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 로드
df = pd.read_csv('전체데이터_병합.csv',encoding='cp949',parse_dates=['y_m'])
df.info()
df.head()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1666 entries, 0 to 1665
Data columns (total 39 columns):
 #   Column            Non-Null Count  Dtype         
---  ------            --------------  -----         
 0   y_m               1666 non-null   datetime64[ns]
 1   city              1666 non-null   object        
 2   location          1666 non-null   object        
 3   area_cnt          1666 non-null   float64       
 4   em_cnt            1666 non-null   int64         
 5   em_g              1666 non-null   int64         
 6   pay_amt           1666 non-null   int64         
 7   제주도민_여            1666 non-null   float64       
 8   외국인거주_여           1666 non-null   float64       
 9   제주도민_남            1666 non-null   float64       
 10  외국인거주_남           1666 non-null   float64       
 11  제주도민_60이상         1666 non-null   float64       
 12  제주도민_60미만         1666 non-null   float64       
 13  total_pop         1666 non-null   float64       
 14  패스트푸드_결제건수        1666 non-null   float64       
 15  패스트푸드_결제금액        1666 non-null   float64       
 16  간식_결제건수           1666 non-null   float64       
 17  간식_결제금액           1666 non-null   float64       
 18  농축수산물_결제건수        1666 non-null   float64       
 19  농축수산물_결제금액        1666 non-null   float64       
 20  마트/슈퍼마켓_결제건수      1666 non-null   float64       
 21  마트/슈퍼마켓_결제금액      1666 non-null   float64       
 22  식품_결제건수           1666 non-null   float64       
 23  식품_결제금액           1666 non-null   float64       
 24  배달_결제건수           1666 non-null   float64       
 25  배달_결제금액           1666 non-null   float64       
 26  식당_결제건수           1666 non-null   float64       
 27  식당_결제금액           1666 non-null   float64       
 28  풍속                1666 non-null   float64       
 29  기온                1666 non-null   float64       
 30  습도                1666 non-null   float64       
 31  강수                1666 non-null   float64       
 32  전국_누적확진자          1666 non-null   float64       
 33  전국_월별확진자          1666 non-null   float64       
 34  제주_누적확진자          1666 non-null   float64       
 35  제주_월별확진자          1666 non-null   float64       
 36  visit_pop_cnt     1666 non-null   float64       
 37  visit_pop_cnt_lf  1666 non-null   float64       
 38  visit_pop_cnt_sf  1666 non-null   float64
```

```
dtypes: datetime64[ns](1), float64(33), int64(3), object(2)
memory usage: 507.7+ KB
```

Out[2]:

	y_m	city	location	area_cnt	em_cnt	em_g	pay_amt	제주도민_여	외국인거주_여	제주도민_남	...	기
0	2018-01-01	서귀포시	남원읍	52.0	9570	42437700	1270773	9306.0	200.0	9806.0	...	6.2565
1	2018-01-01	서귀포시	대륜동	38.0	21666	57612600	1676850	6637.0	95.0	6836.0	...	8.0043
2	2018-01-01	서귀포시	대정읍	89.0	10185	38885550	1164122	10725.0	677.0	10360.0	...	5.4178
3	2018-01-01	서귀포시	대천동	37.0	20280	53858550	1593709	6475.0	137.0	6685.0	...	8.0043
4	2018-01-01	서귀포시	동홍동	49.0	45936	118701000	3501286	11569.0	642.0	11124.0	...	5.7715

5 rows × 39 columns

In [3]:
```
# 결측치 확인
df.isnull().sum()
```

Out[3]:
```
y_m                0
city               0
location           0
area_cnt           0
em_cnt             0
em_g               0
pay_amt            0
제주도민_여             0
외국인거주_여            0
제주도민_남             0
외국인거주_남            0
제주도민_60이상          0
제주도민_60미만          0
total_pop          0
패스트푸드_결제건수         0
패스트푸드_결제금액         0
간식_결제건수            0
간식_결제금액            0
농축수산물_결제건수         0
농축수산물_결제금액         0
마트/슈퍼마켓_결제건수       0
```

```
마트/슈퍼마켓_결제금액          0
식품_결제건수                0
식품_결제금액                0
배달_결제건수                0
배달_결제금액                0
식당_결제건수                0
식당_결제금액                0
풍속                       0
기온                       0
습도                       0
강수                       0
전국_누적확진자                 0
전국_월별확진자                 0
제주_누적확진자                 0
제주_월별확진자                 0
visit_pop_cnt          0
visit_pop_cnt_lf       0
visit_pop_cnt_sf       0
dtype: int64
```

In [4]:
```
# 결측치 0으로 처리
df = df.fillna(0)
```

In [5]:
```
# 시계열 부분 재설정
df['y_m'] = pd.to_datetime(df['y_m'],format='%Y%m')
df['year'] = df['y_m'].dt.year
```

In [6]:
```
# 정규화
scaler = MinMaxScaler()
scale_cols =  df.drop(columns=['y_m', 'city','location'], axis=1)
scale_cols[:] = scaler.fit_transform(scale_cols[:])
scale_cols
```

Out[6]:

	area_cnt	em_cnt	em_g	pay_amt	제주도민_여	외국인거주_여	제주도민_남	외국인거주_남	제주도민_60이상	제주_60
0	0.283133	0.056415	0.128689	0.128995	0.329521	0.147820	0.361258	0.178631	0.599266	0.286
1	0.198795	0.129141	0.175075	0.170545	0.235013	0.070214	0.251842	0.034641	0.315602	0.216
2	0.506024	0.060112	0.117831	0.118083	0.379767	0.500370	0.381668	0.351002	0.575097	0.349
3	0.192771	0.120808	0.163600	0.162038	0.229277	0.101256	0.246279	0.044658	0.255934	0.222
4	0.265060	0.275063	0.361806	0.357223	0.409653	0.474501	0.409814	0.260434	0.420587	0.405
...	...	...	...	...	...	...	...	...	...	
1661	0.493976	0.506085	0.449648	0.449399	0.586700	0.147820	0.592286	0.031302	0.840095	0.507
1662	0.819277	0.165612	0.194378	0.194523	0.439857	0.178862	0.479553	0.116444	0.732413	0.387
1663	0.397590	0.047162	0.081684	0.081838	0.160440	0.073910	0.170461	0.098915	0.371170	0.122
1664	0.644578	0.153113	0.251904	0.252345	0.366170	0.842572	0.401230	0.872287	0.697346	0.363
1665	0.475904	0.396225	0.337502	0.337244	0.433342	0.118995	0.444371	0.070534	0.519206	0.400

1666 rows × 37 columns

In [7]:
```
# 데이터셋 분리(시계열)

TEST_SIZE = 1512 # 3년 데이터
WINDOW_SIZE = 254 # 6개월 데이터

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

In [8]:
```
# 훈련데이터와 테스트데이터 분리에 사용할 함수 정의
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]:
```
((1193, 20, 37), (299, 20, 37))
```

In [10]:
```
# 데이터셋 형태 확인
test_feature = test[feature_cols]
test_label = test[label_cols]

test_feature.shape, test_label.shape
```

Out[10]:
```
((154, 37), (154, 1))
```

In [11]:
```
test_feature, test_label = make_dataset(test_feature, test_label, 20)
test_feature.shape, test_label.shape
```

Out[11]:
```
((134, 20, 37), (134, 1))
```

In [12]:
```
# tensorflow, keras 로드
import tensorflow as tf
from tensorflow import keras
```

In [13]:
```
# keras 모형 불러오기
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 진행
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
75/75 [==============================] - 3s 14ms/step - loss: 0.0514 - acc: 8.3822e-04
- val_loss: 0.0325 - val_acc: 0.0000e+00

Epoch 00001: val_loss improved from inf to 0.03253, saving model to model₩tmp_checkpoi
nt.h5
Epoch 2/200
75/75 [==============================] - 1s 9ms/step - loss: 0.0330 - acc: 8.3822e-04
- val_loss: 0.0304 - val_acc: 0.0000e+00

Epoch 00002: val_loss improved from 0.03253 to 0.03039, saving model to model₩tmp_chec
kpoint.h5
Epoch 3/200
75/75 [==============================] - 1s 17ms/step - loss: 0.0314 - acc: 8.3822e-04
- val_loss: 0.0289 - val_acc: 0.0000e+00

Epoch 00003: val_loss improved from 0.03039 to 0.02893, saving model to model₩tmp_chec
kpoint.h5
Epoch 4/200
75/75 [==============================] - 1s 10ms/step - loss: 0.0298 - acc: 8.3822e-04
- val_loss: 0.0267 - val_acc: 0.0000e+00

Epoch 00004: val_loss improved from 0.02893 to 0.02667, saving model to model₩tmp_chec
kpoint.h5
Epoch 5/200
75/75 [==============================] - 3s 45ms/step - loss: 0.0278 - acc: 8.3822e-04
- val_loss: 0.0247 - val_acc: 0.0000e+00

Epoch 00005: val_loss improved from 0.02667 to 0.02473, saving model to model₩tmp_chec
kpoint.h5
Epoch 6/200
75/75 [==============================] - 3s 44ms/step - loss: 0.0254 - acc: 8.3822e-04
- val_loss: 0.0230 - val_acc: 0.0000e+00

Epoch 00006: val_loss improved from 0.02473 to 0.02298, saving model to model₩tmp_chec
```

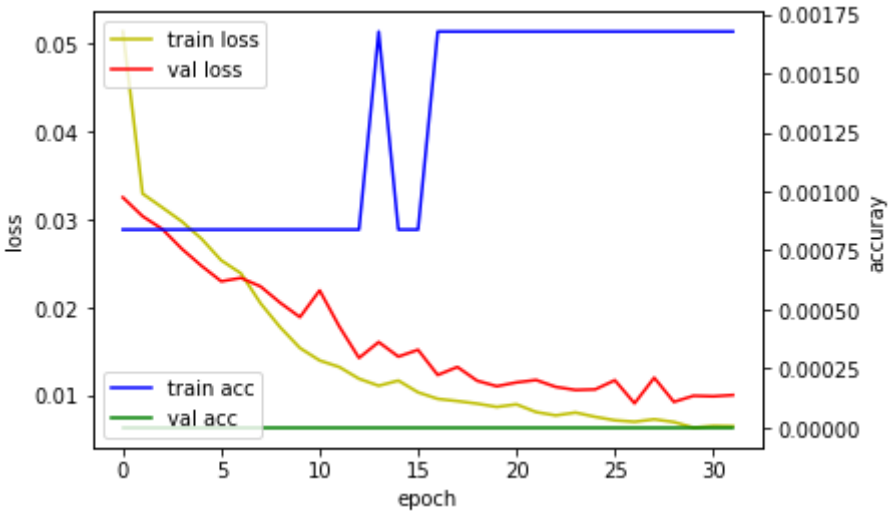
```
kpoint.h5
Epoch 7/200
75/75 [==============================] - 4s 48ms/step - loss: 0.0239 - acc: 8.3822e-04
- val_loss: 0.0234 - val_acc: 0.0000e+00

Epoch 00007: val_loss did not improve from 0.02298
Epoch 8/200
75/75 [==============================] - 3s 44ms/step - loss: 0.0205 - acc: 8.3822e-04
- val_loss: 0.0224 - val_acc: 0.0000e+00

Epoch 00008: val_loss improved from 0.02298 to 0.02239, saving model to model₩tmp_chec
kpoint.h5
Epoch 9/200
75/75 [==============================] - 4s 55ms/step - loss: 0.0177 - acc: 8.3822e-04
- val_loss: 0.0205 - val_acc: 0.0000e+00

Epoch 00009: val_loss improved from 0.02239 to 0.02053, saving model to model₩tmp_chec
kpoint.h5
Epoch 10/200
75/75 [==============================] - 4s 49ms/step - loss: 0.0154 - acc: 8.3822e-04
- val_loss: 0.0189 - val_acc: 0.0000e+00

Epoch 00010: val_loss improved from 0.02053 to 0.01890, saving model to model₩tmp_chec
kpoint.h5
Epoch 11/200
75/75 [==============================] - 4s 49ms/step - loss: 0.0140 - acc: 8.3822e-04
- val_loss: 0.0219 - val_acc: 0.0000e+00

Epoch 00011: val_loss did not improve from 0.01890
Epoch 12/200
75/75 [==============================] - 3s 36ms/step - loss: 0.0132 - acc: 8.3822e-04
- val_loss: 0.0178 - val_acc: 0.0000e+00

Epoch 00012: val_loss improved from 0.01890 to 0.01783, saving model to model₩tmp_chec
kpoint.h5
Epoch 13/200
75/75 [==============================] - 3s 43ms/step - loss: 0.0119 - acc: 8.3822e-04
- val_loss: 0.0143 - val_acc: 0.0000e+00

Epoch 00013: val_loss improved from 0.01783 to 0.01426, saving model to model₩tmp_chec
kpoint.h5
Epoch 14/200
75/75 [==============================] - 3s 45ms/step - loss: 0.0111 - acc: 0.0017 - v
al_loss: 0.0161 - val_acc: 0.0000e+00

Epoch 00014: val_loss did not improve from 0.01426
Epoch 15/200
75/75 [==============================] - 3s 38ms/step - loss: 0.0117 - acc: 8.3822e-04
- val_loss: 0.0144 - val_acc: 0.0000e+00

Epoch 00015: val_loss did not improve from 0.01426
Epoch 16/200
75/75 [==============================] - 3s 37ms/step - loss: 0.0103 - acc: 8.3822e-04
- val_loss: 0.0152 - val_acc: 0.0000e+00

Epoch 00016: val_loss did not improve from 0.01426
Epoch 17/200
75/75 [==============================] - 3s 34ms/step - loss: 0.0096 - acc: 0.0017 - v
al_loss: 0.0123 - val_acc: 0.0000e+00

Epoch 00017: val_loss improved from 0.01426 to 0.01232, saving model to model₩tmp_chec
kpoint.h5
Epoch 18/200
75/75 [==============================] - 1s 20ms/step - loss: 0.0093 - acc: 0.0017 - v
al_loss: 0.0132 - val_acc: 0.0000e+00
```

```
Epoch 00018: val_loss did not improve from 0.01232
Epoch 19/200
75/75 [==============================] - 2s 23ms/step - loss: 0.0091 - acc: 0.0017 - v
al_loss: 0.0117 - val_acc: 0.0000e+00

Epoch 00019: val_loss improved from 0.01232 to 0.01167, saving model to model₩tmp_chec
kpoint.h5
Epoch 20/200
75/75 [==============================] - 1s 20ms/step - loss: 0.0087 - acc: 0.0017 - v
al_loss: 0.0110 - val_acc: 0.0000e+00

Epoch 00020: val_loss improved from 0.01167 to 0.01104, saving model to model₩tmp_chec
kpoint.h5
Epoch 21/200
75/75 [==============================] - 2s 21ms/step - loss: 0.0090 - acc: 0.0017 - v
al_loss: 0.0115 - val_acc: 0.0000e+00

Epoch 00021: val_loss did not improve from 0.01104
Epoch 22/200
75/75 [==============================] - 2s 24ms/step - loss: 0.0081 - acc: 0.0017 - v
al_loss: 0.0117 - val_acc: 0.0000e+00

Epoch 00022: val_loss did not improve from 0.01104
Epoch 23/200
75/75 [==============================] - 2s 26ms/step - loss: 0.0077 - acc: 0.0017 - v
al_loss: 0.0110 - val_acc: 0.0000e+00

Epoch 00023: val_loss improved from 0.01104 to 0.01096, saving model to model₩tmp_chec
kpoint.h5
Epoch 24/200
75/75 [==============================] - 2s 23ms/step - loss: 0.0080 - acc: 0.0017 - v
al_loss: 0.0106 - val_acc: 0.0000e+00

Epoch 00024: val_loss improved from 0.01096 to 0.01061, saving model to model₩tmp_chec
kpoint.h5
Epoch 25/200
75/75 [==============================] - 2s 25ms/step - loss: 0.0076 - acc: 0.0017 - v
al_loss: 0.0107 - val_acc: 0.0000e+00

Epoch 00025: val_loss did not improve from 0.01061
Epoch 26/200
75/75 [==============================] - 2s 31ms/step - loss: 0.0072 - acc: 0.0017 - v
al_loss: 0.0117 - val_acc: 0.0000e+00

Epoch 00026: val_loss did not improve from 0.01061
Epoch 27/200
75/75 [==============================] - 2s 27ms/step - loss: 0.0070 - acc: 0.0017 - v
al_loss: 0.0091 - val_acc: 0.0000e+00

Epoch 00027: val_loss improved from 0.01061 to 0.00909, saving model to model₩tmp_chec
kpoint.h5
Epoch 28/200
75/75 [==============================] - 3s 36ms/step - loss: 0.0073 - acc: 0.0017 - v
al_loss: 0.0120 - val_acc: 0.0000e+00

Epoch 00028: val_loss did not improve from 0.00909
Epoch 29/200
75/75 [==============================] - 2s 29ms/step - loss: 0.0070 - acc: 0.0017 - v
al_loss: 0.0093 - val_acc: 0.0000e+00

Epoch 00029: val_loss did not improve from 0.00909
Epoch 30/200
75/75 [==============================] - 2s 24ms/step - loss: 0.0063 - acc: 0.0017 - v
al_loss: 0.0100 - val_acc: 0.0000e+00
```

```
Epoch 00030: val_loss did not improve from 0.00909
Epoch 31/200
75/75 [==============================] - 2s 21ms/step - loss: 0.0065 - acc: 0.0017 - v
al_loss: 0.0099 - val_acc: 0.0000e+00

Epoch 00031: val_loss did not improve from 0.00909
Epoch 32/200
75/75 [==============================] - 1s 15ms/step - loss: 0.0065 - acc: 0.0017 - v
al_loss: 0.0100 - val_acc: 0.0000e+00

Epoch 00032: val_loss did not improve from 0.00909
```

In [15]:

```
# 훈련 및 검증 loss, 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_m.png')
```



In [16]:

```
# 모델 로드 및 예측
model.load_weights(filename)
pred = model.predict(test_feature)

pred.shape
```

Out[16]:

```
(134, 1)
```

In [17]:

```
# 예측 그래프 확인
plt.figure(figsize=(12, 9))
plt.plot(test_label, label = 'actual')
plt.plot(pred, label = 'prediction')
```

```
plt.legend()
plt.savefig('rnn_p_m.png')
```