LSTM_vr.1

February 3, 2021

1 필요한 모듈을 가져오고 데이터를 로드합니다

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
import os

%matplotlib inline
warnings.filterwarnings('ignore')

plt.rcParams['font.family'] = 'DejaVu Sans'
```

[2]:
```
# FinanceDataReader로 데이터를 불러옵니다
# 예측할 종목은 한양증권(001750) 입니다

import FinanceDataReader as fdr
STOCK_CODE = '001750'
```

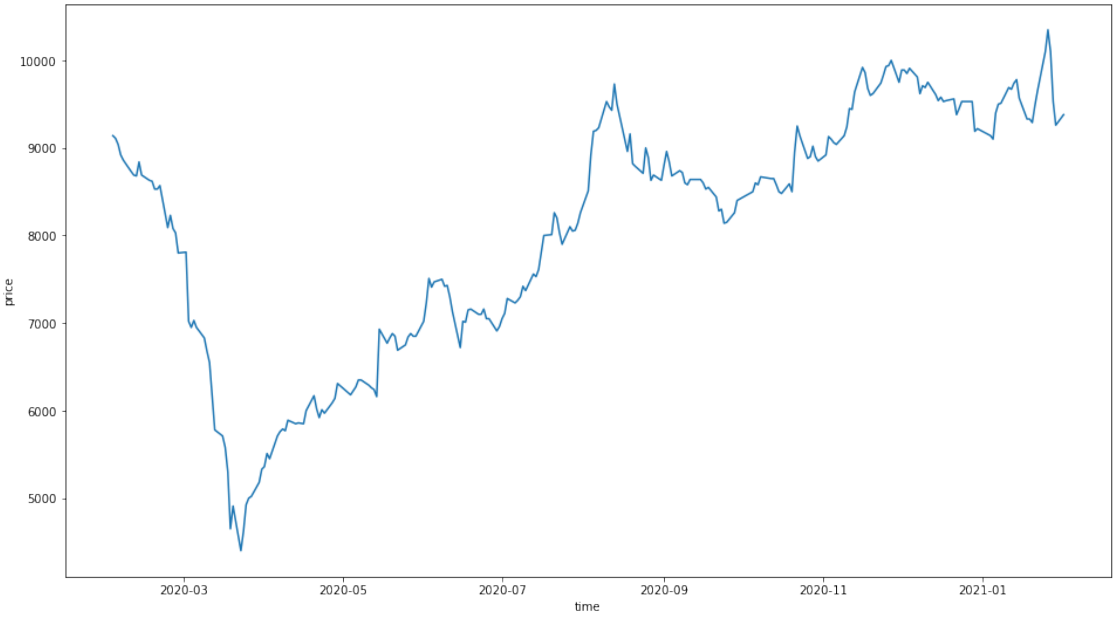
[3]:
```
# 기간은 1년으로 잡았습니다

stock = fdr.DataReader(STOCK_CODE, '2020-02-01', '2021-02-01')
```

[4]:
```
# 학습에 사용될 한양증권 차트입니다

plt.figure(figsize=(16,9))
sns.lineplot(y=stock['Close'], x=stock.index)
plt.xlabel('time')
plt.ylabel('price')
```

[4]:
```
Text(0, 0.5, 'price')
```



2 Normalization을 진행합니다

[5]:
```
from sklearn.preprocessing import MinMaxScaler
```

[6]:
```
scaler = MinMaxScaler()
scale_cols = ['Open', 'High', 'Low', 'Close', 'Volume']
scaled = scaler.fit_transform(stock[scale_cols])
scaled
```

[6]:
```
array([[0.82537068, 0.80536913, 0.81293706, 0.79663866, 0.03296981],
       [0.77594728, 0.75671141, 0.81118881, 0.79159664, 0.0083776 ],
       [0.78583196, 0.76510067, 0.80769231, 0.77983193, 0.01111828],
       ...,
       [0.90280066, 0.88422819, 0.88811189, 0.86218487, 0.06950447],
       [0.84349259, 0.83221477, 0.83391608, 0.81680672, 0.04761135],
       [0.78583196, 0.81208054, 0.82517483, 0.83697479, 0.02615416]])
```

[7]:
```
df = pd.DataFrame(scaled, columns=scale_cols)
```

3 데이터를 분할하여 훈련 데이터를 생성합니다

[8]:
```
# Train과 Test를 분할합니다

from sklearn.model_selection import train_test_split
```

[9]:
```
x_train, x_test, y_train, y_test = train_test_split(df.drop('Close',1),␣
 ↪df['Close'], test_size=0.2, random_state=0, shuffle=False)
```

[10]:
```
x_train.shape, y_train.shape
```

[10]:
```
((199, 4), (199,))
```

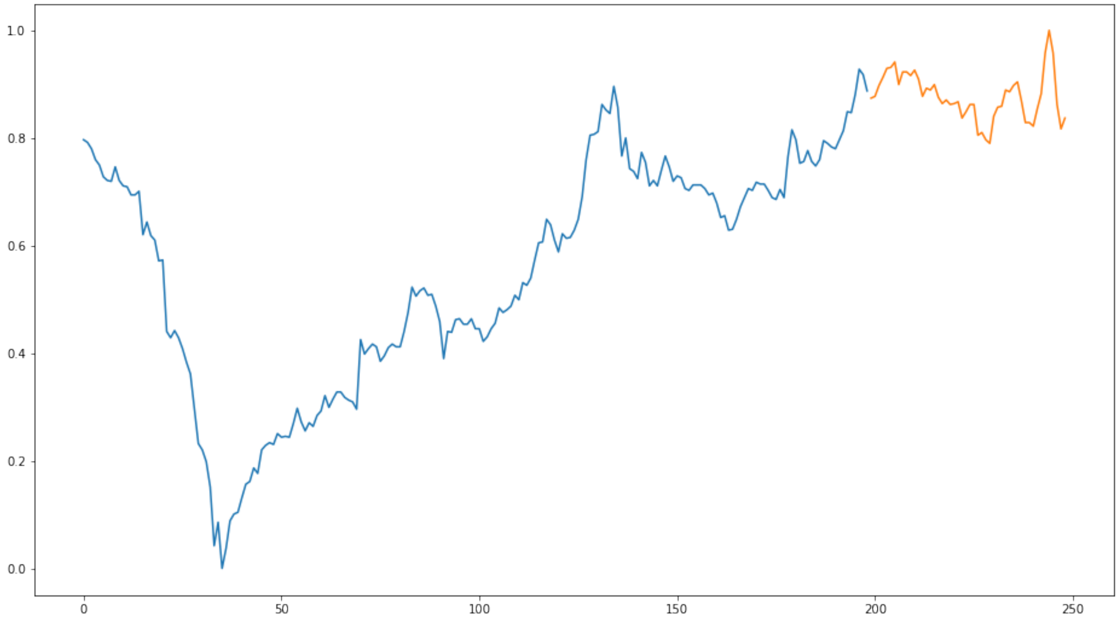
[11]:
```
x_test.shape, y_test.shape
```

[11]:
```
((50, 4), (50,))
```

[12]:
```
# Train과 Test가 분할된 모습을 차트로 표현했습니다

plt.figure(figsize=(16,9))
plt.plot(y_train)
plt.plot(y_test)
```

[12]:
```
[<matplotlib.lines.Line2D at 0x2885fa61700>]
```



4 TensorFlow 데이터 셋로 데이터 세트 구성합니다

[13]:
```
import tensorflow as tf
```

[14]:
```
def windowed_dataset(series, window_size, batch_size, shuffle):
    series = tf.expand_dims(series, axis=-1)
    ds = tf.data.Dataset.from_tensor_slices(series)
    ds = ds.window(window_size + 1, shift=1, drop_remainder=True)
    ds = ds.flat_map(lambda w: w.batch(window_size + 1))
    if shuffle:
        ds = ds.shuffle(1000)
    ds = ds.map(lambda w: (w[:-1], w[-1]))
    return ds.batch(batch_size).prefetch(1)
```

[15]:

```
WINDOW_SIZE = 20
BATCH_SIZE = 32
```

[16]:

```
train_data = windowed_dataset(y_train, WINDOW_SIZE, BATCH_SIZE, True)
test_data = windowed_dataset(y_test, WINDOW_SIZE, BATCH_SIZE, False)
```

```
WARNING:tensorflow:AutoGraph could not transform <function
windowed_dataset.<locals>.<lambda> at 0x00000288654BF940> and will run it as-is.
Please report this to the TensorFlow team. When filing the bug, set the
verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full
output.
Cause: module 'gast' has no attribute 'Index'
To silence this warning, decorate the function with
@tf.autograph.experimental.do_not_convert
WARNING: AutoGraph could not transform <function
windowed_dataset.<locals>.<lambda> at 0x00000288654BF940> and will run it as-is.
Please report this to the TensorFlow team. When filing the bug, set the
verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full
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Cause: module 'gast' has no attribute 'Index'
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@tf.autograph.experimental.do_not_convert
WARNING:tensorflow:AutoGraph could not transform <function
windowed_dataset.<locals>.<lambda> at 0x00000288655BA040> and will run it as-is.
Please report this to the TensorFlow team. When filing the bug, set the
verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full
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Please report this to the TensorFlow team. When filing the bug, set the
verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full
output.
Cause: module 'gast' has no attribute 'Index'
To silence this warning, decorate the function with
@tf.autograph.experimental.do_not_convert
```

[17]:

```
for data in train_data.take(1):
    print(f'데이터셋(X) 구성(batch_size, window_size, feature갯수): {data[0].
 ↪shape}')
    print(f'데이터셋(Y) 구성(batch_size, window_size, feature갯수): {data[1].
 ↪shape}')
```

```
데이터셋(X) 구성(batch_size, window_size, feature갯수): (32, 20, 1)
데이터셋(Y) 구성(batch_size, window_size, feature갯수): (32, 1)
```

5 딥러닝 네트워크를 학습시킵니다

시퀀셜 모델을 활용해서 딥러닝 네트워크를 학습

[18]:

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, LSTM, Conv1D, Lambda
from tensorflow.keras.losses import Huber
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.callbacks import EarlyStopping, ModelCheckpoint

model = Sequential([
    Conv1D(filters=32, kernel_size=5,
           padding="causal",
           activation="relu",
           input_shape=[WINDOW_SIZE, 1]),

    # LSTM
    LSTM(16, activation='tanh'),
    Dense(16, activation="relu"),
    Dense(1),
])
```

[19]:

```
# loss에는 Huber(), optimizer에는 Adam(), metrics에는 mse를 사용합니다

optimizer = Adam(lr = 0.00001)
model.compile(optimizer='rmsprop', loss='mse', metrics=['mae'])
```

[20]:

```
# 10번 epoch 동안 val_loss 기준 개선이 없으면 끝나게 설정하였습니다

earlystopping = EarlyStopping(monitor='val_loss', patience=10)
filename = os.path.join('tmp', 'checkpointer.ckpt')
checkpoint = ModelCheckpoint(filename,
                             save_weights_only=True,
                             save_best_only=True,
                             monitor='val_loss',
                             verbose=1)
```

[21]:

```python
history = model.fit(train_data,
                    validation_data=(test_data),
                    epochs=50,
                    callbacks=[checkpoint, earlystopping])
```

```
Epoch 1/50
6/6 [==============================] - 6s 503ms/step - loss: 0.2150 - mae:
0.4151 - val_loss: 0.0980 - val_mae: 0.3093

Epoch 00001: val_loss improved from inf to 0.09804, saving model to
tmp\checkpointer.ckpt
Epoch 2/50
6/6 [==============================] - 0s 21ms/step - loss: 0.0229 - mae: 0.1230
- val_loss: 0.0154 - val_mae: 0.1139

Epoch 00002: val_loss improved from 0.09804 to 0.01539, saving model to
tmp\checkpointer.ckpt
Epoch 3/50
6/6 [==============================] - 0s 21ms/step - loss: 0.0153 - mae: 0.0919
- val_loss: 0.0189 - val_mae: 0.1285

Epoch 00003: val_loss did not improve from 0.01539
Epoch 4/50
6/6 [==============================] - 0s 25ms/step - loss: 0.0136 - mae: 0.0843
- val_loss: 0.0101 - val_mae: 0.0880

Epoch 00004: val_loss improved from 0.01539 to 0.01012, saving model to
tmp\checkpointer.ckpt
Epoch 5/50
6/6 [==============================] - 0s 25ms/step - loss: 0.0104 - mae: 0.0703
- val_loss: 0.0094 - val_mae: 0.0843

Epoch 00005: val_loss improved from 0.01012 to 0.00943, saving model to
tmp\checkpointer.ckpt
Epoch 6/50
6/6 [==============================] - 0s 38ms/step - loss: 0.0091 - mae: 0.0662
- val_loss: 0.0143 - val_mae: 0.1096

Epoch 00006: val_loss did not improve from 0.00943
Epoch 7/50
6/6 [==============================] - 0s 32ms/step - loss: 0.0093 - mae: 0.0689
- val_loss: 0.0089 - val_mae: 0.0814

Epoch 00007: val_loss improved from 0.00943 to 0.00892, saving model to
tmp\checkpointer.ckpt
Epoch 8/50
6/6 [==============================] - 0s 37ms/step - loss: 0.0064 - mae: 0.0551
- val_loss: 0.0023 - val_mae: 0.0378
```

```
Epoch 00008: val_loss improved from 0.00892 to 0.00232, saving model to
tmp\checkpointer.ckpt
Epoch 9/50
6/6 [==============================] - 0s 21ms/step - loss: 0.0069 - mae: 0.0612
- val_loss: 0.0031 - val_mae: 0.0474

Epoch 00009: val_loss did not improve from 0.00232
Epoch 10/50
6/6 [==============================] - 0s 23ms/step - loss: 0.0079 - mae: 0.0688
- val_loss: 0.0033 - val_mae: 0.0495

Epoch 00010: val_loss did not improve from 0.00232
Epoch 11/50
6/6 [==============================] - 0s 21ms/step - loss: 0.0085 - mae: 0.0681
- val_loss: 0.0042 - val_mae: 0.0479

Epoch 00011: val_loss did not improve from 0.00232
Epoch 12/50
6/6 [==============================] - 0s 23ms/step - loss: 0.0054 - mae: 0.0539
- val_loss: 0.0080 - val_mae: 0.0761

Epoch 00012: val_loss did not improve from 0.00232
Epoch 13/50
6/6 [==============================] - 0s 21ms/step - loss: 0.0052 - mae: 0.0555
- val_loss: 0.0024 - val_mae: 0.0408

Epoch 00013: val_loss did not improve from 0.00232
Epoch 14/50
6/6 [==============================] - 0s 22ms/step - loss: 0.0055 - mae: 0.0570
- val_loss: 0.0027 - val_mae: 0.0435

Epoch 00014: val_loss did not improve from 0.00232
Epoch 15/50
6/6 [==============================] - 0s 22ms/step - loss: 0.0048 - mae: 0.0504
- val_loss: 0.0036 - val_mae: 0.0510

Epoch 00015: val_loss did not improve from 0.00232
Epoch 16/50
6/6 [==============================] - 0s 28ms/step - loss: 0.0038 - mae: 0.0471
- val_loss: 0.0038 - val_mae: 0.0520

Epoch 00016: val_loss did not improve from 0.00232
Epoch 17/50
6/6 [==============================] - 0s 37ms/step - loss: 0.0069 - mae: 0.0656
- val_loss: 0.0051 - val_mae: 0.0555

Epoch 00017: val_loss did not improve from 0.00232
Epoch 18/50
6/6 [==============================] - 0s 22ms/step - loss: 0.0031 - mae: 0.0421
- val_loss: 0.0036 - val_mae: 0.0456

Epoch 00018: val_loss did not improve from 0.00232
```

[22]:
```
model.load_weights(filename)
```

[22]:
```
<tensorflow.python.training.tracking.util.CheckpointLoadStatus at 0x288655e4df0>
```

[23]:
```
# test_data를 활용하여 예측을 진행했습니다

pred = model.predict(test_data)
```

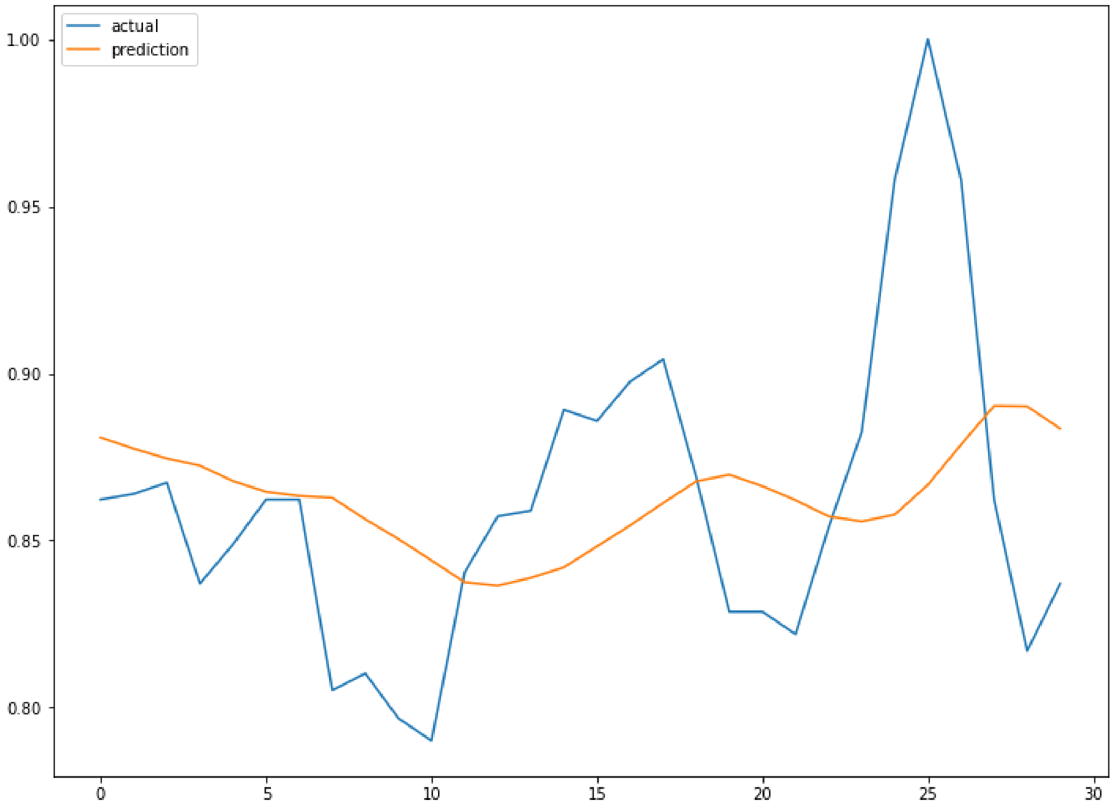
[24]:
```
pred.shape
```

[24]:
```
(30, 1)
```

6 Visualize

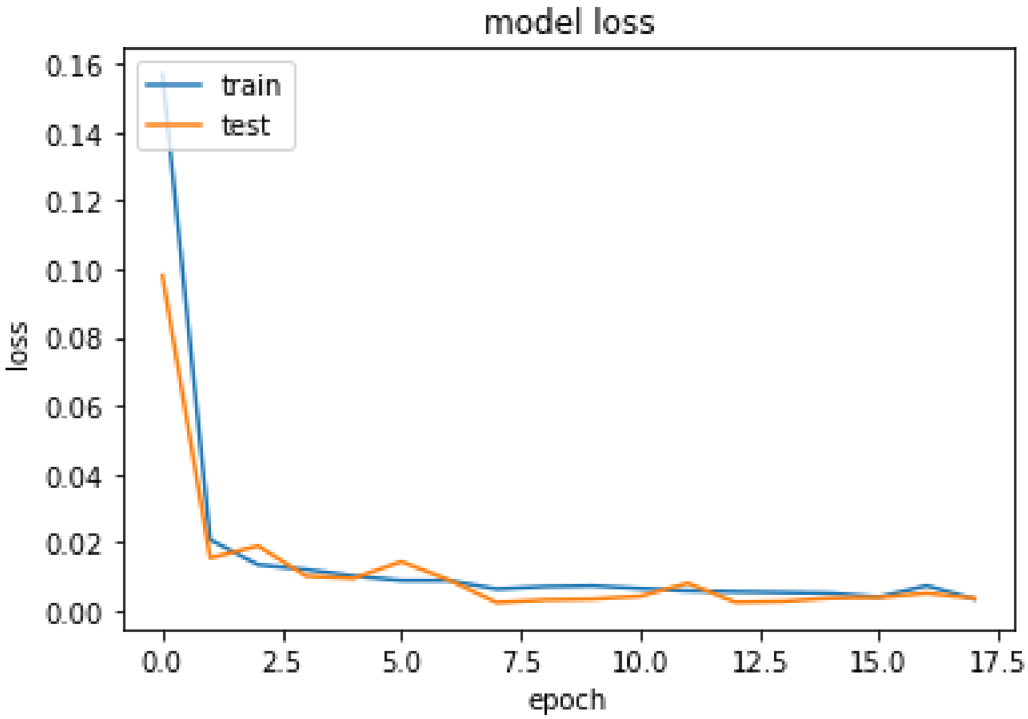
아래의 그래프를 분석해보면 prediction이 실제 차트를 추종하기보다는 그 주변값을 멤도는 완만한 곡선임을 확인할 수 있습니다. model loss는 epoch(반복) 2회에서 극적으로 낮아져 그 이후부터 완만하게 떨어지는 경향을 보이고 있습니다. 다른 모형에서 개선해야할 사항은 prediction이 실제 차트를 추종할 수 있도록 하는 것과 실질적인 model loss를 줄이는 점 등이 있습니다

[25]:
```
# 예측 데이터는 20일치 데이터로 21일치를 예측합니다.
# test_data로 예측할 때 앞에 20일은 예측하지 않습니다

plt.figure(figsize=(12,9))
plt.plot(np.asarray(y_test)[20:], label='actual')
plt.plot(pred, label='prediction')
plt.legend(loc='upper left')
plt.show()
```



[26]:

```
import matplotlib.pyplot as plt

plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.title('model loss')
plt.ylabel('loss')
plt.xlabel('epoch')
plt.legend(['train', 'test'], loc='upper left')
plt.show()
```


model loss
train
test
loss
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
epoch

[ ]: