```
!pip install --upgrade scikit-learn scikeras[tensorflow]
!pip install scikeras[tensorflow]

import numpy as np
import pandas as pd
from sklearn.preprocessing import MinMaxScaler
from sklearn.model_selection import train_test_split
from keras.models import Sequential
from keras.layers import LSTM, Dense, Dropout
import matplotlib.pyplot as plt

from google.colab import files


# Upload the dataset manually
uploaded = files.upload()

# Assuming the dataset is named 'stock_prices.csv'
df = pd.read_csv("HistoricalData_1736175120859.csv")
print(df.head())

data=df

# Assume 'Close' column contains the stock prices
target = df['Close/Last'].values

# Preprocess the data
data['Date'] = pd.to_datetime(data['Date'])
for col in ['Close/Last', 'Open', 'High', 'Low']:
    # Ensure the column is a string before applying .str.replace
    data[col] = data[col].astype(str).str.replace('$', '', regex=False).astype(float)

# Sort by date
data.sort_values(by='Date', inplace=True)

# Feature selection
features = ['Open', 'High', 'Low', 'Volume']
target = 'Close/Last'

# Normalize the data
scaler = MinMaxScaler()
# Ensure all columns are numeric and handle missing values
data[features + [target]] = data[features + [target]].apply(pd.to_numeric, errors='coerce')
data = data.dropna()  # Drop rows with NaN values
scaled_data = scaler.fit_transform(data[features + [target]])

# Prepare the sequences for LSTM
def create_sequences(data, seq_length):
    X, y = [], []
    for i in range(len(data) - seq_length):
        X.append(data[i:i + seq_length, :-1])
        y.append(data[i + seq_length, -1])
    return np.array(X), np.array(y)

sequence_length = 10  # Hyperparameter
data_sequences, target_sequences = create_sequences(scaled_data, sequence_length)

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

# Define the LSTM model
def build_lstm(optimizer='adam', dropout_rate=0.2, units=50):
    model = Sequential()
    model.add(LSTM(units=units, return_sequences=True, input_shape=(X_train.shape[1], X_train.shape[2])))
    model.add(Dropout(dropout_rate))
    model.add(LSTM(units=units))
    model.add(LSTM(units=units))
    model.add(Dropout(dropout_rate))
    model.add(Dense(1))
    model.compile(optimizer=optimizer, loss='mean_squared_error')
    return model

#unit means neurons

# Hyperparameter tuning manually
param_grid = {
    'optimizer': ['adam', 'rmsprop'],
    'dropout_rate': [0.2, 0.3],
    'units': [50, 100],
    'batch_size': [16, 32],
    'epochs': [50, 100]
}

best_loss = float('inf')
best_params = None
best_model = None

for optimizer in param_grid['optimizer']:
    for dropout_rate in param_grid['dropout_rate']:
        for units in param_grid['units']:
            for batch_size in param_grid['batch_size']:
                for epochs in param_grid['epochs']:
                    print(f"Training with optimizer={optimizer}, dropout_rate={dropout_rate}, units={units}, batch_s
                    model = build_lstm(optimizer=optimizer, dropout_rate=dropout_rate, units=units)
                    model.fit(X_train, y_train, epochs=epochs, batch_size=batch_size, verbose=0)
                    loss = model.evaluate(X_test, y_test, verbose=0)
                    print(f"Loss: {loss}")

                    if loss < best_loss:
                        best_loss = loss
                        best_params = {
                            'optimizer': optimizer,
                            'dropout_rate': dropout_rate,
                            'units': units,
                            'batch_size': batch_size,
                            'epochs': epochs
                        }
                        best_model = model

print("Best parameters found: ", best_params)

# Predict
predicted = best_model.predict(X_test)

# Inverse transform to get actual values
# Create a dummy array to match the scaler's input shape for inverse transformation
dummy_features = np.zeros((predicted.shape[0], len(features)))  # Matching the feature columns
dummy_data = np.hstack((dummy_features, predicted.reshape(-1, 1)))

# Inverse transform to get actual predicted values
predicted_actual = scaler.inverse_transform(dummy_data)[:, -1]

# Similarly, process the test target values
dummy_test_features = np.zeros((y_test.shape[0], len(features)))
dummy_test_data = np.hstack((dummy_test_features, y_test.reshape(-1, 1)))
y_test_actual = scaler.inverse_transform(dummy_test_data)[:, -1]
```

```
Requirement already satisfied: scikit-learn in /usr/local/lib/python3.10/dist-packages (1.6.0)
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Requirement already satisfied: MarkupSafe>=2.1.1 in /usr/local/lib/python3.10/dist-packages (from werkzeug>=1.0.1->tensorboard<2.18,>=2.
```
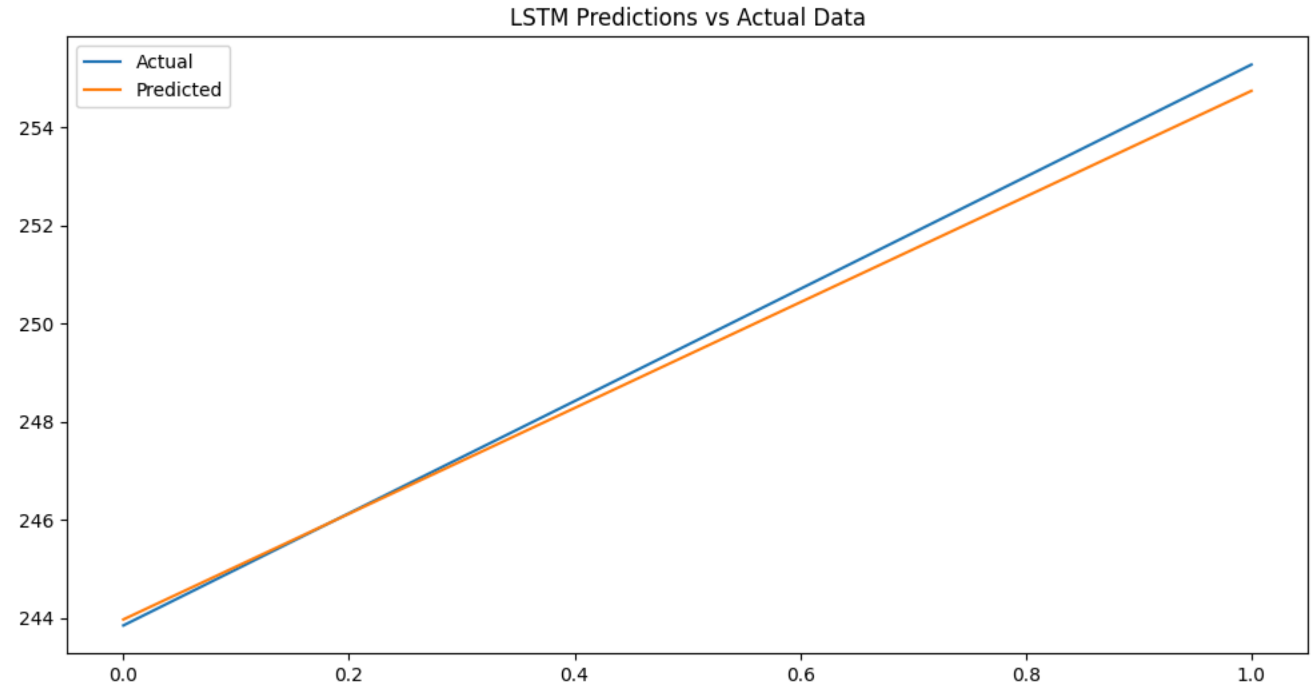

Choose Files HistoricalD…5120859.csv

- **HistoricalData_1736175120859.csv**(text/csv) - 1056 bytes, last modified: 1/6/2025 - 100% done

```
Saving HistoricalData_1736175120859.csv to HistoricalData_1736175120859.csv
         Date Close/Last    Volume     Open     High        Low
0  01/03/2025    $243.36  40244110  $243.36  $244.18    $241.89
1  01/02/2025    $243.85  55740730  $248.93  $249.10  $241.8201
2  12/31/2024    $250.42  39480720  $252.44  $253.28    $249.43
3  12/30/2024    $252.20  35557540  $252.23  $253.50    $250.75
4  12/27/2024    $255.59  42355320  $257.83  $258.70    $253.06
Training with optimizer=adam, dropout_rate=0.2, units=50, batch_size=16, epochs=50
/usr/local/lib/python3.10/dist-packages/keras/src/layers/rnn/rnn.py:204: UserWarning: Do not pass an `input_shape`/`input_dim` argument
  super().__init__(**kwargs)
Loss: 0.20043589174747467
Training with optimizer=adam, dropout_rate=0.2, units=50, batch_size=16, epochs=100
Loss: 0.06393007934093475
Training with optimizer=adam, dropout_rate=0.2, units=50, batch_size=32, epochs=50
Loss: 0.1561945676803589
Training with optimizer=adam, dropout_rate=0.2, units=50, batch_size=32, epochs=100
Loss: 0.011438247747719288
Training with optimizer=adam, dropout_rate=0.2, units=100, batch_size=16, epochs=50
WARNING:tensorflow:5 out of the last 5 calls to <function TensorFlowTrainer.make_test_function.<locals>.one_step_on_iterator at 0x7b2f2b
Loss: 0.0756458193063736
Training with optimizer=adam, dropout_rate=0.2, units=100, batch_size=16, epochs=100
WARNING:tensorflow:6 out of the last 6 calls to <function TensorFlowTrainer.make_test_function.<locals>.one_step_on_iterator at 0x7b2f2a
Loss: 0.021798714995384216
Training with optimizer=adam, dropout_rate=0.2, units=100, batch_size=32, epochs=50
Loss: 0.04470527544617653
Training with optimizer=adam, dropout_rate=0.2, units=100, batch_size=32, epochs=100
Loss: 0.01936744712293148
Training with optimizer=adam, dropout_rate=0.3, units=50, batch_size=16, epochs=50
Loss: 0.2128603458404541
Training with optimizer=adam, dropout_rate=0.3, units=50, batch_size=16, epochs=100
Loss: 0.0332423560321331
Training with optimizer=adam, dropout_rate=0.3, units=50, batch_size=32, epochs=50
Loss: 0.18422016501426697
Training with optimizer=adam, dropout_rate=0.3, units=50, batch_size=32, epochs=100
Loss: 0.013124839402735233
Training with optimizer=adam, dropout_rate=0.3, units=100, batch_size=16, epochs=50
Loss: 0.12137708067893982
Training with optimizer=adam, dropout_rate=0.3, units=100, batch_size=16, epochs=100
Loss: 0.007250993046909571
Training with optimizer=adam, dropout_rate=0.3, units=100, batch_size=32, epochs=50
Loss: 0.09030996263027191
Training with optimizer=adam, dropout_rate=0.3, units=100, batch_size=32, epochs=100
Loss: 0.022385787218809128
Training with optimizer=rmsprop, dropout_rate=0.2, units=50, batch_size=16, epochs=50
Loss: 0.061324313282966614
Training with optimizer=rmsprop, dropout_rate=0.2, units=50, batch_size=16, epochs=100
Loss: 0.03329877182841301
Training with optimizer=rmsprop, dropout_rate=0.2, units=50, batch_size=32, epochs=50
Loss: 0.09121855348348618
Training with optimizer=rmsprop, dropout_rate=0.2, units=50, batch_size=32, epochs=100
Loss: 0.034052763134241104
Training with optimizer=rmsprop, dropout_rate=0.2, units=100, batch_size=16, epochs=50
Loss: 0.03172944858670235
Training with optimizer=rmsprop, dropout_rate=0.2, units=100, batch_size=16, epochs=100
Loss: 0.06026472896337509
Training with optimizer=rmsprop, dropout_rate=0.2, units=100, batch_size=32, epochs=50
Loss: 0.01985284872353077
Training with optimizer=rmsprop, dropout_rate=0.2, units=100, batch_size=32, epochs=100
Loss: 0.003987314645200968
Training with optimizer=rmsprop, dropout_rate=0.3, units=50, batch_size=16, epochs=50
Loss: 0.1313382238149643
Training with optimizer=rmsprop, dropout_rate=0.3, units=50, batch_size=16, epochs=100
Loss: 0.0412243977189064
Training with optimizer=rmsprop, dropout_rate=0.3, units=50, batch_size=32, epochs=50
Loss: 0.1383463740348816
Training with optimizer=rmsprop, dropout_rate=0.3, units=50, batch_size=32, epochs=100
Loss: 0.1530868113040924
Training with optimizer=rmsprop, dropout_rate=0.3, units=100, batch_size=16, epochs=50
Loss: 0.02452634461224079
Training with optimizer=rmsprop, dropout_rate=0.3, units=100, batch_size=16, epochs=100
Loss: 0.0005738771869800985
Training with optimizer=rmsprop, dropout_rate=0.3, units=100, batch_size=32, epochs=50
Loss: 0.21933765709400177
Training with optimizer=rmsprop, dropout_rate=0.3, units=100, batch_size=32, epochs=100
Loss: 0.0764743834733963
Best parameters found:  {'optimizer': 'rmsprop', 'dropout_rate': 0.3, 'units': 100, 'batch_size': 16, 'epochs': 100}
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 251ms/step
```


LSTM Predictions vs Actual Data
Actual
Predicted
254
252
250
248
246
244
0.0
0.2
0.4
0.6
0.8
1.0