DSE RRN

December 22, 2018

In [32]:
```
import pandas as pd
from keras.layers.core import Dense, Dropout
from keras.layers.recurrent import GRU
from keras.models import Sequential, load_model
import matplotlib.pyplot as plt
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import MinMaxScaler
import matplotlib.dates as mdates
```

In [46]:
```
square_stock = pd.read_csv('N:/Stock Prediction project/DSE3/ACI.csv')
square_stock
```

Out[46]:

	Date	Open	Highest_Price	Lowest_Price	Close_Price	Volume
0	1999-01-02	31.0	31.5	30.6	30.6	9400
1	1999-01-03	30.5	30.6	30.4	30.5	14850
2	1999-01-04	30.4	30.6	30.2	30.2	10500
3	1999-01-05	30.2	30.2	30.0	30.1	10200
4	1999-01-06	30.2	30.2	28.0	28.5	45500
5	1999-01-07	28.0	28.0	27.0	27.7	53400
6	1999-01-09	26.2	26.7	26.0	26.3	56950
7	1999-01-10	26.5	27.1	26.0	26.2	46500
8	1999-01-11	26.8	26.8	26.0	26.2	27650
9	1999-01-12	26.1	26.5	26.0	26.3	24350
10	1999-01-13	26.4	26.8	26.3	26.5	31300
11	1999-01-14	26.7	26.7	26.4	26.7	26250
12	1999-01-23	26.7	27.5	26.7	27.3	46750
13	1999-01-24	27.5	28.4	27.4	28.0	75050
14	1999-01-25	28.2	28.9	28.2	28.6	44850
15	1999-01-27	28.8	29.7	28.7	29.1	78750
16	1999-01-28	29.2	29.8	29.2	29.3	65800
17	1999-01-30	29.0	29.4	28.7	28.7	32550
18	1999-01-31	28.5	28.5	27.9	27.9	18200
19	1999-02-01	27.3	28.0	27.3	27.8	13900
20	1999-02-02	28.2	28.2	27.7	27.8	16500
21	1999-02-03	28.0	28.0	27.7	27.7	18200
22	1999-02-04	27.6	27.7	27.1	27.2	28750
23	1999-02-06	27.2	27.4	27.0	27.0	16500

24	1999-02-07	26.9	27.1	26.8	26.9	13000
25	1999-02-08	27.0	27.4	26.8	27.0	10700
26	1999-02-13	27.0	27.4	27.0	27.2	6950
27	1999-02-14	27.3	27.8	27.1	27.5	16200
28	1999-02-15	27.5	27.6	27.3	27.3	13450
29	1999-02-16	27.4	27.8	27.4	27.5	15450
...	...	...	...	...	...	...
4899	2018-10-24	346.3	349.9	345.2	348.5	10451
4900	2018-10-25	354.7	355.0	346.0	347.7	18286
4901	2018-10-28	354.9	355.0	338.2	344.5	36902
4902	2018-10-29	345.0	354.9	345.0	349.5	31422
4903	2018-10-30	353.5	353.5	346.0	348.6	16996
4904	2018-10-31	348.7	350.9	347.0	349.6	22448
4905	2018-11-01	351.6	351.6	349.1	350.2	30276
4906	2018-11-04	351.0	352.9	350.0	351.8	31925
4907	2018-11-05	352.0	352.1	348.1	351.4	28171
4908	2018-11-06	352.2	352.2	350.0	351.6	27668
4909	2018-11-07	352.0	353.8	351.2	353.2	54090
4910	2018-11-08	355.0	364.9	348.1	360.4	27052
4911	2018-11-11	364.0	364.0	355.5	357.4	46864
4912	2018-11-12	355.0	355.0	341.1	353.0	43255
4913	2018-11-13	350.2	353.0	348.0	350.9	26199
4914	2018-11-14	349.0	359.9	349.0	356.7	50270
4915	2018-11-18	341.0	341.0	331.3	336.9	40153
4916	2018-11-19	336.1	336.9	331.5	332.7	32633
4917	2018-11-20	337.5	348.9	332.0	335.7	38049
4918	2018-11-22	338.0	340.0	335.0	335.9	29234
4919	2018-11-25	336.9	337.9	334.0	334.3	20899
4920	2018-11-26	334.3	334.3	331.1	331.9	30661
4921	2018-11-27	331.9	335.0	330.0	331.6	16871
4922	2018-11-28	331.6	332.9	330.1	330.2	18752
4923	2018-11-29	330.5	331.9	324.6	325.2	21778
4924	2018-12-02	326.1	330.0	321.1	321.8	16130
4925	2018-12-03	326.5	326.5	322.1	324.2	14788
4926	2018-12-04	324.2	325.0	323.0	324.3	10616
4927	2018-12-05	324.3	327.8	324.0	326.3	13308
4928	2018-12-06	326.5	328.9	323.0	324.9	18219

[4929 rows x 6 columns]

In [47]:
```
# square_stock = square_stock.drop(['#'],axis=1)
#Preparing andropping columns
# square_stock = square_stock.drop('TRADING CODE', axis=1)
# square_stock = square_stock.drop('LTP*', axis=1)
# square_stock = square_stock.drop('YCP', axis=1)
# square_stock = square_stock.drop('TRADE', axis=1)
# square_stock = square_stock.drop('VALUE (mn)', axis=1)
square_stock = square_stock.drop('Volume', axis=1)
```

```
In [48]: from datetime import datetime

In [49]: square_stock.reset_index(drop=True)
         square_stock
```

Out[49]:

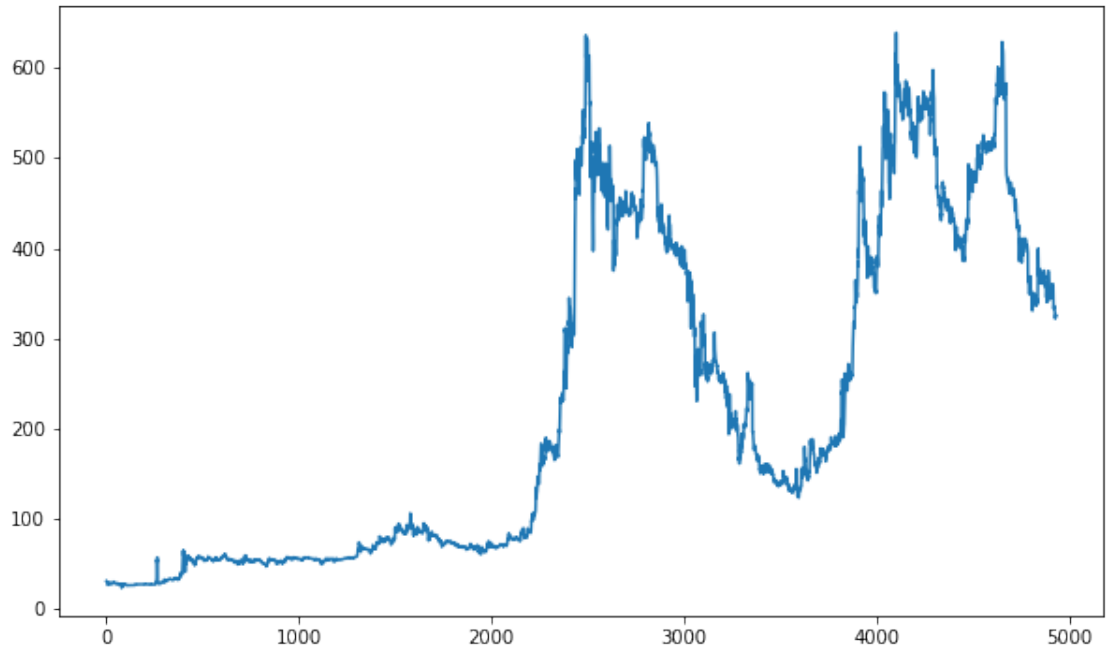
	Date	Open	Highest_Price	Lowest_Price	Close_Price
0	1999-01-02	31.0	31.5	30.6	30.6
1	1999-01-03	30.5	30.6	30.4	30.5
2	1999-01-04	30.4	30.6	30.2	30.2
3	1999-01-05	30.2	30.2	30.0	30.1
4	1999-01-06	30.2	30.2	28.0	28.5
5	1999-01-07	28.0	28.0	27.0	27.7
6	1999-01-09	26.2	26.7	26.0	26.3
7	1999-01-10	26.5	27.1	26.0	26.2
8	1999-01-11	26.8	26.8	26.0	26.2
9	1999-01-12	26.1	26.5	26.0	26.3
10	1999-01-13	26.4	26.8	26.3	26.5
11	1999-01-14	26.7	26.7	26.4	26.7
12	1999-01-23	26.7	27.5	26.7	27.3
13	1999-01-24	27.5	28.4	27.4	28.0
14	1999-01-25	28.2	28.9	28.2	28.6
15	1999-01-27	28.8	29.7	28.7	29.1
16	1999-01-28	29.2	29.8	29.2	29.3
17	1999-01-30	29.0	29.4	28.7	28.7
18	1999-01-31	28.5	28.5	27.9	27.9
19	1999-02-01	27.3	28.0	27.3	27.8
20	1999-02-02	28.2	28.2	27.7	27.8
21	1999-02-03	28.0	28.0	27.7	27.7
22	1999-02-04	27.6	27.7	27.1	27.2
23	1999-02-06	27.2	27.4	27.0	27.0
24	1999-02-07	26.9	27.1	26.8	26.9
25	1999-02-08	27.0	27.4	26.8	27.0
26	1999-02-13	27.0	27.4	27.0	27.2
27	1999-02-14	27.3	27.8	27.1	27.5
28	1999-02-15	27.5	27.6	27.3	27.3
29	1999-02-16	27.4	27.8	27.4	27.5
...	...	...	...	...	...
4899	2018-10-24	346.3	349.9	345.2	348.5
4900	2018-10-25	354.7	355.0	346.0	347.7
4901	2018-10-28	354.9	355.0	338.2	344.5
4902	2018-10-29	345.0	354.9	345.0	349.5
4903	2018-10-30	353.5	353.5	346.0	348.6
4904	2018-10-31	348.7	350.9	347.0	349.6
4905	2018-11-01	351.6	351.6	349.1	350.2
4906	2018-11-04	351.0	352.9	350.0	351.8
4907	2018-11-05	352.0	352.1	348.1	351.4
4908	2018-11-06	352.2	352.2	350.0	351.6
4909	2018-11-07	352.0	353.8	351.2	353.2

4910	2018-11-08	355.0	364.9	348.1	360.4
4911	2018-11-11	364.0	364.0	355.5	357.4
4912	2018-11-12	355.0	355.0	341.1	353.0
4913	2018-11-13	350.2	353.0	348.0	350.9
4914	2018-11-14	349.0	359.9	349.0	356.7
4915	2018-11-18	341.0	341.0	331.3	336.9
4916	2018-11-19	336.1	336.9	331.5	332.7
4917	2018-11-20	337.5	348.9	332.0	335.7
4918	2018-11-22	338.0	340.0	335.0	335.9
4919	2018-11-25	336.9	337.9	334.0	334.3
4920	2018-11-26	334.3	334.3	331.1	331.9
4921	2018-11-27	331.9	335.0	330.0	331.6
4922	2018-11-28	331.6	332.9	330.1	330.2
4923	2018-11-29	330.5	331.9	324.6	325.2
4924	2018-12-02	326.1	330.0	321.1	321.8
4925	2018-12-03	326.5	326.5	322.1	324.2
4926	2018-12-04	324.2	325.0	323.0	324.3
4927	2018-12-05	324.3	327.8	324.0	326.3
4928	2018-12-06	326.5	328.9	323.0	324.9

[4929 rows x 5 columns]

In [50]:
```
plt.figure(figsize=(10,6))
square_stock['Close_Price'].plot()
```

Out[50]: <matplotlib.axes._subplots.AxesSubplot at 0x1c9654b4198>



```
In [51]: #Preaparing Labels
         square_shift = square_stock.shift(-1)
         label = square_shift['Close_Price']

In [52]: label

Out[52]: 0        30.5
         1        30.2
         2        30.1
         3        28.5
         4        27.7
         5        26.3
         6        26.2
         7        26.2
         8        26.3
         9        26.5
         10       26.7
         11       27.3
         12       28.0
         13       28.6
         14       29.1
         15       29.3
         16       28.7
         17       27.9
         18       27.8
         19       27.8
         20       27.7
         21       27.2
         22       27.0
         23       26.9
         24       27.0
         25       27.2
         26       27.5
         27       27.3
         28       27.5
         29       27.6
                 ...
         4899    347.7
         4900    344.5
         4901    349.5
         4902    348.6
         4903    349.6
         4904    350.2
         4905    351.8
         4906    351.4
         4907    351.6
         4908    353.2
         4909    360.4
```

```
4910    357.4
4911    353.0
4912    350.9
4913    356.7
4914    336.9
4915    332.7
4916    335.7
4917    335.9
4918    334.3
4919    331.9
4920    331.6
4921    330.2
4922    325.2
4923    321.8
4924    324.2
4925    324.3
4926    326.3
4927    324.9
4928      NaN
Name: Close_Price, Length: 4929, dtype: float64
```

```
In [54]: # adjusting the shape of both for NaN
         square_stock.drop(square_stock.index[len(square_stock)-1], axis=0, inplace=True)
         label.drop(label.index[len(label)-1], axis=0, inplace=True)
         square_stock = square_stock.drop('Date', axis=1)
```

```
In [55]: trainX = square_stock.loc[100:]
         testX = square_stock.loc[:100]
         trainY = label.loc[100:]
         testY = label.loc[:100]
```

```
trainX
```

Out[55]:

	Open	Highest_Price	Lowest_Price	Close_Price
100	26.2	26.5	26.2	26.4
101	26.4	26.4	26.3	26.3
102	26.4	26.4	25.9	26.0
103	26.3	26.3	26.2	26.2
104	26.0	26.2	25.9	26.0
105	26.0	26.2	25.9	26.0
106	26.2	26.2	26.0	26.1
107	26.1	26.1	26.0	26.0
108	26.0	26.2	25.9	26.0
109	26.0	26.1	25.9	25.9
110	25.9	25.9	25.5	25.6
111	25.4	25.9	25.3	25.6

112	25.9	25.9	25.6	25.7
113	25.6	25.8	25.5	25.6
114	25.7	26.0	25.7	25.9
115	26.3	26.3	26.0	26.0
116	26.0	26.1	25.9	25.9
117	26.0	26.0	25.9	25.9
118	26.0	26.0	25.8	25.8
119	25.9	25.9	25.8	25.8
120	26.0	26.0	25.8	25.9
121	25.9	25.9	25.7	25.7
122	25.6	25.9	25.6	25.7
123	26.0	26.0	25.7	25.8
124	25.9	25.9	25.5	25.7
125	25.9	26.0	25.8	25.8
126	25.6	25.9	25.6	25.8
127	25.9	25.9	25.7	25.8
128	25.8	25.9	25.7	25.7
129	25.8	25.9	25.8	25.8
...	...	...	...	...
4897	346.1	350.8	342.6	343.8
4898	344.2	346.6	342.1	343.4
4899	346.3	349.9	345.2	348.5
4900	354.7	355.0	346.0	347.7
4901	354.9	355.0	338.2	344.5
4902	345.0	354.9	345.0	349.5
4903	353.5	353.5	346.0	348.6
4904	348.7	350.9	347.0	349.6
4905	351.6	351.6	349.1	350.2
4906	351.0	352.9	350.0	351.8
4907	352.0	352.1	348.1	351.4
4908	352.2	352.2	350.0	351.6
4909	352.0	353.8	351.2	353.2
4910	355.0	364.9	348.1	360.4
4911	364.0	364.0	355.5	357.4
4912	355.0	355.0	341.1	353.0
4913	350.2	353.0	348.0	350.9
4914	349.0	359.9	349.0	356.7
4915	341.0	341.0	331.3	336.9
4916	336.1	336.9	331.5	332.7
4917	337.5	348.9	332.0	335.7
4918	338.0	340.0	335.0	335.9
4919	336.9	337.9	334.0	334.3
4920	334.3	334.3	331.1	331.9
4921	331.9	335.0	330.0	331.6
4922	331.6	332.9	330.1	330.2
4923	330.5	331.9	324.6	325.2
4924	326.1	330.0	321.1	321.8
4925	326.5	326.5	322.1	324.2

```
         4926  324.2          325.0         323.0        324.3

         [4827 rows x 4 columns]
```

```
In [56]: # conversion to numpy array x-Features y-labels
         x, y = square_stock.values, label.values
```

```
In [57]: y
```

```
Out[57]: array([ 30.5,  30.2,  30.1, ..., 324.2, 324.3, 326.3])
```

```
In [58]: # scaling values for model
         x_scale = MinMaxScaler()
         y_scale = MinMaxScaler()
```

```
In [59]: X = x_scale.fit_transform(x)
         Y = y_scale.fit_transform(y.reshape(-1,1))
```

```
In [60]: # splitting train and test
         X_train, X_test, y_train, y_test = train_test_split(X, Y, test_size=0.33)
         X_train = X_train.reshape((-1,1,4))
         X_test = X_test.reshape((-1,1,4))

         print('x_train shape:',X_train.shape)
         print('Number of samples in x_train', X_train.shape[0])
         print('Number of samples in x_test', X_test.shape[0])

         print('Y_train shape:',y_train.shape)
```

```
x_train shape: (3301, 1, 4)
Number of samples in x_train 3301
Number of samples in x_test 1626
Y_train shape: (3301, 1)
```

```
In [61]: model_name = 'stock_price_Square'
```

```
In [62]: model = Sequential()
         model.add(GRU(units=512,return_sequences=True,input_shape=(1, 4)))
         model.add(Dropout(0.2))
         model.add(GRU(units=256))
         model.add(Dropout(0.2))
         model.add(Dense(1, activation='sigmoid'))
         model.compile(loss='mse', optimizer='adam', metrics=['mse', 'mae', 'mape', 'cosine'])
```

```
In [63]: history = model.fit(X_train,y_train,batch_size=100, epochs=100, validation_split=0.1,
         # plot metrics
         plt.plot(history.history['mean_squared_error'],'r')
         plt.plot(history.history['mean_absolute_error'],'g')
```

```
        plt.plot(history.history['mean_absolute_percentage_error'],'b')
        plt.plot(history.history['cosine_proximity'],'c')
        plt.show()

        model.save("{}.h5".format(model_name))
        print('MODEL-SAVED')
```

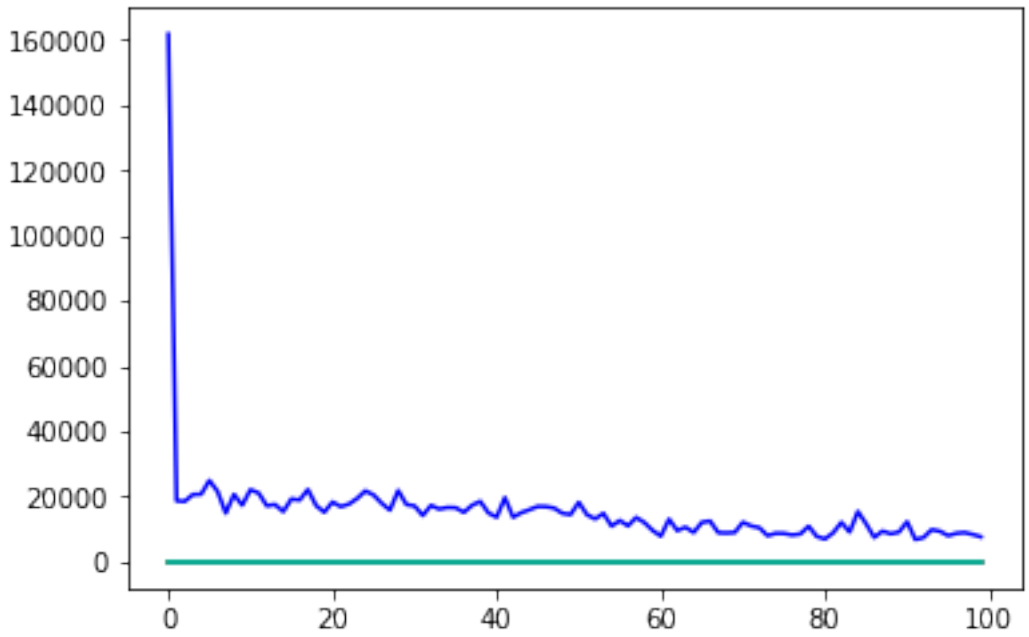
```
Train on 2970 samples, validate on 331 samples
Epoch 1/100
2970/2970 [==============================] - 3s 1ms/step - loss: 0.0596 - mean_squared_error: 
Epoch 2/100
2970/2970 [==============================] - 1s 429us/step - loss: 0.0028 - mean_squared_error
Epoch 3/100
2970/2970 [==============================] - 1s 449us/step - loss: 0.0014 - mean_squared_error
Epoch 4/100
2970/2970 [==============================] - 1s 440us/step - loss: 0.0012 - mean_squared_error
Epoch 5/100
2970/2970 [==============================] - 1s 435us/step - loss: 0.0012 - mean_squared_error
Epoch 6/100
2970/2970 [==============================] - 1s 439us/step - loss: 0.0011 - mean_squared_error
Epoch 7/100
2970/2970 [==============================] - 1s 448us/step - loss: 0.0010 - mean_squared_error
Epoch 8/100
2970/2970 [==============================] - 1s 426us/step - loss: 0.0010 - mean_squared_error
Epoch 9/100
2970/2970 [==============================] - 1s 457us/step - loss: 9.7705e-04 - mean_squared_er
Epoch 10/100
2970/2970 [==============================] - 1s 449us/step - loss: 9.7537e-04 - mean_squared_er
Epoch 11/100
2970/2970 [==============================] - 2s 547us/step - loss: 9.5054e-04 - mean_squared_er
Epoch 12/100
2970/2970 [==============================] - 2s 622us/step - loss: 9.1853e-04 - mean_squared_er
Epoch 13/100
2970/2970 [==============================] - 2s 579us/step - loss: 9.2372e-04 - mean_squared_er
Epoch 14/100
2970/2970 [==============================] - 1s 473us/step - loss: 9.1943e-04 - mean_squared_er
Epoch 15/100
2970/2970 [==============================] - 1s 457us/step - loss: 9.0145e-04 - mean_squared_er
Epoch 16/100
2970/2970 [==============================] - 1s 449us/step - loss: 9.2862e-04 - mean_squared_er
Epoch 17/100
2970/2970 [==============================] - 1s 450us/step - loss: 9.2486e-04 - mean_squared_er
Epoch 18/100
2970/2970 [==============================] - 1s 437us/step - loss: 9.1470e-04 - mean_squared_er
Epoch 19/100
2970/2970 [==============================] - 1s 443us/step - loss: 9.0996e-04 - mean_squared_er
Epoch 20/100
2970/2970 [==============================] - 1s 463us/step - loss: 9.3432e-04 - mean_squared_er
```

```
Epoch 21/100
2970/2970 [==============================] - 1s 443us/step - loss: 9.3254e-04 - mean_squared_er
Epoch 22/100
2970/2970 [==============================] - 1s 450us/step - loss: 9.1804e-04 - mean_squared_er
Epoch 23/100
2970/2970 [==============================] - 1s 445us/step - loss: 8.9786e-04 - mean_squared_er
Epoch 24/100
2970/2970 [==============================] - 1s 477us/step - loss: 8.9757e-04 - mean_squared_er
Epoch 25/100
2970/2970 [==============================] - 1s 454us/step - loss: 8.9295e-04 - mean_squared_er
Epoch 26/100
2970/2970 [==============================] - 1s 428us/step - loss: 8.9018e-04 - mean_squared_er
Epoch 27/100
2970/2970 [==============================] - 1s 422us/step - loss: 8.9137e-04 - mean_squared_er
Epoch 28/100
2970/2970 [==============================] - 1s 438us/step - loss: 8.7705e-04 - mean_squared_er
Epoch 29/100
2970/2970 [==============================] - 1s 468us/step - loss: 8.8785e-04 - mean_squared_er
Epoch 30/100
2970/2970 [==============================] - 1s 473us/step - loss: 8.7078e-04 - mean_squared_er
Epoch 31/100
2970/2970 [==============================] - 1s 477us/step - loss: 8.7820e-04 - mean_squared_er
Epoch 32/100
2970/2970 [==============================] - 1s 443us/step - loss: 8.7626e-04 - mean_squared_er
Epoch 33/100
2970/2970 [==============================] - 1s 438us/step - loss: 8.7959e-04 - mean_squared_er
Epoch 34/100
2970/2970 [==============================] - 1s 478us/step - loss: 8.8216e-04 - mean_squared_er
Epoch 35/100
2970/2970 [==============================] - 1s 504us/step - loss: 9.0377e-04 - mean_squared_er
Epoch 36/100
2970/2970 [==============================] - 1s 470us/step - loss: 8.7673e-04 - mean_squared_er
Epoch 37/100
2970/2970 [==============================] - 2s 518us/step - loss: 8.6137e-04 - mean_squared_er
Epoch 38/100
2970/2970 [==============================] - 1s 433us/step - loss: 8.6843e-04 - mean_squared_er
Epoch 39/100
2970/2970 [==============================] - 1s 485us/step - loss: 8.8997e-04 - mean_squared_er
Epoch 40/100
2970/2970 [==============================] - 1s 434us/step - loss: 8.6907e-04 - mean_squared_er
Epoch 41/100
2970/2970 [==============================] - 1s 452us/step - loss: 8.5450e-04 - mean_squared_er
Epoch 42/100
2970/2970 [==============================] - 1s 440us/step - loss: 8.3142e-04 - mean_squared_er
Epoch 43/100
2970/2970 [==============================] - 1s 420us/step - loss: 8.5572e-04 - mean_squared_er
Epoch 44/100
2970/2970 [==============================] - 1s 422us/step - loss: 8.4636e-04 - mean_squared_er
```

```
Epoch 45/100
2970/2970 [==============================] - 1s 438us/step - loss: 8.3763e-04 - mean_squared_er
Epoch 46/100
2970/2970 [==============================] - 1s 450us/step - loss: 8.0604e-04 - mean_squared_er
Epoch 47/100
2970/2970 [==============================] - 1s 448us/step - loss: 8.3906e-04 - mean_squared_er
Epoch 48/100
2970/2970 [==============================] - 1s 477us/step - loss: 7.7078e-04 - mean_squared_er
Epoch 49/100
2970/2970 [==============================] - 1s 468us/step - loss: 7.3160e-04 - mean_squared_er
Epoch 50/100
2970/2970 [==============================] - 1s 452us/step - loss: 7.2228e-04 - mean_squared_er
Epoch 51/100
2970/2970 [==============================] - 1s 448us/step - loss: 7.3676e-04 - mean_squared_er
Epoch 52/100
2970/2970 [==============================] - 1s 454us/step - loss: 6.5171e-04 - mean_squared_er
Epoch 53/100
2970/2970 [==============================] - 1s 424us/step - loss: 5.9736e-04 - mean_squared_er
Epoch 54/100
2970/2970 [==============================] - 1s 439us/step - loss: 5.4819e-04 - mean_squared_er
Epoch 55/100
2970/2970 [==============================] - 1s 482us/step - loss: 5.1135e-04 - mean_squared_er
Epoch 56/100
2970/2970 [==============================] - 1s 464us/step - loss: 4.8562e-04 - mean_squared_er
Epoch 57/100
2970/2970 [==============================] - 1s 484us/step - loss: 4.3066e-04 - mean_squared_er
Epoch 58/100
2970/2970 [==============================] - 1s 494us/step - loss: 3.9899e-04 - mean_squared_er
Epoch 59/100
2970/2970 [==============================] - 1s 500us/step - loss: 3.6024e-04 - mean_squared_er
Epoch 60/100
2970/2970 [==============================] - 1s 489us/step - loss: 3.5323e-04 - mean_squared_er
Epoch 61/100
2970/2970 [==============================] - 1s 464us/step - loss: 3.4031e-04 - mean_squared_er
Epoch 62/100
2970/2970 [==============================] - 1s 450us/step - loss: 3.2379e-04 - mean_squared_er
Epoch 63/100
2970/2970 [==============================] - 1s 422us/step - loss: 3.1024e-04 - mean_squared_er
Epoch 64/100
2970/2970 [==============================] - 1s 441us/step - loss: 3.1704e-04 - mean_squared_er
Epoch 65/100
2970/2970 [==============================] - 1s 437us/step - loss: 3.0925e-04 - mean_squared_er
Epoch 66/100
2970/2970 [==============================] - 1s 432us/step - loss: 2.9983e-04 - mean_squared_er
Epoch 67/100
2970/2970 [==============================] - 1s 461us/step - loss: 3.0342e-04 - mean_squared_er
Epoch 68/100
2970/2970 [==============================] - 1s 414us/step - loss: 2.8407e-04 - mean_squared_er
```

```
Epoch 69/100
2970/2970 [==============================] - 1s 447us/step - loss: 3.0306e-04 - mean_squared_er
Epoch 70/100
2970/2970 [==============================] - 1s 438us/step - loss: 3.0024e-04 - mean_squared_er
Epoch 71/100
2970/2970 [==============================] - 1s 448us/step - loss: 2.8717e-04 - mean_squared_er
Epoch 72/100
2970/2970 [==============================] - 1s 459us/step - loss: 2.8670e-04 - mean_squared_er
Epoch 73/100
2970/2970 [==============================] - 1s 442us/step - loss: 2.8162e-04 - mean_squared_er
Epoch 74/100
2970/2970 [==============================] - 1s 429us/step - loss: 2.9772e-04 - mean_squared_er
Epoch 75/100
2970/2970 [==============================] - 1s 428us/step - loss: 2.8688e-04 - mean_squared_er
Epoch 76/100
2970/2970 [==============================] - 1s 433us/step - loss: 2.8583e-04 - mean_squared_er
Epoch 77/100
2970/2970 [==============================] - 1s 437us/step - loss: 2.7867e-04 - mean_squared_er
Epoch 78/100
2970/2970 [==============================] - 1s 431us/step - loss: 2.9131e-04 - mean_squared_er
Epoch 79/100
2970/2970 [==============================] - 1s 446us/step - loss: 3.0111e-04 - mean_squared_er
Epoch 80/100
2970/2970 [==============================] - 1s 431us/step - loss: 2.9393e-04 - mean_squared_er
Epoch 81/100
2970/2970 [==============================] - 1s 461us/step - loss: 2.8895e-04 - mean_squared_er
Epoch 82/100
2970/2970 [==============================] - 2s 519us/step - loss: 2.9164e-04 - mean_squared_er
Epoch 83/100
2970/2970 [==============================] - 1s 462us/step - loss: 2.9349e-04 - mean_squared_er
Epoch 84/100
2970/2970 [==============================] - 1s 448us/step - loss: 2.9081e-04 - mean_squared_er
Epoch 85/100
2970/2970 [==============================] - 1s 454us/step - loss: 3.0994e-04 - mean_squared_er
Epoch 86/100
2970/2970 [==============================] - 1s 426us/step - loss: 2.7848e-04 - mean_squared_er
Epoch 87/100
2970/2970 [==============================] - 1s 448us/step - loss: 2.7728e-04 - mean_squared_er
Epoch 88/100
2970/2970 [==============================] - 1s 494us/step - loss: 2.8505e-04 - mean_squared_er
Epoch 89/100
2970/2970 [==============================] - 1s 482us/step - loss: 2.9112e-04 - mean_squared_er
Epoch 90/100
2970/2970 [==============================] - 1s 467us/step - loss: 2.8789e-04 - mean_squared_er
Epoch 91/100
2970/2970 [==============================] - 2s 523us/step - loss: 2.8101e-04 - mean_squared_er
Epoch 92/100
2970/2970 [==============================] - 1s 427us/step - loss: 2.7069e-04 - mean_squared_er
```

```
Epoch 93/100
2970/2970 [==============================] - 1s 479us/step - loss: 2.7702e-04 - mean_squared_er
Epoch 94/100
2970/2970 [==============================] - 1s 450us/step - loss: 2.7189e-04 - mean_squared_er
Epoch 95/100
2970/2970 [==============================] - 1s 450us/step - loss: 2.8449e-04 - mean_squared_er
Epoch 96/100
2970/2970 [==============================] - 1s 435us/step - loss: 2.6789e-04 - mean_squared_er
Epoch 97/100
2970/2970 [==============================] - 2s 512us/step - loss: 2.5931e-04 - mean_squared_er
Epoch 98/100
2970/2970 [==============================] - 1s 462us/step - loss: 2.7369e-04 - mean_squared_er
Epoch 99/100
2970/2970 [==============================] - 1s 439us/step - loss: 2.7514e-04 - mean_squared_er
Epoch 100/100
2970/2970 [==============================] - 1s 458us/step - loss: 2.7406e-04 - mean_squared_er
```




```
MODEL-SAVED
```

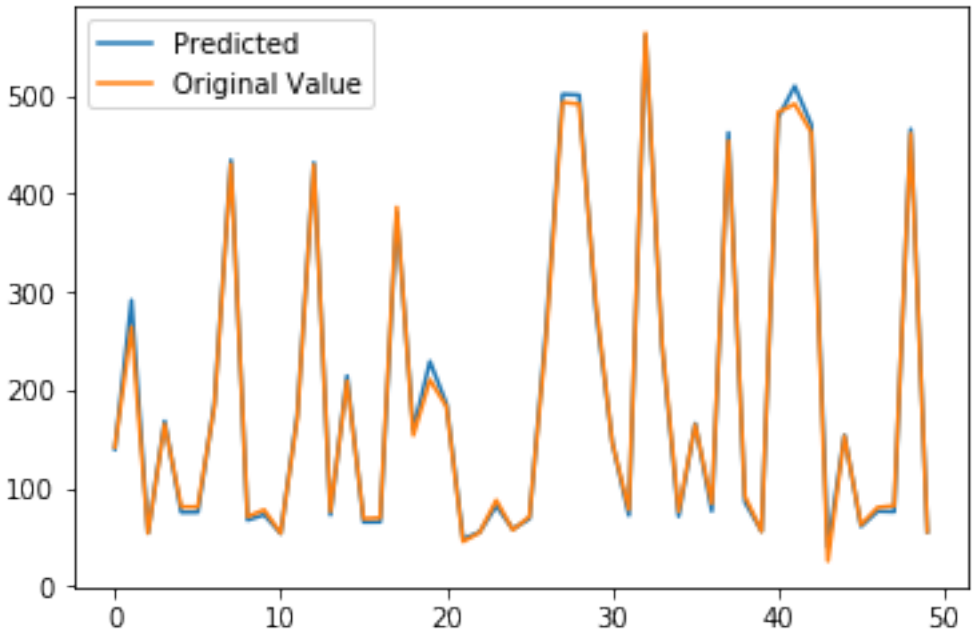
```
In [64]: # #Load saved Model
         # model = load_model("{}.h5".format(model_name))
         # print("MODEL-LOADED")

In [65]: score = model.evaluate(X_test, y_test)
         print('Score: {}'.format(score))
```

```
1626/1626 [==============================] - 0s 141us/step
Score: [0.00019945367377238214, 0.00019945367377238214, 0.009311007966973612, 24.523127906583484
```

```
In [66]: yhata = model.predict(X_test)
         yhata_inverse = y_scale.inverse_transform(yhata)
         y_test_inverse = y_scale.inverse_transform(y_test)
```

```
In [73]: plt.plot(yhata_inverse[-50:], label='Predicted')
         plt.plot(y_test_inverse[-50:], label='Original Value')
         plt.legend()
         plt.show()
```




```
In [68]: X_train
```

```
Out[68]: array([[[0.2063745 , 0.20548372, 0.21374686, 0.20756248]],

                [[0.19840637, 0.19925222, 0.20737636, 0.20480364]],

                [[0.04749004, 0.0461131 , 0.04945516, 0.04803635]],

                ...,

                [[0.05227092, 0.05063094, 0.05498743, 0.0529049 ]],

                [[0.012749  , 0.01168406, 0.01324392, 0.01233366]],
```

```
                [[0.05115538, 0.04938464, 0.05364627, 0.05128205]]])
```

```
In [69]: from sklearn.metrics import mean_squared_error

         error = mean_squared_error(y_test_inverse, yhata_inverse)
         print('Test MSE: %.3f' % error)
```

```
Test MSE: 75.733
```