RNN_timeseries1

May 9, 2021

Recurrent Neural Network (RNN)

Import Libraries

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt

import tensorflow as tf
from scipy.spatial.distance import cdist

from keras.models import Sequential
from keras.layers import Dense
from keras.layers import LSTM
from keras import optimizers
import keras

import warnings
warnings.filterwarnings('ignore')
```

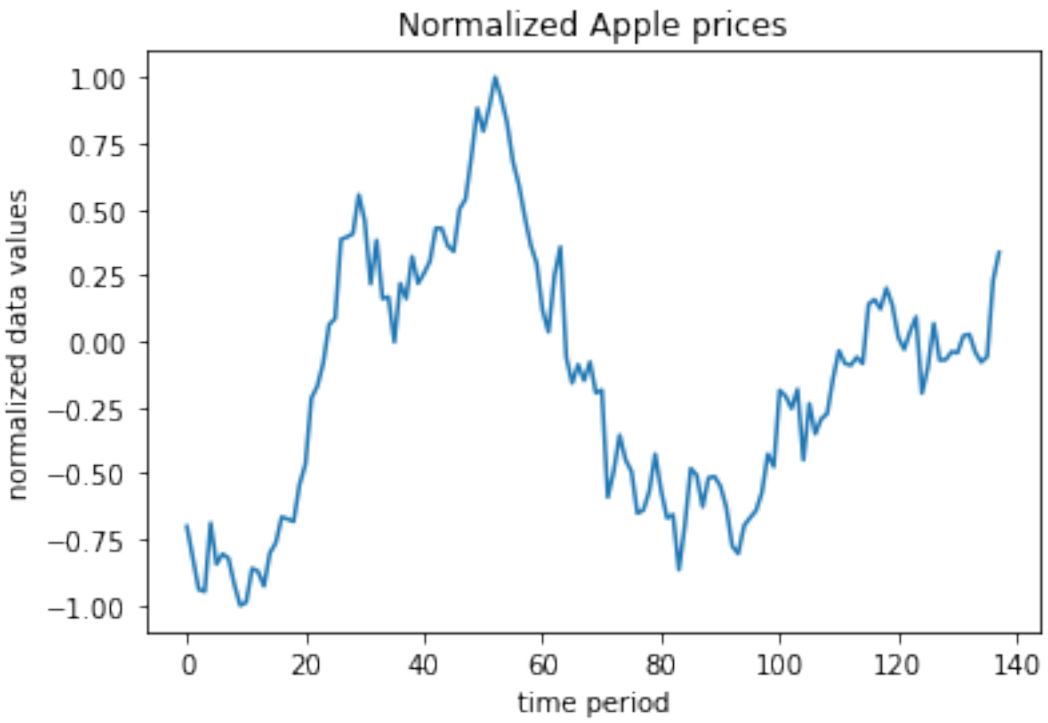
Load the dataset

[2]:
```
### load in and normalize the dataset
dataset = np.loadtxt('/home/jayanthikishore/Downloads/ML_classwork/Week5_srrt/
 ↪normalized_apple_prices.csv')
# dataset = pd.read_csv('/Downloads/ML_classwork/Week5_srrt/
 ↪normalized_apple_prices.csv')
```

How it bahaves the normalized datasets

[3]:
```
plt.plot(dataset)
plt.xlabel('time period')
plt.ylabel('normalized data values')
plt.title('Normalized Apple prices')
```

[3]:
```
Text(0.5, 1.0, 'Normalized Apple prices')
```



Transform window size to time series pairs

[4]:
```
def transform_win_series(series,win_size):
    # containers for input/output pairs
    X = []
    y = []

    # For the series, loop through the series minus the window size.
    for i in range(win_size, len(series)):
        X.append(series[i - win_size:i])  # insert our inputs into the input␣
↪array
        y.append(series[i]) # insert our output pairs into the output array


    # reshape each
    X = np.asarray(X)
    X.shape = (np.shape(X)[0:2])
    y = np.asarray(y)
    y.shape = (len(y),1)

    return X,y

odd_nums = np.array([1,3,5,7,9,11,13,15,17])
```

```
wind_size = 2
X,y = transform_win_series(odd_nums,wind_size)
print ('the shape of X is ' + str(np.shape(X)))
print ('the shape of y is ' + str(np.shape(y)))
print('X type:',type(X))
print('y tupe:',type(y))
```

```
the shape of X is (7, 2)
the shape of y is (7, 1)
X type: <class 'numpy.ndarray'>
y tupe: <class 'numpy.ndarray'>
```

Splitting the data into train and test

[5]:
```
wind_size = len(odd_nums)
X,y = transform_win_series(series = dataset,win_size = wind_size)
print(X.shape, y.shape)
```

```
(129, 9) (129, 1)
```

[6]:
```
# split our dataset into training / testing sets
train_test_split = int(np.ceil(2*len(y)/float(3)))   # set the split point

# partition the training set
X_train = X[:train_test_split,:]
y_train = y[:train_test_split]

# keep the last chunk for testing
X_test = X[train_test_split:,:]
y_test = y[train_test_split:]

# NOTE: to use keras's RNN LSTM module our input must be reshaped to [samples,␣
 ↪window size, stepsize]
X_train = np.asarray(np.reshape(X_train, (X_train.shape[0], wind_size, 1)))
X_test = np.asarray(np.reshape(X_test, (X_test.shape[0], wind_size, 1)))
```

Build RNN regression model

- layer 1 uses an LSTM module with 5 hidden units (note here the input_shape = (window_size,1))
- layer 2 uses a fully connected module with one unit
- the 'mean_squared_error' loss should be used (remember: we are performing regression here)

[7]:
```
np.random.seed(0)
step_size = 1

##### build an RNN to perform regression on our time series input/output data
```

```
model = Sequential()

###### Layer1 add a LSTM layer with 5 hidden units and shape of (window_size, 1)
model.add(LSTM(5, input_shape=(wind_size, step_size)))

###### Layer2 Dense layer with 1 output node and linear activation function
model.add(Dense(step_size, input_dim=wind_size, activation='linear'))

##### Optimizer
###### https://keras.io/getting-started/sequential-model-guide/
opt = keras.optimizers.RMSprop(lr=0.001, rho=0.9, epsilon=1e-08, decay=0.0)

###### compile the model
model.compile(loss='mean_squared_error', optimizer=opt)
```

Run the model

[8]:
```
# model.fit(X_train, y_train, epochs=100, batch_size=50, verbose=0)
model.fit(X_train, y_train, epochs=1000, batch_size=100, verbose=0)
```

[8]:
```
<tensorflow.python.keras.callbacks.History at 0x7f051c39a310>
```

Model performance

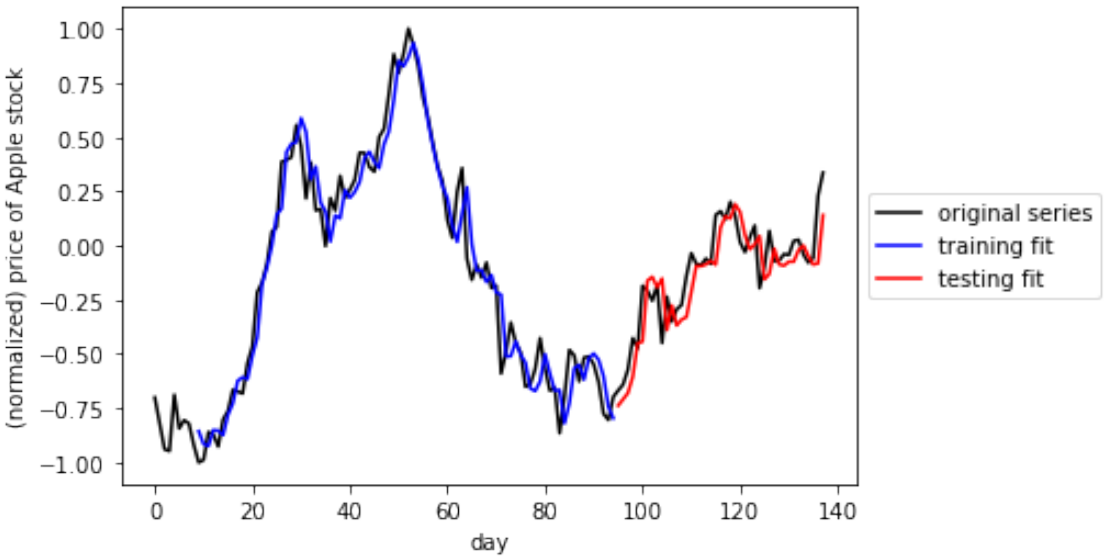
[9]:
```
# generate predictions for training
train_predict = model.predict(X_train)
test_predict = model.predict(X_test)
```

[10]:
```
# print out training and testing errors
training_error = model.evaluate(X_train, y_train, verbose=0)
print('training error = ' + str(training_error))

testing_error = model.evaluate(X_test, y_test, verbose=0)
print('testing error = ' + str(testing_error))
```

```
training error = 0.014836924150586128
testing error = 0.016076071187853813
```

[11]:
```
### Plot everything - the original series as well as predictions on training␣
 ↪and testing sets
import matplotlib.pyplot as plt
%matplotlib inline

# plot original series
plt.plot(dataset,color = 'k')

# plot training set prediction
```

```
splt_pnts = train_test_split + wind_size
plt.plot(np.arange(wind_size,splt_pnts,1),train_predict,color = 'b')

# plot testing set prediction

plt.plot(np.arange(splt_pnts,splt_pnts +␣
 ↪len(test_predict),1),test_predict,color = 'r')

# pretty up graph
plt.xlabel('day')
plt.ylabel('(normalized) price of Apple stock')
plt.legend(['original series','training fit','testing fit'],loc='center left',␣
 ↪bbox_to_anchor=(1, 0.5))
plt.show()
```



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