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DATA SCIENCE AND BUSINESS ANALYTICS INTERN

Task 7 : Stock Market Prediction using Numerical and Textual Analysis

Create a hybrid model for stock price or performance prediction using numerical analysis of historical stock prices, and sentimental analysis of news headlines. The stock to analyze and predict is SENSEX (S&P BSE SENSEX)

Import the Important Libraries

In [168]:

```
# Import the libraries
import os
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt

import warnings
warnings.filterwarnings('ignore')


from statsmodels.tsa.arima_model import ARIMA
from statsmodels.tsa.statespace.sarimax import SARIMAX

import nltk
import re
from textblob import TextBlob
from nltk.sentiment.vader import SentimentIntensityAnalyzer
from sklearn.preprocessing import MinMaxScaler

from sklearn.metrics import mean_squared_error
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestRegressor, AdaBoostRegressor
from sklearn.tree import DecisionTreeRegressor
import xgboost
import lightgbm
```

In [131]:

```
# For reading stock data from yahoo
from pandas_datareader.data import DataReader
# For time stamps
from datetime import datetime
```

In [132]:

```
# Load the first dataset
columns=['Date','Category','News']
ndf = pd.read_csv("D:\india-news-headlines.csv",names=columns)
```

In [133]:

```
print('Showing part of the whole dataset:')
ndf.head(5)
```

Showing part of the whole dataset:

Out[133]:

	Date	Category	News
0	publish_date	headline_category	headline_text
1	20010101	sports.wwe	win over cena satisfying but defeating underta...
2	20010102	unknown	Status quo will not be disturbed at Ayodhya; s...
3	20010102	unknown	Fissures in Hurriyat over Pak visit
4	20010102	unknown	America's unwanted heading for India?

In [134]:

```
ndf.drop(0, inplace=True)
ndf.drop('Category', axis = 1, inplace=True)
print('Showing part of the whole dataset:')
ndf.head(-5)
```

```
Showing part of the whole dataset:
```

Out[134]:

	Date	News
1	20010101	win over cena satisfying but defeating underta...
2	20010102	Status quo will not be disturbed at Ayodhya; s...
3	20010102	Fissures in Hurriyat over Pak visit
4	20010102	America's unwanted heading for India?
5	20010102	For bigwigs; it is destination Goa
...	...	...
3297163	20200630	vehicle of up stf team bringing gangster vikas...
3297164	20200630	sushant singh rajputs demise fans trend cbifor...
3297165	20200630	amitabh bachchans grandson agastya nanda prepp...
3297166	20200630	icse isc result 2020 when where to check class...
3297167	20200630	up govt imposes weekend restrictions from tonight

3297167 rows × 2 columns

In [135]:

```
# Load the second dataset
hisdf = pd.read_csv("D:\BSESN.csv")
hisdf.head(-5)
```

Out[135]:

	Date	Open	High	Low	Close	Adj Close	Volume
0	2015-12-14	24935.599609	25194.150391	24867.730469	25150.349609	25150.349609	11600.0
1	2015-12-15	25186.679688	25342.779297	25075.539063	25320.439453	25320.439453	9700.0
2	2015-12-16	25402.470703	25572.900391	25372.470703	25494.369141	25494.369141	10800.0
3	2015-12-17	25596.630859	25831.310547	25448.320313	25803.779297	25803.779297	22700.0
4	2015-12-18	25764.669922	25789.509766	25481.509766	25519.220703	25519.220703	10400.0
...	...	...	...	...	...	...	...
1224	2020-11-27	44325.031250	44407.281250	43995.410156	44149.718750	44149.718750	15700.0
1225	2020-12-01	44435.828125	44730.789063	44118.101563	44655.441406	44655.441406	16000.0
1226	2020-12-02	44729.519531	44729.640625	44169.968750	44618.039063	44618.039063	16000.0
1227	2020-12-03	44902.019531	44953.011719	44551.421875	44632.648438	44632.648438	30700.0
1228	2020-12-04	44665.910156	45148.281250	44665.910156	45079.550781	45079.550781	27600.0

1229 rows × 7 columns

Common Dataset Exploration

In [136]:

```
# Check for common information of the first datast
ndf["Date"] = pd.to_datetime(ndf["Date"],format='%Y%m%d')
ndf.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 3297172 entries, 1 to 3297172
Data columns (total 2 columns):
 #   Column  Dtype
---  ------  -----
 0   Date    datetime64[ns]
 1   News    object
dtypes: datetime64[ns](1), object(1)
memory usage: 75.5+ MB
```

In [137]:

```
# Group the headlines for each day
ndf['News'] = ndf.groupby(['Date']).transform(lambda x : ' '.join(x))
ndf = ndf.drop_duplicates()
ndf.reset_index(inplace=True,drop=True)
```

In [138]:

```
ndf
```

Out[138]:

	Date	News
0	2001-01-01	win over cena satisfying but defeating underta...
1	2001-01-02	Status quo will not be disturbed at Ayodhya; s...
2	2001-01-03	Powerless north India gropes in the dark Think...
3	2001-01-04	The string that pulled Stephen Hawking to Indi...
4	2001-01-05	Light combat craft takes India into club class...
...	...	...
7075	2020-06-26	Containment zone residents slam high prices ch...
7076	2020-06-27	like me i wont let you have a toxic relationsh...
7077	2020-06-28	Atanu Ghosh plans to rewrite old scripts to ma...
7078	2020-06-29	6 hot and stylish bikini looks of Katrina Kaif...
7079	2020-06-30	Detective Byomkesh Bakshy! Edge of Tomorrow Fi...

7080 rows × 2 columns

In [139]:

```
# Check for any duplicated values
ndf.isnull().sum()
```

Out[139]:

```
Date    0
News    0
dtype: int64
```

In [140]:

```
len(ndf)
```

Out[140]:

```
7080
```

In [141]:

```
hisdf=hisdf[["Date","Open","High","Low","Close","Volume"]]
hisdf.head(-5)
```

Out[141]:

	Date	Open	High	Low	Close	Volume
0	2015-12-14	24935.599609	25194.150391	24867.730469	25150.349609	11600.0
1	2015-12-15	25186.679688	25342.779297	25075.539063	25320.439453	9700.0
2	2015-12-16	25402.470703	25572.900391	25372.470703	25494.369141	10800.0
3	2015-12-17	25596.630859	25831.310547	25448.320313	25803.779297	22700.0
4	2015-12-18	25764.669922	25789.509766	25481.509766	25519.220703	10400.0
...	...	...	...	...	...	...
1224	2020-11-27	44325.031250	44407.281250	43995.410156	44149.718750	15700.0
1225	2020-12-01	44435.828125	44730.789063	44118.101563	44655.441406	16000.0
1226	2020-12-02	44729.519531	44729.640625	44169.968750	44618.039063	16000.0
1227	2020-12-03	44902.019531	44953.011719	44551.421875	44632.648438	30700.0
1228	2020-12-04	44665.910156	45148.281250	44665.910156	45079.550781	27600.0

1229 rows × 6 columns

In [142]:

```
# Check for common information of the second dataset
hisdf["Date"]= pd.to_datetime(hisdf["Date"])
hisdf.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1234 entries, 0 to 1233
Data columns (total 6 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   Date    1234 non-null   datetime64[ns]
 1   Open    1229 non-null   float64
 2   High    1229 non-null   float64
 3   Low     1229 non-null   float64
 4   Close   1229 non-null   float64
 5   Volume  1229 non-null   float64
dtypes: datetime64[ns](1), float64(5)
memory usage: 58.0 KB
```

In [143]:

```
hisdf.describe()
```

Out[143]:

	Open	High	Low	Close	Volume
count	1229.000000	1229.000000	1229.000000	1229.000000	1.229000e+03
mean	33612.537529	33770.774116	33378.082519	33568.855966	2.737271e+05
std	5145.385399	5155.580751	5113.753852	5134.402915	2.123753e+06
min	23060.390625	23142.960938	22494.609375	22951.830078	2.500000e+03
25%	29006.000000	29077.279297	28789.300781	28929.130859	1.050000e+04
50%	34167.531250	34351.339844	33949.460938	34142.148438	1.430000e+04
75%	37840.640625	38022.320313	37586.878906	37752.171875	1.980000e+04
max	46060.320313	46309.628906	45792.011719	46103.500000	3.181510e+07

In [144]:

```
# Check for duplicated values
hisdf.isnull().sum()
```

Out[144]:

```
Date      0
Open      5
High      5
Low       5
Close     5
Volume    5
dtype: int64
```

In [145]:

```
len(hisdf)
```

Out[145]:

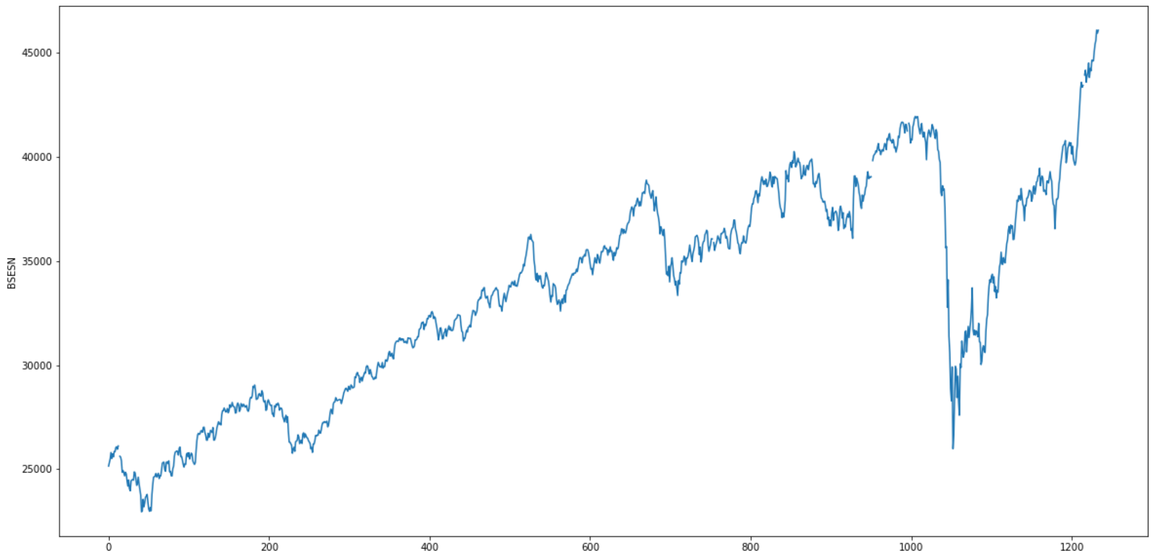
```
1234
```

In [147]:

```
# Figure plot
plt.figure(figsize=(20,10))
hisdf['Close'].plot()
plt.ylabel('BSESN')
```

Out[147]:

```
Text(0, 0.5, 'BSESN')
```



Remove Unwanted Characters from the News

In [148]:

```
#removing unwanted characters from the News
ndf.replace("[^a-zA-Z']"," ",regex=True,inplace=True)
ndf["News"].head(5)
```

Out[148]:

```
0    win over cena satisfying but defeating underta...
1    Status quo will not be disturbed at Ayodhya  s...
2    Powerless north India gropes in the dark Think...
3    The string that pulled Stephen Hawking to Indi...
4    Light combat craft takes India into club class...
Name: News, dtype: object
```

Historical Analysis

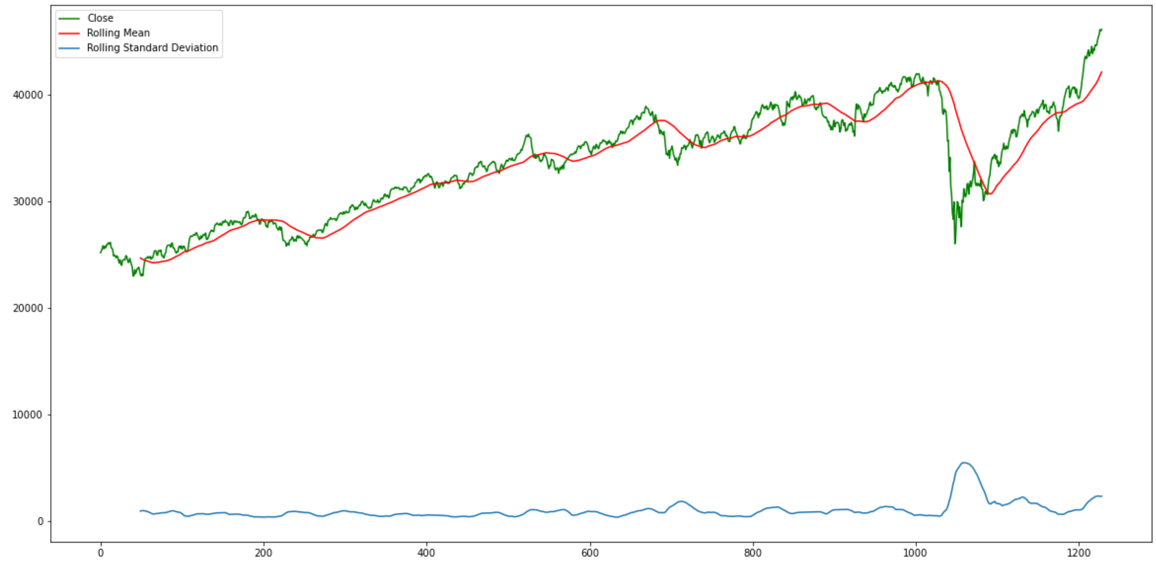
Plot the Moving Average

In [22]:

```
#Plotting moving average
close = hisdf['Close']

ma = close.rolling(window = 50).mean()
std = close.rolling(window = 50).std()

plt.figure(figsize=(20,10))
hisdf['Close'].plot(color='g',label='Close')
ma.plot(color = 'r',label='Rolling Mean')
std.plot(label = 'Rolling Standard Deviation')

plt.legend()
```

Out[22]:

```
<matplotlib.legend.Legend at 0x11c24c730>
```



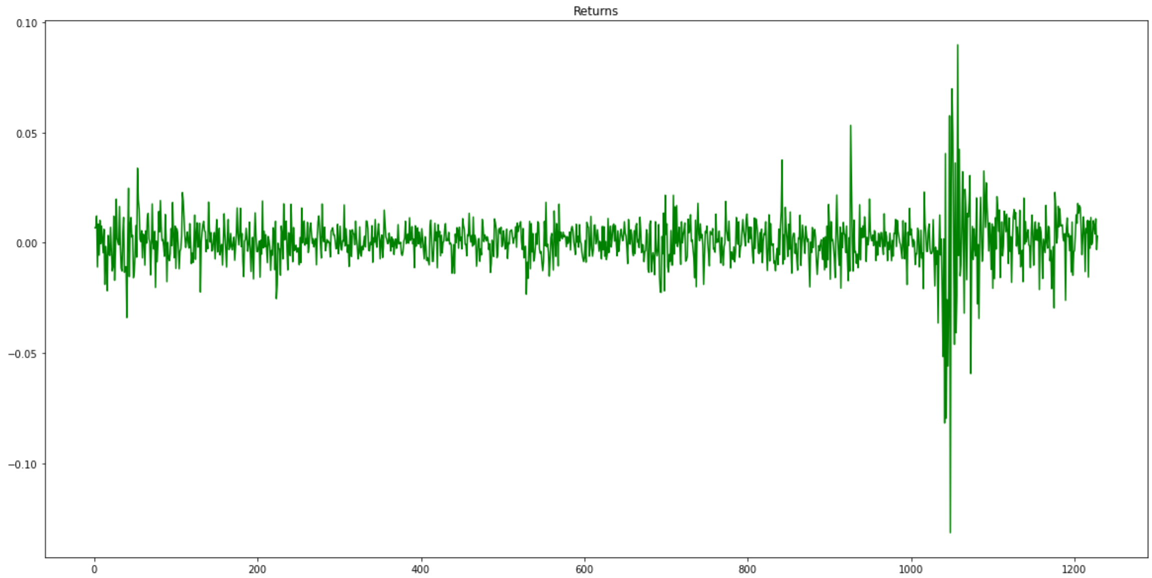
Plot the Returns

In [24]:

```
#Plotting returns
returns = close / close.shift(1) - 1

plt.figure(figsize = (20,10))
returns.plot(label='Return', color = 'g')
plt.title("Returns")
```

Out[24]:

```
Text(0.5, 1.0, 'Returns')
```



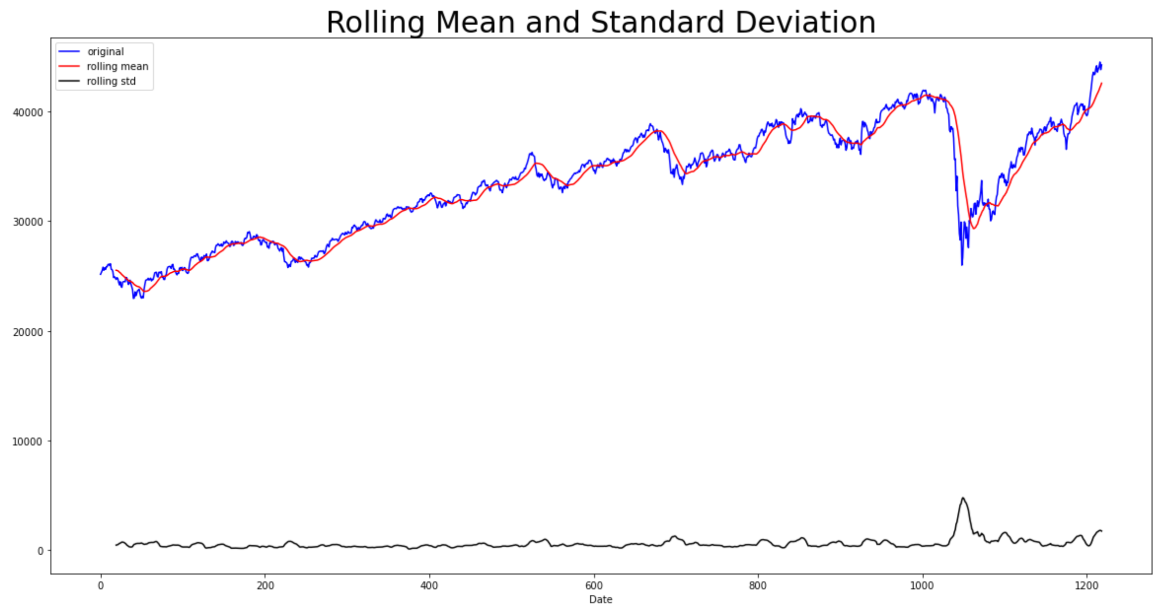
In [77]:

```
# Train test split
train = hisdf[:1219]
test = hisdf[1219:]
```

Rolling mean and Standard Deviation

In [78]:

```
#Stationarity test
def test_stationarity(timeseries):

 #Determine the rolling statistics
 rolmean = timeseries.rolling(20).mean()
 rolstd = timeseries.rolling(20).std()

 #Plot rolling statistics:
 plt.figure(figsize = (20,10))
 plt.plot(timeseries, color = 'blue', label = 'original')
 plt.plot(rolmean, color = 'r', label = 'rolling mean')
 plt.plot(rolstd, color = 'black', label = 'rolling std')
 plt.xlabel('Date')
 plt.legend()
 plt.title('Rolling Mean and Standard Deviation',  fontsize = 30)
 plt.show(block = False)

 print('Results of dickey fuller test')
 result = adfuller(timeseries, autolag = 'AIC')
 labels = ['ADF Test Statistic','p-value','#Lags Used','Number of Observations Used']
 for value,label in zip(result, labels):
   print(label+' : '+str(value) )
 if result[1] <= 0.05:
   print("Strong evidence against the null hypothesis(Ho), reject the null hypothesis.
 Data is stationary")
 else:
   print("Weak evidence against null hypothesis, time series is non-stationary ")
test_stationarity(train['Close'])
```



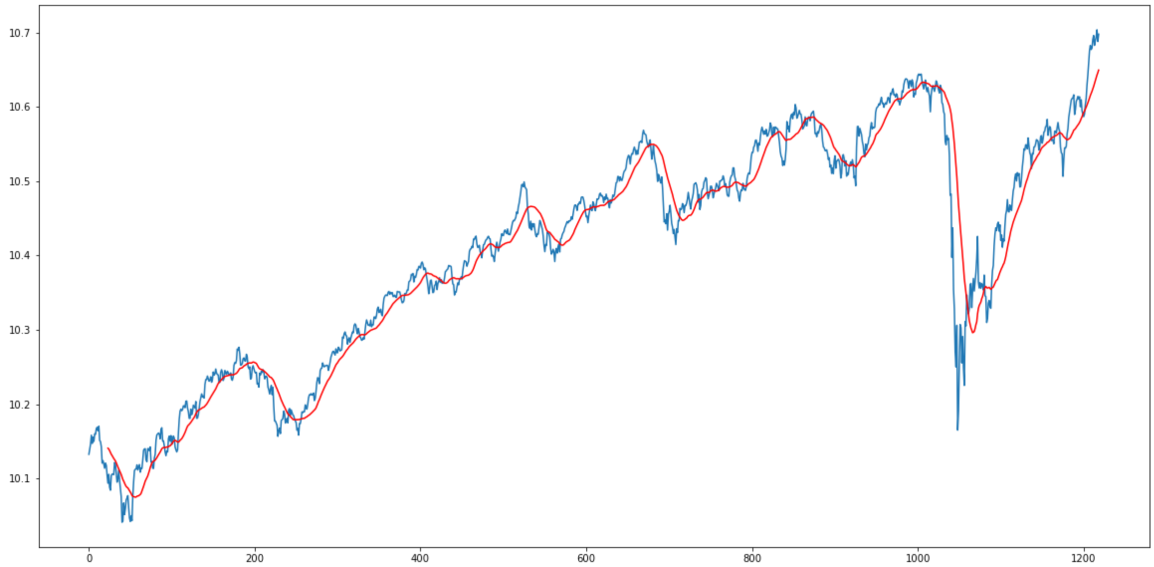

```
Results of dickey fuller test
ADF Test Statistic : -1.2371986562284674
p-value : 0.6573926747294222
#Lags Used : 12
Number of Observations Used : 1206
Weak evidence against null hypothesis, time series is non-stationary
```

In [79]:

```
train_log = np.log(train['Close'])
test_log = np.log(test['Close'])

mav = train_log.rolling(24).mean()
plt.figure(figsize = (20,10))
plt.plot(train_log)
plt.plot(mav, color = 'red')
```

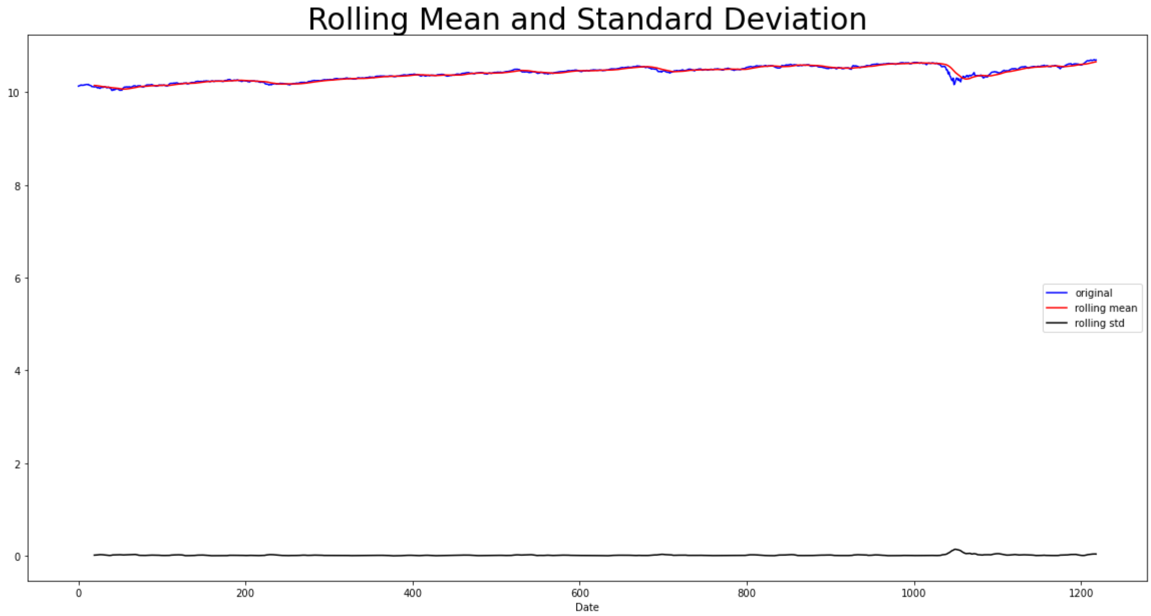
Out[79]:

```
[<matplotlib.lines.Line2D at 0x12f9369d0>]
```



In [80]:

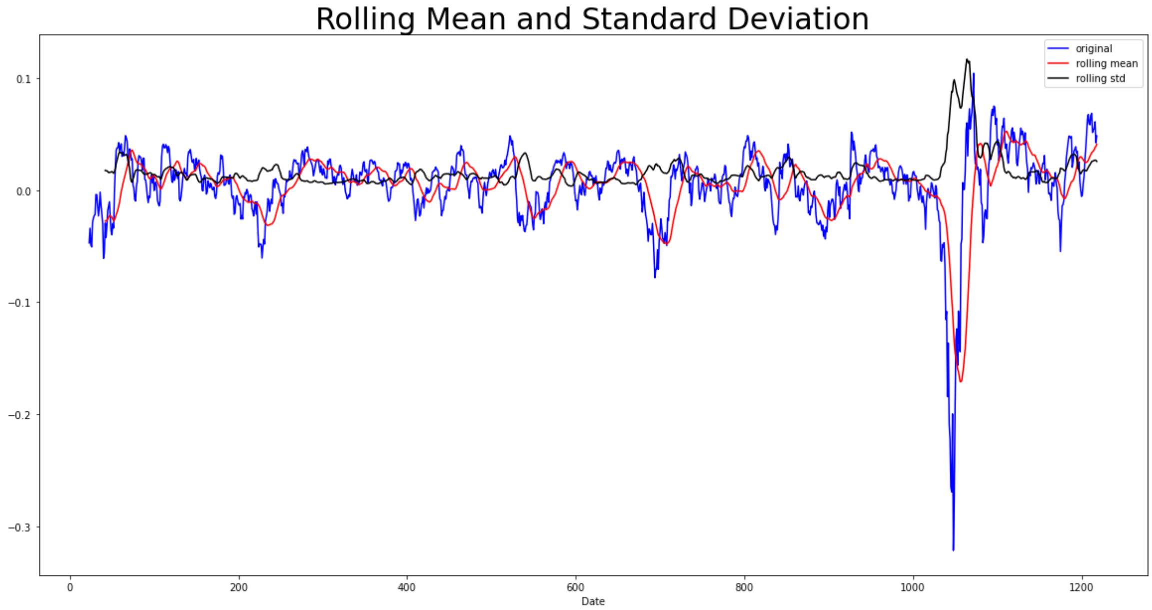
```
train_log.dropna(inplace = True)
test_log.dropna(inplace = True)

test_stationarity(train_log)
```




```
Results of dickey fuller test
ADF Test Statistic : -1.3255659230909311
p-value : 0.6173962367893951
#Lags Used : 12
Number of Observations Used : 1206
Weak evidence against null hypothesis, time series is non-stationary
```

In [81]:

```
train_log_diff = train_log - mav
train_log_diff.dropna(inplace = True)

test_stationarity(train_log_diff)
```




```
Results of dickey fuller test
ADF Test Statistic : -7.069643762070366
p-value : 4.975591908076066e-10
#Lags Used : 12
Number of Observations Used : 1183
Strong evidence against the null hypothesis(Ho), reject the null hypothesi
s. Data is stationary
```

In [82]:

```
#Using auto arima to make predictions using log data
from pmdarima import auto_arima
```

In [83]:

```
model = auto_arima(train_log, trace = True, error_action = 'ignore', suppress_warnings
= True)
model.fit(train_log)
predictions = model.predict(periods = len(test))
predictions = pd.DataFrame(predictions,index = test_log.index,columns=['Prediction'])
```

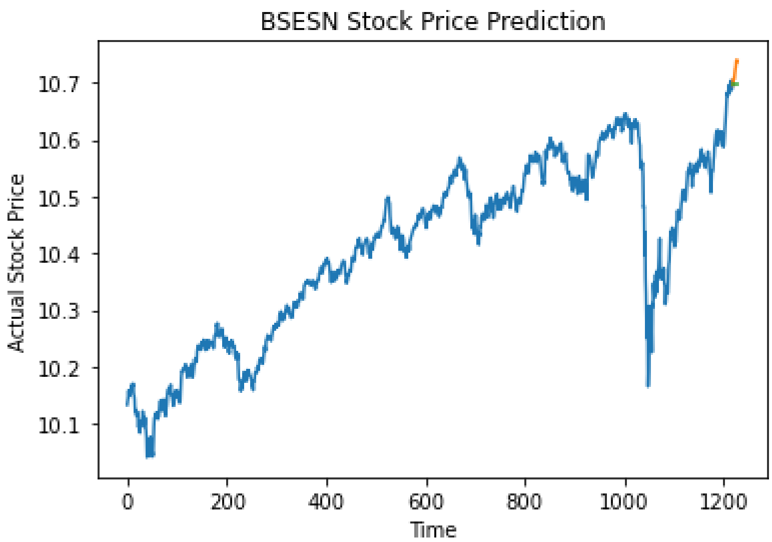
```
Performing stepwise search to minimize aic
 ARIMA(2,1,2)(0,0,0)[0] intercept   : AIC=-7372.030, Time=0.71 sec
 ARIMA(0,1,0)(0,0,0)[0] intercept   : AIC=-7379.211, Time=0.27 sec
 ARIMA(1,1,0)(0,0,0)[0] intercept   : AIC=-7382.510, Time=0.68 sec
 ARIMA(0,1,1)(0,0,0)[0] intercept   : AIC=-7382.013, Time=0.14 sec
 ARIMA(0,1,0)(0,0,0)[0]             : AIC=-7379.290, Time=0.08 sec
 ARIMA(2,1,0)(0,0,0)[0] intercept   : AIC=-7382.581, Time=0.24 sec
 ARIMA(3,1,0)(0,0,0)[0] intercept   : AIC=-7383.659, Time=0.58 sec
 ARIMA(4,1,0)(0,0,0)[0] intercept   : AIC=-7381.766, Time=0.29 sec
 ARIMA(3,1,1)(0,0,0)[0] intercept   : AIC=-7381.633, Time=1.07 sec
 ARIMA(2,1,1)(0,0,0)[0] intercept   : AIC=-7380.186, Time=0.51 sec
 ARIMA(4,1,1)(0,0,0)[0] intercept   : AIC=-7379.695, Time=1.39 sec
 ARIMA(3,1,0)(0,0,0)[0]             : AIC=-7383.838, Time=0.20 sec
 ARIMA(2,1,0)(0,0,0)[0]             : AIC=-7382.575, Time=0.22 sec
 ARIMA(4,1,0)(0,0,0)[0]             : AIC=-7381.915, Time=0.29 sec
 ARIMA(3,1,1)(0,0,0)[0]             : AIC=-7381.817, Time=0.18 sec
 ARIMA(2,1,1)(0,0,0)[0]             : AIC=-7380.746, Time=0.48 sec
 ARIMA(4,1,1)(0,0,0)[0]             : AIC=-7379.857, Time=0.44 sec

Best model:  ARIMA(3,1,0)(0,0,0)[0]
Total fit time: 7.762 seconds
```

In [87]:

```
plt.plot(train_log, label='Train')
plt.plot(test_log, label='Test')
plt.plot(predictions, label='Prediction')
plt.title('BSESN Stock Price Prediction')
plt.xlabel('Time')
plt.ylabel('Actual Stock Price')
```

Out[87]:

```
Text(0, 0.5, 'Actual Stock Price')
```



Error Calculation

In [88]:

```
#Calculating error
rms = np.sqrt(mean_squared_error(test_log,predictions))
print("RMSE : ", rms)
```

```
RMSE :  0.026837616405067617
```

Textual Analysis

In [89]:

```
#Functions to get the subjectivity and polarity
def getSubjectivity(text):
  return TextBlob(text).sentiment.subjectivity

def getPolarity(text):
  return  TextBlob(text).sentiment.polarity
```

In [90]:

```
#Adding subjectivity and polarity columns
ndf['Subjectivity'] = ndf['News'].apply(getSubjectivity)
ndf['Polarity'] = ndf['News'].apply(getPolarity)
ndf
```

Out[90]:

	Date	News	Subjectivity	Polarity
0	2001-01-01	win over cena satisfying but defeating underta...	0.633333	0.433333
1	2001-01-02	Status quo will not be disturbed at Ayodhya s...	0.286859	0.143590
2	2001-01-03	Powerless north India gropes in the dark Think...	0.392857	0.089286
3	2001-01-04	The string that pulled Stephen Hawking to Indi...	0.445360	0.093039
4	2001-01-05	Light combat craft takes India into club class...	0.480553	0.264024
...	...	...	...	...
7075	2020-06-26	Containment zone residents slam high prices ch...	0.377957	0.060128
7076	2020-06-27	like me i wont let you have a toxic relationsh...	0.390221	0.080373
7077	2020-06-28	Atanu Ghosh plans to rewrite old scripts to ma...	0.397919	0.058824
7078	2020-06-29	hot and stylish bikini looks of Katrina Kaif...	0.397084	0.065397
7079	2020-06-30	Detective Byomkesh Bakshy Edge of Tomorrow Fi...	0.382257	0.072504

7080 rows × 4 columns

In [91]:

```
#Adding sentiment score to df_news
sia = SentimentIntensityAnalyzer()
```

In [92]:

```
ndf['Compound'] = [sia.polarity_scores(v)['compound'] for v in ndf['News']]
ndf['Negative'] = [sia.polarity_scores(v)['neg'] for v in ndf['News']]
ndf['Neutral'] = [sia.polarity_scores(v)['neu'] for v in ndf['News']]
ndf['Positive'] = [sia.polarity_scores(v)['pos'] for v in ndf['News']]
ndf
```

Out[92]:

	Date	News	Subjectivity	Polarity	Compound	Negative	Neutral	Positive
0	2001-01-01	win over cena satisfying but defeating underta...	0.633333	0.433333	-0.0000	0.230	0.473	0.297
1	2001-01-02	Status quo will not be disturbed at Ayodhya s...	0.286859	0.143590	-0.9792	0.121	0.809	0.071
2	2001-01-03	Powerless north India gropes in the dark Think...	0.392857	0.089286	-0.8910	0.156	0.735	0.109
3	2001-01-04	The string that pulled Stephen Hawking to Indi...	0.445360	0.093039	0.7543	0.104	0.792	0.104
4	2001-01-05	Light combat craft takes India into club class...	0.480553	0.264024	0.9645	0.142	0.694	0.164
...	...	...	...	...	...	...	...	...
7075	2020-06-26	Containment zone residents slam high prices ch...	0.377957	0.060128	-0.9999	0.170	0.738	0.092
7076	2020-06-27	like me i wont let you have a toxic relationsh...	0.390221	0.080373	-0.9999	0.162	0.743	0.095
7077	2020-06-28	Atanu Ghosh plans to rewrite old scripts to ma...	0.397919	0.058824	-0.9999	0.156	0.767	0.077
7078	2020-06-29	hot and stylish bikini looks of Katrina Kaif...	0.397084	0.065397	-0.9999	0.151	0.760	0.090
7079	2020-06-30	Detective Byomkesh Bakshy Edge of Tomorrow Fi...	0.382257	0.072504	-0.9999	0.141	0.786	0.073

7080 rows × 8 columns

Merge the Historical and Textual Data

In [108]:

```
df_merge = pd.merge(hisdf, ndf, how='inner', on='Date')
df_merge
```

Out[108]:

	Date	Open	High	Low	Close	Volume	News
0	2015-12-14	24935.599609	25194.150391	24867.730469	25150.349609	11600.0	things men do that make women fall deeper i...
1	2015-12-15	25186.679688	25342.779297	25075.539063	25320.439453	9700.0	Do looks matter at workplace Common running m...
2	2015-12-16	25402.470703	25572.900391	25372.470703	25494.369141	10800.0	In pics foods that make you smarter Dos and...
3	2015-12-17	25596.630859	25831.310547	25448.320313	25803.779297	22700.0	sex secrets every woman must know You too ca...
4	2015-12-18	25764.669922	25789.509766	25481.509766	25519.220703	10400.0	Stop making THESE diet disasters How to get s...
...	...	...	...	...	...	...	...
1109	2020-06-24	35679.738281	35706.550781	34794.929688	34868.980469	26600.0	I never thought I had a voice until today Vid...
1110	2020-06-25	34525.390625	35081.609375	34499.781250	34842.101563	24600.0	Truck firms look for new export markets to sel...
1111	2020-06-26	35144.781250	35254.878906	34910.339844	35171.269531	24800.0	Containment zone residents slam high prices ch...
1112	2020-06-29	34926.949219	35032.359375	34662.058594	34961.519531	18300.0	hot and stylish bikini looks of Katrina Kaif...
1113	2020-06-30	35168.300781	35233.910156	34812.800781	34915.800781	18500.0	Detective Byomkesh Bakshy Edge of Tomorrow Fi...

1114 rows × 13 columns

Create Dataset for Model Training

In [113]:

```
dfmerge1 = df_merge[['Close','Subjectivity', 'Polarity', 'Compound', 'Negative', 'Neutr
al', 'Positive']]
dfmerge1
```

Out[113]:

	Close	Subjectivity	Polarity	Compound	Negative	Neutral	Positive
0	25150.349609	0.472105	0.100389	-0.9996	0.153	0.719	0.128
1	25320.439453	0.421103	0.074733	-0.9999	0.149	0.745	0.106
2	25494.369141	0.434933	0.111113	-0.9724	0.107	0.786	0.107
3	25803.779297	0.389598	0.058890	-0.9997	0.150	0.735	0.115
4	25519.220703	0.412045	0.071201	-0.9999	0.161	0.726	0.113
...	...	...	...	...	...	...	...
1109	34868.980469	0.385245	0.087935	-0.9999	0.139	0.782	0.080
1110	34842.101563	0.398419	0.028698	-0.9999	0.145	0.789	0.066
1111	35171.269531	0.377957	0.060128	-0.9999	0.170	0.738	0.092
1112	34961.519531	0.397084	0.065397	-0.9999	0.151	0.760	0.090
1113	34915.800781	0.382257	0.072504	-0.9999	0.141	0.786	0.073

1114 rows × 7 columns

Normalize Data

In [115]:

```
scaler = MinMaxScaler()

df = pd.DataFrame(scaler.fit_transform(dfmerge1))
df.columns = dfmerge1.columns
df.index = dfmerge1.index
df.head()
```

Out[115]:

	Close	Subjectivity	Polarity	Compound	Negative	Neutral	Positive
0	0.115707	1.000000	0.804262	0.000200	0.496063	0.131034	0.837209
1	0.124658	0.637680	0.618084	0.000050	0.464567	0.310345	0.581395
2	0.133812	0.735928	0.882084	0.013803	0.133858	0.593103	0.593023
3	0.150096	0.413875	0.503113	0.000150	0.472441	0.241379	0.686047
4	0.135120	0.573336	0.592454	0.000050	0.559055	0.179310	0.662791

In [116]:

```
X=df.drop('Close',axis=1)
X
```

Out[116]:

	Subjectivity	Polarity	Compound	Negative	Neutral	Positive
0	1.000000	0.804262	0.000200	0.496063	0.131034	0.837209
1	0.637680	0.618084	0.000050	0.464567	0.310345	0.581395
2	0.735928	0.882084	0.013803	0.133858	0.593103	0.593023
3	0.413875	0.503113	0.000150	0.472441	0.241379	0.686047
4	0.573336	0.592454	0.000050	0.559055	0.179310	0.662791
...	...	...	...	...	...	...
1109	0.382947	0.713887	0.000050	0.385827	0.565517	0.279070
1110	0.476536	0.284023	0.000050	0.433071	0.613793	0.116279
1111	0.331174	0.512097	0.000050	0.629921	0.262069	0.418605
1112	0.467056	0.550338	0.000050	0.480315	0.413793	0.395349
1113	0.361724	0.601906	0.000050	0.401575	0.593103	0.197674

1114 rows × 6 columns

In [118]:

```
Y=df['Close']
Y
```

Out[118]:

```
0       0.115707
1       0.124658
2       0.133812
3       0.150096
4       0.135120
          ...
1109    0.627192
1110    0.625777
1111    0.643101
1112    0.632062
1113    0.629656
Name: Close, Length: 1114, dtype: float64
```

Split the Dataset into Train & Test Data

In [119]:

```
x_train, x_test, y_train, y_test = train_test_split(X, Y, test_size=0.2, random_state =
0)
x_train.shape
```

Out[119]:

```
(891, 6)
```

In [149]:

```
x_train[:10]
```

Out[149]:

	Subjectivity	Polarity	Compound	Negative	Neutral	Positive
927	0.484416	0.739807	0.00005	0.590551	0.144828	0.674419
876	0.265810	0.484699	0.00005	0.598425	0.241379	0.511628
1050	0.402516	0.605501	0.00015	0.440945	0.344828	0.558140
1081	0.393804	0.604870	0.00015	0.377953	0.448276	0.476744
658	0.484525	0.393420	0.00005	0.307087	0.648276	0.244186
622	0.362822	0.174151	0.00000	0.677165	0.213793	0.430233
965	0.421373	0.338042	0.00005	0.566929	0.393103	0.302326
818	0.298472	0.603939	0.00005	0.535433	0.420690	0.302326
787	0.356953	0.474171	0.00005	0.566929	0.379310	0.302326
920	0.466131	0.428890	0.00010	0.433071	0.448276	0.395349

RandomForestRegressor Model

In [150]:

```
rf = RandomForestRegressor()
rf.fit(x_train, y_train)
prediction=rf.predict(x_test)
```

In [151]:

```
print(prediction[:10])
print(y_test[:10])
print('Mean Squared error: ',mean_squared_error(prediction,y_test))
```

```
[0.59204602 0.77743871 0.46716064 0.73144085 0.25611568 0.33254211
 0.63953336 0.683319   0.59969559 0.26583055]
1006    0.966906
1109    0.627192
187     0.299075
896     0.723549
413     0.465435
501     0.578316
546     0.591144
881     0.839169
959     0.903342
268     0.228219
Name: Close, dtype: float64
Mean Squared error:  0.05257968397499098
```

DecisionTreeRegressor Model

In [153]:

```
dtr = DecisionTreeRegressor()
dtr.fit(x_train, y_train)
predictions = dtr.predict(x_test)
```

In [154]:

```
print(predictions[:10])
print(y_test[:10])
print('Mean Squared error: ',mean_squared_error(predictions,y_test))
```

```
[0.46121848 0.98284344 0.69232194 0.71547783 0.19176137 0.28527224
 0.88757586 0.69698498 0.23569794 0.11570669]
1006    0.966906
1109    0.627192
187     0.299075
896     0.723549
413     0.465435
501     0.578316
546     0.591144
881     0.839169
959     0.903342
268     0.228219
Name: Close, dtype: float64
Mean Squared error:  0.10831900809236311
```

AdaBoostRegressor Model

In [165]:

```
adb = AdaBoostRegressor()
adb.fit(x_train, y_train)
```

Out[165]:

```
AdaBoostRegressor()
```

In [167]:

```
predictions = adb.predict(x_test)
print(mean_squared_error(predictions, y_test))
```

```
0.05492347045438241
```

LGBMRegressor Model

In [163]:

```
gbm = lightgbm.LGBMRegressor()
gbm.fit(x_train, y_train)
```

Out[163]:

```
LGBMRegressor()
```

In [160]:

```
predictions = gbm.predict(x_test)
print(mean_squared_error(predictions, y_test))
```

```
0.0583079056070462
```

XGBRegressor Model

In [162]:

```
xgb = xgboost.XGBRegressor()
xgb.fit(x_train, y_train)
```

Out[162]:

```
XGBRegressor(base_score=0.5, booster='gbtree', colsample_bylevel=1,
             colsample_bynode=1, colsample_bytree=1, gamma=0, gpu_id=-1,
             importance_type='gain', interaction_constraints='',
             learning_rate=0.300000012, max_delta_step=0, max_depth=6,
             min_child_weight=1, missing=nan, monotone_constraints='()',
             n_estimators=100, n_jobs=4, num_parallel_tree=1, random_state
=0,
             reg_alpha=0, reg_lambda=1, scale_pos_weight=1, subsample=1,
             tree_method='exact', validate_parameters=1, verbosity=None)
```

In [164]:

```
predictions = xgb.predict(x_test)
print(mean_squared_error(predictions, y_test))
```

```
0.05968830860645931
```

Conclusion

- RandomForest = 0.05257968397499098
- DecisionTree = 0.10831900809236311
- AdaBoost = 0.05492347045438241
- LightGBM = 0.0583079056070462
- XGBoost = 0.05968830860645931 From here we can see that RandomForestRegressor shows a better performance than the others