================] - 0s 5ms/step - loss: 17.4438 - mae: 2.6910 -
val_loss: 15.8506 - val_mae: 2.5291
Epoch 10/100
12/12 [==============================] - 0s 4ms/step - loss: 17.6348 - mae: 2.7626 -
val_loss: 15.7027 - val_mae: 2.7406
Epoch 11/100
12/12 [==============================] - 0s 5ms/step - loss: 17.7168 - mae: 2.7387 -
val_loss: 15.2175 - val_mae: 2.4733
Epoch 12/100
12/12 [==============================] - 0s 6ms/step - loss: 17.6497 - mae: 2.7372 -
val_loss: 15.2201 - val_mae: 2.4711
Epoch 13/100
12/12 [==============================] - 0s 5ms/step - loss: 17.8313 - mae: 2.8160 -
val_loss: 17.2592 - val_mae: 2.7129
Epoch 14/100
12/12 [==============================] - 0s 5ms/step - loss: 17.0810 - mae: 2.6401 -
val_loss: 15.4434 - val_mae: 2.4923
Epoch 15/100
12/12 [==============================] - 0s 4ms/step - loss: 17.1364 - mae: 2.6446 -
val_loss: 15.2732 - val_mae: 2.5494
Epoch 16/100
12/12 [==============================] - 0s 5ms/step - loss: 17.4642 - mae: 2.7664 -
val_loss: 15.1672 - val_mae: 2.4720
Epoch 17/100
12/12 [==============================] - 0s 5ms/step - loss: 16.7437 - mae: 2.6397 -
val_loss: 16.5494 - val_mae: 2.6305
Epoch 18/100
12/12 [==============================] - 0s 6ms/step - loss: 16.6850 - mae: 2.6149 -
val_loss: 15.4525 - val_mae: 2.4958
Epoch 19/100
```

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12/12 [==============================] - 0s 5ms/step - loss: 16.9114 - mae: 2.6945 -
val_loss: 14.7792 - val_mae: 2.5446
Epoch 20/100
12/12 [==============================] - 0s 6ms/step - loss: 18.0162 - mae: 2.8074 -
val_loss: 14.3498 - val_mae: 2.5019
Epoch 21/100
12/12 [==============================] - 0s 5ms/step - loss: 17.0407 - mae: 2.6652 -
val_loss: 14.8670 - val_mae: 2.4394
Epoch 22/100
12/12 [==============================] - 0s 7ms/step - loss: 16.3545 - mae: 2.6192 -
val_loss: 18.3375 - val_mae: 2.8807
Epoch 23/100
12/12 [==============================] - 0s 6ms/step - loss: 16.3265 - mae: 2.6559 -
val_loss: 15.3078 - val_mae: 2.4841
Epoch 24/100
12/12 [==============================] - 0s 4ms/step - loss: 16.4073 - mae: 2.6196 -
val_loss: 17.1065 - val_mae: 2.7233
Epoch 25/100
12/12 [==============================] - 0s 6ms/step - loss: 16.4582 - mae: 2.6088 -
val_loss: 16.4833 - val_mae: 2.6174
Epoch 26/100
12/12 [==============================] - 0s 6ms/step - loss: 15.8875 - mae: 2.5631 -
val_loss: 14.5147 - val_mae: 2.4095
Epoch 27/100
12/12 [==============================] - 0s 5ms/step - loss: 16.5011 - mae: 2.6641 -
val_loss: 13.7195 - val_mae: 2.3763
Epoch 28/100
12/12 [==============================] - 0s 5ms/step - loss: 16.3594 - mae: 2.6610 -
val_loss: 14.2892 - val_mae: 2.3943
Epoch 29/100
12/12 [==============================] - 0s 4ms/step - loss: 15.9117 - mae: 2.6455 -
val_loss: 19.3030 - val_mae: 3.0582
Epoch 30/100
12/12 [==============================] - 0s 5ms/step - loss: 16.1051 - mae: 2.6233 -
val_loss: 14.9457 - val_mae: 2.4585
Epoch 31/100
12/12 [==============================] - 0s 5ms/step - loss: 15.8910 - mae: 2.6129 -
val_loss: 14.3959 - val_mae: 2.4045
Epoch 32/100
12/12 [==============================] - 0s 5ms/step - loss: 16.0007 - mae: 2.5978 -
val_loss: 14.5166 - val_mae: 2.4180
Epoch 33/100
12/12 [==============================] - 0s 5ms/step - loss: 16.6106 - mae: 2.7799 -
val_loss: 13.8293 - val_mae: 2.3994
Epoch 34/100
12/12 [==============================] - 0s 4ms/step - loss: 16.2078 - mae: 2.6765 -
val_loss: 13.8015 - val_mae: 2.3494
Epoch 35/100
12/12 [==============================] - 0s 5ms/step - loss: 15.0550 - mae: 2.4949 -
val_loss: 13.9228 - val_mae: 2.3643
Epoch 36/100
12/12 [==============================] - 0s 5ms/step - loss: 15.1123 - mae: 2.4875 -
val_loss: 15.2418 - val_mae: 2.5128
Epoch 37/100
12/12 [==============================] - 0s 7ms/step - loss: 15.3185 - mae: 2.5958 -
val_loss: 14.0517 - val_mae: 2.3737
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Epoch 38/100
12/12 [==============================] - 0s 4ms/step - loss: 15.1263 - mae: 2.4614 -
val_loss: 14.4931 - val_mae: 2.4274
Epoch 39/100
12/12 [==============================] - 0s 5ms/step - loss: 15.0732 - mae: 2.5005 -
val_loss: 13.8693 - val_mae: 2.3546
Epoch 40/100
12/12 [==============================] - 0s 5ms/step - loss: 15.3598 - mae: 2.5993 -
val_loss: 13.4305 - val_mae: 2.3161
Epoch 41/100
12/12 [==============================] - 0s 6ms/step - loss: 14.9984 - mae: 2.5735 -
val_loss: 13.0811 - val_mae: 2.3147
Epoch 42/100
12/12 [==============================] - 0s 4ms/step - loss: 15.3971 - mae: 2.6069 -
val_loss: 12.8489 - val_mae: 2.3545
Epoch 43/100
12/12 [==============================] - 0s 4ms/step - loss: 15.2360 - mae: 2.5994 -
val_loss: 12.7609 - val_mae: 2.3682
Epoch 44/100
12/12 [==============================] - 0s 6ms/step - loss: 14.7911 - mae: 2.5358 -
val_loss: 12.5690 - val_mae: 2.2569
Epoch 45/100
12/12 [==============================] - 0s 5ms/step - loss: 14.7690 - mae: 2.4980 -
val_loss: 12.6503 - val_mae: 2.2491
Epoch 46/100
12/12 [==============================] - 0s 5ms/step - loss: 14.1970 - mae: 2.3979 -
val_loss: 13.0209 - val_mae: 2.2831
Epoch 47/100
12/12 [==============================] - 0s 7ms/step - loss: 14.4100 - mae: 2.4569 -
val_loss: 13.8987 - val_mae: 2.3772
Epoch 48/100
12/12 [==============================] - 0s 7ms/step - loss: 14.1381 - mae: 2.3902 -
val_loss: 13.4748 - val_mae: 2.3239
Epoch 49/100
12/12 [==============================] - 0s 5ms/step - loss: 14.0693 - mae: 2.4032 -
val_loss: 12.4619 - val_mae: 2.2322
Epoch 50/100
12/12 [==============================] - 0s 4ms/step - loss: 14.1263 - mae: 2.4158 -
val_loss: 12.4316 - val_mae: 2.2299
Epoch 51/100
12/12 [==============================] - 0s 5ms/step - loss: 14.0390 - mae: 2.4092 -
val_loss: 12.2617 - val_mae: 2.2332
Epoch 52/100
12/12 [==============================] - 0s 5ms/step - loss: 13.8707 - mae: 2.3681 -
val_loss: 12.6138 - val_mae: 2.2441
Epoch 53/100
12/12 [==============================] - 0s 5ms/step - loss: 13.7393 - mae: 2.3699 -
val_loss: 13.2527 - val_mae: 2.3063
Epoch 54/100
12/12 [==============================] - 0s 5ms/step - loss: 14.0765 - mae: 2.4287 -
val_loss: 12.0292 - val_mae: 2.1957
Epoch 55/100
12/12 [==============================] - 0s 5ms/step - loss: 13.9804 - mae: 2.4278 -
val_loss: 11.8662 - val_mae: 2.1847
Epoch 56/100
12/12 [==============================] - 0s 5ms/step - loss: 13.7340 - mae: 2.3623 -
```

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val_loss: 12.0402 - val_mae: 2.3065
Epoch 57/100
12/12 [==============================] - 0s 5ms/step - loss: 14.0452 - mae: 2.4766 -
val_loss: 11.8812 - val_mae: 2.1803
Epoch 58/100
12/12 [==============================] - 0s 6ms/step - loss: 13.6866 - mae: 2.3683 -
val_loss: 11.7876 - val_mae: 2.2087
Epoch 59/100
12/12 [==============================] - 0s 4ms/step - loss: 13.5858 - mae: 2.4156 -
val_loss: 12.6144 - val_mae: 2.2422
Epoch 60/100
12/12 [==============================] - 0s 5ms/step - loss: 13.2495 - mae: 2.3272 -
val_loss: 13.5500 - val_mae: 2.3568
Epoch 61/100
12/12 [==============================] - 0s 6ms/step - loss: 13.3494 - mae: 2.3874 -
val_loss: 13.3221 - val_mae: 2.3397
Epoch 62/100
12/12 [==============================] - 0s 6ms/step - loss: 13.1356 - mae: 2.3156 -
val_loss: 12.1852 - val_mae: 2.2014
Epoch 63/100
12/12 [==============================] - 0s 6ms/step - loss: 13.2318 - mae: 2.3202 -
val_loss: 11.7301 - val_mae: 2.1634
Epoch 64/100
12/12 [==============================] - 0s 4ms/step - loss: 12.8373 - mae: 2.2796 -
val_loss: 11.3637 - val_mae: 2.1934
Epoch 65/100
12/12 [==============================] - 0s 4ms/step - loss: 13.2411 - mae: 2.3882 -
val_loss: 11.2770 - val_mae: 2.1403
Epoch 66/100
12/12 [==============================] - 0s 6ms/step - loss: 13.1565 - mae: 2.3793 -
val_loss: 11.3764 - val_mae: 2.2476
Epoch 67/100
12/12 [==============================] - 0s 7ms/step - loss: 13.8994 - mae: 2.4901 -
val_loss: 11.3869 - val_mae: 2.1264
Epoch 68/100
12/12 [==============================] - 0s 6ms/step - loss: 13.2078 - mae: 2.3869 -
val_loss: 11.5561 - val_mae: 2.1465
Epoch 69/100
12/12 [==============================] - 0s 5ms/step - loss: 12.7768 - mae: 2.2758 -
val_loss: 11.5281 - val_mae: 2.3067
Epoch 70/100
12/12 [==============================] - 0s 5ms/step - loss: 12.7516 - mae: 2.3501 -
val_loss: 11.5865 - val_mae: 2.1500
Epoch 71/100
12/12 [==============================] - 0s 4ms/step - loss: 12.3273 - mae: 2.2573 -
val_loss: 11.3159 - val_mae: 2.1217
Epoch 72/100
12/12 [==============================] - 0s 6ms/step - loss: 12.4187 - mae: 2.2486 -
val_loss: 11.1260 - val_mae: 2.1053
Epoch 73/100
12/12 [==============================] - 0s 5ms/step - loss: 12.2727 - mae: 2.2416 -
val_loss: 12.3606 - val_mae: 2.2558
Epoch 74/100
12/12 [==============================] - 0s 4ms/step - loss: 12.2602 - mae: 2.2495 -
val_loss: 11.4658 - val_mae: 2.1360
Epoch 75/100
```

```
12/12 [==============================] - 0s 5ms/step - loss: 12.1042 - mae: 2.2338 -
val_loss: 11.8118 - val_mae: 2.1831
Epoch 76/100
12/12 [==============================] - 0s 5ms/step - loss: 12.0058 - mae: 2.2253 -
val_loss: 10.7473 - val_mae: 2.2070
Epoch 77/100
12/12 [==============================] - 0s 5ms/step - loss: 12.2276 - mae: 2.2482 -
val_loss: 12.4651 - val_mae: 2.3037
Epoch 78/100
12/12 [==============================] - 0s 5ms/step - loss: 11.9282 - mae: 2.2034 -
val_loss: 10.9295 - val_mae: 2.0898
Epoch 79/100
12/12 [==============================] - 0s 5ms/step - loss: 11.6835 - mae: 2.1839 -
val_loss: 11.9279 - val_mae: 2.2053
Epoch 80/100
12/12 [==============================] - 0s 5ms/step - loss: 11.8536 - mae: 2.1947 -
val_loss: 11.9171 - val_mae: 2.2047
Epoch 81/100
12/12 [==============================] - 0s 4ms/step - loss: 11.7709 - mae: 2.2045 -
val_loss: 11.6727 - val_mae: 2.1626
Epoch 82/100
12/12 [==============================] - 0s 4ms/step - loss: 11.4931 - mae: 2.1850 -
val_loss: 12.0493 - val_mae: 2.2324
Epoch 83/100
12/12 [==============================] - 0s 5ms/step - loss: 11.5568 - mae: 2.1583 -
val_loss: 10.4090 - val_mae: 2.0445
Epoch 84/100
12/12 [==============================] - 0s 5ms/step - loss: 11.4727 - mae: 2.1824 -
val_loss: 11.0720 - val_mae: 2.1014
Epoch 85/100
12/12 [==============================] - 0s 5ms/step - loss: 11.6731 - mae: 2.2211 -
val_loss: 13.7010 - val_mae: 2.5092
Epoch 86/100
12/12 [==============================] - 0s 5ms/step - loss: 12.0869 - mae: 2.3282 -
val_loss: 11.9290 - val_mae: 2.2383
Epoch 87/100
12/12 [==============================] - 0s 5ms/step - loss: 11.3150 - mae: 2.1568 -
val_loss: 10.2798 - val_mae: 2.0248
Epoch 88/100
12/12 [==============================] - 0s 5ms/step - loss: 11.3811 - mae: 2.1813 -
val_loss: 9.8165 - val_mae: 2.0256
Epoch 89/100
12/12 [==============================] - 0s 4ms/step - loss: 11.1084 - mae: 2.1617 -
val_loss: 9.7481 - val_mae: 2.0081
Epoch 90/100
12/12 [==============================] - 0s 5ms/step - loss: 12.0367 - mae: 2.3863 -
val_loss: 9.8549 - val_mae: 1.9753
Epoch 91/100
12/12 [==============================] - 0s 5ms/step - loss: 11.3541 - mae: 2.1918 -
val_loss: 9.6519 - val_mae: 1.9619
Epoch 92/100
12/12 [==============================] - 0s 5ms/step - loss: 11.2773 - mae: 2.1648 -
val_loss: 9.6596 - val_mae: 1.9644
Epoch 93/100
12/12 [==============================] - 0s 5ms/step - loss: 10.7875 - mae: 2.1063 -
val_loss: 9.1762 - val_mae: 1.9310
```

```
Epoch 94/100
12/12 [==============================] - 0s 4ms/step - loss: 10.7685 - mae: 2.0772 -
val_loss: 10.6721 - val_mae: 2.1083
Epoch 95/100
12/12 [==============================] - 0s 6ms/step - loss: 10.7847 - mae: 2.1151 -
val_loss: 10.8230 - val_mae: 2.1031
Epoch 96/100
12/12 [==============================] - 0s 5ms/step - loss: 11.9380 - mae: 2.3228 -
val_loss: 13.3413 - val_mae: 2.5119
Epoch 97/100
12/12 [==============================] - 0s 5ms/step - loss: 11.2024 - mae: 2.1688 -
val_loss: 9.4247 - val_mae: 1.9346
Epoch 98/100
12/12 [==============================] - 0s 4ms/step - loss: 10.4148 - mae: 2.0574 -
val_loss: 9.7739 - val_mae: 1.9607
Epoch 99/100
12/12 [==============================] - 0s 5ms/step - loss: 10.4785 - mae: 2.0452 -
val_loss: 8.9941 - val_mae: 1.9151
Epoch 100/100
12/12 [==============================] - 0s 5ms/step - loss: 10.4329 - mae: 2.0712 -
val_loss: 9.0042 - val_mae: 2.0083
LSTM Model saved.
1/1 [==============================] - ETA: 0s
c:\Users\rohit\AppData\Local\Programs\Python\Python311\Lib\site-packages\keras\src\e
ngine\training.py:3000: UserWarning: You are saving your model as an HDF5 file via `
model.save()`. This file format is considered legacy. We recommend using instead the
native Keras format, e.g. `model.save('my_model.keras')`.
  saving_api.save_model(
1/1 [==============================] - 0s 141ms/step
True Consumption: 983.9000000000001 kWh
Predicted Consumption: 984.1824340820312 kWh

True Consumption: 888.3 kWh
Predicted Consumption: 889.7838745117188 kWh

True Consumption: 933.1 kWh
Predicted Consumption: 935.72509765625 kWh

True Consumption: 945.3000000000001 kWh
Predicted Consumption: 949.1727905273438 kWh

True Consumption: 942.7 kWh
Predicted Consumption: 945.3286743164062 kWh

LSTM Mean Absolute Error (MAE): 2.18
LSTM Mean Squared Error (MSE): 6.22
LSTM Root Mean Squared Error (RMSE): 2.49
```

In [ ]:

```python
import matplotlib.pyplot as plt

# Assuming you have the necessary imports and data loaded

# Code to get y_true_last_5 and y_pred_last_5

# Create a line plot for the last 5 rows
plt.figure(figsize=(10, 6))
```

```
plt.plot(range(1, 6), y_true_last_5, label='True Consumption',
         marker='o', linestyle='-', color='blue')
plt.plot(range(1, 6), y_pred_last_5, label='Predicted Consumption',
         marker='o', linestyle='-', color='orange')

plt.title('Actual vs Predicted Electricity Consumption for Last 5 Rows')
plt.xlabel('Sample Number')
plt.ylabel('Electricity Consumption (kWh)')
plt.legend()
plt.grid(True)
plt.show()
```