RNN

```
import numpy as np
import pandas as pd

import torch
from torch.autograd import Variable

import matplotlib.pyplot as plt
import os

import sklearn.preprocessing
import datetime
```

```
device = torch.device("cuda:0" if torch.cuda.is_available() else "cpu")
```

Fundamental data

```
data_url = 'https://bitbucket.org/hyuk125/lg_dic/raw/12b61c0c3c223378d52ae530c
data = pd.read_csv(data_url, index_col=0)
data.head()
```

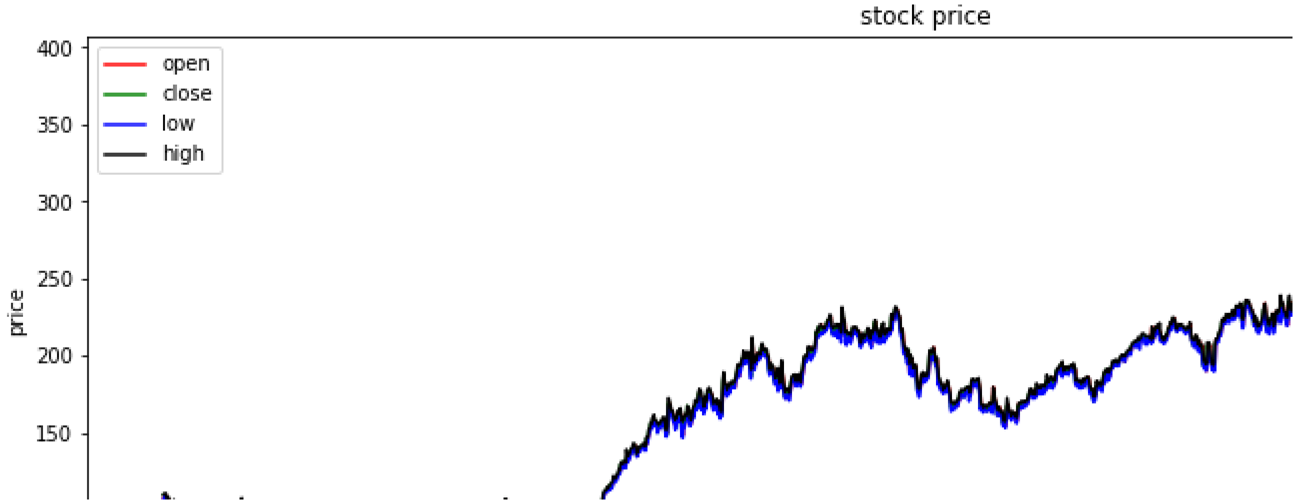
	symbol	open	close	low	high	volume
date						
2016-01-05	WLTW	123.430000	125.839996	122.309998	126.250000	2163600.0
2016-01-06	WLTW	125.239998	119.980003	119.940002	125.540001	2386400.0
2016-01-07	WLTW	116.379997	114.949997	114.930000	119.739998	2489500.0
2016-01-08	WLTW	115.480003	116.620003	113.500000	117.440002	2006300.0
2016-01-11	WLTW	117.010002	114.970001	114.089996	117.330002	1408600.0

```
print('₩nnumber of different stocks: ', len(list(set(data.symbol))))
print(list(set(data.symbol))[:10])
```

```
number of different stocks:  501
['SJM', 'HBI', 'NKE', 'KHC', 'ROP', 'SNI', 'SWN', 'RAI', 'DHR', 'SRCL']
```

```
plt.figure(figsize=(15, 5));
plt.plot(data[data.symbol == 'EQIX'].open.values, color='red', label='open')
plt.plot(data[data.symbol == 'EQIX'].close.values, color='green', label='close
plt.plot(data[data.symbol == 'EQIX'].low.values, color='blue', label='low')
plt.plot(data[data.symbol == 'EQIX'].high.values, color='black', label='high')
plt.plot(data[data.symbol == 'EQIX'].high.values, color='black', label='high')
plt.title('stock price')
plt.xlabel('time [days]')
plt.ylabel('price')
plt.legend(loc='best')
plt.show()


```



Preprocessing - minmax normalize

```
def normalize_data(data):
    min_max_scaler = sklearn.preprocessing.MinMaxScaler()
    data['open'] = min_max_scaler.fit_transform(data.open.values.reshape(-1,1)
    data['high'] = min_max_scaler.fit_transform(data.high.values.reshape(-1,1)
    data['low'] = min_max_scaler.fit_transform(data.low.values.reshape(-1,1))
    data['close'] = min_max_scaler.fit_transform(data.close.values.reshape(-1,
    return data
```

```
data_norm = normalize_data(data[data.symbol=='EQIX'].copy())
data_norm.drop(['symbol'],1,inplace=True)
data_norm.drop(['volume'],1,inplace=True)
```

```
data_norm
```

	open	close	low	high
date				
2010-01-04	0.109250	0.122904	0.117440	0.110911
2010-01-05	0.118896	0.119708	0.123361	0.110816
2010-01-06	0.116886	0.122810	0.122855	0.113912
2010-01-07	0.117828	0.115791	0.117852	0.113217
2010-01-08	0.110130	0.114161	0.115509	0.103519

Train Test split

Making sliding window data

2016-12-28 0.896971 0.888471 0.899278 0.900430

```
data_norm_raw = data_norm.values.astype(float)
```

2016-12-30 0.899893 0.899596 0.899436 0.896607

```
data_norm_raw
```

```
array([[0.10925029, 0.12290433, 0.11744033, 0.11091105],
       [0.11889648, 0.11970795, 0.12336141, 0.11081625],
       [0.11688555, 0.12281032, 0.1228548 , 0.11391205],
       ...,
       [0.896971  , 0.88847098, 0.89927808, 0.90042956],
       [0.88503112, 0.89859292, 0.89440195, 0.89847102],
       [0.89989312, 0.89959573, 0.89943645, 0.89660725]])
```

```
sliding_data = []
window_size = 20
for index in range(len(data_norm_raw) - window_size):
    sliding_data.append(data_norm_raw[index : index + window_size])

sliding_data = torch.FloatTensor(sliding_data)
```

```
sliding_data.shape
```

```
torch.Size([1742, 20, 4])
```

Split train/test, make batch data

```
from sklearn.model_selection import train_test_split

train, test = train_test_split(sliding_data, test_size=0.2, shuffle=False)
```

```
batch_size=50
```

```
trainloader = torch.utils.data.DataLoader(train, batch_size=batch_size, shuffl
trainloader = torch.utils.data.DataLoader(train, batch_size=batch_size, shuffl
```

Define Model

```
import torch.nn as nn
```

```
rnn_hidden = 20
rnn_layers = 2
intput_features = train.size(2)
output_features = test.size(2)
```

```
class Net(nn.Module):
    def __init__(self):
        super(Net, self).__init__()

        self.rnn = nn.RNN(input_size=intput_features, hidden_size=rnn_hidden,
        self.fc = nn.Linear(rnn_hidden, output_features)

    def forward(self, x):
        h0 = torch.zeros(rnn_layers, x.size(0), rnn_hidden).to(device)

        out, hn = self.rnn(x, h0)
        out = self.fc(out[:, -1, :]) # many to one solution

        return out


net = Net()
net.to(device)
```

```
Net(
  (rnn): RNN(4, 20, num_layers=2, batch_first=True)
  (fc): Linear(in_features=20, out_features=4, bias=True)
)
```

Learning the model

```
learning_rate = 0.001
epochs = 1000
```

```
import torch.optim as optim

criterion = nn.MSELoss().to(device)
optimizer = optim.Adam(net.parameters(), lr = learning_rate)
```

```
for epoch in range(epochs):
    running_cost = 0.0
    running_cost = 0.0

    for step, (batch_data) in enumerate(trainloader):
        batch_x = batch_data[:, :-1, :].float().to(device)
        batch_y = batch_data[:, -1, :].to(device)

        outputs = net(batch_x)
        cost = criterion(outputs, batch_y)

        optimizer.zero_grad()

        cost.backward()
        optimizer.step()

        running_cost += cost.item()
        if step % 10 == 0:
            print('[%d, %5d] cost: %.3f' % (epoch + 1, step + 1, running_cost)
            running_cost = 0.0

```

Trace

```
X_test = test[:, :-1, :].float().to(device)
y_test = test[:, -1, :].view(-1, 1, output_features).to(device)
```

```
X_test.shape, y_test.shape
```

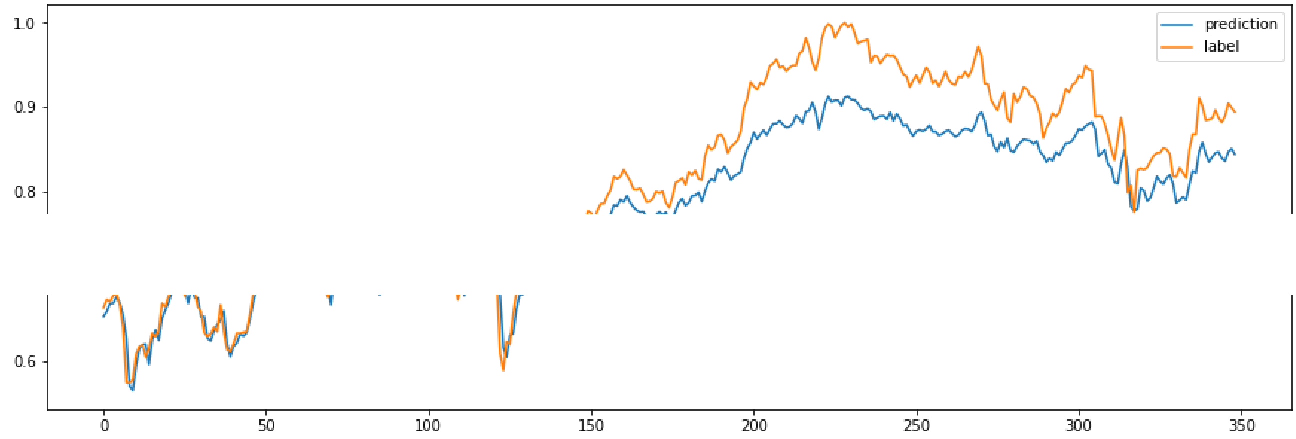
```
(torch.Size([349, 19, 4]), torch.Size([349, 1, 4]))
```

```
y_predict = net(X_test).cpu()
```

```
y_predict.shape
```

```
torch.Size([349, 4])
```

```
value = 2 # 0 = open, 1 = close, 2 = highest, 3 = lowest
with torch.no_grad():
    plt.figure(figsize=[15, 5])
    plt.plot(y_predict[:,value], label='prediction')
    plt.plot(y_test[:, 0, value].cpu(), label='label')
    plt.legend()
```



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