StockPrediction RNN

December 22, 2018

In [1]:
```
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
```

```
Using TensorFlow backend.
```

<!DOCTYPE html>
Stock Price Ananlysis
RRN

In [2]:
```
prices = pd.read_csv('N:/Stock Prediction project/Micrisoft Dataset/New folder/Stock-Pr
```

In [3]:
```
prices.index
```

Out[3]:
```
Index(['2016-01-05 00:00:00', '2016-01-06 00:00:00', '2016-01-07 00:00:00',
       '2016-01-08 00:00:00', '2016-01-11 00:00:00', '2016-01-12 00:00:00',
       '2016-01-13 00:00:00', '2016-01-14 00:00:00', '2016-01-15 00:00:00',
       '2016-01-19 00:00:00',
       ...
       '2016-12-30', '2016-12-30', '2016-12-30', '2016-12-30', '2016-12-30',
       '2016-12-30', '2016-12-30', '2016-12-30', '2016-12-30 00:00:00',
       '2016-12-30 00:00:00'],
      dtype='object', name='date', length=851264)
```

In [4]:
```
prices
```

Out[4]:

date	symbol	open	close	low	high	\
2016-01-05 00:00:00	WLTW	123.430000	125.839996	122.309998	126.250000	
2016-01-06 00:00:00	WLTW	125.239998	119.980003	119.940002	125.540001	
2016-01-07 00:00:00	WLTW	116.379997	114.949997	114.930000	119.739998	
2016-01-08 00:00:00	WLTW	115.480003	116.620003	113.500000	117.440002	

2016-01-11 00:00:00	WLTW	117.010002	114.970001	114.089996	117.330002
2016-01-12 00:00:00	WLTW	115.510002	115.550003	114.500000	116.059998
2016-01-13 00:00:00	WLTW	116.459999	112.849998	112.589996	117.070000
2016-01-14 00:00:00	WLTW	113.510002	114.379997	110.050003	115.029999
2016-01-15 00:00:00	WLTW	113.330002	112.529999	111.919998	114.879997
2016-01-19 00:00:00	WLTW	113.660004	110.379997	109.870003	115.870003
2016-01-20 00:00:00	WLTW	109.059998	109.300003	108.320000	111.599998
2016-01-21 00:00:00	WLTW	109.730003	110.000000	108.320000	110.580002
2016-01-22 00:00:00	WLTW	111.879997	111.949997	110.190002	112.949997
2016-01-25 00:00:00	WLTW	111.320000	110.120003	110.000000	114.629997
2016-01-26 00:00:00	WLTW	110.419998	111.000000	107.300003	111.400002
2016-01-27 00:00:00	WLTW	110.769997	110.709999	109.019997	112.570000
2016-01-28 00:00:00	WLTW	110.900002	112.580002	109.900002	112.970001
2016-01-29 00:00:00	WLTW	113.349998	114.470001	111.669998	114.589996
2016-02-01 00:00:00	WLTW	114.000000	114.500000	112.900002	114.849998
2016-02-02 00:00:00	WLTW	113.250000	110.559998	109.750000	113.860001
2016-02-03 00:00:00	WLTW	113.379997	114.050003	109.639999	114.639999
2016-02-04 00:00:00	WLTW	114.080002	115.709999	114.080002	116.320000
2016-02-05 00:00:00	WLTW	115.120003	114.019997	109.709999	116.489998
2016-02-08 00:00:00	WLTW	113.300003	111.160004	110.459999	113.300003
2016-02-09 00:00:00	WLTW	111.169998	110.650002	109.639999	112.110001
2016-02-10 00:00:00	WLTW	106.730003	107.519997	106.360001	112.110001
2016-02-11 00:00:00	WLTW	105.629997	107.129997	104.110001	109.260002
2016-02-12 00:00:00	WLTW	108.559998	107.839996	107.070000	109.430000
2016-02-16 00:00:00	WLTW	109.110001	110.769997	107.010002	111.300003
2016-02-17 00:00:00	WLTW	110.830002	111.239998	107.970001	112.110001
...	...	...	...	...	...
2016-12-30	WAT	135.240005	134.389999	133.710007	135.300003
2016-12-30	WBA	83.459999	82.760002	82.419998	83.620003
2016-12-30	WDC	68.550003	67.949997	67.610001	69.400002
2016-12-30	WEC	58.980000	58.650002	58.419998	59.119999
2016-12-30	WFC	54.889999	55.110001	54.790001	55.360001
2016-12-30	WFM	31.059999	30.760000	30.670000	31.299999
2016-12-30	WHR	183.800003	181.770004	180.869995	184.289993
2016-12-30	WM	71.269997	70.910004	70.750000	71.500000
2016-12-30	WMB	30.940001	31.139999	30.889999	31.650000
2016-12-30	WMT	69.120003	69.120003	68.830002	69.430000
2016-12-30	WRK	51.840000	50.770000	50.529999	51.840000
2016-12-30	WU	21.840000	21.719999	21.600000	21.900000
2016-12-30	WY	30.450001	30.090000	29.950001	30.450001
2016-12-30	WYN	76.849998	76.370003	76.180000	76.970001
2016-12-30	WYNN	87.099998	86.510002	85.570000	87.449997
2016-12-30	XEC	136.520004	135.899994	135.309998	137.559998
2016-12-30	XEL	41.000000	40.700001	40.560001	41.070000
2016-12-30	XL	37.360001	37.259998	37.060001	37.419998
2016-12-30	XLNX	61.090000	60.369999	60.020000	61.480000
2016-12-30	XOM	90.029999	90.260002	90.010002	90.699997
2016-12-30	XRAY	58.290001	57.730000	57.540001	58.360001

2016-12-30		XRX	8.720000	8.730000	8.700000	8.800000
2016-12-30		XYL	49.980000	49.520000	49.360001	50.000000
2016-12-30		YHOO	38.720001	38.669998	38.430000	39.000000
2016-12-30		YUM	63.930000	63.330002	63.160000	63.939999
2016-12-30		ZBH	103.309998	103.199997	102.849998	103.930000
2016-12-30		ZION	43.070000	43.040001	42.689999	43.310001
2016-12-30		ZTS	53.639999	53.529999	53.270000	53.740002
2016-12-30	00:00:00	AIV	44.730000	45.450001	44.410000	45.590000
2016-12-30	00:00:00	FTV	54.200001	53.630001	53.389999	54.480000

	volume
date	
2016-01-05 00:00:00	2163600.0
2016-01-06 00:00:00	2386400.0
2016-01-07 00:00:00	2489500.0
2016-01-08 00:00:00	2006300.0
2016-01-11 00:00:00	1408600.0
2016-01-12 00:00:00	1098000.0
2016-01-13 00:00:00	949600.0
2016-01-14 00:00:00	785300.0
2016-01-15 00:00:00	1093700.0
2016-01-19 00:00:00	1523500.0
2016-01-20 00:00:00	1653900.0
2016-01-21 00:00:00	944300.0
2016-01-22 00:00:00	744900.0
2016-01-25 00:00:00	703800.0
2016-01-26 00:00:00	563100.0
2016-01-27 00:00:00	896100.0
2016-01-28 00:00:00	680400.0
2016-01-29 00:00:00	749900.0
2016-02-01 00:00:00	574200.0
2016-02-02 00:00:00	694800.0
2016-02-03 00:00:00	896300.0
2016-02-04 00:00:00	956300.0
2016-02-05 00:00:00	997100.0
2016-02-08 00:00:00	1200500.0
2016-02-09 00:00:00	1725200.0
2016-02-10 00:00:00	1946000.0
2016-02-11 00:00:00	1319500.0
2016-02-12 00:00:00	922400.0
2016-02-16 00:00:00	1185100.0
2016-02-17 00:00:00	921500.0
...	...
2016-12-30	464200.0
2016-12-30	3343200.0
2016-12-30	2824100.0
2016-12-30	1221800.0
2016-12-30	15095500.0

```
2016-12-30            2707500.0
2016-12-30             458200.0
2016-12-30            1230600.0
2016-12-30            3980300.0
2016-12-30            6872000.0
2016-12-30             811200.0
2016-12-30            2538900.0
2016-12-30            2825300.0
2016-12-30             524600.0
2016-12-30            1888500.0
2016-12-30             466100.0
2016-12-30            1887600.0
2016-12-30             959200.0
2016-12-30            2111700.0
2016-12-30            9117800.0
2016-12-30             949200.0
2016-12-30           11250400.0
2016-12-30             646200.0
2016-12-30            6431600.0
2016-12-30            1887100.0
2016-12-30             973800.0
2016-12-30            1938100.0
2016-12-30            1701200.0
2016-12-30 00:00:00   1380900.0
2016-12-30 00:00:00    705100.0

[851264 rows x 6 columns]
```

```
In [5]: # selecting YHOO stocks
        yahoo = prices[prices['symbol']=='YHOO']
```

```
In [6]: # preparing input features
        yahoo = yahoo.drop(['symbol'], axis=1)
        yahoo = yahoo.drop(['volume'], axis=1)

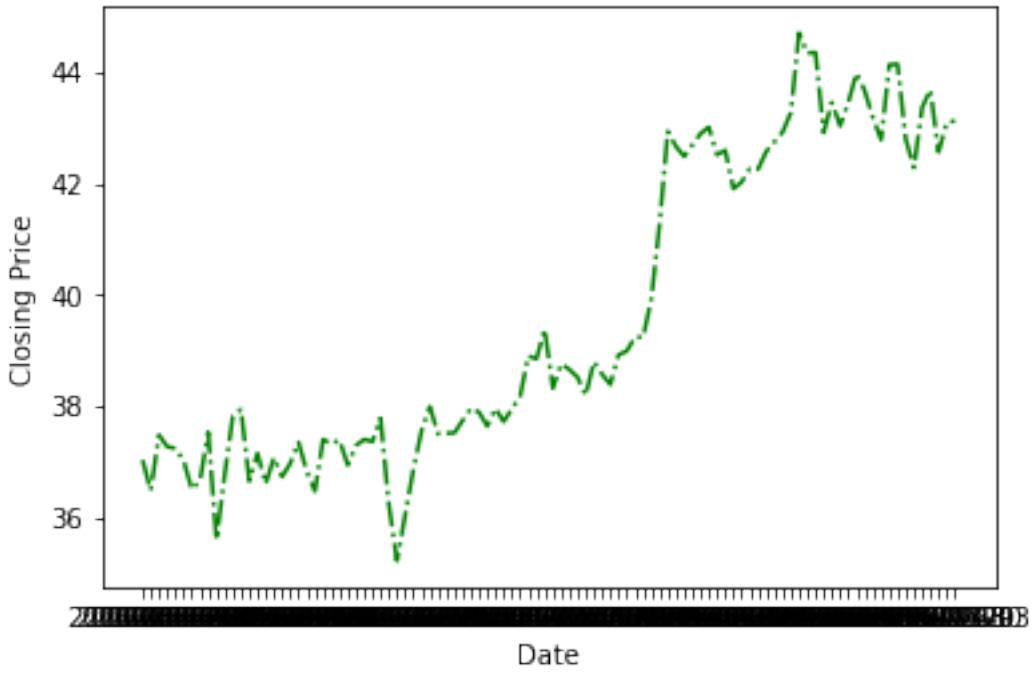
        #Preparing andropping columns
        # square_stock = square_stock.drop('TRADING CODE', axis=1)
        # square_stock = square_stock.drop('LTP*', axis=1)
        # square_stock = square_stock.drop('YCP', axis=1)
        # square_stock = square_stock.drop('TRADE', axis=1)
        # square_stock = square_stock.drop('VALUE (mn)', axis=1)
        # square_stock = square_stock.drop('VOLUME', axis=1)
```

```
In [9]: yahoo = yahoo[['open', 'low', 'high', 'close']]

        #Converting to numpy arrays
        yahoo_nmp = yahoo.values
```

```
        # plt.plot(yahoo_nmp[:,3],'-r')
        # plt.ylabel("Closing Price")
        # plt.xlabel("Index")
        # plt.show()
        # plt.plot(yahoo_nmp[:,2],yahoo_nmp[:,3],'.g')
        # plt.ylabel("Closing Price")
        # plt.xlabel("Hign")
        # plt.show()
```

In [10]:
```
plt.plot(yahoo.index[1600:1700],yahoo_nmp[1600:1700,3],'-.g')
plt.ylabel("Closing Price")
plt.xlabel("Date")
plt.show()
```



In [13]:
```
# preparing label data
yahoo_shift = yahoo.shift(-1)
label = yahoo_shift['close']

#Square
# square_shift = square_stock.shift(-1)
# square_label = square_shift['CLOSEP*']
```

In [14]:
```
#Resetting index
yahoo_shift.reset_index(drop=True)
```

Out[14]:

	open	low	high	close
0	17.219999	17.000000	17.230000	17.230000
1	17.170000	17.070000	17.299999	17.170000
2	16.809999	16.570000	16.900000	16.700001
3	16.680000	16.620001	16.760000	16.700001
4	16.770000	16.480000	16.830000	16.740000
5	16.650000	16.600000	16.860001	16.680000
6	16.879999	16.650000	16.980000	16.900000
7	16.809999	16.799999	17.230000	17.120001
8	17.250000	16.750000	17.250000	16.820000
9	16.780001	16.639999	16.959999	16.750000
10	16.650000	16.250000	16.680000	16.379999
11	16.389999	16.100000	16.580000	16.200001
12	16.080000	15.810000	16.209999	15.880000
13	16.070000	15.740000	16.110001	15.860000
14	15.820000	15.700000	16.170000	15.990000
15	16.459999	15.770000	16.490000	15.980000
16	15.930000	15.440000	15.960000	15.440000
17	15.510000	14.900000	15.670000	15.010000
18	15.140000	14.870000	15.300000	15.050000
19	15.100000	15.030000	15.320000	15.170000
20	15.120000	15.120000	15.600000	15.460000
21	15.340000	14.990000	15.520000	15.010000
22	15.010000	14.920000	15.250000	15.190000
23	15.180000	14.950000	15.470000	14.990000
24	15.200000	14.940000	15.240000	15.070000
25	15.020000	14.480000	15.020000	14.800000
26	14.870000	14.770000	15.250000	15.220000
27	15.070000	14.850000	15.190000	15.170000
28	15.230000	15.180000	15.480000	15.410000
29	15.500000	15.320000	15.520000	15.440000
...	...	...	...	...
1732	41.480000	40.900002	41.650002	41.189999
1733	41.439999	40.939999	41.480000	41.110001
1734	41.200001	40.830002	41.400002	41.009998
1735	40.910000	40.549999	40.980000	40.959999
1736	41.080002	40.709999	41.080002	40.869999
1737	40.849998	40.740002	41.700001	41.450001
1738	41.430000	41.119999	41.830002	41.599998
1739	41.619999	40.880001	41.669998	41.020000
1740	41.000000	39.529999	41.040001	39.630001
1741	39.770000	39.580002	40.320000	40.070000
1742	40.020000	39.849998	40.389999	40.200001
1743	40.310001	39.880001	40.419998	39.970001
1744	39.980000	39.750000	40.570000	40.520000
1745	40.660000	40.419998	41.599998	41.410000
1746	41.520000	41.439999	41.799999	41.759998
1747	41.450001	41.130001	41.529999	41.299999

```
1748  41.349998  41.139999  41.790001  41.470001
1749  41.439999  40.830002  41.529999  40.910000
1750  40.000000  38.250000  40.000000  38.410000
1751  38.619999  38.419998  39.220001  38.610001
1752  38.660000  38.270000  38.790001  38.419998
1753  38.400002  38.240002  39.180000  39.160000
1754  39.080002  38.970001  39.320000  39.150002
1755  38.689999  38.259998  38.790001  38.500000
1756  38.459999  38.369999  38.810001  38.660000
1757  38.590000  38.500000  39.070000  38.919998
1758  39.119999  38.709999  39.220001  38.730000
1759  38.759998  38.480000  38.930000  38.639999
1760  38.720001  38.430000  39.000000  38.669998
1761         NaN         NaN         NaN         NaN

[1762 rows x 4 columns]
```

In [15]:
```
#Next Day Closing price is used as labeling
label
yahoo
```

Out[15]:

date	open	low	high	close
2010-01-04	16.940001	16.879999	17.200001	17.100000
2010-01-05	17.219999	17.000000	17.230000	17.230000
2010-01-06	17.170000	17.070000	17.299999	17.170000
2010-01-07	16.809999	16.570000	16.900000	16.700001
2010-01-08	16.680000	16.620001	16.760000	16.700001
2010-01-11	16.770000	16.480000	16.830000	16.740000
2010-01-12	16.650000	16.600000	16.860001	16.680000
2010-01-13	16.879999	16.650000	16.980000	16.900000
2010-01-14	16.809999	16.799999	17.230000	17.120001
2010-01-15	17.250000	16.750000	17.250000	16.820000
2010-01-19	16.780001	16.639999	16.959999	16.750000
2010-01-20	16.650000	16.250000	16.680000	16.379999
2010-01-21	16.389999	16.100000	16.580000	16.200001
2010-01-22	16.080000	15.810000	16.209999	15.880000
2010-01-25	16.070000	15.740000	16.110001	15.860000
2010-01-26	15.820000	15.700000	16.170000	15.990000
2010-01-27	16.459999	15.770000	16.490000	15.980000
2010-01-28	15.930000	15.440000	15.960000	15.440000
2010-01-29	15.510000	14.900000	15.670000	15.010000
2010-02-01	15.140000	14.870000	15.300000	15.050000
2010-02-02	15.100000	15.030000	15.320000	15.170000
2010-02-03	15.120000	15.120000	15.600000	15.460000
2010-02-04	15.340000	14.990000	15.520000	15.010000
2010-02-05	15.010000	14.920000	15.250000	15.190000
2010-02-08	15.180000	14.950000	15.470000	14.990000

```
2010-02-09  15.200000  14.940000  15.240000  15.070000
2010-02-10  15.020000  14.480000  15.020000  14.800000
2010-02-11  14.870000  14.770000  15.250000  15.220000
2010-02-12  15.070000  14.850000  15.190000  15.170000
2010-02-16  15.230000  15.180000  15.480000  15.410000
...              ...        ...        ...        ...
2016-11-17  41.340000  41.200001  41.650002  41.450001
2016-11-18  41.480000  40.900002  41.650002  41.189999
2016-11-21  41.439999  40.939999  41.480000  41.110001
2016-11-22  41.200001  40.830002  41.400002  41.009998
2016-11-23  40.910000  40.549999  40.980000  40.959999
2016-11-25  41.080002  40.709999  41.080002  40.869999
2016-11-28  40.849998  40.740002  41.700001  41.450001
2016-11-29  41.430000  41.119999  41.830002  41.599998
2016-11-30  41.619999  40.880001  41.669998  41.020000
2016-12-01  41.000000  39.529999  41.040001  39.630001
2016-12-02  39.770000  39.580002  40.320000  40.070000
2016-12-05  40.020000  39.849998  40.389999  40.200001
2016-12-06  40.310001  39.880001  40.419998  39.970001
2016-12-07  39.980000  39.750000  40.570000  40.520000
2016-12-08  40.660000  40.419998  41.599998  41.410000
2016-12-09  41.520000  41.439999  41.799999  41.759998
2016-12-12  41.450001  41.130001  41.529999  41.299999
2016-12-13  41.349998  41.139999  41.790001  41.470001
2016-12-14  41.439999  40.830002  41.529999  40.910000
2016-12-15  40.000000  38.250000  40.000000  38.410000
2016-12-16  38.619999  38.419998  39.220001  38.610001
2016-12-19  38.660000  38.270000  38.790001  38.419998
2016-12-20  38.400002  38.240002  39.180000  39.160000
2016-12-21  39.080002  38.970001  39.320000  39.150002
2016-12-22  38.689999  38.259998  38.790001  38.500000
2016-12-23  38.459999  38.369999  38.810001  38.660000
2016-12-27  38.590000  38.500000  39.070000  38.919998
2016-12-28  39.119999  38.709999  39.220001  38.730000
2016-12-29  38.759998  38.480000  38.930000  38.639999
2016-12-30  38.720001  38.430000  39.000000  38.669998

[1762 rows x 4 columns]
```

In [16]:
```
# adjusting the shape of both
yahoo.drop(yahoo.index[len(yahoo)-1], axis=0, inplace=True)
label.drop(label.index[len(label)-1], axis=0, inplace=True)
```

In [17]:
```
train_start_date = '2016-01-03'
train_end_date = '2017-01-01'
test_start_date = '2017-01-02'
test_end_date = '2018-11-29'
```

In [18]:
```
trainX = yahoo.loc[train_start_date:train_end_date]
```

```
testX = yahoo.loc[test_start_date:test_end_date]
trainY = label.loc[train_start_date:train_end_date]
testY = label.loc[test_start_date:test_end_date]
```

In [19]:
```
# conversion to numpy array x-Features y-labels
x, y = yahoo.values, label.values

#Plotting label(Closing Price) against Date
# plt.plot(yahoo.index,y,'-.g')
# plt.ylabel("Closing Price")
# plt.xlabel("Date")
# plt.show()
# y
```

In [20]:
```
# scaling values for model
x_scale = MinMaxScaler()
y_scale = MinMaxScaler()
```

In [21]:
```
X = x_scale.fit_transform(x)
Y = y_scale.fit_transform(y.reshape(-1,1))
```

In [22]:
```
X[:1,:]
```

Out[22]:
```
array([[0.13762814, 0.14278666, 0.13228812, 0.14559109]])
```

In [23]:
```
# 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: (1179, 1, 4)
Number of samples in x_train 1179
Number of samples in x_test 582
Y_train shape: (1179, 1)
```

In [24]:
```
X_test
```

Out[24]:
```
array([[[0.07881894, 0.06880395, 0.06712396, 0.07146318]],

       [[0.66300639, 0.6697904 , 0.67613921, 0.68289728]],

       [[0.09272816, 0.097164  , 0.08623224, 0.09883721]],
```

```
                ...,

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                [[0.0954124 , 0.09667078, 0.08549731, 0.09859496]]])
```

```
In [25]: y_test
```

```
Out[25]: array([[0.06661822],
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```

In [26]:
```
# creating model using Keras
# tf.reset_default_graph()

model_name = 'stock_price_GRU'

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')
```

In [27]:
```
model.fit(X_train,y_train,batch_size=250, epochs=500, validation_split=0.1, verbose=1)
model.save("{}.h5".format(model_name))
print('MODEL-SAVED')
```

```
Train on 1061 samples, validate on 118 samples
Epoch 1/500
1061/1061 [==============================] - 2s 2ms/step - loss: 0.0826 - val_loss: 0.0725
Epoch 2/500
1061/1061 [==============================] - 0s 267us/step - loss: 0.0709 - val_loss: 0.0590
Epoch 3/500
1061/1061 [==============================] - 0s 274us/step - loss: 0.0542 - val_loss: 0.0397
Epoch 4/500
1061/1061 [==============================] - 0s 272us/step - loss: 0.0339 - val_loss: 0.0179
Epoch 5/500
1061/1061 [==============================] - 0s 276us/step - loss: 0.0129 - val_loss: 0.0038
Epoch 6/500
1061/1061 [==============================] - 0s 284us/step - loss: 0.0024 - val_loss: 0.0010
```

```
Epoch 7/500
1061/1061 [==============================] - 0s 277us/step - loss: 0.0013 - val_loss: 0.0022
Epoch 8/500
1061/1061 [==============================] - 0s 284us/step - loss: 0.0028 - val_loss: 0.0031
Epoch 9/500
1061/1061 [==============================] - 0s 273us/step - loss: 0.0030 - val_loss: 0.0026
Epoch 10/500
1061/1061 [==============================] - 0s 273us/step - loss: 0.0025 - val_loss: 0.0017
Epoch 11/500
1061/1061 [==============================] - 0s 283us/step - loss: 0.0015 - val_loss: 8.1320e-0
Epoch 12/500
1061/1061 [==============================] - 0s 282us/step - loss: 8.9915e-04 - val_loss: 5.655
Epoch 13/500
1061/1061 [==============================] - 0s 280us/step - loss: 8.1180e-04 - val_loss: 5.989
Epoch 14/500
1061/1061 [==============================] - 0s 284us/step - loss: 8.8445e-04 - val_loss: 6.469
Epoch 15/500
1061/1061 [==============================] - 0s 278us/step - loss: 9.0013e-04 - val_loss: 5.878
Epoch 16/500
1061/1061 [==============================] - 0s 279us/step - loss: 8.3427e-04 - val_loss: 5.506
Epoch 17/500
1061/1061 [==============================] - 0s 281us/step - loss: 8.0135e-04 - val_loss: 5.378
Epoch 18/500
1061/1061 [==============================] - 0s 281us/step - loss: 7.8234e-04 - val_loss: 5.501
Epoch 19/500
1061/1061 [==============================] - 0s 283us/step - loss: 7.5924e-04 - val_loss: 5.494
Epoch 20/500
1061/1061 [==============================] - 0s 320us/step - loss: 7.9275e-04 - val_loss: 5.365
Epoch 21/500
1061/1061 [==============================] - 0s 289us/step - loss: 7.6646e-04 - val_loss: 5.275
Epoch 22/500
1061/1061 [==============================] - 0s 277us/step - loss: 7.7115e-04 - val_loss: 5.193
Epoch 23/500
1061/1061 [==============================] - 0s 306us/step - loss: 7.6706e-04 - val_loss: 5.239
Epoch 24/500
1061/1061 [==============================] - 0s 300us/step - loss: 7.6260e-04 - val_loss: 5.162
Epoch 25/500
1061/1061 [==============================] - 0s 347us/step - loss: 7.2752e-04 - val_loss: 5.271
Epoch 26/500
1061/1061 [==============================] - 0s 314us/step - loss: 7.7542e-04 - val_loss: 5.195
Epoch 27/500
1061/1061 [==============================] - 0s 284us/step - loss: 7.4340e-04 - val_loss: 5.678
Epoch 28/500
1061/1061 [==============================] - 0s 293us/step - loss: 7.6185e-04 - val_loss: 5.434
Epoch 29/500
1061/1061 [==============================] - 0s 384us/step - loss: 8.0906e-04 - val_loss: 5.522
Epoch 30/500
1061/1061 [==============================] - 0s 295us/step - loss: 7.8304e-04 - val_loss: 5.117
```

```
Epoch 31/500
1061/1061 [==============================] - 0s 291us/step - loss: 7.3201e-04 - val_loss: 5.296
Epoch 32/500
1061/1061 [==============================] - 0s 284us/step - loss: 7.5401e-04 - val_loss: 5.113
Epoch 33/500
1061/1061 [==============================] - 0s 269us/step - loss: 7.2452e-04 - val_loss: 5.448
Epoch 34/500
1061/1061 [==============================] - 0s 275us/step - loss: 7.2149e-04 - val_loss: 5.144
Epoch 35/500
1061/1061 [==============================] - 0s 269us/step - loss: 7.3061e-04 - val_loss: 5.323
Epoch 36/500
1061/1061 [==============================] - 0s 287us/step - loss: 7.0496e-04 - val_loss: 4.995
Epoch 37/500
1061/1061 [==============================] - 0s 271us/step - loss: 7.4934e-04 - val_loss: 4.895
Epoch 38/500
1061/1061 [==============================] - 0s 271us/step - loss: 7.0010e-04 - val_loss: 5.242
Epoch 39/500
1061/1061 [==============================] - 0s 277us/step - loss: 7.0841e-04 - val_loss: 5.118
Epoch 40/500
1061/1061 [==============================] - 0s 274us/step - loss: 7.8314e-04 - val_loss: 4.941
Epoch 41/500
1061/1061 [==============================] - 0s 274us/step - loss: 7.5950e-04 - val_loss: 5.090
Epoch 42/500
1061/1061 [==============================] - 0s 298us/step - loss: 7.0477e-04 - val_loss: 5.315
Epoch 43/500
1061/1061 [==============================] - 0s 268us/step - loss: 7.7122e-04 - val_loss: 5.637
Epoch 44/500
1061/1061 [==============================] - 0s 273us/step - loss: 7.4984e-04 - val_loss: 5.118
Epoch 45/500
1061/1061 [==============================] - 0s 261us/step - loss: 7.1466e-04 - val_loss: 5.166
Epoch 46/500
1061/1061 [==============================] - 0s 266us/step - loss: 7.2682e-04 - val_loss: 4.807
Epoch 47/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.9425e-04 - val_loss: 4.840
Epoch 48/500
1061/1061 [==============================] - 0s 274us/step - loss: 7.2098e-04 - val_loss: 4.888
Epoch 49/500
1061/1061 [==============================] - 0s 274us/step - loss: 6.7082e-04 - val_loss: 4.852
Epoch 50/500
1061/1061 [==============================] - 0s 267us/step - loss: 7.2789e-04 - val_loss: 4.921
Epoch 51/500
1061/1061 [==============================] - 0s 269us/step - loss: 6.9422e-04 - val_loss: 4.747
Epoch 52/500
1061/1061 [==============================] - 0s 266us/step - loss: 7.0328e-04 - val_loss: 4.756
Epoch 53/500
1061/1061 [==============================] - 0s 272us/step - loss: 6.9370e-04 - val_loss: 4.741
Epoch 54/500
1061/1061 [==============================] - 0s 273us/step - loss: 6.9393e-04 - val_loss: 4.732
```

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Epoch 55/500
1061/1061 [==============================] - 0s 274us/step - loss: 6.9099e-04 - val_loss: 4.954
Epoch 56/500
1061/1061 [==============================] - 0s 266us/step - loss: 6.8260e-04 - val_loss: 4.778
Epoch 57/500
1061/1061 [==============================] - 0s 265us/step - loss: 6.9847e-04 - val_loss: 4.950
Epoch 58/500
1061/1061 [==============================] - 0s 262us/step - loss: 6.8792e-04 - val_loss: 4.783
Epoch 59/500
1061/1061 [==============================] - 0s 262us/step - loss: 7.1552e-04 - val_loss: 5.302
Epoch 60/500
1061/1061 [==============================] - 0s 266us/step - loss: 7.0975e-04 - val_loss: 4.734
Epoch 61/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.7654e-04 - val_loss: 4.737
Epoch 62/500
1061/1061 [==============================] - 0s 257us/step - loss: 6.9633e-04 - val_loss: 4.945
Epoch 63/500
1061/1061 [==============================] - 0s 270us/step - loss: 6.8527e-04 - val_loss: 4.707
Epoch 64/500
1061/1061 [==============================] - 0s 274us/step - loss: 6.7514e-04 - val_loss: 4.689
Epoch 65/500
1061/1061 [==============================] - 0s 274us/step - loss: 7.0485e-04 - val_loss: 4.874
Epoch 66/500
1061/1061 [==============================] - 0s 271us/step - loss: 6.8044e-04 - val_loss: 4.718
Epoch 67/500
1061/1061 [==============================] - 0s 273us/step - loss: 6.3919e-04 - val_loss: 4.719
Epoch 68/500
1061/1061 [==============================] - 0s 270us/step - loss: 6.8124e-04 - val_loss: 4.935
Epoch 69/500
1061/1061 [==============================] - 0s 276us/step - loss: 6.7183e-04 - val_loss: 4.733
Epoch 70/500
1061/1061 [==============================] - 0s 275us/step - loss: 6.7679e-04 - val_loss: 4.673
Epoch 71/500
1061/1061 [==============================] - 0s 269us/step - loss: 6.7121e-04 - val_loss: 4.673
Epoch 72/500
1061/1061 [==============================] - 0s 273us/step - loss: 6.9213e-04 - val_loss: 4.720
Epoch 73/500
1061/1061 [==============================] - 0s 277us/step - loss: 6.5409e-04 - val_loss: 4.949
Epoch 74/500
1061/1061 [==============================] - 0s 284us/step - loss: 7.0122e-04 - val_loss: 4.696
Epoch 75/500
1061/1061 [==============================] - 0s 282us/step - loss: 6.9459e-04 - val_loss: 4.661
Epoch 76/500
1061/1061 [==============================] - 0s 278us/step - loss: 6.8245e-04 - val_loss: 4.782
Epoch 77/500
1061/1061 [==============================] - 0s 276us/step - loss: 6.6611e-04 - val_loss: 4.864
Epoch 78/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.8934e-04 - val_loss: 4.703
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Epoch 79/500
1061/1061 [==============================] - 0s 269us/step - loss: 6.6812e-04 - val_loss: 4.726
Epoch 80/500
1061/1061 [==============================] - 0s 272us/step - loss: 7.1820e-04 - val_loss: 4.839
Epoch 81/500
1061/1061 [==============================] - 0s 278us/step - loss: 6.6575e-04 - val_loss: 4.648
Epoch 82/500
1061/1061 [==============================] - 0s 275us/step - loss: 6.8193e-04 - val_loss: 4.631
Epoch 83/500
1061/1061 [==============================] - 0s 277us/step - loss: 6.5807e-04 - val_loss: 4.730
Epoch 84/500
1061/1061 [==============================] - 0s 272us/step - loss: 6.6175e-04 - val_loss: 4.641
Epoch 85/500
1061/1061 [==============================] - 0s 278us/step - loss: 6.6478e-04 - val_loss: 4.671
Epoch 86/500
1061/1061 [==============================] - 0s 277us/step - loss: 6.8205e-04 - val_loss: 4.759
Epoch 87/500
1061/1061 [==============================] - 0s 256us/step - loss: 6.6256e-04 - val_loss: 4.666
Epoch 88/500
1061/1061 [==============================] - 0s 256us/step - loss: 6.7048e-04 - val_loss: 4.653
Epoch 89/500
1061/1061 [==============================] - 0s 260us/step - loss: 6.5469e-04 - val_loss: 4.624
Epoch 90/500
1061/1061 [==============================] - 0s 255us/step - loss: 6.7823e-04 - val_loss: 4.870
Epoch 91/500
1061/1061 [==============================] - 0s 253us/step - loss: 6.7038e-04 - val_loss: 4.822
Epoch 92/500
1061/1061 [==============================] - 0s 257us/step - loss: 6.8481e-04 - val_loss: 4.832
Epoch 93/500
1061/1061 [==============================] - 0s 254us/step - loss: 7.0723e-04 - val_loss: 4.770
Epoch 94/500
1061/1061 [==============================] - 0s 262us/step - loss: 6.5859e-04 - val_loss: 4.676
Epoch 95/500
1061/1061 [==============================] - 0s 261us/step - loss: 6.4510e-04 - val_loss: 4.662
Epoch 96/500
1061/1061 [==============================] - 0s 256us/step - loss: 6.7357e-04 - val_loss: 4.914
Epoch 97/500
1061/1061 [==============================] - 0s 254us/step - loss: 6.6636e-04 - val_loss: 4.827
Epoch 98/500
1061/1061 [==============================] - 0s 259us/step - loss: 6.5936e-04 - val_loss: 4.670
Epoch 99/500
1061/1061 [==============================] - 0s 258us/step - loss: 6.5218e-04 - val_loss: 4.743
Epoch 100/500
1061/1061 [==============================] - 0s 258us/step - loss: 6.9559e-04 - val_loss: 5.197
Epoch 101/500
1061/1061 [==============================] - 0s 265us/step - loss: 6.6939e-04 - val_loss: 4.774
Epoch 102/500
1061/1061 [==============================] - 0s 265us/step - loss: 6.9507e-04 - val_loss: 4.633
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Epoch 103/500
1061/1061 [==============================] - 0s 259us/step - loss: 6.5177e-04 - val_loss: 4.707
Epoch 104/500
1061/1061 [==============================] - 0s 267us/step - loss: 6.6748e-04 - val_loss: 4.800
Epoch 105/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.7147e-04 - val_loss: 4.599
Epoch 106/500
1061/1061 [==============================] - 0s 285us/step - loss: 6.7162e-04 - val_loss: 4.718
Epoch 107/500
1061/1061 [==============================] - 0s 267us/step - loss: 6.6857e-04 - val_loss: 4.644
Epoch 108/500
1061/1061 [==============================] - 0s 264us/step - loss: 6.5386e-04 - val_loss: 4.698
Epoch 109/500
1061/1061 [==============================] - 0s 261us/step - loss: 6.5655e-04 - val_loss: 4.623
Epoch 110/500
1061/1061 [==============================] - 0s 262us/step - loss: 6.6332e-04 - val_loss: 4.656
Epoch 111/500
1061/1061 [==============================] - 0s 256us/step - loss: 6.6003e-04 - val_loss: 4.592
Epoch 112/500
1061/1061 [==============================] - 0s 256us/step - loss: 6.5575e-04 - val_loss: 4.738
Epoch 113/500
1061/1061 [==============================] - 0s 253us/step - loss: 6.7560e-04 - val_loss: 4.994
Epoch 114/500
1061/1061 [==============================] - 0s 259us/step - loss: 7.0208e-04 - val_loss: 4.667
Epoch 115/500
1061/1061 [==============================] - 0s 262us/step - loss: 6.5958e-04 - val_loss: 4.755
Epoch 116/500
1061/1061 [==============================] - 0s 260us/step - loss: 6.7271e-04 - val_loss: 4.621
Epoch 117/500
1061/1061 [==============================] - 0s 265us/step - loss: 6.6308e-04 - val_loss: 4.609
Epoch 118/500
1061/1061 [==============================] - 0s 267us/step - loss: 6.5171e-04 - val_loss: 4.637
Epoch 119/500
1061/1061 [==============================] - 0s 262us/step - loss: 6.7583e-04 - val_loss: 4.855
Epoch 120/500
1061/1061 [==============================] - 0s 261us/step - loss: 6.7117e-04 - val_loss: 4.559
Epoch 121/500
1061/1061 [==============================] - 0s 260us/step - loss: 6.8501e-04 - val_loss: 5.058
Epoch 122/500
1061/1061 [==============================] - 0s 258us/step - loss: 6.7876e-04 - val_loss: 4.669
Epoch 123/500
1061/1061 [==============================] - 0s 253us/step - loss: 6.6981e-04 - val_loss: 4.648
Epoch 124/500
1061/1061 [==============================] - 0s 257us/step - loss: 6.6236e-04 - val_loss: 4.881
Epoch 125/500
1061/1061 [==============================] - 0s 261us/step - loss: 6.5525e-04 - val_loss: 4.668
Epoch 126/500
1061/1061 [==============================] - 0s 260us/step - loss: 6.7283e-04 - val_loss: 4.600
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Epoch 127/500
1061/1061 [==============================] - 0s 261us/step - loss: 6.8885e-04 - val_loss: 5.026
Epoch 128/500
1061/1061 [==============================] - 0s 259us/step - loss: 6.6825e-04 - val_loss: 4.635
Epoch 129/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.8340e-04 - val_loss: 4.564
Epoch 130/500
1061/1061 [==============================] - 0s 274us/step - loss: 6.6984e-04 - val_loss: 5.837
Epoch 131/500
1061/1061 [==============================] - 0s 293us/step - loss: 7.4872e-04 - val_loss: 4.537
Epoch 132/500
1061/1061 [==============================] - 0s 280us/step - loss: 7.4231e-04 - val_loss: 4.846
Epoch 133/500
1061/1061 [==============================] - 0s 287us/step - loss: 6.6246e-04 - val_loss: 4.838
Epoch 134/500
1061/1061 [==============================] - 0s 277us/step - loss: 7.0017e-04 - val_loss: 5.769
Epoch 135/500
1061/1061 [==============================] - 0s 282us/step - loss: 7.2522e-04 - val_loss: 4.702
Epoch 136/500
1061/1061 [==============================] - 0s 281us/step - loss: 6.7770e-04 - val_loss: 4.547
Epoch 137/500
1061/1061 [==============================] - 0s 293us/step - loss: 6.6194e-04 - val_loss: 5.211
Epoch 138/500
1061/1061 [==============================] - 0s 276us/step - loss: 6.9851e-04 - val_loss: 4.574
Epoch 139/500
1061/1061 [==============================] - 0s 287us/step - loss: 6.6506e-04 - val_loss: 4.627
Epoch 140/500
1061/1061 [==============================] - 0s 290us/step - loss: 6.4693e-04 - val_loss: 4.555
Epoch 141/500
1061/1061 [==============================] - 0s 278us/step - loss: 6.8379e-04 - val_loss: 4.550
Epoch 142/500
1061/1061 [==============================] - 0s 277us/step - loss: 6.5226e-04 - val_loss: 4.746
Epoch 143/500
1061/1061 [==============================] - 0s 291us/step - loss: 6.5984e-04 - val_loss: 4.776
Epoch 144/500
1061/1061 [==============================] - 0s 261us/step - loss: 6.6781e-04 - val_loss: 4.634
Epoch 145/500
1061/1061 [==============================] - 0s 254us/step - loss: 6.3538e-04 - val_loss: 4.614
Epoch 146/500
1061/1061 [==============================] - 0s 258us/step - loss: 6.6570e-04 - val_loss: 4.812
Epoch 147/500
1061/1061 [==============================] - 0s 250us/step - loss: 6.8213e-04 - val_loss: 5.775
Epoch 148/500
1061/1061 [==============================] - 0s 258us/step - loss: 7.1244e-04 - val_loss: 4.759
Epoch 149/500
1061/1061 [==============================] - 0s 261us/step - loss: 6.8033e-04 - val_loss: 5.246
Epoch 150/500
1061/1061 [==============================] - 0s 264us/step - loss: 7.0797e-04 - val_loss: 5.197
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Epoch 151/500
1061/1061 [==============================] - 0s 260us/step - loss: 6.7565e-04 - val_loss: 4.545
Epoch 152/500
1061/1061 [==============================] - 0s 284us/step - loss: 7.0266e-04 - val_loss: 4.514
Epoch 153/500
1061/1061 [==============================] - 0s 260us/step - loss: 6.6192e-04 - val_loss: 4.771
Epoch 154/500
1061/1061 [==============================] - 0s 257us/step - loss: 6.4256e-04 - val_loss: 4.568
Epoch 155/500
1061/1061 [==============================] - 0s 258us/step - loss: 6.6149e-04 - val_loss: 4.625
Epoch 156/500
1061/1061 [==============================] - 0s 265us/step - loss: 6.7546e-04 - val_loss: 4.492
Epoch 157/500
1061/1061 [==============================] - 0s 260us/step - loss: 6.5593e-04 - val_loss: 4.573
Epoch 158/500
1061/1061 [==============================] - 0s 257us/step - loss: 6.7873e-04 - val_loss: 5.020
Epoch 159/500
1061/1061 [==============================] - 0s 258us/step - loss: 6.7690e-04 - val_loss: 4.652
Epoch 160/500
1061/1061 [==============================] - 0s 267us/step - loss: 6.6658e-04 - val_loss: 4.655
Epoch 161/500
1061/1061 [==============================] - 0s 270us/step - loss: 6.6137e-04 - val_loss: 4.848
Epoch 162/500
1061/1061 [==============================] - 0s 258us/step - loss: 6.8235e-04 - val_loss: 4.736
Epoch 163/500
1061/1061 [==============================] - 0s 260us/step - loss: 7.0846e-04 - val_loss: 4.500
Epoch 164/500
1061/1061 [==============================] - 0s 252us/step - loss: 6.5455e-04 - val_loss: 4.790
Epoch 165/500
1061/1061 [==============================] - 0s 252us/step - loss: 6.6912e-04 - val_loss: 4.535
Epoch 166/500
1061/1061 [==============================] - 0s 269us/step - loss: 6.4231e-04 - val_loss: 4.588
Epoch 167/500
1061/1061 [==============================] - 0s 249us/step - loss: 6.5458e-04 - val_loss: 4.496
Epoch 168/500
1061/1061 [==============================] - 0s 259us/step - loss: 6.5193e-04 - val_loss: 4.543
Epoch 169/500
1061/1061 [==============================] - 0s 261us/step - loss: 6.7380e-04 - val_loss: 5.358
Epoch 170/500
1061/1061 [==============================] - 0s 257us/step - loss: 7.0056e-04 - val_loss: 4.545
Epoch 171/500
1061/1061 [==============================] - 0s 263us/step - loss: 7.0350e-04 - val_loss: 4.697
Epoch 172/500
1061/1061 [==============================] - 0s 261us/step - loss: 6.7485e-04 - val_loss: 4.658
Epoch 173/500
1061/1061 [==============================] - 0s 264us/step - loss: 6.4464e-04 - val_loss: 4.509
Epoch 174/500
1061/1061 [==============================] - 0s 278us/step - loss: 6.6455e-04 - val_loss: 4.475
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Epoch 175/500
1061/1061 [==============================] - 0s 278us/step - loss: 6.4296e-04 - val_loss: 4.526
Epoch 176/500
1061/1061 [==============================] - 0s 267us/step - loss: 6.8268e-04 - val_loss: 5.249
Epoch 177/500
1061/1061 [==============================] - 0s 277us/step - loss: 6.9110e-04 - val_loss: 4.708
Epoch 178/500
1061/1061 [==============================] - 0s 280us/step - loss: 6.6508e-04 - val_loss: 4.523
Epoch 179/500
1061/1061 [==============================] - 0s 283us/step - loss: 6.8976e-04 - val_loss: 5.294
Epoch 180/500
1061/1061 [==============================] - 0s 293us/step - loss: 6.9968e-04 - val_loss: 4.803
Epoch 181/500
1061/1061 [==============================] - 0s 261us/step - loss: 6.7553e-04 - val_loss: 4.762
Epoch 182/500
1061/1061 [==============================] - 0s 272us/step - loss: 6.7728e-04 - val_loss: 4.521
Epoch 183/500
1061/1061 [==============================] - 0s 265us/step - loss: 6.5552e-04 - val_loss: 4.498
Epoch 184/500
1061/1061 [==============================] - 0s 264us/step - loss: 6.7399e-04 - val_loss: 4.824
Epoch 185/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.7646e-04 - val_loss: 4.488
Epoch 186/500
1061/1061 [==============================] - 0s 301us/step - loss: 6.4767e-04 - val_loss: 4.484
Epoch 187/500
1061/1061 [==============================] - 0s 310us/step - loss: 6.9286e-04 - val_loss: 5.196
Epoch 188/500
1061/1061 [==============================] - 0s 282us/step - loss: 7.0181e-04 - val_loss: 4.442
Epoch 189/500
1061/1061 [==============================] - 0s 287us/step - loss: 6.4967e-04 - val_loss: 4.686
Epoch 190/500
1061/1061 [==============================] - 0s 291us/step - loss: 6.7448e-04 - val_loss: 5.523
Epoch 191/500
1061/1061 [==============================] - 0s 276us/step - loss: 7.1948e-04 - val_loss: 4.481
Epoch 192/500
1061/1061 [==============================] - 0s 277us/step - loss: 6.6071e-04 - val_loss: 4.585
Epoch 193/500
1061/1061 [==============================] - 0s 275us/step - loss: 6.7490e-04 - val_loss: 4.662
Epoch 194/500
1061/1061 [==============================] - 0s 271us/step - loss: 6.6334e-04 - val_loss: 4.462
Epoch 195/500
1061/1061 [==============================] - 0s 277us/step - loss: 6.5205e-04 - val_loss: 4.604
Epoch 196/500
1061/1061 [==============================] - 0s 274us/step - loss: 6.8033e-04 - val_loss: 4.564
Epoch 197/500
1061/1061 [==============================] - 0s 286us/step - loss: 6.4557e-04 - val_loss: 4.494
Epoch 198/500
1061/1061 [==============================] - 0s 293us/step - loss: 6.4592e-04 - val_loss: 4.421
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Epoch 199/500
1061/1061 [==============================] - 0s 273us/step - loss: 6.4613e-04 - val_loss: 4.524
Epoch 200/500
1061/1061 [==============================] - 0s 280us/step - loss: 6.4594e-04 - val_loss: 4.464
Epoch 201/500
1061/1061 [==============================] - 0s 256us/step - loss: 6.5522e-04 - val_loss: 5.060
Epoch 202/500
1061/1061 [==============================] - 0s 262us/step - loss: 6.8097e-04 - val_loss: 4.586
Epoch 203/500
1061/1061 [==============================] - 0s 277us/step - loss: 6.8665e-04 - val_loss: 4.496
Epoch 204/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.4100e-04 - val_loss: 4.523
Epoch 205/500
1061/1061 [==============================] - 0s 279us/step - loss: 6.5713e-04 - val_loss: 4.445
Epoch 206/500
1061/1061 [==============================] - 0s 261us/step - loss: 6.6649e-04 - val_loss: 4.549
Epoch 207/500
1061/1061 [==============================] - 0s 258us/step - loss: 6.7909e-04 - val_loss: 5.269
Epoch 208/500
1061/1061 [==============================] - 0s 264us/step - loss: 6.7444e-04 - val_loss: 4.755
Epoch 209/500
1061/1061 [==============================] - 0s 258us/step - loss: 6.5233e-04 - val_loss: 4.479
Epoch 210/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.4234e-04 - val_loss: 4.427
Epoch 211/500
1061/1061 [==============================] - 0s 261us/step - loss: 6.5502e-04 - val_loss: 4.611
Epoch 212/500
1061/1061 [==============================] - 0s 267us/step - loss: 6.6129e-04 - val_loss: 6.165
Epoch 213/500
1061/1061 [==============================] - 0s 263us/step - loss: 7.1029e-04 - val_loss: 4.897
Epoch 214/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.7490e-04 - val_loss: 4.417
Epoch 215/500
1061/1061 [==============================] - 0s 263us/step - loss: 6.4557e-04 - val_loss: 5.250
Epoch 216/500
1061/1061 [==============================] - 0s 262us/step - loss: 6.8858e-04 - val_loss: 4.452
Epoch 217/500
1061/1061 [==============================] - 0s 255us/step - loss: 6.5810e-04 - val_loss: 4.447
Epoch 218/500
1061/1061 [==============================] - 0s 256us/step - loss: 6.6103e-04 - val_loss: 4.874
Epoch 219/500
1061/1061 [==============================] - 0s 262us/step - loss: 6.8861e-04 - val_loss: 4.470
Epoch 220/500
1061/1061 [==============================] - 0s 251us/step - loss: 6.5325e-04 - val_loss: 4.487
Epoch 221/500
1061/1061 [==============================] - 0s 254us/step - loss: 6.5911e-04 - val_loss: 4.484
Epoch 222/500
1061/1061 [==============================] - 0s 258us/step - loss: 6.8746e-04 - val_loss: 4.544
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Epoch 223/500
1061/1061 [==============================] - 0s 256us/step - loss: 6.5503e-04 - val_loss: 4.420
Epoch 224/500
1061/1061 [==============================] - 0s 255us/step - loss: 6.9007e-04 - val_loss: 4.756
Epoch 225/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.5886e-04 - val_loss: 4.398
Epoch 226/500
1061/1061 [==============================] - 0s 257us/step - loss: 6.6931e-04 - val_loss: 4.689
Epoch 227/500
1061/1061 [==============================] - 0s 259us/step - loss: 6.7833e-04 - val_loss: 5.663
Epoch 228/500
1061/1061 [==============================] - 0s 276us/step - loss: 6.9370e-04 - val_loss: 4.406
Epoch 229/500
1061/1061 [==============================] - 0s 283us/step - loss: 6.9015e-04 - val_loss: 4.950
Epoch 230/500
1061/1061 [==============================] - 0s 290us/step - loss: 6.6511e-04 - val_loss: 4.541
Epoch 231/500
1061/1061 [==============================] - 0s 310us/step - loss: 6.6019e-04 - val_loss: 4.875
Epoch 232/500
1061/1061 [==============================] - 0s 309us/step - loss: 6.2949e-04 - val_loss: 4.454
Epoch 233/500
1061/1061 [==============================] - 0s 291us/step - loss: 6.6125e-04 - val_loss: 4.431
Epoch 234/500
1061/1061 [==============================] - 0s 274us/step - loss: 6.2630e-04 - val_loss: 4.476
Epoch 235/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.7366e-04 - val_loss: 4.470
Epoch 236/500
1061/1061 [==============================] - 0s 266us/step - loss: 6.5427e-04 - val_loss: 4.430
Epoch 237/500
1061/1061 [==============================] - 0s 263us/step - loss: 6.4669e-04 - val_loss: 4.409
Epoch 238/500
1061/1061 [==============================] - 0s 259us/step - loss: 6.4237e-04 - val_loss: 4.639
Epoch 239/500
1061/1061 [==============================] - 0s 277us/step - loss: 6.6784e-04 - val_loss: 4.409
Epoch 240/500
1061/1061 [==============================] - 0s 274us/step - loss: 6.2803e-04 - val_loss: 4.439
Epoch 241/500
1061/1061 [==============================] - 0s 284us/step - loss: 6.5549e-04 - val_loss: 4.433
Epoch 242/500
1061/1061 [==============================] - 0s 286us/step - loss: 6.4876e-04 - val_loss: 4.975
Epoch 243/500
1061/1061 [==============================] - 0s 289us/step - loss: 6.7749e-04 - val_loss: 4.465
Epoch 244/500
1061/1061 [==============================] - 0s 277us/step - loss: 6.3427e-04 - val_loss: 4.451
Epoch 245/500
1061/1061 [==============================] - 0s 283us/step - loss: 6.5628e-04 - val_loss: 4.460
Epoch 246/500
1061/1061 [==============================] - 0s 273us/step - loss: 6.3774e-04 - val_loss: 4.370
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Epoch 247/500
1061/1061 [==============================] - 0s 278us/step - loss: 6.4245e-04 - val_loss: 5.088
Epoch 248/500
1061/1061 [==============================] - 0s 270us/step - loss: 6.6045e-04 - val_loss: 4.501
Epoch 249/500
1061/1061 [==============================] - 0s 281us/step - loss: 6.4820e-04 - val_loss: 4.391
Epoch 250/500
1061/1061 [==============================] - 0s 291us/step - loss: 6.6371e-04 - val_loss: 4.661
Epoch 251/500
1061/1061 [==============================] - 0s 291us/step - loss: 6.4996e-04 - val_loss: 4.378
Epoch 252/500
1061/1061 [==============================] - 0s 329us/step - loss: 6.6938e-04 - val_loss: 4.592
Epoch 253/500
1061/1061 [==============================] - 0s 272us/step - loss: 6.7662e-04 - val_loss: 4.449
Epoch 254/500
1061/1061 [==============================] - 0s 270us/step - loss: 6.8527e-04 - val_loss: 5.508
Epoch 255/500
1061/1061 [==============================] - 0s 263us/step - loss: 6.8159e-04 - val_loss: 4.382
Epoch 256/500
1061/1061 [==============================] - 0s 263us/step - loss: 6.4222e-04 - val_loss: 4.540
Epoch 257/500
1061/1061 [==============================] - 0s 258us/step - loss: 6.6041e-04 - val_loss: 5.285
Epoch 258/500
1061/1061 [==============================] - 0s 263us/step - loss: 6.7058e-04 - val_loss: 4.340
Epoch 259/500
1061/1061 [==============================] - 0s 259us/step - loss: 6.7755e-04 - val_loss: 4.374
Epoch 260/500
1061/1061 [==============================] - 0s 262us/step - loss: 6.3595e-04 - val_loss: 4.727
Epoch 261/500
1061/1061 [==============================] - 0s 264us/step - loss: 6.6735e-04 - val_loss: 4.617
Epoch 262/500
1061/1061 [==============================] - 0s 272us/step - loss: 6.8084e-04 - val_loss: 4.367
Epoch 263/500
1061/1061 [==============================] - 0s 269us/step - loss: 6.6555e-04 - val_loss: 4.609
Epoch 264/500
1061/1061 [==============================] - 0s 271us/step - loss: 6.7168e-04 - val_loss: 4.450
Epoch 265/500
1061/1061 [==============================] - 0s 275us/step - loss: 6.3777e-04 - val_loss: 4.679
Epoch 266/500
1061/1061 [==============================] - 0s 269us/step - loss: 6.4860e-04 - val_loss: 5.330
Epoch 267/500
1061/1061 [==============================] - 0s 274us/step - loss: 6.8738e-04 - val_loss: 4.333
Epoch 268/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.6799e-04 - val_loss: 4.913
Epoch 269/500
1061/1061 [==============================] - 0s 266us/step - loss: 6.8686e-04 - val_loss: 5.034
Epoch 270/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.9104e-04 - val_loss: 4.902
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Epoch 271/500
1061/1061 [==============================] - 0s 261us/step - loss: 6.7864e-04 - val_loss: 4.793
Epoch 272/500
1061/1061 [==============================] - 0s 263us/step - loss: 6.7798e-04 - val_loss: 4.352
Epoch 273/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.4800e-04 - val_loss: 4.774
Epoch 274/500
1061/1061 [==============================] - 0s 272us/step - loss: 6.9007e-04 - val_loss: 4.333
Epoch 275/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.5927e-04 - val_loss: 4.387
Epoch 276/500
1061/1061 [==============================] - 0s 260us/step - loss: 6.4790e-04 - val_loss: 4.516
Epoch 277/500
1061/1061 [==============================] - 0s 274us/step - loss: 6.3911e-04 - val_loss: 5.038
Epoch 278/500
1061/1061 [==============================] - 0s 267us/step - loss: 7.0298e-04 - val_loss: 4.456
Epoch 279/500
1061/1061 [==============================] - 0s 261us/step - loss: 6.8068e-04 - val_loss: 4.621
Epoch 280/500
1061/1061 [==============================] - 0s 258us/step - loss: 6.9090e-04 - val_loss: 4.548
Epoch 281/500
1061/1061 [==============================] - 0s 259us/step - loss: 6.4230e-04 - val_loss: 4.402
Epoch 282/500
1061/1061 [==============================] - 0s 266us/step - loss: 6.2798e-04 - val_loss: 4.603
Epoch 283/500
1061/1061 [==============================] - 0s 264us/step - loss: 6.5785e-04 - val_loss: 4.339
Epoch 284/500
1061/1061 [==============================] - 0s 264us/step - loss: 6.3976e-04 - val_loss: 4.439
Epoch 285/500
1061/1061 [==============================] - 0s 276us/step - loss: 6.1395e-04 - val_loss: 4.388
Epoch 286/500
1061/1061 [==============================] - 0s 258us/step - loss: 6.7643e-04 - val_loss: 4.313
Epoch 287/500
1061/1061 [==============================] - 0s 252us/step - loss: 6.6301e-04 - val_loss: 4.388
Epoch 288/500
1061/1061 [==============================] - 0s 252us/step - loss: 6.6192e-04 - val_loss: 4.958
Epoch 289/500
1061/1061 [==============================] - 0s 253us/step - loss: 6.7691e-04 - val_loss: 4.410
Epoch 290/500
1061/1061 [==============================] - 0s 262us/step - loss: 6.4225e-04 - val_loss: 4.482
Epoch 291/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.6141e-04 - val_loss: 4.314
Epoch 292/500
1061/1061 [==============================] - 0s 267us/step - loss: 6.3084e-04 - val_loss: 4.357
Epoch 293/500
1061/1061 [==============================] - 0s 262us/step - loss: 6.5409e-04 - val_loss: 4.689
Epoch 294/500
1061/1061 [==============================] - 0s 259us/step - loss: 6.7549e-04 - val_loss: 4.796
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Epoch 295/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.9603e-04 - val_loss: 4.553
Epoch 296/500
1061/1061 [==============================] - 0s 258us/step - loss: 6.6565e-04 - val_loss: 4.348
Epoch 297/500
1061/1061 [==============================] - 0s 270us/step - loss: 6.3745e-04 - val_loss: 4.830
Epoch 298/500
1061/1061 [==============================] - 0s 299us/step - loss: 6.5992e-04 - val_loss: 4.669
Epoch 299/500
1061/1061 [==============================] - 0s 271us/step - loss: 6.6315e-04 - val_loss: 4.516
Epoch 300/500
1061/1061 [==============================] - 0s 270us/step - loss: 6.6510e-04 - val_loss: 4.513
Epoch 301/500
1061/1061 [==============================] - 0s 284us/step - loss: 6.4253e-04 - val_loss: 4.332
Epoch 302/500
1061/1061 [==============================] - 0s 283us/step - loss: 6.5014e-04 - val_loss: 4.315
Epoch 303/500
1061/1061 [==============================] - 0s 266us/step - loss: 6.4590e-04 - val_loss: 4.296
Epoch 304/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.4158e-04 - val_loss: 4.361
Epoch 305/500
1061/1061 [==============================] - 0s 270us/step - loss: 6.3131e-04 - val_loss: 4.627
Epoch 306/500
1061/1061 [==============================] - 0s 267us/step - loss: 6.5819e-04 - val_loss: 4.401
Epoch 307/500
1061/1061 [==============================] - 0s 283us/step - loss: 6.6661e-04 - val_loss: 5.031
Epoch 308/500
1061/1061 [==============================] - 0s 277us/step - loss: 6.9183e-04 - val_loss: 4.338
Epoch 309/500
1061/1061 [==============================] - 0s 277us/step - loss: 6.7566e-04 - val_loss: 4.739
Epoch 310/500
1061/1061 [==============================] - 0s 277us/step - loss: 7.3267e-04 - val_loss: 4.582
Epoch 311/500
1061/1061 [==============================] - 0s 288us/step - loss: 6.7104e-04 - val_loss: 4.810
Epoch 312/500
1061/1061 [==============================] - 0s 275us/step - loss: 6.7801e-04 - val_loss: 4.447
Epoch 313/500
1061/1061 [==============================] - 0s 263us/step - loss: 6.6749e-04 - val_loss: 4.486
Epoch 314/500
1061/1061 [==============================] - 0s 260us/step - loss: 6.7938e-04 - val_loss: 5.467
Epoch 315/500
1061/1061 [==============================] - 0s 257us/step - loss: 7.6418e-04 - val_loss: 4.531
Epoch 316/500
1061/1061 [==============================] - 0s 255us/step - loss: 6.6013e-04 - val_loss: 4.475
Epoch 317/500
1061/1061 [==============================] - 0s 257us/step - loss: 6.4522e-04 - val_loss: 4.598
Epoch 318/500
1061/1061 [==============================] - 0s 263us/step - loss: 6.4871e-04 - val_loss: 5.165
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Epoch 319/500
1061/1061 [==============================] - 0s 267us/step - loss: 6.6663e-04 - val_loss: 4.284
Epoch 320/500
1061/1061 [==============================] - 0s 257us/step - loss: 6.5915e-04 - val_loss: 4.324
Epoch 321/500
1061/1061 [==============================] - 0s 256us/step - loss: 6.3941e-04 - val_loss: 4.318
Epoch 322/500
1061/1061 [==============================] - 0s 262us/step - loss: 6.5881e-04 - val_loss: 4.350
Epoch 323/500
1061/1061 [==============================] - 0s 266us/step - loss: 6.4267e-04 - val_loss: 4.362
Epoch 324/500
1061/1061 [==============================] - 0s 263us/step - loss: 6.4698e-04 - val_loss: 4.296
Epoch 325/500
1061/1061 [==============================] - 0s 266us/step - loss: 6.3468e-04 - val_loss: 4.924
Epoch 326/500
1061/1061 [==============================] - 0s 265us/step - loss: 6.4317e-04 - val_loss: 4.420
Epoch 327/500
1061/1061 [==============================] - 0s 265us/step - loss: 6.6470e-04 - val_loss: 4.466
Epoch 328/500
1061/1061 [==============================] - 0s 267us/step - loss: 6.6266e-04 - val_loss: 4.299
Epoch 329/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.3952e-04 - val_loss: 4.315
Epoch 330/500
1061/1061 [==============================] - 0s 261us/step - loss: 6.3887e-04 - val_loss: 4.726
Epoch 331/500
1061/1061 [==============================] - 0s 260us/step - loss: 6.7269e-04 - val_loss: 5.487
Epoch 332/500
1061/1061 [==============================] - 0s 262us/step - loss: 7.3225e-04 - val_loss: 5.011
Epoch 333/500
1061/1061 [==============================] - 0s 269us/step - loss: 7.2871e-04 - val_loss: 4.492
Epoch 334/500
1061/1061 [==============================] - 0s 262us/step - loss: 6.4921e-04 - val_loss: 4.988
Epoch 335/500
1061/1061 [==============================] - 0s 263us/step - loss: 6.5549e-04 - val_loss: 4.287
Epoch 336/500
1061/1061 [==============================] - 0s 264us/step - loss: 6.3627e-04 - val_loss: 4.377
Epoch 337/500
1061/1061 [==============================] - 0s 259us/step - loss: 6.4533e-04 - val_loss: 4.283
Epoch 338/500
1061/1061 [==============================] - 0s 261us/step - loss: 6.1523e-04 - val_loss: 4.403
Epoch 339/500
1061/1061 [==============================] - 0s 264us/step - loss: 6.5847e-04 - val_loss: 4.527
Epoch 340/500
1061/1061 [==============================] - 0s 279us/step - loss: 6.5495e-04 - val_loss: 4.316
Epoch 341/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.2982e-04 - val_loss: 4.297
Epoch 342/500
1061/1061 [==============================] - 0s 269us/step - loss: 6.3602e-04 - val_loss: 4.267
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Epoch 343/500
1061/1061 [==============================] - 0s 264us/step - loss: 6.4155e-04 - val_loss: 4.273
Epoch 344/500
1061/1061 [==============================] - 0s 263us/step - loss: 6.3679e-04 - val_loss: 4.526
Epoch 345/500
1061/1061 [==============================] - 0s 264us/step - loss: 6.4777e-04 - val_loss: 4.260
Epoch 346/500
1061/1061 [==============================] - 0s 265us/step - loss: 6.4046e-04 - val_loss: 4.591
Epoch 347/500
1061/1061 [==============================] - 0s 267us/step - loss: 6.6333e-04 - val_loss: 4.441
Epoch 348/500
1061/1061 [==============================] - 0s 259us/step - loss: 6.3714e-04 - val_loss: 4.255
Epoch 349/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.4076e-04 - val_loss: 4.255
Epoch 350/500
1061/1061 [==============================] - 0s 259us/step - loss: 6.4807e-04 - val_loss: 4.405
Epoch 351/500
1061/1061 [==============================] - 0s 268us/step - loss: 6.7266e-04 - val_loss: 4.862
Epoch 352/500
1061/1061 [==============================] - 0s 264us/step - loss: 6.6193e-04 - val_loss: 4.339
Epoch 353/500
1061/1061 [==============================] - 0s 292us/step - loss: 6.5169e-04 - val_loss: 4.688
Epoch 354/500
1061/1061 [==============================] - 0s 301us/step - loss: 7.0936e-04 - val_loss: 4.376
Epoch 355/500
1061/1061 [==============================] - 0s 302us/step - loss: 6.7184e-04 - val_loss: 4.542
Epoch 356/500
1061/1061 [==============================] - 0s 297us/step - loss: 6.7423e-04 - val_loss: 4.461
Epoch 357/500
1061/1061 [==============================] - 0s 272us/step - loss: 6.4857e-04 - val_loss: 4.398
Epoch 358/500
1061/1061 [==============================] - 0s 274us/step - loss: 6.4016e-04 - val_loss: 4.338
Epoch 359/500
1061/1061 [==============================] - 0s 257us/step - loss: 6.1535e-04 - val_loss: 4.702
Epoch 360/500
1061/1061 [==============================] - 0s 267us/step - loss: 6.4236e-04 - val_loss: 4.307
Epoch 361/500
1061/1061 [==============================] - 0s 281us/step - loss: 6.5189e-04 - val_loss: 4.353
Epoch 362/500
1061/1061 [==============================] - 0s 278us/step - loss: 6.4425e-04 - val_loss: 4.268
Epoch 363/500
1061/1061 [==============================] - 0s 260us/step - loss: 6.1275e-04 - val_loss: 4.252
Epoch 364/500
1061/1061 [==============================] - 0s 266us/step - loss: 6.4212e-04 - val_loss: 4.789
Epoch 365/500
1061/1061 [==============================] - 0s 271us/step - loss: 6.7821e-04 - val_loss: 4.582
Epoch 366/500
1061/1061 [==============================] - 0s 281us/step - loss: 6.6652e-04 - val_loss: 4.313
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Epoch 367/500
1061/1061 [==============================] - 0s 267us/step - loss: 6.4475e-04 - val_loss: 4.302
Epoch 368/500
1061/1061 [==============================] - 0s 250us/step - loss: 6.5873e-04 - val_loss: 5.116
Epoch 369/500
1061/1061 [==============================] - 0s 267us/step - loss: 6.1744e-04 - val_loss: 4.224
Epoch 370/500
1061/1061 [==============================] - 0s 260us/step - loss: 6.7838e-04 - val_loss: 4.850
Epoch 371/500
1061/1061 [==============================] - 0s 254us/step - loss: 6.8171e-04 - val_loss: 4.246
Epoch 372/500
1061/1061 [==============================] - 0s 232us/step - loss: 6.6221e-04 - val_loss: 4.753
Epoch 373/500
1061/1061 [==============================] - 0s 239us/step - loss: 6.4501e-04 - val_loss: 4.431
Epoch 374/500
1061/1061 [==============================] - 0s 241us/step - loss: 6.5977e-04 - val_loss: 4.243
Epoch 375/500
1061/1061 [==============================] - 0s 240us/step - loss: 6.6897e-04 - val_loss: 4.512
Epoch 376/500
1061/1061 [==============================] - 0s 252us/step - loss: 6.4797e-04 - val_loss: 4.271
Epoch 377/500
1061/1061 [==============================] - 0s 262us/step - loss: 6.4038e-04 - val_loss: 4.251
Epoch 378/500
1061/1061 [==============================] - 0s 246us/step - loss: 6.4696e-04 - val_loss: 4.277
Epoch 379/500
1061/1061 [==============================] - 0s 237us/step - loss: 6.3815e-04 - val_loss: 4.285
Epoch 380/500
1061/1061 [==============================] - 0s 234us/step - loss: 6.2931e-04 - val_loss: 4.273
Epoch 381/500
1061/1061 [==============================] - 0s 235us/step - loss: 6.5787e-04 - val_loss: 4.377
Epoch 382/500
1061/1061 [==============================] - 0s 265us/step - loss: 6.5442e-04 - val_loss: 4.218
Epoch 383/500
1061/1061 [==============================] - 0s 255us/step - loss: 6.3719e-04 - val_loss: 4.833
Epoch 384/500
1061/1061 [==============================] - 0s 238us/step - loss: 6.7634e-04 - val_loss: 4.356
Epoch 385/500
1061/1061 [==============================] - 0s 233us/step - loss: 6.7453e-04 - val_loss: 4.258
Epoch 386/500
1061/1061 [==============================] - 0s 236us/step - loss: 6.3661e-04 - val_loss: 4.251
Epoch 387/500
1061/1061 [==============================] - 0s 235us/step - loss: 6.3262e-04 - val_loss: 4.407
Epoch 388/500
1061/1061 [==============================] - 0s 235us/step - loss: 6.4237e-04 - val_loss: 4.342
Epoch 389/500
1061/1061 [==============================] - 0s 235us/step - loss: 6.6080e-04 - val_loss: 4.411
Epoch 390/500
1061/1061 [==============================] - 0s 233us/step - loss: 6.3135e-04 - val_loss: 4.599
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Epoch 391/500
1061/1061 [==============================] - 0s 238us/step - loss: 6.3173e-04 - val_loss: 4.229
Epoch 392/500
1061/1061 [==============================] - 0s 227us/step - loss: 6.2774e-04 - val_loss: 4.252
Epoch 393/500
1061/1061 [==============================] - 0s 237us/step - loss: 6.5589e-04 - val_loss: 5.211
Epoch 394/500
1061/1061 [==============================] - 0s 234us/step - loss: 6.8358e-04 - val_loss: 4.555
Epoch 395/500
1061/1061 [==============================] - 0s 235us/step - loss: 6.9851e-04 - val_loss: 4.925
Epoch 396/500
1061/1061 [==============================] - 0s 239us/step - loss: 6.9409e-04 - val_loss: 4.611
Epoch 397/500
1061/1061 [==============================] - 0s 241us/step - loss: 7.0946e-04 - val_loss: 5.368
Epoch 398/500
1061/1061 [==============================] - 0s 230us/step - loss: 6.6575e-04 - val_loss: 4.302
Epoch 399/500
1061/1061 [==============================] - 0s 233us/step - loss: 6.4833e-04 - val_loss: 4.268
Epoch 400/500
1061/1061 [==============================] - 0s 237us/step - loss: 6.7718e-04 - val_loss: 4.212
Epoch 401/500
1061/1061 [==============================] - 0s 243us/step - loss: 6.2679e-04 - val_loss: 4.290
Epoch 402/500
1061/1061 [==============================] - 0s 239us/step - loss: 6.4548e-04 - val_loss: 4.275
Epoch 403/500
1061/1061 [==============================] - 0s 238us/step - loss: 6.2963e-04 - val_loss: 4.262
Epoch 404/500
1061/1061 [==============================] - 0s 241us/step - loss: 6.2415e-04 - val_loss: 4.776
Epoch 405/500
1061/1061 [==============================] - 0s 233us/step - loss: 6.8307e-04 - val_loss: 4.473
Epoch 406/500
1061/1061 [==============================] - 0s 232us/step - loss: 6.6084e-04 - val_loss: 4.222
Epoch 407/500
1061/1061 [==============================] - 0s 235us/step - loss: 6.4880e-04 - val_loss: 4.399
Epoch 408/500
1061/1061 [==============================] - 0s 230us/step - loss: 6.4465e-04 - val_loss: 4.860
Epoch 409/500
1061/1061 [==============================] - 0s 234us/step - loss: 6.8869e-04 - val_loss: 4.269
Epoch 410/500
1061/1061 [==============================] - 0s 239us/step - loss: 6.3254e-04 - val_loss: 4.240
Epoch 411/500
1061/1061 [==============================] - 0s 231us/step - loss: 6.4080e-04 - val_loss: 4.323
Epoch 412/500
1061/1061 [==============================] - 0s 235us/step - loss: 6.2514e-04 - val_loss: 4.367
Epoch 413/500
1061/1061 [==============================] - 0s 243us/step - loss: 6.3372e-04 - val_loss: 4.209
Epoch 414/500
1061/1061 [==============================] - 0s 248us/step - loss: 6.3073e-04 - val_loss: 5.185
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Epoch 415/500
1061/1061 [==============================] - 0s 266us/step - loss: 6.6752e-04 - val_loss: 4.196
Epoch 416/500
1061/1061 [==============================] - 0s 247us/step - loss: 6.3264e-04 - val_loss: 4.238
Epoch 417/500
1061/1061 [==============================] - 0s 250us/step - loss: 6.3443e-04 - val_loss: 4.192
Epoch 418/500
1061/1061 [==============================] - 0s 259us/step - loss: 6.4661e-04 - val_loss: 4.309
Epoch 419/500
1061/1061 [==============================] - 0s 250us/step - loss: 6.3106e-04 - val_loss: 5.179
Epoch 420/500
1061/1061 [==============================] - 0s 256us/step - loss: 6.7797e-04 - val_loss: 4.307
Epoch 421/500
1061/1061 [==============================] - 0s 246us/step - loss: 6.8430e-04 - val_loss: 4.488
Epoch 422/500
1061/1061 [==============================] - 0s 252us/step - loss: 6.5556e-04 - val_loss: 4.251
Epoch 423/500
1061/1061 [==============================] - 0s 245us/step - loss: 6.6530e-04 - val_loss: 4.259
Epoch 424/500
1061/1061 [==============================] - 0s 252us/step - loss: 6.5416e-04 - val_loss: 5.213
Epoch 425/500
1061/1061 [==============================] - 0s 249us/step - loss: 7.1130e-04 - val_loss: 4.572
Epoch 426/500
1061/1061 [==============================] - 0s 256us/step - loss: 6.5378e-04 - val_loss: 5.122
Epoch 427/500
1061/1061 [==============================] - 0s 254us/step - loss: 6.6961e-04 - val_loss: 4.343
Epoch 428/500
1061/1061 [==============================] - 0s 235us/step - loss: 6.6964e-04 - val_loss: 5.476
Epoch 429/500
1061/1061 [==============================] - 0s 227us/step - loss: 6.7775e-04 - val_loss: 4.915
Epoch 430/500
1061/1061 [==============================] - 0s 235us/step - loss: 6.4775e-04 - val_loss: 4.180
Epoch 431/500
1061/1061 [==============================] - 0s 235us/step - loss: 6.3661e-04 - val_loss: 4.444
Epoch 432/500
1061/1061 [==============================] - 0s 229us/step - loss: 6.1786e-04 - val_loss: 4.216
Epoch 433/500
1061/1061 [==============================] - 0s 233us/step - loss: 6.3523e-04 - val_loss: 4.275
Epoch 434/500
1061/1061 [==============================] - 0s 235us/step - loss: 6.5239e-04 - val_loss: 4.842
Epoch 435/500
1061/1061 [==============================] - 0s 235us/step - loss: 6.5484e-04 - val_loss: 4.302
Epoch 436/500
1061/1061 [==============================] - 0s 241us/step - loss: 6.8439e-04 - val_loss: 5.135
Epoch 437/500
1061/1061 [==============================] - 0s 231us/step - loss: 7.2303e-04 - val_loss: 6.035
Epoch 438/500
1061/1061 [==============================] - 0s 232us/step - loss: 7.4671e-04 - val_loss: 4.891
```

```
Epoch 439/500
1061/1061 [==============================] - 0s 233us/step - loss: 6.8224e-04 - val_loss: 4.68
Epoch 440/500
1061/1061 [==============================] - 0s 235us/step - loss: 6.9717e-04 - val_loss: 4.28
Epoch 441/500
1061/1061 [==============================] - 0s 228us/step - loss: 6.5483e-04 - val_loss: 4.63
Epoch 442/500
1061/1061 [==============================] - 0s 236us/step - loss: 6.6486e-04 - val_loss: 4.25
Epoch 443/500
1061/1061 [==============================] - 0s 229us/step - loss: 6.2381e-04 - val_loss: 4.31
Epoch 444/500
1061/1061 [==============================] - 0s 229us/step - loss: 6.4972e-04 - val_loss: 4.17
Epoch 445/500
1061/1061 [==============================] - 0s 232us/step - loss: 6.5620e-04 - val_loss: 4.30
Epoch 446/500
1061/1061 [==============================] - 0s 236us/step - loss: 6.3959e-04 - val_loss: 4.50
Epoch 447/500
1061/1061 [==============================] - 0s 235us/step - loss: 6.5537e-04 - val_loss: 4.23
Epoch 448/500
1061/1061 [==============================] - 0s 230us/step - loss: 6.3979e-04 - val_loss: 4.17
Epoch 449/500
1061/1061 [==============================] - 0s 230us/step - loss: 6.3289e-04 - val_loss: 4.39
Epoch 450/500
1061/1061 [==============================] - 0s 232us/step - loss: 6.4023e-04 - val_loss: 4.25
Epoch 451/500
1061/1061 [==============================] - 0s 233us/step - loss: 6.2515e-04 - val_loss: 4.93
Epoch 452/500
1061/1061 [==============================] - 0s 232us/step - loss: 6.5605e-04 - val_loss: 4.17
Epoch 453/500
1061/1061 [==============================] - 0s 230us/step - loss: 6.5097e-04 - val_loss: 4.30
Epoch 454/500
1061/1061 [==============================] - 0s 235us/step - loss: 6.6708e-04 - val_loss: 4.17
Epoch 455/500
1061/1061 [==============================] - 0s 230us/step - loss: 6.3468e-04 - val_loss: 4.71
Epoch 456/500
1061/1061 [==============================] - 0s 230us/step - loss: 6.5357e-04 - val_loss: 4.29
Epoch 457/500
1061/1061 [==============================] - 0s 238us/step - loss: 6.5456e-04 - val_loss: 4.18
Epoch 458/500
1061/1061 [==============================] - 0s 244us/step - loss: 6.2485e-04 - val_loss: 4.46
Epoch 459/500
1061/1061 [==============================] - 0s 237us/step - loss: 6.4984e-04 - val_loss: 4.23
Epoch 460/500
1061/1061 [==============================] - 0s 250us/step - loss: 6.3100e-04 - val_loss: 4.18
Epoch 461/500
1061/1061 [==============================] - 0s 238us/step - loss: 6.5278e-04 - val_loss: 4.21
Epoch 462/500
1061/1061 [==============================] - 0s 238us/step - loss: 6.3217e-04 - val_loss: 4.17
```

```
Epoch 463/500
1061/1061 [==============================] - 0s 241us/step - loss: 6.2698e-04 - val_loss: 4.164
Epoch 464/500
1061/1061 [==============================] - 0s 247us/step - loss: 6.4480e-04 - val_loss: 4.371
Epoch 465/500
1061/1061 [==============================] - 0s 245us/step - loss: 6.3935e-04 - val_loss: 5.017
Epoch 466/500
1061/1061 [==============================] - 0s 246us/step - loss: 6.9337e-04 - val_loss: 4.144
Epoch 467/500
1061/1061 [==============================] - 0s 241us/step - loss: 6.5453e-04 - val_loss: 4.195
Epoch 468/500
1061/1061 [==============================] - 0s 236us/step - loss: 6.6559e-04 - val_loss: 4.416
Epoch 469/500
1061/1061 [==============================] - 0s 237us/step - loss: 6.4463e-04 - val_loss: 4.663
Epoch 470/500
1061/1061 [==============================] - 0s 240us/step - loss: 6.4913e-04 - val_loss: 4.192
Epoch 471/500
1061/1061 [==============================] - 0s 232us/step - loss: 6.2333e-04 - val_loss: 4.125
Epoch 472/500
1061/1061 [==============================] - 0s 260us/step - loss: 6.4910e-04 - val_loss: 4.522
Epoch 473/500
1061/1061 [==============================] - 0s 227us/step - loss: 6.6759e-04 - val_loss: 4.503
Epoch 474/500
1061/1061 [==============================] - 0s 244us/step - loss: 6.4797e-04 - val_loss: 4.250
Epoch 475/500
1061/1061 [==============================] - 0s 241us/step - loss: 6.5826e-04 - val_loss: 4.350
Epoch 476/500
1061/1061 [==============================] - 0s 245us/step - loss: 6.7170e-04 - val_loss: 4.269
Epoch 477/500
1061/1061 [==============================] - 0s 243us/step - loss: 6.6899e-04 - val_loss: 4.181
Epoch 478/500
1061/1061 [==============================] - 0s 259us/step - loss: 6.4599e-04 - val_loss: 4.865
Epoch 479/500
1061/1061 [==============================] - 0s 250us/step - loss: 6.6497e-04 - val_loss: 4.141
Epoch 480/500
1061/1061 [==============================] - 0s 253us/step - loss: 6.2478e-04 - val_loss: 4.864
Epoch 481/500
1061/1061 [==============================] - 0s 255us/step - loss: 6.7691e-04 - val_loss: 4.401
Epoch 482/500
1061/1061 [==============================] - 0s 250us/step - loss: 6.6138e-04 - val_loss: 4.207
Epoch 483/500
1061/1061 [==============================] - 0s 253us/step - loss: 6.3941e-04 - val_loss: 5.337
Epoch 484/500
1061/1061 [==============================] - 0s 258us/step - loss: 6.7469e-04 - val_loss: 4.125
Epoch 485/500
1061/1061 [==============================] - 0s 254us/step - loss: 6.1492e-04 - val_loss: 4.618
Epoch 486/500
1061/1061 [==============================] - 0s 271us/step - loss: 6.4466e-04 - val_loss: 4.484
```

```
Epoch 487/500
1061/1061 [==============================] - 0s 266us/step - loss: 6.2621e-04 - val_loss: 4.645
Epoch 488/500
1061/1061 [==============================] - 0s 257us/step - loss: 6.4750e-04 - val_loss: 4.557
Epoch 489/500
1061/1061 [==============================] - 0s 262us/step - loss: 6.8713e-04 - val_loss: 4.170
Epoch 490/500
1061/1061 [==============================] - 0s 258us/step - loss: 6.4129e-04 - val_loss: 4.415
Epoch 491/500
1061/1061 [==============================] - 0s 250us/step - loss: 6.3504e-04 - val_loss: 4.070
Epoch 492/500
1061/1061 [==============================] - 0s 246us/step - loss: 6.3009e-04 - val_loss: 4.316
Epoch 493/500
1061/1061 [==============================] - 0s 234us/step - loss: 6.2615e-04 - val_loss: 4.134
Epoch 494/500
1061/1061 [==============================] - 0s 233us/step - loss: 6.2410e-04 - val_loss: 4.076
Epoch 495/500
1061/1061 [==============================] - 0s 235us/step - loss: 6.4744e-04 - val_loss: 4.098
Epoch 496/500
1061/1061 [==============================] - 0s 244us/step - loss: 5.9448e-04 - val_loss: 5.002
Epoch 497/500
1061/1061 [==============================] - 0s 242us/step - loss: 6.4208e-04 - val_loss: 4.225
Epoch 498/500
1061/1061 [==============================] - 0s 237us/step - loss: 6.8632e-04 - val_loss: 4.588
Epoch 499/500
1061/1061 [==============================] - 0s 237us/step - loss: 6.6176e-04 - val_loss: 4.155
Epoch 500/500
1061/1061 [==============================] - 0s 245us/step - loss: 6.2791e-04 - val_loss: 4.199
MODEL-SAVED
```

```
In [33]: #Load saved Model
         model = load_model("{}.h5".format(model_name))
         print("MODEL-LOADED")
```

```
MODEL-LOADED
```

```
In [34]: score = model.evaluate(X_test, y_test)
         print('Score: {}'.format(score))
```

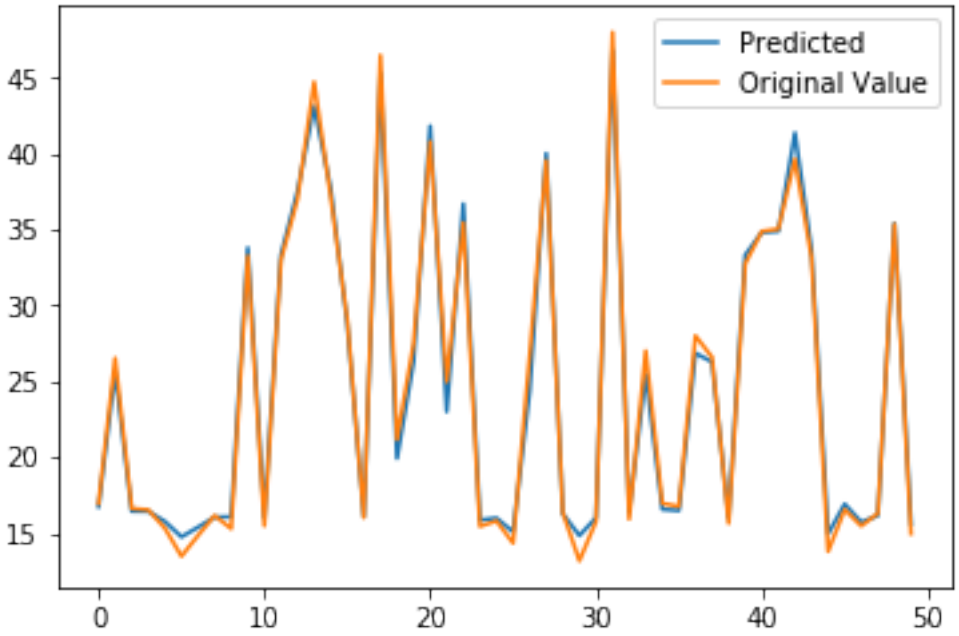
```
582/582 [==============================] - 0s 654us/step
Score: 0.0005604520740541166
```

```
In [35]: X_test.size
```

```
Out[35]: 2328
```

```
In [36]: yhata = model.predict(X_test)
         yhata_inverse = y_scale.inverse_transform(yhata)
         y_test_inverse = y_scale.inverse_transform(y_test)

In [56]: plt.plot(yhata_inverse[-50:], label='Predicted')
         plt.plot(y_test_inverse[-50:], label='Original Value')
         plt.legend()
         plt.show()
```




```
In [46]: from sklearn import preprocessing
         from sklearn.metrics import mean_squared_error

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

```
Test MSE: 0.955
```