In [ ]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import math
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import LSTM
from tensorflow.keras.layers import Flatten
from tensorflow.keras.layers import BatchNormalization
from tensorflow.keras.layers import Dropout
from sklearn.preprocessing import MinMaxScaler
from sklearn.metrics import mean_squared_error
```

In [ ]:

```
data = pd.read_excel("Data1.xlsx",index_col="DateTime")
```

In [ ]:

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 4501 entries, 2022-11-11 to 2010-07-17
Data columns (total 16 columns):
 #   Column                          Non-Null Count  Dtype  
---  ------                          --------------  -----  
 0   Bitcoin Price                   4501 non-null   float64
 1   BTC Network Difficulty          4501 non-null   float64
 2   Bitcoin Circulation             4501 non-null   float64
 3   ALL BTC Transaction             4501 non-null   int64  
 4   BTC Transections over 100000$  4501 non-null   int64  
 5   Ethereum price                  2654 non-null   float64
 6   BTC Hash Rate                   4501 non-null   float64
 7   Active Address                  4501 non-null   int64  
 8   ATM for Crypto                  3329 non-null   float64
 9   VIX Index                       3108 non-null   float64
 10  DXY Index                       3215 non-null   float64
 11  Gold Price                      3210 non-null   float64
 12  Telegram positive sentiments    1212 non-null   float64
 13  Telegram Negative sentiments    1212 non-null   float64
 14  twitter positive sentiments     1212 non-null   float64
 15  twitter Negative sentiments     1212 non-null   float64
dtypes: float64(13), int64(3)
memory usage: 597.8 KB
```

In [ ]:

```
data.corr()
```

Out[ ]:

	Bitcoin Price	BTC Network Difficulty	Bitcoin Circulation	ALL BTC Transaction	BTC Transections over 100000$	Ethereum price	BTC Hash Rate	Active Address	ATM for Crypto
Bitcoin Price	1.000000	0.808505	0.557306	0.474770	0.794442	0.937832	0.806348	0.683538	0.802973
BTC Network Difficulty	0.808505	1.000000	0.650541	0.574641	0.713344	0.688374	0.991732	0.738920	0.922139
Bitcoin Circulation	0.557306	0.650541	1.000000	0.890169	0.692179	0.633077	0.647851	0.894710	0.684244
ALL BTC Transaction	0.474770	0.574641	0.890169	1.000000	0.750303	-0.007060	0.579370	0.937550	0.303649
BTC Transections over 100000$	0.794442	0.713344	0.692179	0.750303	1.000000	0.639817	0.712217	0.867803	0.596285
Ethereum price	0.937832	0.688374	0.633077	-0.007060	0.639817	1.000000	0.688305	0.546333	0.817303
BTC Hash Rate	0.806348	0.991732	0.647851	0.579370	0.712217	0.688305	1.000000	0.741168	0.918415
Active Address	0.683538	0.738920	0.894710	0.937550	0.867803	0.546333	0.741168	1.000000	0.595652
ATM for Crypto	0.802973	0.922139	0.684244	0.303649	0.596285	0.817303	0.918415	0.595652	1.000000
VIX Index	0.204230	0.427223	0.036462	0.043096	0.111535	0.170785	0.417499	0.143172	0.436876
DXY Index	0.338231	0.550389	0.837555	0.822929	0.508039	-0.074494	0.549945	0.765154	0.423906
Gold Price	0.604370	0.680261	0.155088	0.127771	0.428666	0.672336	0.674859	0.314732	0.795068
Telegram positive sentiments	0.252360	0.364989	0.351760	-0.170164	0.185123	0.380021	0.359643	0.066611	0.425478
Telegram Negative sentiments	0.078873	0.227129	0.200721	-0.100723	0.127350	0.139088	0.204514	0.067523	0.237104
twitter positive sentiments	0.448721	0.090883	0.294954	-0.080047	0.462519	0.363304	0.072210	0.445058	0.146863
twitter Negative sentiments	0.360418	0.008396	0.165330	-0.033751	0.432233	0.270824	-0.023394	0.382037	0.031299

In [ ]:

```
data = data.drop(["twitter Negative sentiments","DXY Index","Telegram Negative sentiments","Teleg
```

In [ ]:

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 4501 entries, 2022-11-11 to 2010-07-17
Data columns (total 11 columns):
 #   Column                        Non-Null Count  Dtype  
---  ------                        --------------  -----  
 0   Bitcoin Price                 4501 non-null   float64
 1   BTC Network Difficulty        4501 non-null   float64
 2   Bitcoin Circulation           4501 non-null   float64
 3   ALL BTC Transaction           4501 non-null   int64  
 4   BTC Transections over 100000$  4501 non-null   int64  
 5   Ethereum price                2654 non-null   float64
 6   BTC Hash Rate                 4501 non-null   float64
 7   Active Address                4501 non-null   int64  
 8   ATM for Crypto                3329 non-null   float64
 9   Gold Price                    3210 non-null   float64
 10  twitter positive sentiments    1212 non-null   float64
dtypes: float64(8), int64(3)
memory usage: 422.0 KB
```

In [ ]:

```python
data[data.columns[10:]] = data[data.columns[10:]].fillna(0)
```

In [ ]:

```python
for col in data[data.columns[:10]]:
    data[col] = data[col].fillna(data[col].mean())
```

In [ ]:

```python
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 4501 entries, 2022-11-11 to 2010-07-17
Data columns (total 11 columns):
 #   Column                        Non-Null Count  Dtype  
---  ------                        --------------  -----  
 0   Bitcoin Price                 4501 non-null   float64
 1   BTC Network Difficulty        4501 non-null   float64
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 3   ALL BTC Transaction           4501 non-null   int64  
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 5   Ethereum price                4501 non-null   float64
 6   BTC Hash Rate                 4501 non-null   float64
 7   Active Address                4501 non-null   int64  
 8   ATM for Crypto                4501 non-null   float64
 9   Gold Price                    4501 non-null   float64
 10  twitter positive sentiments    4501 non-null   float64
dtypes: float64(8), int64(3)
memory usage: 422.0 KB
```

In [ ]:

```python
BTC_PRICE_MEAN = data["Bitcoin Price"].mean()
```

In [ ]:

```python
dataset = data[::-1]
dataset = dataset.values
dataset = dataset.astype('float64')
```

In [ ]:

```python
# normalize the dataset
price_scaler = MinMaxScaler(feature_range=(0, 1))
feature_scaler = MinMaxScaler(feature_range=(0, 1))
dataset[:,0] = price_scaler.fit_transform(dataset[:,0].reshape(-1, 1)).reshape(1,-1)
dataset[:,1:] = feature_scaler.fit_transform(dataset[:,1:])
```

In [ ]:

```python
dataset
```

Out[ ]:

```
array([[7.56527374e-09, 0.00000000e+00, 1.74473151e-04, ...,
         2.10109503e-01, 4.02543410e-01, 0.00000000e+00],
        [3.50524350e-07, 1.38455817e-24, 0.00000000e+00, ...,
         2.10109503e-01, 4.02543410e-01, 0.00000000e+00],
        [5.36244403e-07, 0.00000000e+00, 1.25937892e-03, ...,
         2.10109503e-01, 1.30386238e-01, 0.00000000e+00],
        ...,
        [2.53129031e-01, 9.98005094e-01, 9.99885403e-01, ...,
         9.97941646e-01, 6.46980940e-01, 1.92838334e-01],
        [2.50603268e-01, 9.98005094e-01, 9.99942503e-01, ...,
         9.97941646e-01, 6.92165562e-01, 1.79469289e-01],
        [2.52379327e-01, 9.98005094e-01, 1.00000000e+00, ...,
         9.97941646e-01, 7.11097059e-01, 1.90024983e-01]])
```

In [ ]:

```python
def create_dataset(dataset, look_back=1):
    dataX, dataY = [], []
    for i in range(len(dataset)-look_back-1):
        a = dataset[i:(i+look_back), 1:]
        dataX.append(a)
        dataY.append(dataset[i + look_back, 0])
    return np.array(dataX), np.array(dataY)
```

In [ ]:

```python
# split into train and test sets
train_size = int(len(dataset) * 0.85)
test_size = len(dataset) - train_size
train, test = dataset[0:train_size,:], dataset[train_size:len(dataset),:]
```

In [ ]:

```python
# reshape into X=t and Y=t+1
look_back = 30
trainX, trainY = create_dataset(train, look_back)
testX, testY = create_dataset(test, look_back)
```

In [ ]:

```python
# create and fit the LSTM network
model = Sequential()
model.add(LSTM(64,activation="relu", input_shape=(look_back,10), return_sequences=True))
model.add(Dropout(0.2))
model.add(LSTM(32,activation="relu"))
model.add(Dense(64,activation="relu"))
model.add(Dense(1,activation="relu"))
model.compile(loss='mean_squared_error', optimizer=tf.keras.optimizers.Adam(learning_rate=1e-3))
model.fit(trainX, trainY, epochs=10, batch_size=256, verbose=1)
```

```
Epoch 1/10
17/17 [==============================] - 4s 89ms/step - loss: 0.0161
Epoch 2/10
17/17 [==============================] - 1s 86ms/step - loss: 0.0041
Epoch 3/10
17/17 [==============================] - 2s 93ms/step - loss: 0.0029
Epoch 4/10
17/17 [==============================] - 2s 88ms/step - loss: 0.0019
Epoch 5/10
17/17 [==============================] - 2s 97ms/step - loss: 0.0014
Epoch 6/10
17/17 [==============================] - 2s 91ms/step - loss: 0.0013
Epoch 7/10
17/17 [==============================] - 2s 109ms/step - loss: 0.0011
Epoch 8/10
17/17 [==============================] - 2s 100ms/step - loss: 9.1350e-04
Epoch 9/10
17/17 [==============================] - 2s 95ms/step - loss: 8.0558e-04
Epoch 10/10
17/17 [==============================] - 2s 89ms/step - loss: 9.1090e-04
```

Out[ ]:

```
<keras.callbacks.History at 0x25bb7a64f70>
```

In [ ]:

```python
# make predictions
trainPredict = model.predict(trainX)
testPredict = model.predict(testX)
```

```
119/119 [==============================] - 1s 11ms/step
21/21 [==============================] - 0s 11ms/step
```

In [ ]:

```python
# invert predictions
trainpred_scaled = price_scaler.inverse_transform(trainPredict)
trainY_scaled = price_scaler.inverse_transform(trainY.reshape(-1, 1)).reshape(1,-1)
testpred_scaled = price_scaler.inverse_transform(testPredict)
testY_scaled = price_scaler.inverse_transform(testY.reshape(-1, 1)).reshape(1,-1)
```

In [ ]:

```python
# calculate root mean squared error
trainScore = np.sqrt(mean_squared_error(trainY_scaled[0], trainpred_scaled[:,0]))/BTC_PRICE_MEAN
print('Score: %.3f RMSE' % (trainScore))
```

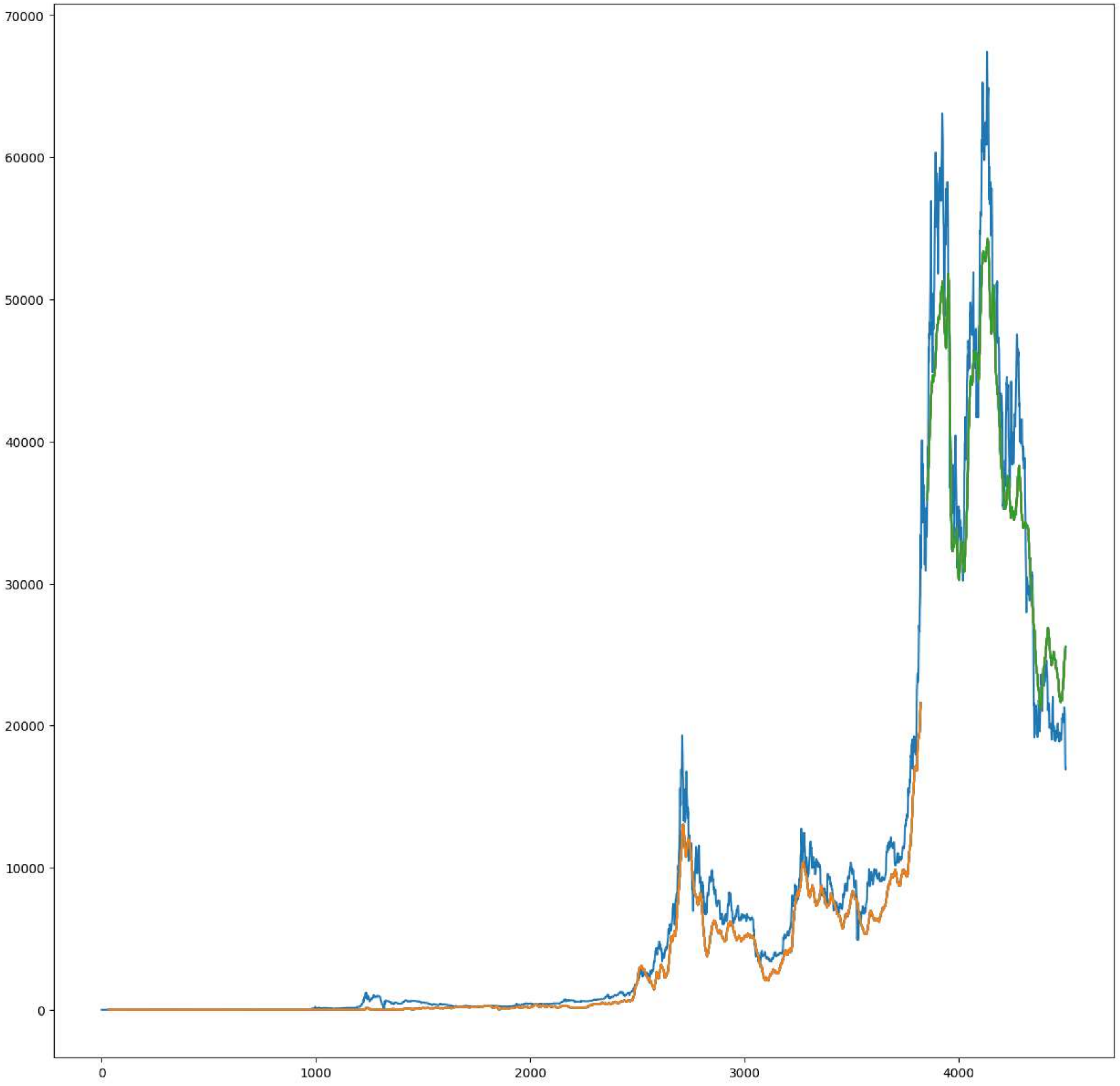
```
Score: 0.092 RMSE
```

In [ ]:

```python
trainPredictPlot = np.empty_like(dataset)
trainPredictPlot[:, :] = np.nan
trainPredictPlot[look_back:len(trainpred_scaled)+look_back, :] = trainpred_scaled
# shift test predictions for plotting
testPredictPlot = np.empty_like(dataset)
testPredictPlot[:, :] = np.nan
testPredictPlot[len(trainpred_scaled)+(look_back*2)+1:len(dataset)-1, :] = testpred_scaled
```

In [ ]:

```python
# plot baseline and predictions
plt.figure(figsize=(15,15))
plt.plot(np.abs(price_scaler.inverse_transform(dataset[:,0].reshape(-1, 1))))
plt.plot(np.abs(trainPredictPlot))
plt.plot(np.abs(testPredictPlot))
plt.show()
```


70000
60000
50000
40000
30000
20000
10000
0
0
1000
2000
3000
4000