In [1]:
```
import datetime
import pandas as pd
import pandas_datareader.data as web
```

In [2]:
```
start = datetime.datetime(1999, 1, 22) # or start = '1/1/2016'
end = datetime.date.today()
df = web.DataReader('NVDA', 'yahoo', start, end)
print (df.head())  # print first rows of the prices data
```

```
                Open      High       Low     Close  Adj Close    Volume
Date
1999-01-22  1.750000  1.953125  1.552083  1.640625   1.521034  67867200
1999-01-25  1.770833  1.833333  1.640625  1.812500   1.680380  12762000
1999-01-26  1.833333  1.869792  1.645833  1.671875   1.550005   8580000
1999-01-27  1.677083  1.718750  1.583333  1.666667   1.545177   6109200
1999-01-28  1.666667  1.677083  1.651042  1.661458   1.540348   5688000
```

In [3]:
```
import time
import math
from keras.models import Sequential
from keras.layers.core import Dense, Dropout, Activation
from keras.layers.recurrent import LSTM
import numpy as np
import pandas as pd
import tensorflow as tf
import sklearn.preprocessing as prep
from keras import backend
```

```
Using TensorFlow backend.
```

In [4]:
```
#import os
#s=os.getcwd()
#s
```

In [5]:
```
#df = pd.read_csv('/Users/Yuffie/USA/SCU/COEN281DataMining/TermProject/data/GOOG.csv')
#df.head()
```

In [6]:
```
# Data preparation
col_list = df.columns.tolist()
col_list
```

Out[6]: ['Open', 'High', 'Low', 'Close', 'Adj Close', 'Volume']

In [7]:
```
col_list.remove('Close')
col_list.append('Close')
#col_list.remove('Date')
col_list.remove('Volume')
col_list
```

Out[7]: ['Open', 'High', 'Low', 'Adj Close', 'Close']

In [8]:
```
df = df[col_list]
df.head()
```

Out[8]:

	Open	High	Low	Adj Close	Close
Date					
1999-01-22	1.750000	1.953125	1.552083	1.521034	1.640625
1999-01-25	1.770833	1.833333	1.640625	1.680380	1.812500
1999-01-26	1.833333	1.869792	1.645833	1.550005	1.671875
1999-01-27	1.677083	1.718750	1.583333	1.545177	1.666667
1999-01-28	1.666667	1.677083	1.651042	1.540348	1.661458

In [9]:
```
# Save data
df.to_csv('NVDA-adjust.csv', index=False)
validate_df = pd.read_csv('NVDA-adjust.csv')
validate_df.head()
```

Out[9]:

	Open	High	Low	Adj Close	Close
0	1.750000	1.953125	1.552083	1.521034	1.640625
1	1.770833	1.833333	1.640625	1.680380	1.812500
2	1.833333	1.869792	1.645833	1.550005	1.671875
3	1.677083	1.718750	1.583333	1.545177	1.666667
4	1.666667	1.677083	1.651042	1.540348	1.661458

In [10]:
```
# Standardization the dataset
def standard_scaler(X_train, X_test):
    train_samples, train_nx, train_ny = X_train.shape
    test_samples, test_nx, test_ny = X_test.shape

    X_train = X_train.reshape((train_samples, train_nx * train_ny))
    X_test = X_test.reshape((test_samples, test_nx * test_ny))

    preprocessor = prep.StandardScaler().fit(X_train)
    X_train = preprocessor.transform(X_train)
    X_test = preprocessor.transform(X_test)

    X_train = X_train.reshape((train_samples, train_nx, train_ny))
    X_test = X_test.reshape((test_samples, test_nx, test_ny))

    return X_train, X_test
```

In [11]:
```
# Split the data to X_train, y_train, X_test, y_test
def preprocess_data(stock, seq_len):
    amount_of_features = len(stock.columns)
    data = stock.as_matrix()

    sequence_length = seq_len + 1
    result = []
    for index in range(len(data) - sequence_length):
        result.append(data[index : index + sequence_length])

    result = np.array(result)
    row = round(0.95 * result.shape[0])
    train = result[: int(row), :]
    y_test_org = result[int(row) :, -1][ : ,-1]

    train, result = standard_scaler(train, result)

    X_train = train[:, : -1]
    y_train = train[:, -1][: ,-1]
    X_test = result[int(row) :, : -1]
    y_test = result[int(row) :, -1][ : ,-1]

    X_train = np.reshape(X_train, (X_train.shape[0], X_train.shape[1], amount_of_features))
    X_test = np.reshape(X_test, (X_test.shape[0], X_test.shape[1], amount_of_features))

    return [X_train, y_train, X_test, y_test, y_test_org]
```

In [12]:
```
# Build LSTM Neural Network
# LSTM --> Dropout --> LSTM --> Dropout --> Fully-Conneted(Dense)
def build_model(layers):
    model = Sequential()

    # By setting return_sequences to True we are able to stack another LSTM layer
    model.add(LSTM(
        return_sequences=True,
        input_shape=(None, 5), units=20))
    model.add(Dropout(0.4))

    model.add(LSTM(
        layers[2],
        return_sequences=False))
    model.add(Dropout(0.3))

    model.add(Dense(
        units=1))
    model.add(Activation("linear"))

    start = time.time()
    model.compile(loss="mse", optimizer="rmsprop", metrics=['accuracy'])
    print("Compilation Time : ", time.time() - start)
    return model
```

In [13]:
```
window = 20
X_train, y_train, X_test, y_test, y_test_org = preprocess_data(df[:: -1], window)
print("X_train", X_train.shape)
print("y_train", y_train.shape)
print("X_test", X_test.shape)
print("y_test", y_test.shape)
```

```
X_train (4492, 20, 5)
y_train (4492,)
X_test (236, 20, 5)
y_test (236,)
```

In [14]:
```
model = build_model([X_train.shape[2], window, 100, 1])
```

```
Compilation Time :  0.056817054748535156
```

In [15]:
```
# Training the model
model.fit(
    X_train,
    y_train,
    batch_size=768,
    epochs=300,
    validation_split=0.1,
    verbose=0)
```

Out[15]:
```
<keras.callbacks.History at 0x11cc537b8>
```

In [16]:
```
trainScore = model.evaluate(X_train, y_train, verbose=0)
print('Train Score: %.2f MSE (%.2f RMSE)' % (trainScore[0], math.sqrt(trainScore[0])))
print(model.metrics_names)
testScore = model.evaluate(X_test, y_test, verbose=0)
print('Test Score: %.2f MSE (%.2f RMSE)' % (testScore[0], math.sqrt(testScore[0])))
```

```
Train Score: 0.01 MSE (0.11 RMSE)
['loss', 'acc']
Test Score: 0.01 MSE (0.08 RMSE)
```

In [17]:
```
#Visualize the Prediction
diff = []
ratio = []
pred = model.predict(X_test)
for u in range(len(y_test)):
    pr = pred[u][0]
    ratio.append((y_test[u] / pr) - 1)
    diff.append(abs(y_test[u] - pr))
print('error_ratio', ratio)
#print('error_abs', diff)
#print(pred)
```

```
error_ratio [0.1342657551982076, 0.14280182793684548, 0.14155707060567391, 0.13226028506682619, 0.1463841691
5918362, 0.14826904824697129, 0.15198380230167596, 0.16055808023283591, 0.16175237413459076, 0.1526062643052
9212, 0.1409174508463511, 0.1355999442226572, 0.13488999796526135, 0.133861098323665, 0.12975807316055477,
0.13986157869723614, 0.13374830113607517, 0.13963565595481953, 0.13529156931333541, 0.14806061670808401, 0.1
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1150613, 0.15436377836641224, 0.15499472931013791, 0.15764907403292705, 0.14979355251242743, 0.1427661360920
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4, 0.15747270421858017, 0.15837702672402054, 0.14761439397256826, 0.13931122385385986, 0.14689072725486008,
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661, 0.1368613872219453, 0.13970025697770905, 0.14371663862161266, 0.14262185303917296, 0.14156247891052987,
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9308430757, 0.13539359224038905, 0.13513032041620954, 0.13272350473975014, 0.13715251275462248, 0.1401411266
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0.13281276065464231, 0.13694887870945704, 0.14493830683158127, 0.14485357376700914, 0.14228689452146659, 0.1
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```

```
5, 0.14580442275234606, 0.14628718937484742, 0.14498586531538349, 0.13758059801668265, 0.13703043371274393,
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774978864722, 0.13481528016836641, 0.13562883131292347, 0.12954394049658768]
```

In [18]:
```
# Scale the representation back
y_test = y_test_org
pred_org = []
for u in range(len(y_test)):
    pred_org.append(y_test[u]/(ratio[u] + 1))
    #print(ratio[u])
print(pred_org)
print(y_test)
```

```
[3.3795721879394511, 3.2449484323059146, 3.2576119895844973, 3.413157779151383, 3.162116241241153, 3.0843529
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```
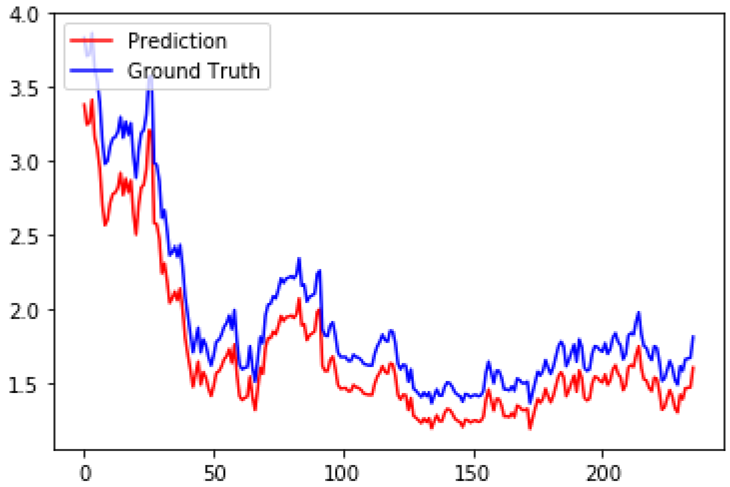

```
1.3302276271963707, 1.3022534353531987, 1.4215224473496832, 1.3918935623241599, 1.4653272454875015, 1.468668
0987876066, 1.4722019676685307, 1.6046299174542609]
[ 3.833333  3.708333  3.71875   3.864583  3.625     3.541667  3.395833
  3.135417  2.979167  3.        3.098958  3.151042  3.161458  3.197917
  3.296875  3.15625   3.265625  3.177083  3.255208  3.03125   2.885417
  3.072917  3.1875    3.208333  3.3125    3.567708  3.572917  2.984375
  2.973958  2.864583  2.614583  2.666667  2.53125   2.364583  2.385417
  2.421875  2.354167  2.432292  2.286458  2.083333  1.958333  1.84375
  1.708333  1.791667  1.875     1.708333  1.796875  1.755208  1.677083
  1.619792  1.6875    1.78125   1.791667  1.828125  1.880208  1.90625
  1.958333  1.864583  1.994792  1.78125   1.625     1.59375   1.604167
  1.609375  1.75      1.604167  1.510417  1.661458  1.8125    1.770833
  1.958333  2.03125   2.036458  2.088542  2.072917  2.135417  2.208333
  2.177083  2.208333  2.213542  2.223958  2.208333  2.234375  2.34375
  2.15885   2.166667  2.052083  2.083333  2.09375   2.104167  2.239583
  2.260417  1.864583  1.822917  1.817708  1.890625  1.911458  1.822917
  1.708333  1.677083  1.677083  1.677083  1.651042  1.651042  1.692708
  1.677083  1.671875  1.65625   1.630208  1.625     1.619792  1.619792
  1.697917  1.75      1.78125   1.828125  1.791667  1.78125   1.854167
  1.848958  1.768225  1.630208  1.59375   1.625     1.619792  1.510417
  1.59375   1.463542  1.447917  1.427083  1.40625   1.4375    1.411458
  1.4375    1.364583  1.416667  1.458333  1.416667  1.416667  1.473958
  1.505208  1.5       1.473958  1.4375    1.421875  1.411458  1.375
  1.427083  1.421875  1.40625   1.416667  1.421875  1.411458  1.416667
  1.447917  1.572917  1.645833  1.572917  1.5       1.583333  1.583333
  1.536458  1.458333  1.458333  1.450517  1.479167  1.447917  1.53125
  1.520833  1.5       1.5       1.510417  1.364583  1.4375    1.510417
  1.578125  1.552083  1.583333  1.65625   1.604167  1.5625    1.609375
  1.677083  1.75      1.78125   1.75      1.614583  1.65625   1.708333
  1.760417  1.645833  1.796875  1.744792  1.604167  1.583333  1.59375
  1.697917  1.75      1.744792  1.723958  1.713542  1.770833  1.697917
  1.729167  1.807292  1.838542  1.78125   1.755208  1.661458  1.697917
  1.822917  1.838542  1.828125  1.916667  1.979167  1.833333  1.75
  1.739583  1.682292  1.65625   1.75      1.739583  1.645833  1.515625
  1.53125   1.59375   1.651042  1.604167  1.520833  1.489583  1.614583
  1.583333  1.661458  1.666667  1.671875  1.8125  ]
```

In [19]:
```
import matplotlib.pyplot as plt2

plt2.plot(pred_org, color='red', label='Prediction')
plt2.plot(y_test, color='blue', label='Ground Truth')
plt2.legend(loc='upper left')
plt2.show()
```



In [ ]: