In [1]:

```
import pandas as pd
import matplotlib.pyplot as plt
from statsmodels.tsa.seasonal import seasonal_decompose
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense,SimpleRNN, LSTM

from sklearn.preprocessing import MinMaxScaler

from sklearn.metrics import mean_squared_error
import numpy as np
```

In [2]:

```
df = pd.read_csv("BAJAJ-AUTO.csv")
```

In [3]:

```
df.head()
```

Out[3]:

	Date	Symbol	Series	Prev Close	Open	High	Low	Last	Close	VWAP	Volume	
0	2008-05-26	BAJAJ-AUTO	EQ	2101.05	898.00	898.0	551.35	600.25	604.75	624.61	3972485	2.48
1	2008-05-27	BAJAJ-AUTO	EQ	604.75	624.70	639.0	580.30	595.50	593.15	606.43	1751063	1.06
2	2008-05-28	BAJAJ-AUTO	EQ	593.15	561.65	621.9	561.65	605.10	608.15	608.75	1652355	1.00
3	2008-05-29	BAJAJ-AUTO	EQ	608.15	619.40	619.4	576.00	600.00	599.45	600.98	669269	4.02
4	2008-05-30	BAJAJ-AUTO	EQ	599.45	605.40	607.0	538.00	576.25	571.70	565.55	1262117	7.13

In [4]:

```
df.tail()
```

Out[4]:

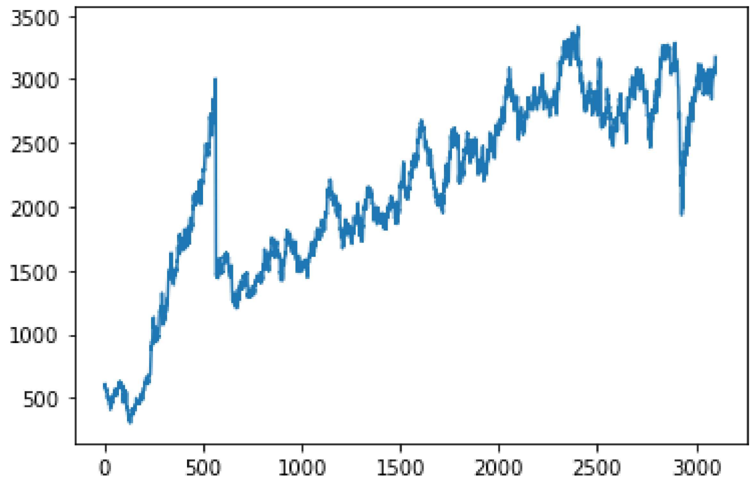
	Date	Symbol	Series	Prev Close	Open	High	Low	Last	Close	VWAP	Volur
3095	2020-11-23	BAJAJ-AUTO	EQ	3058.55	3068.0	3085.0	3030.6	3072.70	3077.75	3062.45	4936
3096	2020-11-24	BAJAJ-AUTO	EQ	3077.75	3077.0	3122.0	3053.0	3094.90	3095.70	3096.37	8589
3097	2020-11-25	BAJAJ-AUTO	EQ	3095.70	3100.0	3160.0	3041.0	3045.00	3051.25	3112.04	12191
3098	2020-11-26	BAJAJ-AUTO	EQ	3051.25	3053.0	3150.0	3053.0	3145.00	3129.20	3096.73	12646
3099	2020-11-27	BAJAJ-AUTO	EQ	3129.20	3144.9	3249.0	3135.7	3170.25	3173.55	3204.30	25483

In [5]:

```
plt.plot(df["Close"])
```

Out[5]:

```
[<matplotlib.lines.Line2D at 0x2592f7f6e80>]
```



In [6]:

```
df.shape
```

Out[6]:

```
(3100, 15)
```

In [7]:

```
train = df["Close"][:2170]
test = df["Close"][2170:]
```

In [8]:

```
train.shape
```

Out[8]:

```
(2170,)
```

In [9]:

```
test.shape
```

Out[9]:

```
(930,)
```

In [10]:

```
scaler = MinMaxScaler()
train_scaled = scaler.fit_transform(np.array(train).reshape(-1,1))
test_scaled = scaler.transform(np.array(test).reshape(-1,1))
```

In [11]:

```
#convert an array of values into a dataset matrix
def create_dataset(dataset, time_step=1):
    X, y = [], []
    for i in range(len(dataset)-time_step-1):
        sample = dataset[i:(i+time_step), 0]
        X.append(sample)
        y.append(dataset[i + time_step, 0])
    return np.array(X), np.array(y)
```

In [12]:

```
time_step = 50
X_train, y_train = create_dataset(train_scaled, time_step)
X_test, y_test = create_dataset(test_scaled, time_step)
```

In [13]:

```
print(X_train.shape)
print(X_test.shape)
```

```
(2119, 50)
(879, 50)
```

In [14]:

```
# reshape into (samples, time steps, features)
X_train = X_train.reshape(X_train.shape[0],X_train.shape[1] , 1)
X_test  = X_test.reshape(X_test.shape[0],X_test.shape[1] , 1)
```

In [15]:

```
print(X_train.shape)
print(X_test.shape)
```

```
(2119, 50, 1)
(879, 50, 1)
```

In [16]:

```
model = Sequential()
model.add(SimpleRNN(32, return_sequences=True, input_shape=(time_step,1)))
model.add(SimpleRNN(32))
model.add(Dense(1))
model.compile(loss='mean_squared_error',optimizer='adam')
```

In [17]:

```
model.fit(X_train,y_train, epochs=20, batch_size=32)
```

```
Epoch 1/20
67/67 [==============================] - 2s 12ms/step - loss: 0.0594
Epoch 2/20
67/67 [==============================] - 1s 14ms/step - loss: 0.0016
Epoch 3/20
67/67 [==============================] - 1s 13ms/step - loss: 0.0012
Epoch 4/20
67/67 [==============================] - 1s 12ms/step - loss: 9.9688e-04
Epoch 5/20
67/67 [==============================] - 1s 12ms/step - loss: 8.8079e-04
Epoch 6/20
67/67 [==============================] - 1s 12ms/step - loss: 9.0445e-04
Epoch 7/20
67/67 [==============================] - 1s 13ms/step - loss: 7.5397e-04
Epoch 8/20
67/67 [==============================] - 1s 14ms/step - loss: 8.1282e-04
Epoch 9/20
67/67 [==============================] - 1s 14ms/step - loss: 7.1421e-04
Epoch 10/20
67/67 [==============================] - 1s 12ms/step - loss: 6.0386e-04
Epoch 11/20
67/67 [==============================] - 1s 12ms/step - loss: 5.3694e-04
Epoch 12/20
67/67 [==============================] - 1s 14ms/step - loss: 5.8889e-04
Epoch 13/20
67/67 [==============================] - 1s 16ms/step - loss: 4.8008e-04
Epoch 14/20
67/67 [==============================] - 1s 13ms/step - loss: 4.7191e-04
Epoch 15/20
67/67 [==============================] - 1s 15ms/step - loss: 4.5945e-04
Epoch 16/20
67/67 [==============================] - 1s 13ms/step - loss: 4.5544e-04
Epoch 17/20
67/67 [==============================] - 1s 14ms/step - loss: 4.4622e-04
Epoch 18/20
67/67 [==============================] - 1s 13ms/step - loss: 4.9952e-04
Epoch 19/20
67/67 [==============================] - 1s 13ms/step - loss: 4.2526e-04
Epoch 20/20
67/67 [==============================] - 1s 14ms/step - loss: 4.2606e-04
```

Out[17]:

```
<keras.callbacks.History at 0x25930237af0>
```

In [18]:

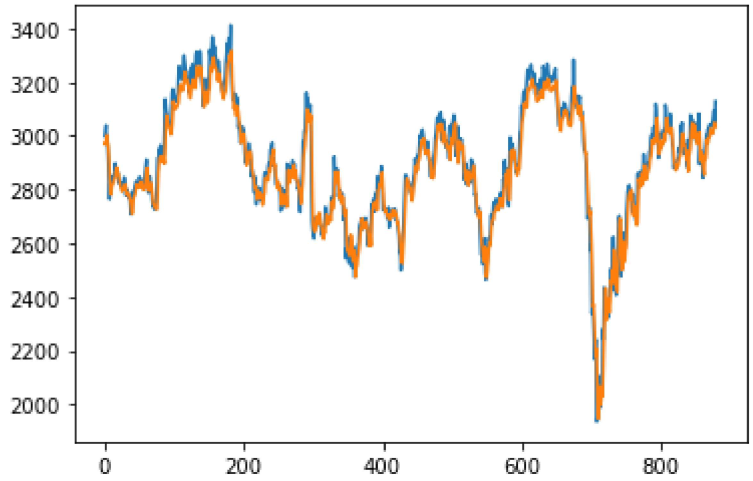
```
y_pred = model.predict(X_test)
mean_squared_error(y_test,y_pred)
```

Out[18]:

```
0.0003990128458580506
```

In [19]:

```
plt.figure()
plt.plot(scaler.inverse_transform(np.array(y_test).reshape(-1,1)))
plt.plot(scaler.inverse_transform(y_pred))
plt.show()
```



In [20]:

```
model = Sequential()
model.add(LSTM(32, return_sequences=True, input_shape=(time_step,1)))
model.add(LSTM(32, return_sequences=True))
model.add(LSTM(32))
model.add(Dense(1))
model.compile(loss='mean_squared_error',optimizer='adam')
```

In [21]:

```
model.fit(X_train,y_train, epochs=20, batch_size=32)
```

```
Epoch 1/20
67/67 [==============================] - 8s 39ms/step - loss: 0.0308
Epoch 2/20
67/67 [==============================] - 3s 39ms/step - loss: 0.0023
Epoch 3/20
67/67 [==============================] - 3s 40ms/step - loss: 0.0021
Epoch 4/20
67/67 [==============================] - 3s 40ms/step - loss: 0.0020
Epoch 5/20
67/67 [==============================] - 3s 41ms/step - loss: 0.0019
Epoch 6/20
67/67 [==============================] - 3s 39ms/step - loss: 0.0018
Epoch 7/20
67/67 [==============================] - 3s 38ms/step - loss: 0.0016
Epoch 8/20
67/67 [==============================] - 3s 38ms/step - loss: 0.0016
Epoch 9/20
67/67 [==============================] - 3s 39ms/step - loss: 0.0015
Epoch 10/20
67/67 [==============================] - 2s 37ms/step - loss: 0.0017
Epoch 11/20
67/67 [==============================] - 3s 40ms/step - loss: 0.0013
Epoch 12/20
67/67 [==============================] - 3s 39ms/step - loss: 0.0014
Epoch 13/20
67/67 [==============================] - 3s 38ms/step - loss: 0.0013
Epoch 14/20
67/67 [==============================] - 3s 38ms/step - loss: 0.0012
Epoch 15/20
67/67 [==============================] - 3s 38ms/step - loss: 0.0012
Epoch 16/20
67/67 [==============================] - 3s 39ms/step - loss: 0.0012
Epoch 17/20
67/67 [==============================] - 3s 40ms/step - loss: 0.0011
Epoch 18/20
67/67 [==============================] - 3s 38ms/step - loss: 0.0010
Epoch 19/20
67/67 [==============================] - 3s 39ms/step - loss: 0.0010
Epoch 20/20
67/67 [==============================] - 3s 39ms/step - loss: 0.0011
```

Out[21]:

```
<keras.callbacks.History at 0x2593aab2940>
```

In [22]:

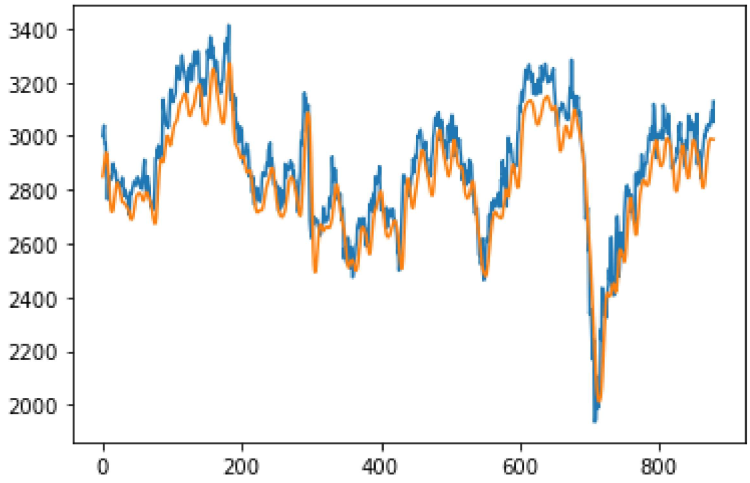
```
y_pred = model.predict(X_test)
mean_squared_error(y_test,y_pred)
```

Out[22]:

```
0.0014908201991205596
```

In [23]:

```
plt.figure()
plt.plot(scaler.inverse_transform(np.array(y_test).reshape(-1,1)))
plt.plot(scaler.inverse_transform(y_pred))
plt.show()
```



In [24]:

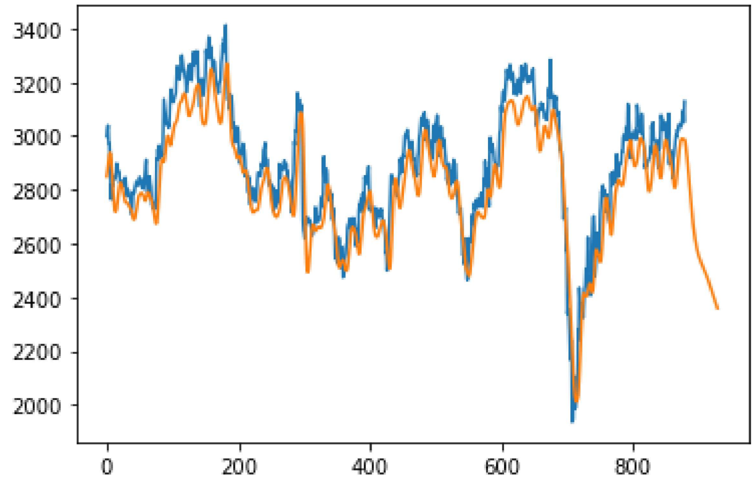
```
# next 50 days

days = 50
last_input = X_test[-1]
last_output = y_pred[-1]
y_forecast = []

for i in range(1,days+1):
    last_input = np.append(last_input[1:], last_output)
    last_output = model.predict(last_input.reshape(1,50,1))
    y_forecast.append(last_output[0][0])
```

In [25]:

```
all_predictions = np.append(y_pred,y_forecast)
```

In [26]:

```
plt.figure()
plt.plot(scaler.inverse_transform(np.array(y_test).reshape(-1,1)))
plt.plot(scaler.inverse_transform(all_predictions.reshape(-1,1)))
plt.show()
```



In [ ]:

```

```