RNN

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

from sklearn.preprocessing import MinMaxScaler
from sklearn.model_selection import train_test_split
```

In [2]:

```
# 파일
df = pd.read_csv('일별 전처리 데이터.csv',encoding='utf8',parse_dates=['base_date'])
df.info()
df.head()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 55824 entries, 0 to 55823
Data columns (total 16 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   base_date      55824 non-null  datetime64[ns]
 1   location       55824 non-null  object
 2   area_cnt       50522 non-null  float64
 3   em_cnt         50522 non-null  float64
 4   em_g           50522 non-null  float64
 5   resd_kor       54911 non-null  float64
 6   work_kor       54911 non-null  float64
 7   visit_kor      54911 non-null  float64
 8   resd_lf        54911 non-null  float64
 9   work_lf        54911 non-null  float64
 10  visit_lf       54911 non-null  float64
 11  visit_pop_cnt  54911 non-null  float64
 12  풍속             54911 non-null  float64
 13  기온             54911 non-null  float64
 14  습도             54911 non-null  float64
 15  강수             54911 non-null  float64
dtypes: datetime64[ns](1), float64(14), object(1)
memory usage: 6.8+ MB
```

Out[2]:

	base_date	location	area_cnt	em_cnt	em_g	resd_kor	work_kor	visit_kor	resd_lf
0	2018-01-01	건입동	32.0	668.0	1708250.0	199.611889	22.270278	213.621737	12.226698
1	2018-01-01	구좌읍	NaN	NaN	NaN	311.449242	19.475967	280.604967	13.681149
2	2018-01-01	남원읍	52.0	304.0	1239600.0	329.234019	20.512157	247.501202	16.354599
3	2018-01-01	노형동	171.0	3903.0	9357900.0	1355.900118	83.139934	491.447266	67.677266
4	2018-01-01	대륜동	38.0	650.0	1717700.0	306.384283	23.104325	241.575148	8.031951

In [3]:

```
# 결측치 확인
df.isnull().sum()
```

Out[3]:

```
base_date           0
location            0
area_cnt         5302
em_cnt           5302
em_g             5302
resd_kor          913
work_kor          913
visit_kor         913
resd_lf           913
work_lf           913
visit_lf          913
visit_pop_cnt     913
풍속                913
기온                913
습도                913
강수                913
dtype: int64
```

In [4]:

```
# 결측치 0 처리
df = df.fillna(0)
```

In [5]:

```
df['base_date'] = pd.to_datetime(df['base_date'],format='%Y%m')
df['year'] = df['base_date'].dt.year
```

In [6]:

```
# 정규화
scaler = MinMaxScaler()
scale_cols =  df.drop(columns=['base_date','location'], axis=1)
scale_cols[:] = scaler.fit_transform(scale_cols[:])
scale_cols
```

Out[6]:

	area_cnt	em_cnt	em_g	resd_kor	work_kor	visit_kor	resd_lf	work_lf	visit_lf	vis
0	0.187135	0.096129	0.123399	0.117456	0.071197	0.247152	0.114795	0.123365	0.146728	
1	0.000000	0.000000	0.000000	0.183264	0.062264	0.324649	0.128451	0.077653	0.071065	
2	0.304094	0.043747	0.089545	0.193729	0.065576	0.286349	0.153552	0.136043	0.058062	
3	1.000000	0.561664	0.675990	0.797843	0.265794	0.568586	0.635415	0.273113	0.198654	
4	0.222222	0.093539	0.124082	0.180284	0.073863	0.279493	0.075411	0.033183	0.082788	
...	...	...	...	...	...	...	...	...	...	
55819	0.280702	0.053245	0.099503	0.162964	0.087032	0.211643	0.055906	0.045485	0.055686	
55820	0.415205	0.038711	0.070348	0.114019	0.059312	0.131988	0.107645	0.029386	0.107047	
55821	0.654971	0.125198	0.238246	0.320422	0.182023	0.384249	0.269423	0.093260	0.194272	
55822	0.491228	0.324507	0.270861	0.389899	0.185573	0.322782	0.107942	0.086317	0.046461	
55823	0.128655	0.045042	0.073036	0.060151	0.019578	0.058289	0.038147	0.020431	0.036625	

55824 rows × 15 columns

In [7]:

```
# 데이터셋 분리(시계열)

TEST_SIZE = 48222 # 3년 데이터
WINDOW_SIZE = 7602 # 6개월 데이터
```

```
test = scale_cols[:-TEST_SIZE]
train = scale_cols[-TEST_SIZE:]
```

In [8]:

```
# 훈련데이터와 테스트데이터 분리에 사용
def make_dataset(data, label, window_size=20):
    feature_list = []
    label_list = []
    for i in range(len(data) - window_size):
        feature_list.append(np.array(data.iloc[i:i+window_size]))
        label_list.append(np.array(label.iloc[i+window_size]))
    return np.array(feature_list), np.array(label_list)
```

In [9]:

```
# 훈련데이터와 테스트데이터 분리
feature_cols = scale_cols.columns
label_cols = ['em_g']

train_feature = train[feature_cols]
train_label = train[label_cols]

train_feature, train_label = make_dataset(train_feature, train_label, 20)

x_train, x_valid, y_train, y_valid = train_test_split(train_feature, train_label, test
x_train.shape, x_valid.shape
```

Out[9]:

```
((38561, 20, 15), (9641, 20, 15))
```

In [10]:

```
test_feature = test[feature_cols]
test_label = test[label_cols]

test_feature.shape, test_label.shape
```

Out[10]:

```
((7602, 15), (7602, 1))
```

In [11]:

```
test_feature, test_label = make_dataset(test_feature, test_label, 20)
test_feature.shape, test_label.shape
```

Out[11]:

```
((7582, 20, 15), (7582, 1))
```

In [12]:

```
# tensorflow, keras
import tensorflow as tf
from tensorflow import keras
```

In [13]:

```
# keras 모형
from keras.models import Sequential
from keras.layers import Dense
from keras.callbacks import EarlyStopping, ModelCheckpoint
from keras.layers import LSTM

model = Sequential()
model.add(LSTM(16,
               input_shape=(train_feature.shape[1], train_feature.shape[2]),
               activation='relu',
               return_sequences=False)
          )
```

```
model.add(Dense(1))
```

In [14]:

```
# 훈련
import os

model.compile(loss='mean_squared_error', optimizer='adam',metrics=["acc"]) # acc 안나
early_stop = EarlyStopping(monitor='val_loss', patience=5)

model_path = 'model'
filename = os.path.join(model_path, 'tmp_checkpoint.h5')
checkpoint = ModelCheckpoint(filename, monitor='val_loss', verbose=1, save_best_only=

history = model.fit(x_train, y_train,
                                    epochs=200,
                                    batch_size=16,
                                    validation_data=(x_valid, y_valid),
                                    callbacks=[early_stop, checkpoint])
```

```
Epoch 1/200
2411/2411 [==============================] - 33s 13ms/step - loss: 0.0147 - acc: 0.088
7 - val_loss: 0.0064 - val_acc: 0.0875

Epoch 00001: val_loss improved from inf to 0.00636, saving model to model₩tmp_checkpoi
nt.h5
Epoch 2/200
2411/2411 [==============================] - 25s 11ms/step - loss: 0.0053 - acc: 0.088
7 - val_loss: 0.0035 - val_acc: 0.0875

Epoch 00002: val_loss improved from 0.00636 to 0.00349, saving model to model₩tmp_chec
kpoint.h5
Epoch 3/200
2411/2411 [==============================] - 26s 11ms/step - loss: 0.0029 - acc: 0.088
7 - val_loss: 0.0024 - val_acc: 0.0875

Epoch 00003: val_loss improved from 0.00349 to 0.00241, saving model to model₩tmp_chec
kpoint.h5
Epoch 4/200
2411/2411 [==============================] - 32s 13ms/step - loss: 0.0022 - acc: 0.088
7 - val_loss: 0.0025 - val_acc: 0.0875

Epoch 00004: val_loss did not improve from 0.00241
Epoch 5/200
2411/2411 [==============================] - 29s 12ms/step - loss: 0.0017 - acc: 0.088
7 - val_loss: 0.0023 - val_acc: 0.0875

Epoch 00005: val_loss improved from 0.00241 to 0.00231, saving model to model₩tmp_chec
kpoint.h5
Epoch 6/200
2411/2411 [==============================] - 29s 12ms/step - loss: 0.0015 - acc: 0.088
7 - val_loss: 0.0015 - val_acc: 0.0875

Epoch 00006: val_loss improved from 0.00231 to 0.00152, saving model to model₩tmp_chec
kpoint.h5
Epoch 7/200
2411/2411 [==============================] - 30s 12ms/step - loss: 0.0013 - acc: 0.088
7 - val_loss: 0.0020 - val_acc: 0.0875

Epoch 00007: val_loss did not improve from 0.00152
Epoch 8/200
2411/2411 [==============================] - 24s 10ms/step - loss: 0.0012 - acc: 0.088
7 - val_loss: 0.0011 - val_acc: 0.0875
```

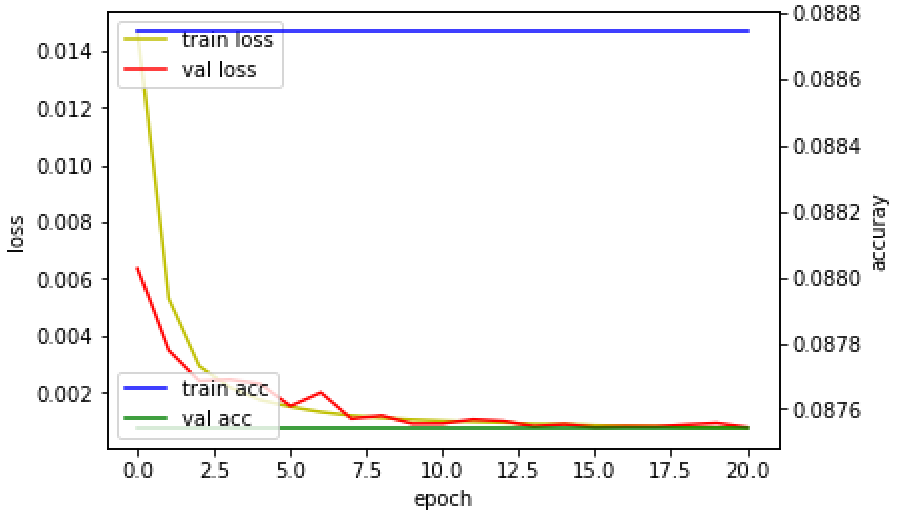
```
Epoch 00008: val_loss improved from 0.00152 to 0.00108, saving model to model₩tmp_chec
kpoint.h5
Epoch 9/200
2411/2411 [==============================] - 30s 13ms/step - loss: 0.0011 - acc: 0.088
7 - val_loss: 0.0012 - val_acc: 0.0875

Epoch 00009: val_loss did not improve from 0.00108
Epoch 10/200
2411/2411 [==============================] - 42s 18ms/step - loss: 0.0010 - acc: 0.088
7 - val_loss: 9.0238e-04 - val_acc: 0.0875ETA: 1s

Epoch 00010: val_loss improved from 0.00108 to 0.00090, saving model to model₩tmp_chec
kpoint.h5
Epoch 11/200
2411/2411 [==============================] - 65s 27ms/step - loss: 0.0010 - acc: 0.088
7 - val_loss: 9.0652e-04 - val_acc: 0.0875

Epoch 00011: val_loss did not improve from 0.00090
Epoch 12/200
2411/2411 [==============================] - 62s 26ms/step - loss: 9.6902e-04 - acc:
0.0887 - val_loss: 0.0011 - val_acc: 0.0875

Epoch 00012: val_loss did not improve from 0.00090
Epoch 13/200
2411/2411 [==============================] - 49s 20ms/step - loss: 9.3814e-04 - acc:
0.0887 - val_loss: 9.9497e-04 - val_acc: 0.0875

Epoch 00013: val_loss did not improve from 0.00090
Epoch 14/200
2411/2411 [==============================] - 33s 14ms/step - loss: 8.9003e-04 - acc:
0.0887 - val_loss: 8.1026e-04 - val_acc: 0.0875

Epoch 00014: val_loss improved from 0.00090 to 0.00081, saving model to model₩tmp_chec
kpoint.h5
Epoch 15/200
2411/2411 [==============================] - 29s 12ms/step - loss: 8.8698e-04 - acc:
0.0887 - val_loss: 8.8551e-04 - val_acc: 0.0875

Epoch 00015: val_loss did not improve from 0.00081
Epoch 16/200
2411/2411 [==============================] - 22s 9ms/step - loss: 8.4393e-04 - acc: 0.
0887 - val_loss: 7.7369e-04 - val_acc: 0.0875

Epoch 00016: val_loss improved from 0.00081 to 0.00077, saving model to model₩tmp_chec
kpoint.h5
Epoch 17/200
2411/2411 [==============================] - 23s 10ms/step - loss: 8.2805e-04 - acc:
0.0887 - val_loss: 8.0333e-04 - val_acc: 0.0875

Epoch 00017: val_loss did not improve from 0.00077
Epoch 18/200
2411/2411 [==============================] - 24s 10ms/step - loss: 8.1766e-04 - acc:
0.0887 - val_loss: 8.0059e-04 - val_acc: 0.0875

Epoch 00018: val_loss did not improve from 0.00077
Epoch 19/200
2411/2411 [==============================] - 24s 10ms/step - loss: 7.7786e-04 - acc:
0.0887 - val_loss: 8.6841e-04 - val_acc: 0.0875

Epoch 00019: val_loss did not improve from 0.00077
Epoch 20/200
2411/2411 [==============================] - 23s 10ms/step - loss: 7.6879e-04 - acc:
0.0887 - val_loss: 9.2617e-04 - val_acc: 0.0875

Epoch 00020: val_loss did not improve from 0.00077
Epoch 21/200
2411/2411 [==============================] - 23s 10ms/step - loss: 7.5686e-04 - acc:
0.0887 - val_loss: 7.7923e-04 - val_acc: 0.0875

Epoch 00021: val_loss did not improve from 0.00077
```

In [15]:

```
# loss와 accuracy 그래프
fig, loss_ax = plt.subplots()

acc_ax = loss_ax.twinx()

loss_ax.plot(history.history['loss'], 'y', label='train loss')
loss_ax.plot(history.history['val_loss'], 'r', label='val loss')

acc_ax.plot(history.history['acc'], 'b', label='train acc')
acc_ax.plot(history.history['val_acc'], 'g', label='val acc')

loss_ax.set_xlabel('epoch')
loss_ax.set_ylabel('loss')
acc_ax.set_ylabel('accuray')
loss_ax.legend(loc='upper left')
acc_ax.legend(loc='lower left')

# plt.savefig('rnn_d')
```

Out[15]:

```
<matplotlib.legend.Legend at 0x1ceae1e5cd0>
```



In [16]:

```
model.load_weights(filename)
pred = model.predict(test_feature)

pred.shape
```

Out[16]:

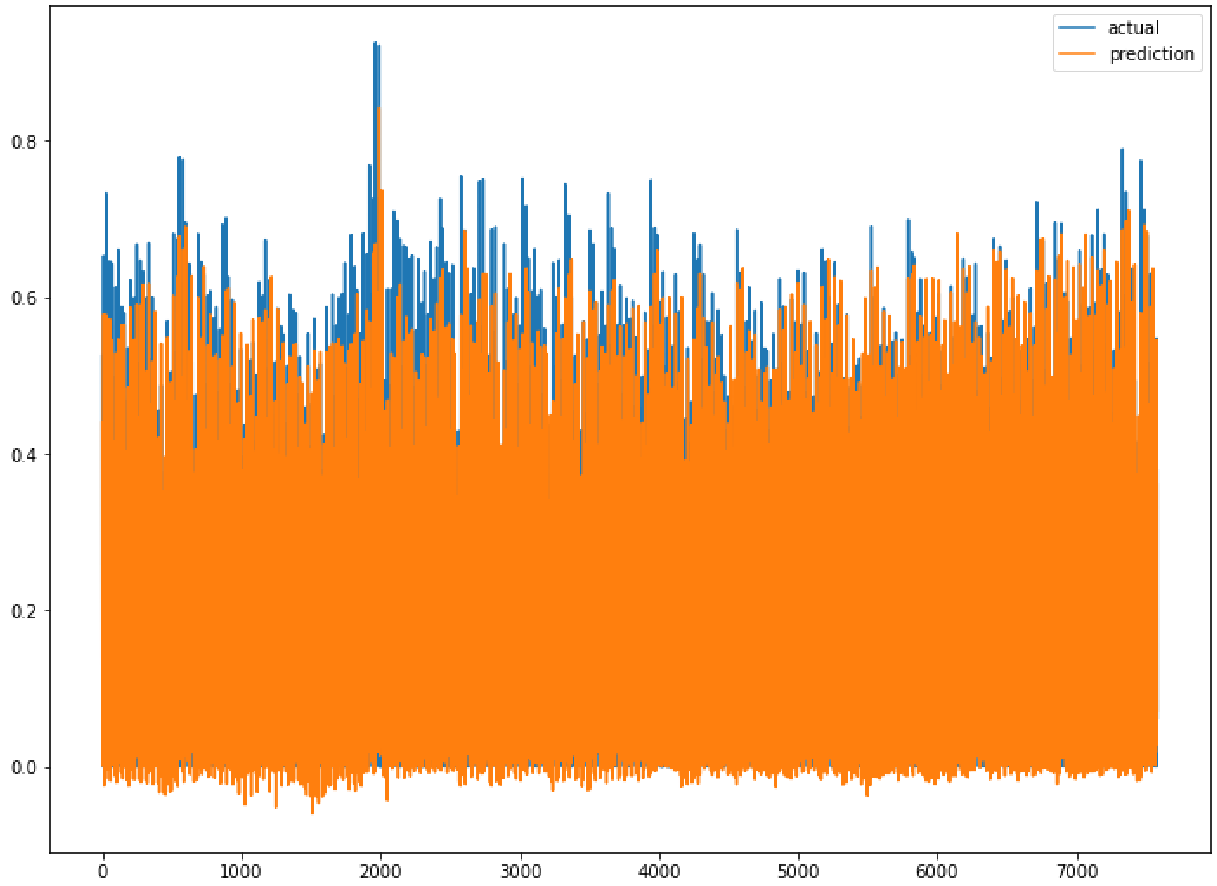
```
(7582, 1)
```

In [17]:

```
# 실제값과 예측값 그래프
plt.figure(figsize=(12, 9))
plt.plot(test_label, label = 'actual')
plt.plot(pred, label = 'prediction')
plt.legend()
# plt.savefig('rnn_p_d')()
```

Out[17]:

```
<matplotlib.legend.Legend at 0x1ceae1e2e50>
```


actual
prediction
0.8
0.6
0.4
0.2
0.0
0
1000
2000
3000
4000
5000
6000
7000