Bitcoin Price Prediction

Computational Physics

Ma Yangha

Project Overview

- Objective:
  - Predict Bitcoin prices
  - Analyze the relationship with various economic indicators

- Methodology:
  - Utilizing LSTM (Long Short-Term Memory) models for prediction

LSTM

- Long Short-Term Memory (LSTM) networks are a type of recurrent neural network (RNN).
- They are designed to capture long-term dependencies in sequential data.
- LSTM cells have three gates:
  - Input gate, Forget gate, Output gate

Data Collection and Preprocessing

- Data Sources:
  - FinanceDataReader library for data collection
- Collected Data:
  - Bitcoin price / trading volume
  - Gold price /
  - Dollar index/ NASDAQ index
- Time Period:
  - Data from the 900 days
- Data Preprocessing:
  - Handling missing values using forward/backward fill
  - Normalizing data using MinMaxScaler

```
import FinanceDataReader as fdr
```

```
# 비트코인 데이터
df_btc = fdr.DataReader('BTC/USD', start_date, end_date)
btc_price = df_btc['Close'] # 종가
btc_volume = df_btc['Volume'] # 거래량

# 금 가격
df_gold = fdr.DataReader('GC=F', start_date, end_date)
gold_price = df_gold['Close']

# 달러 인덱스
df_USD = fdr.DataReader('DX-Y.NYB', start_date, end_date)
USD = df_USD['Close']

# 나스닥
df_NASDAQ = fdr.DataReader('IXIC', start_date, end_date)
NASDAQ = df_NASDAQ['Close']
```

```
# 데이터 프레임 생성
df = pd.DataFrame({
    'Bitcoin_Price': btc_price,
    'Bitcoin_Volume': btc_volume,
    'Gold_Price': gold_price,
    'Dollar_Index': USD,
    'NASDAQ': NASDAQ
})
```

```
# 학습 모델
num = len(a[n]) # dfx 열 개수
model = Sequential()
model.add(LSTM(units=20, activation='relu', return_sequences=True, input_shape=(10, num)))
model.add(Dropout(0.2))
model.add(LSTM(units=20, activation='relu'))
model.add(Dropout(0.2))
model.add(Dense(units=1))
model.compile(optimizer='adam', loss='mean_squared_error')
model.fit(train_X, train_y, epochs=70, batch_size=30) # 학습
```

Model Architecture

- Model Used:
  - LSTM (Long Short-Term Memory) network
- Model Structure:
  - Input layer: combination of economic indicators
  - LSTM layers: Two LSTM layers (each with 20 units)
  - Dropout: 20% dropout rate
  - Output layer: Predicting Bitcoin prices

Model Training

- Training Parameters:
  - Training data: 70%
  - Test data: 30%
  - Number of epochs: 70
  - Batch size: 32
- Loss Function:
  - Mean Squared Error (MSE)

```
Epoch 68/70
21/21 [==============================] - 0s 11ms/step - loss: 0.0118
Epoch 69/70
21/21 [==============================] - 0s 14ms/step - loss: 0.0112
Epoch 70/70
21/21 [==============================] - 0s 12ms/step - loss: 0.0121
9/9 [==============================] - 0s 4ms/step
['Bitcoin_Volume', 'Dollar_Index']
Epoch 1/70
21/21 [==============================] - 3s 12ms/step - loss: 0.0446
Epoch 2/70
21/21 [==============================] - 0s 12ms/step - loss: 0.0258
Epoch 3/70
21/21 [==============================] - 0s 10ms/step - loss: 0.0180
Epoch 4/70
21/21 [==============================] - 0s 11ms/step - loss: 0.0107
Epoch 5/70
21/21 [==============================] - 0s 11ms/step - loss: 0.0061
Epoch 6/70
21/21 [==============================] - 0s 11ms/step - loss: 0.0064
Epoch 7/70
21/21 [==============================] - 0s 11ms/step - loss: 0.0057
Epoch 8/70
21/21 [==============================] - 0s 13ms/step - loss: 0.0057
Epoch 9/70
21/21 [==============================] - 0s 10ms/step - loss: 0.0056
Epoch 10/70
21/21 [==============================] - 0s 11ms/step - loss: 0.0051
Epoch 11/70
21/21 [==============================] - 0s 12ms/step - loss: 0.0053
Epoch 12/70
21/21 [==============================] - 0s 16ms/step - loss: 0.0052
Epoch 13/70
21/21 [==============================] - 0s 15ms/step - loss: 0.0049
Epoch 14/70
21/21 [==============================] - 0s 16ms/step - loss: 0.0051
```

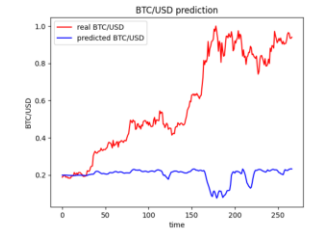
```python
# 그래프 그리기
for n in range(len(a)):
    plt.figure()
    plt.plot(test_y, color='red', label='real BTC/USD')
    plt.plot(ys[n], color='blue', label='predicted BTC/USD')
    plt.title('BTC/USD prediction')
    plt.xlabel('time')
    plt.ylabel('BTC/USD')
    plt.legend()
    plt.show()
    print("조합 : ", a[n])
    print("R2 : ", Rs[n])
    print("내일 BTC :", df.Bitcoin_Price[-1] * ys[n][-1] / dfy_scaled.Bitcoin_Price[-1], 'USD')

print("가장 연관이 많은 자료 : ", best_a, "R2 : ", best)
```

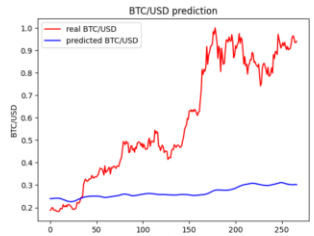
Results and Analysis

- Prediction Results:
  - Graph of real vs predicted Bitcoin prices
- Model Evaluation:
  - R^2 value
  - Analysis of prediction performance

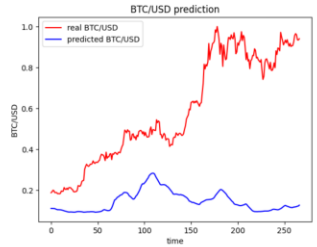
Conclusion



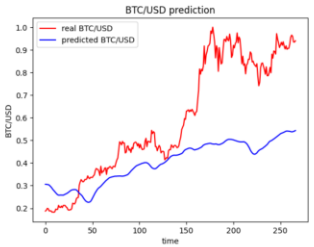
조합 : ['Bitcoin_Volume']
R2 : -2.3385105303987 1
내일 BTC : [17190.09] USD



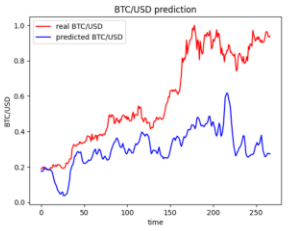
조합 : ['Gold_Price']
R2 : -1.384762214859871
내일 BTC : [22362.588] USD



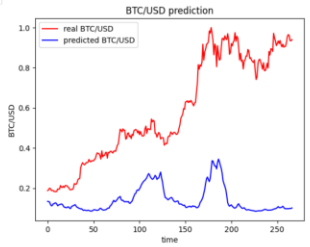
조합 : ['Dollar_Index']
R2 : -2.953754664108365
내일 BTC : [9388.918] USD



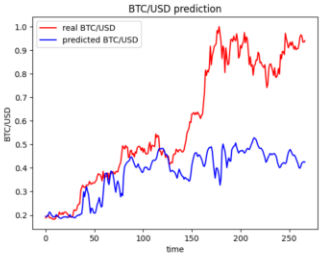
조합 : ['NASDAQ']
R2 : 0.021031172640319173
내일 BTC : [40255.277] USD



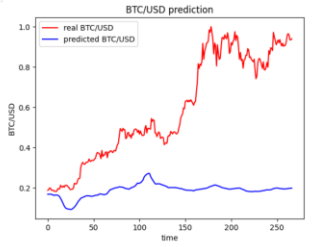
조합 : ['Bitcoin_Volume', 'Gold_Price']
R2 : -0.7549198717699919
내일 BTC : [20225.395] USD



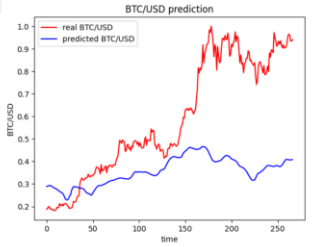
조합 : ['Bitcoin_Volume', 'Dollar_Index']
R2 : -2.969032614915321
내일 BTC : [7505.466] USD



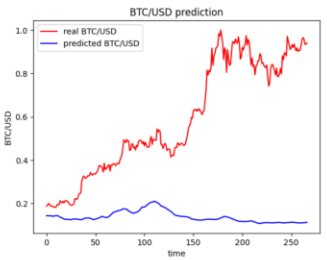
조합 : ['Bitcoin_Volume', 'NASDAQ']
R2 : -0.1937248098999631
내일 BTC : [31463.092] USD



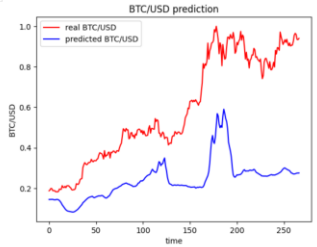
조합 : ['Gold_Price', 'Dollar_Index']
R2 : -2.288258288791587
내일 BTC : [14690.719] USD



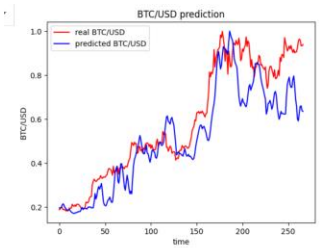
조합 : ['Gold_Price', 'NASDAQ']
R2 : -0.5161994482045 86
내일 BTC : [30224.049] USD



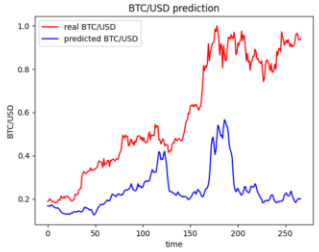
조합 : ['Dollar_Index', 'NASDAQ']
R2 : -3.1144741241864 97
내일 BTC : [8348.114] USD



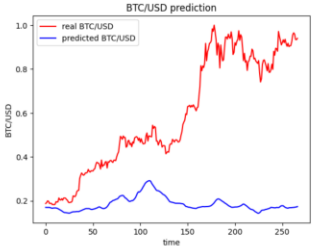
조합 : ['Bitcoin_Volume', 'Gold_Price', 'Dollar_Index']
R2 : -1.3664044160602455
내일 BTC : [20406.846] USD



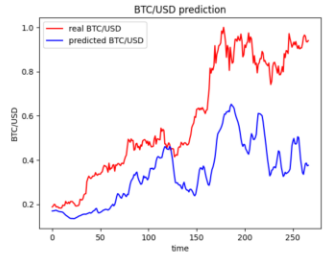
조합 : ['Bitcoin_Volume', 'Gold_Price', 'NASDAQ']
R2 : 0.7585706046708833
내일 BTC : [47086.74] USD



조합 : ['Bitcoin_Volume', 'Dollar_Index', 'NASDAQ']
R2 : -1.5838402019953919
내일 BTC : [14814.79] USD



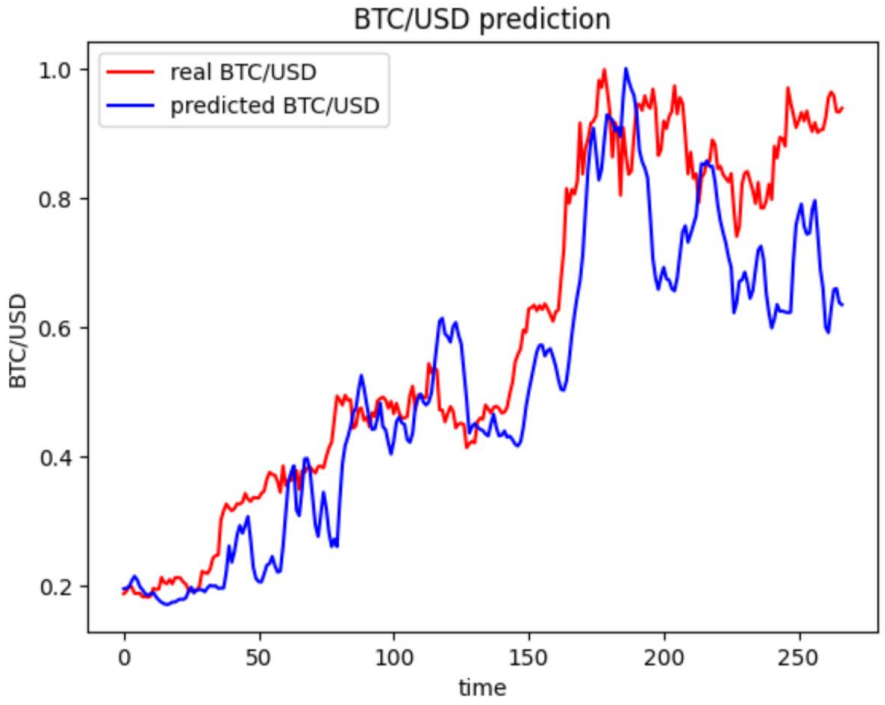
조합 : ['Gold_Price', 'Dollar_Index', 'NASDAQ']
R2 : -2.4520630687481573
내일 BTC : [12864.132] USD



조합 : ['Bitcoin_Volume', 'Gold_Price', 'Dollar_Index', 'NASDAQ']
R2 : -0.3080445117476684 5
내일 BTC : [27842.227] USD

Conclusion

- Highest R^2
- Combination of trading volume, gold price and NASDAQ
- But, the predicted BTC price appears to follow the actual BTC price over time.
- Not suitable as an investment indicator



조합 : ['Bitcoin_Volume', 'Gold_Price', 'NASDAQ']
R2 : 0.7585706046708833
내일 BTC : [47086.74] USD