```
%tensorflow_version 2.x
import json
import requests
from keras.models import Sequential
from keras.layers import Activation, Dense, Dropout, LSTM
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
import seaborn as sns
from sklearn.metrics import mean_absolute_error
%matplotlib inline
```

```
     Colab only includes TensorFlow 2.x; %tensorflow_version has no effect.
```

```
endpoint = 'https://min-api.cryptocompare.com/data/histoday'
res = requests.get(endpoint + '?fsym=BTC&tsym=CAD&limit=500')
hist = pd.DataFrame(json.loads(res.content)['Data'])
hist = hist.set_index('time')
hist.index = pd.to_datetime(hist.index, unit='s')
target_col = 'close'
```

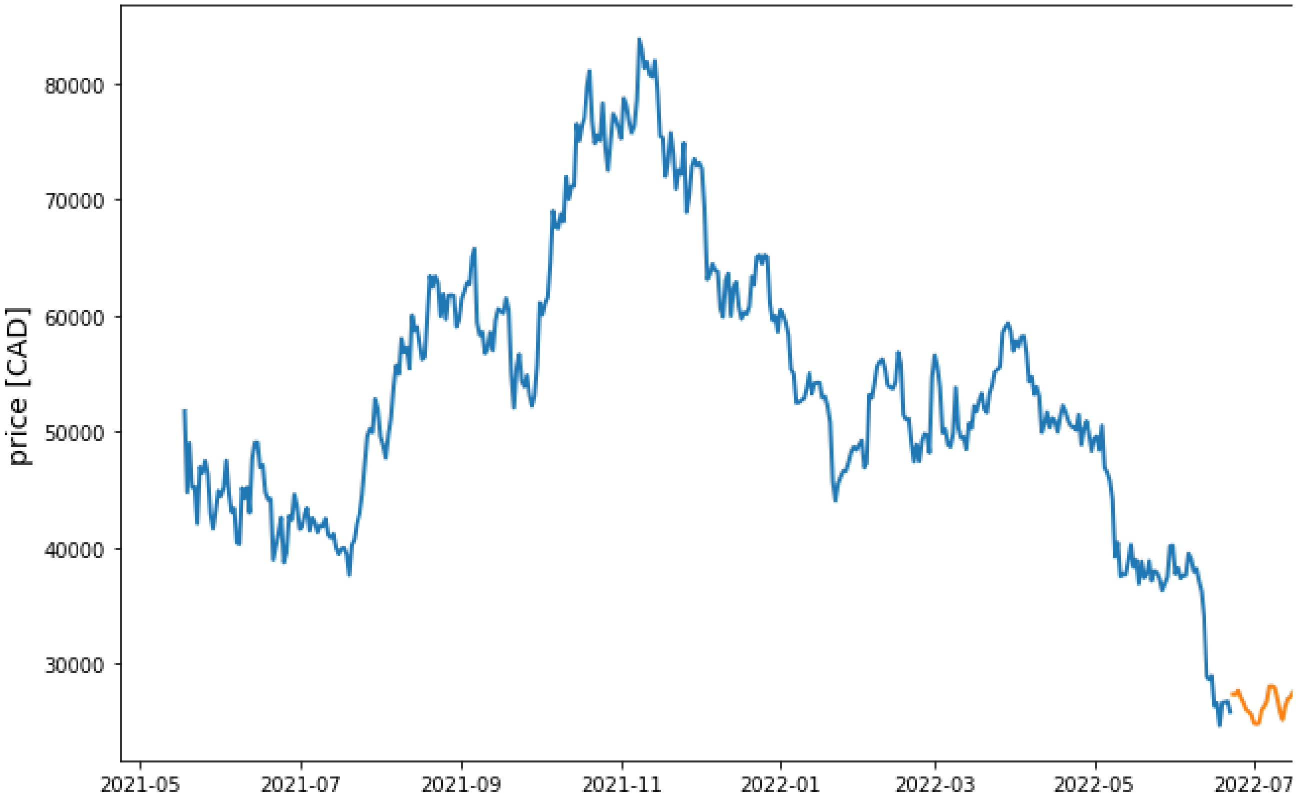
```
hist.drop(["conversionType", "conversionSymbol"], axis = 'columns', inplace = True)
```

```
hist.head(500)
```

	high	low	open	volumefrom	volumeto	close
time						
2021-05-18	55233.78	51188.02	52491.57	103.92	5505788.51	51756.01
2021-05-19	52581.04	37161.97	51756.01	388.18	17992653.18	44720.39
2021-05-20	51549.23	42572.44	44720.39	226.30	10939478.97	49029.01
2021-05-21	51385.89	40627.45	49029.01	235.88	10836710.18	45155.71
2021-05-22	47102.04	42790.32	45155.71	95.25	4330980.22	45273.75
...	...	...	...	...	...	...
2022-09-25	26015.37	25394.85	25727.84	51.11	1318310.10	25514.32
2022-09-26	26378.41	25461.90	25514.32	118.00	3071596.83	26320.65
2022-09-27	27816.42	25889.56	26320.65	166.38	4491163.83	26198.58
2022-09-28	26835.93	25466.20	26198.58	181.56	4754973.24	26379.93
2022-09-29	26859.84	25938.63	26379.93	118.57	3137920.87	26772.63

500 rows × 6 columns

```
def train_test_split(df, test_size=0.2):
    split_row = len(df) - int(test_size * len(df))
    train_data = df.iloc[:split_row]
    test_data = df.iloc[split_row:]
    return train_data, test_data


train, test = train_test_split(hist, test_size=0.2)


def line_plot(line1, line2, label1=None, label2=None, title='', lw=2):
    fig, ax = plt.subplots(1, figsize=(13, 7))
    ax.plot(line1, label=label1, linewidth=lw)
    ax.plot(line2, label=label2, linewidth=lw)
    ax.set_ylabel('price [CAD]', fontsize=14)
    ax.set_title(title, fontsize=16)
    ax.legend(loc='best', fontsize=16);


line_plot(train[target_col], test[target_col], 'training', 'test', title='')
```

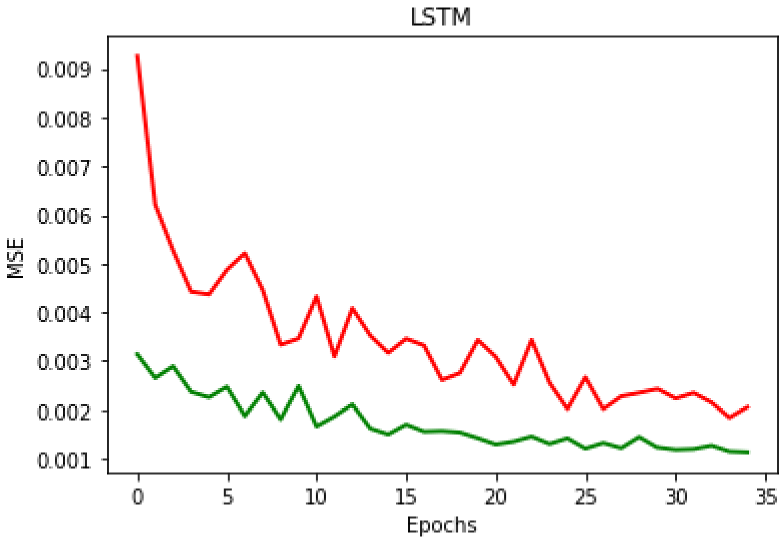


```
def normalise_zero_base(df):
    return df / df.iloc[0] - 1

def normalise_min_max(df):
    return (df - df.min()) / (data.max() - df.min())


def extract_window_data(df, window_len=5, zero_base=True):
    window_data = []
    for idx in range(len(df) - window_len):
        tmp = df[idx: (idx + window_len)].copy()
        if zero_base:
            tmp = normalise_zero_base(tmp)
        window_data.append(tmp.values)
    return np.array(window_data)

def prepare_data(df, target_col, window_len=10, zero_base=True, test_size=0.2):
    train_data, test_data = train_test_split(df, test_size=test_size)
    X_train = extract_window_data(train_data, window_len, zero_base)
    X_test = extract_window_data(test_data, window_len, zero_base)
    y_train = train_data[target_col][window_len:].values
    y_test = test_data[target_col][window_len:].values
    if zero_base:
        y_train = y_train / train_data[target_col][:-window_len].values - 1
        y_test = y_test / test_data[target_col][:-window_len].values - 1

    return train_data, test_data, X_train, X_test, y_train, y_test


def build_lstm_model(input_data, output_size, neurons=100, activ_func='linear',
                     dropout=0.2, loss='mse', optimizer='adam'):
    model = Sequential()
    model.add(LSTM(neurons, input_shape=(input_data.shape[1], input_data.shape[2])))
    model.add(Dropout(dropout))
    model.add(Dense(units=output_size))
    model.add(Activation(activ_func))

    model.compile(loss=loss, optimizer=optimizer)
    return model


np.random.seed(42)
window_len = 5
test_size = 0.2
zero_base = True
lstm_neurons = 100
epochs = 35
batch_size = 40
loss = 'mse'
dropout = 0.2
optimizer = 'adam'


train, test, X_train, X_test, y_train, y_test = prepare_data(
    hist, target_col, window_len=window_len, zero_base=zero_base, test_size=test_size)


model = build_lstm_model(
    X_train, output_size=1, neurons=lstm_neurons, dropout=dropout, loss=loss,
    optimizer=optimizer)
history = model.fit(
    X_train, y_train, validation_data=(X_test, y_test), epochs=epochs, batch_size=batch_si
```

```
10/10 [==============================] - 0s 13ms/step - loss: 0.0052 - val_loss: 0
Epoch 8/35
10/10 [==============================] - 0s 10ms/step - loss: 0.0045 - val_loss: 0
Epoch 9/35
10/10 [==============================] - 0s 11ms/step - loss: 0.0033 - val_loss: 0
Epoch 10/35
10/10 [==============================] - 0s 10ms/step - loss: 0.0035 - val_loss: 0
Epoch 11/35
```

```
10/10 [==============================] - 0s 11ms/step - loss: 0.0043 - val_loss: 0
Epoch 12/35
10/10 [==============================] - 0s 10ms/step - loss: 0.0031 - val_loss: 0
Epoch 13/35
10/10 [==============================] - 0s 11ms/step - loss: 0.0041 - val_loss: 0
Epoch 14/35
10/10 [==============================] - 0s 11ms/step - loss: 0.0035 - val_loss: 0
Epoch 15/35
10/10 [==============================] - 0s 12ms/step - loss: 0.0032 - val_loss: 0
Epoch 16/35
10/10 [==============================] - 0s 12ms/step - loss: 0.0035 - val_loss: 0
Epoch 17/35
10/10 [==============================] - 0s 13ms/step - loss: 0.0033 - val_loss: 0
Epoch 18/35
10/10 [==============================] - 0s 10ms/step - loss: 0.0026 - val_loss: 0
Epoch 19/35
10/10 [==============================] - 0s 11ms/step - loss: 0.0028 - val_loss: 0
Epoch 20/35
10/10 [==============================] - 0s 13ms/step - loss: 0.0034 - val_loss: 0
Epoch 21/35
10/10 [==============================] - 0s 12ms/step - loss: 0.0031 - val_loss: 0
Epoch 22/35
10/10 [==============================] - 0s 12ms/step - loss: 0.0025 - val_loss: 0
Epoch 23/35
10/10 [==============================] - 0s 12ms/step - loss: 0.0034 - val_loss: 0
Epoch 24/35
10/10 [==============================] - 0s 12ms/step - loss: 0.0026 - val_loss: 0
Epoch 25/35
10/10 [==============================] - 0s 10ms/step - loss: 0.0020 - val_loss: 0
Epoch 26/35
10/10 [==============================] - 0s 12ms/step - loss: 0.0027 - val_loss: 0
Epoch 27/35
10/10 [==============================] - 0s 11ms/step - loss: 0.0020 - val_loss: 0
Epoch 28/35
10/10 [==============================] - 0s 11ms/step - loss: 0.0023 - val_loss: 0
Epoch 29/35
10/10 [==============================] - 0s 12ms/step - loss: 0.0023 - val_loss: 0
Epoch 30/35
10/10 [==============================] - 0s 11ms/step - loss: 0.0024 - val_loss: 0
Epoch 31/35
10/10 [==============================] - 0s 12ms/step - loss: 0.0022 - val_loss: 0
Epoch 32/35
10/10 [==============================] - 0s 10ms/step - loss: 0.0023 - val_loss: 0
Epoch 33/35
10/10 [==============================] - 0s 12ms/step - loss: 0.0022 - val_loss: 0
Epoch 34/35
10/10 [==============================] - 0s 12ms/step - loss: 0.0018 - val_loss: 0
Epoch 35/35
10/10 [==============================] - 0s 10ms/step - loss: 0.0021 - val_loss: 0
```

```
import matplotlib.pyplot as plt
plt.plot(history.history['loss'],'r',linewidth=2, label='Train loss')
plt.plot(history.history['val_loss'], 'g',linewidth=2, label='Validation loss')
plt.title('LSTM')
plt.xlabel('Epochs')
plt.ylabel('MSE')
plt.show()
```



```
targets = test[target_col][window_len:]
preds = model.predict(X_test).squeeze()
mean_absolute_error(preds, y_test)
```

```
0.02554982940364087
```

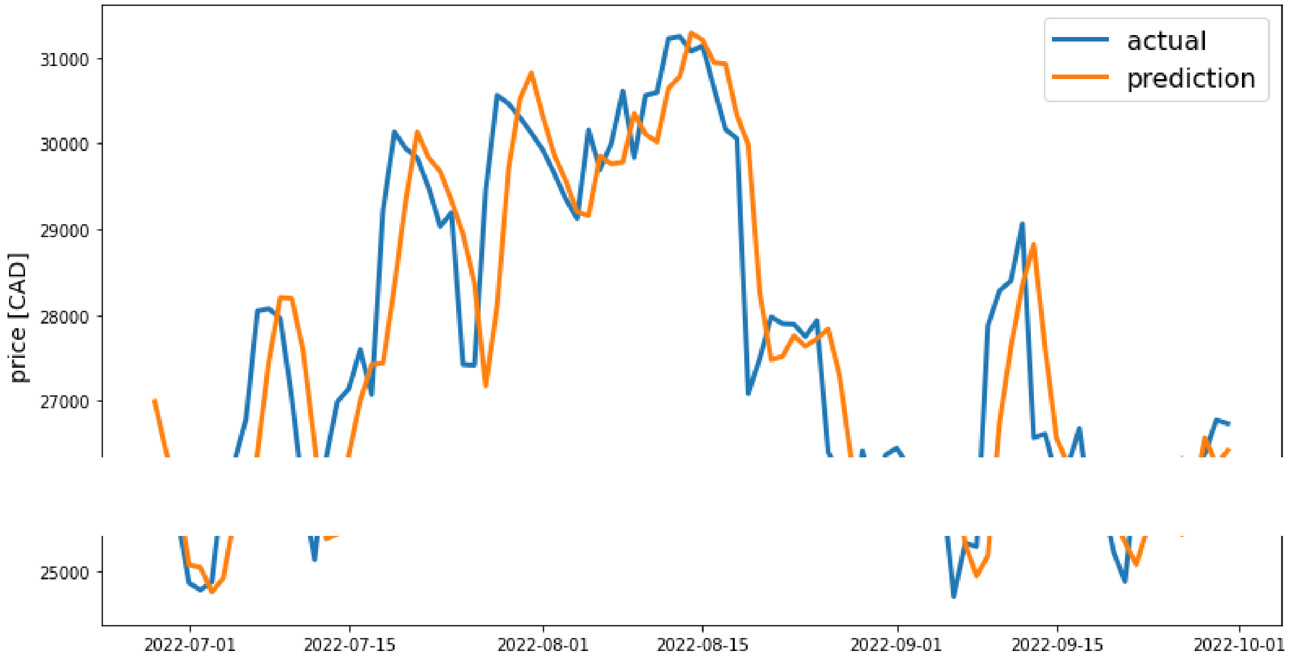
```
from sklearn.metrics import mean_squared_error
MAE=mean_squared_error(preds, y_test)
MAE
```

```
0.0011294702449779806
```

```
from sklearn.metrics import r2_score
R2=r2_score(y_test, preds)
R2
```

```
0.7135908938100886
```

```
preds = test[target_col].values[:-window_len] * (preds + 1)
preds = pd.Series(index=targets.index, data=preds)
line_plot(targets, preds, 'actual', 'prediction', lw=3)
```



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