

CIND820 Initial Coding

December 4, 2020

```
[1]: import os
import warnings
warnings.filterwarnings('ignore')
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
plt.style.use('fivethirtyeight')
from pylab import rcParams
rcParams['figure.figsize'] = 10, 6
from datetime import datetime
from statsmodels.tsa.stattools import adfuller
from statsmodels.tsa.seasonal import seasonal_decompose
from statsmodels.tsa.arima_model import ARIMA
from sklearn.metrics import mean_squared_error, mean_absolute_error
import math
from statsmodels.tsa.stattools import acf, pacf
```

```
[2]: pip install pmdarima
```

```
Requirement already satisfied: pmdarima in /opt/conda/lib/python3.7/site-
packages (1.8.0)
Requirement already satisfied: numpy>=1.17.3 in /opt/conda/lib/python3.7/site-
packages (from pmdarima) (1.18.4)
Requirement already satisfied: scipy>=1.3.2 in /opt/conda/lib/python3.7/site-
packages (from pmdarima) (1.4.1)
Requirement already satisfied: Cython<0.29.18,>=0.29 in
/opt/conda/lib/python3.7/site-packages (from pmdarima) (0.29.17)
Requirement already satisfied: setuptools!=50.0.0,>=38.6.0 in
/opt/conda/lib/python3.7/site-packages (from pmdarima) (46.1.3.post20200325)
Requirement already satisfied: pandas>=0.19 in /opt/conda/lib/python3.7/site-
packages (from pmdarima) (1.0.3)
Requirement already satisfied: joblib>=0.11 in /opt/conda/lib/python3.7/site-
packages (from pmdarima) (0.15.1)
Requirement already satisfied: urllib3 in /opt/conda/lib/python3.7/site-packages
(from pmdarima) (1.25.9)
Requirement already satisfied: scikit-learn>=0.22 in
/opt/conda/lib/python3.7/site-packages (from pmdarima) (0.22.2.post1)
Requirement already satisfied: statsmodels!=0.12.0,>=0.11 in
```

```

/opt/conda/lib/python3.7/site-packages (from pmdarima) (0.11.1)
Requirement already satisfied: pytz>=2017.2 in /opt/conda/lib/python3.7/site-
packages (from pandas>=0.19->pmdarima) (2020.1)
Requirement already satisfied: python-dateutil>=2.6.1 in
/opt/conda/lib/python3.7/site-packages (from pandas>=0.19->pmdarima) (2.8.1)
Requirement already satisfied: patsy>=0.5 in /opt/conda/lib/python3.7/site-
packages (from statsmodels!=0.12.0,>=0.11->pmdarima) (0.5.1)
Requirement already satisfied: six>=1.5 in /opt/conda/lib/python3.7/site-
packages (from python-dateutil>=2.6.1->pandas>=0.19->pmdarima) (1.14.0)
Note: you may need to restart the kernel to use updated packages.

```

```
[3]: from pmdarima.arima import auto_arima
```

```
[132]: #import NASDAQ data
df=pd.read_csv("IXIC_v1.csv", sep=",")
```

```
[133]: #understand data format and clean up data
from datetime import datetime
con=df['Date']
df['Date']=pd.to_datetime(df['Date'])
df.set_index('Date', inplace=True)
#check datatype of index
df.index
```

```
[133]: DatetimeIndex(['2010-01-04', '2010-01-05', '2010-01-06', '2010-01-07',
                    '2010-01-08', '2010-01-11', '2010-01-12', '2010-01-13',
                    '2010-01-14', '2010-01-15',
                    ...,
                    '2020-09-17', '2020-09-18', '2020-09-21', '2020-09-22',
                    '2020-09-23', '2020-09-24', '2020-09-25', '2020-09-28',
                    '2020-09-29', '2020-09-30'],
                    dtype='datetime64[ns]', name='Date', length=2705, freq=None)
```

```
[134]: df['year'] = df.index.year
df['month'] = df.index.month
df['day'] = df.index.day
```

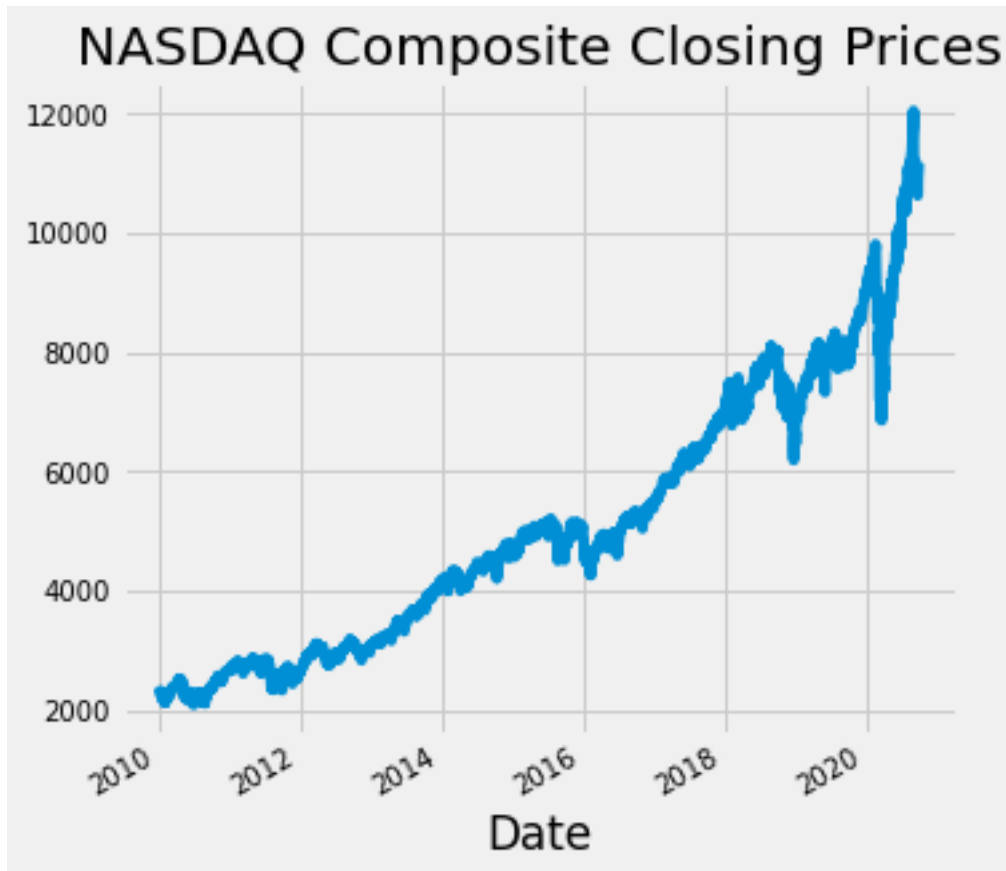
```
[135]: df.head()
```

```
[135]:
```

	Close	year	month	day
Date				
2010-01-04	2308.419922	2010	1	4
2010-01-05	2308.709961	2010	1	5
2010-01-06	2301.090088	2010	1	6
2010-01-07	2300.050049	2010	1	7
2010-01-08	2317.169922	2010	1	8

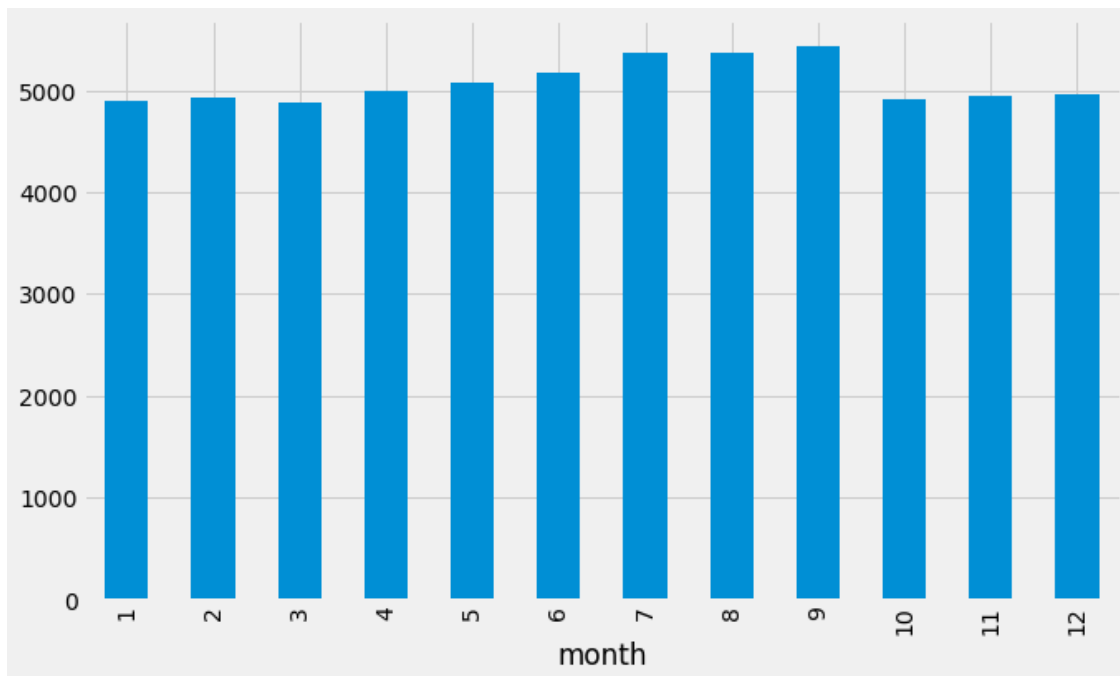
```
[136]: #plot NASDAQ trend
temp=df.groupby(['Date'])['Close'].mean()
temp.plot(figsize=(5,5), title= 'NASDAQ Composite Closing Prices', fontsize=10)
```

[136]: <matplotlib.axes._subplots.AxesSubplot at 0x7fde86daad50>



```
[137]: df.groupby('month')['Close'].mean().plot.bar()
#on average, september has the highest average price compares to the other
↪ months.
```

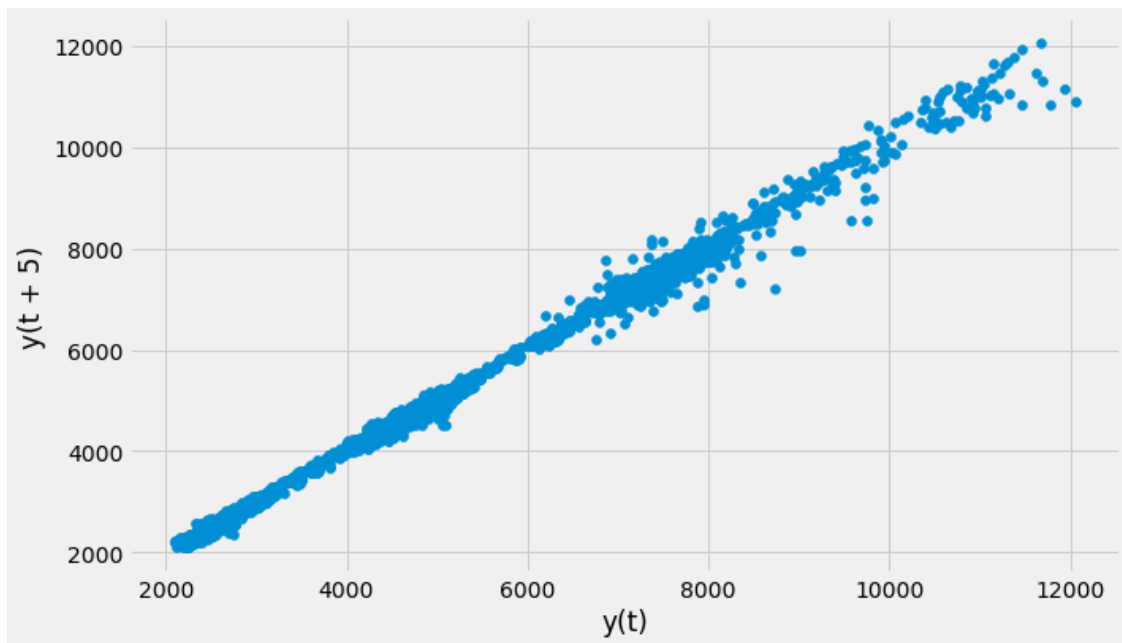
[137]: <matplotlib.axes._subplots.AxesSubplot at 0x7fde86d9e190>



```
[138]: #lag plot
from pandas.plotting import lag_plot
lag_plot(df['Close'],lag=5)

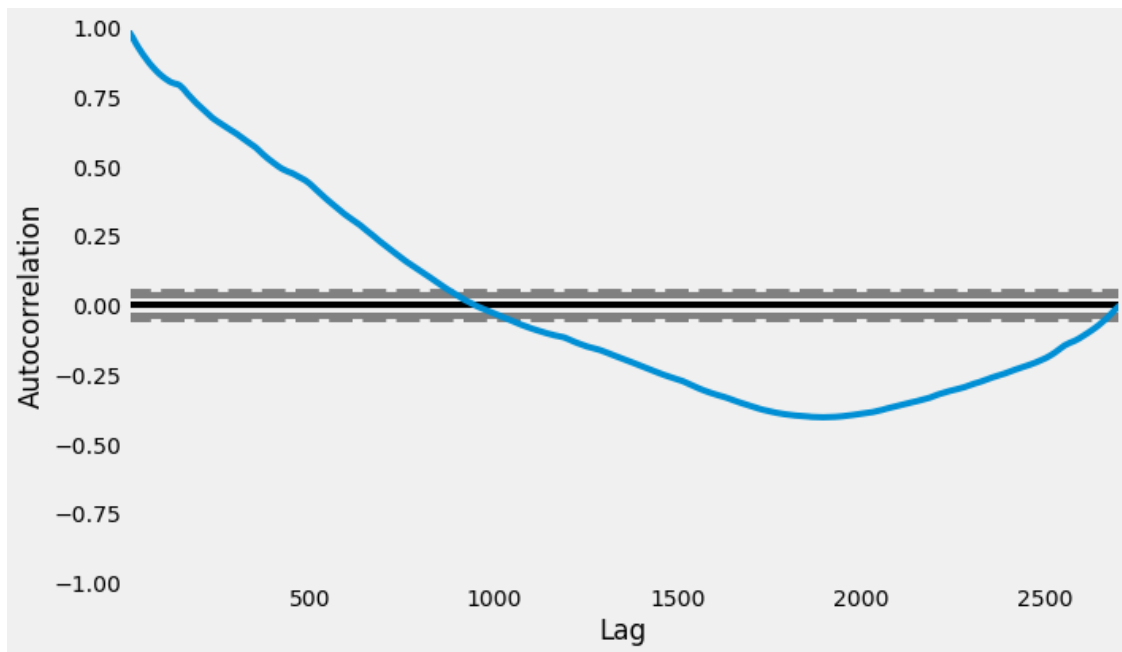
#Graph shows a linear pattern. Implies data points are non random and suggests
↳ that an autoregressive model might be appropriate.
```

```
[138]: <matplotlib.axes._subplots.AxesSubplot at 0x7fde86d163d0>
```



```
[139]: from pandas.plotting import autocorrelation_plot
autocorrelation_plot(df['Close'])
#there is high level of correlation
```

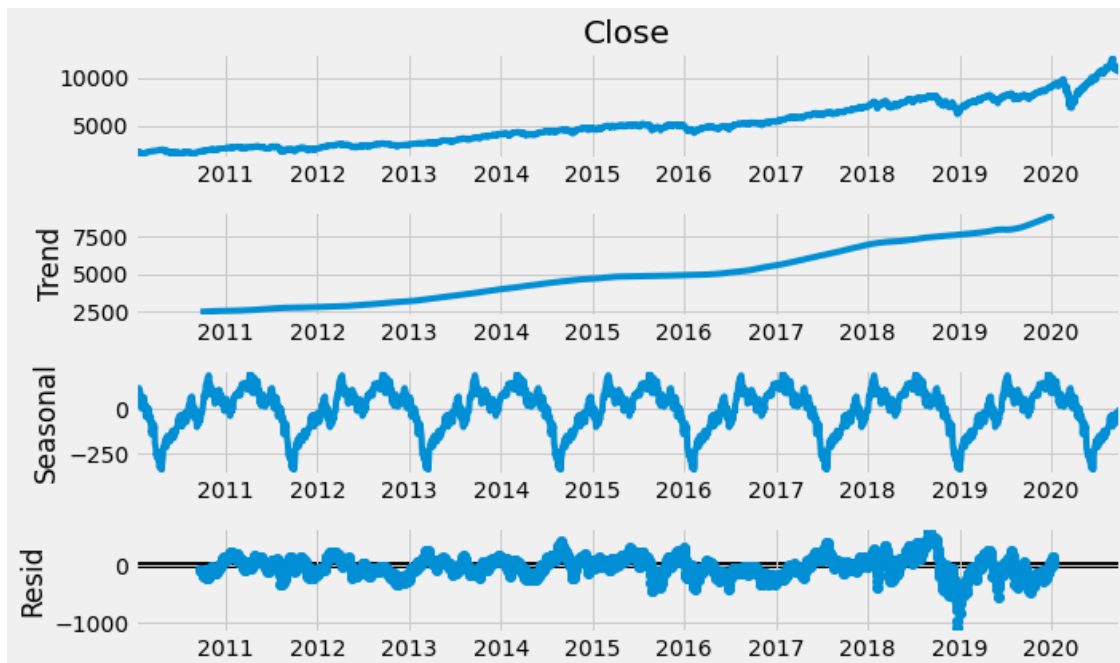
[139]: <matplotlib.axes._subplots.AxesSubplot at 0x7fde86c8a410>



```
[140]: #data is not stationary based on high p value
from statsmodels.tsa.stattools import adfuller
result = adfuller(df.Close.dropna())
print(f"ADF Statistic: {result[0]}")
print(f"p-value:{result[1]}")
```

ADF Statistic: 1.4430465972942679
p-value:0.9973011850493003

```
[141]: #decompose data
import statsmodels.api as sm
res = sm.tsa.seasonal_decompose(df['Close'],model= 'addictive',period = 365)
resplot = res.plot()
#data shows upward trend and presents seasonlity
```



```
[142]: def plot_df(df,x,y,title= "", xlabel = "Date", ylabel='Value',dpi=50):
plt.plot(x,y)
plt.show()
```

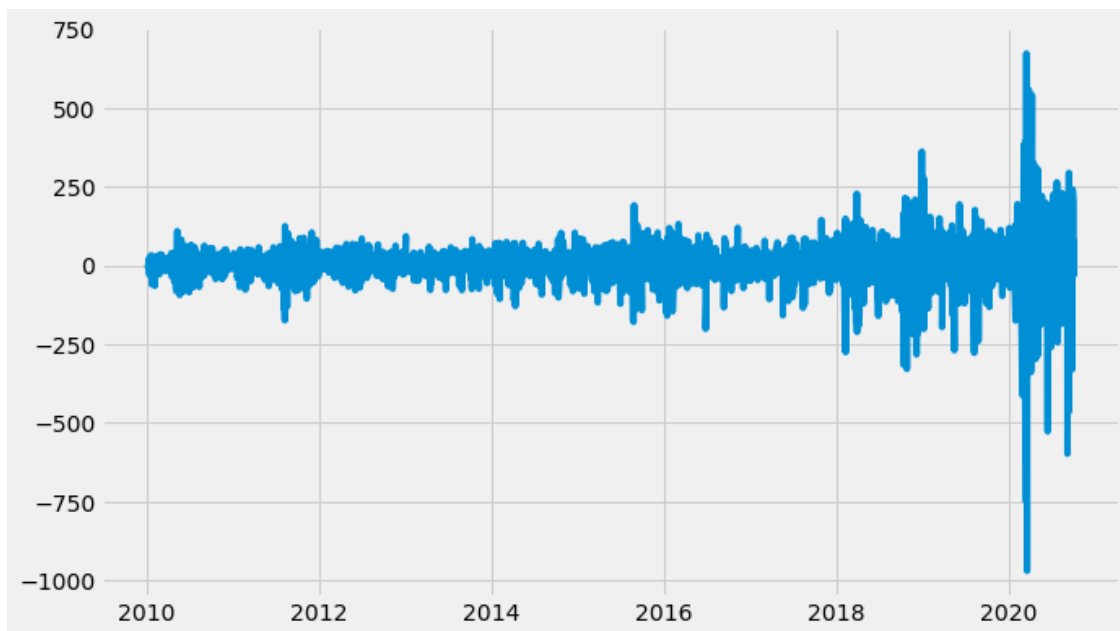
```
[143]: #apply log transformation to stablize data
plt.plot(df.apply(np.log)['Close'])
```

```
[143]: [<matplotlib.lines.Line2D at 0x7fdeb01b89d0>]
```



```
[144]: #To covert data into stationary dataset, first differencing has to be applied.
        ↪With first differencing, empty field needs to be filled as 0.
        plt.plot(df['Close'].diff(1).fillna(0))
```

```
[144]: [<matplotlib.lines.Line2D at 0x7fde84a13c90>]
```



```
[145]: #confirm stationarity
from statsmodels.tsa.stattools import adfuller
result = adfuller(np.log(df['Close']).diff(1).fillna(0))
print(f"ADF Statstic: {result[0]}")
print(f"p-value:{result[1]}")
```

```
ADF Statstic: -11.770291597674845
p-value:1.0940406662618215e-21
```

```
[146]: df_st= df.diff(1).fillna(0)
```

```
[147]: import time

t = time.process_time()
```

```
[148]: #understand the structure of the stationary dataset
df_st.head()
```

```
[148]:
```

	Close	year	month	day
Date				
2010-01-04	0.000000	0.0	0.0	0.0
2010-01-05	0.290039	0.0	0.0	1.0
2010-01-06	-7.619873	0.0	0.0	1.0
2010-01-07	-1.040039	0.0	0.0	1.0
2010-01-08	17.119873	0.0	0.0	1.0

```
[149]: #With transformation to maintain stationarity, we need to be model back to the
↳original dataset in order to predict stock price.
df_revert=df_st.copy()
df_revert=df_revert.cumsum()
```

```
[150]: df_revert.iloc[0,:]=df.iloc[0,:]
df_revert = df_revert.cumsum()
```

```
[151]: #define data
class TimeSeriesData():
    def __init__(self, df):
        self.data = df
        self.stationary = self.stationarize(df)
        self.revert = self.revert(self.stationary, self.data)

    def revert(self, st, org):
        x = st.copy()
        x.iloc[0,:] = org.iloc[0,:]
        return x.cumsum()

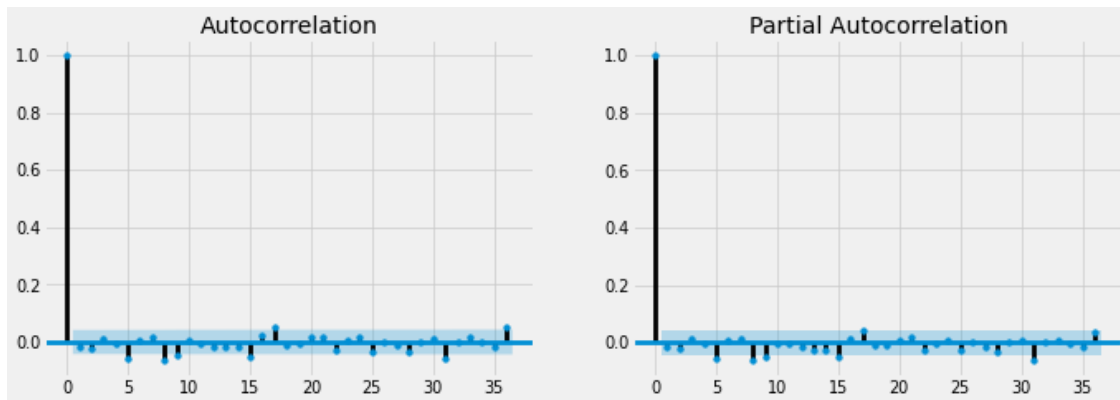
    def stationarize(self, data):
```



```
return data.diff(1).fillna(0)
```

```
[152]: #split dataset
x_train = TimeSeriesData(df[:int((len(df)*0.8))])
x_test = TimeSeriesData(df[int((len(df)*0.8)):])
```

```
[153]: #plot ACF and PACF for the stationary dataset
from statsmodels.graphics.tsaplots import plot_acf, plot_pacf
fig, axes = plt.subplots(1,2,figsize=(15,5), dpi= 50)
plot_acf(x_train.stationary['Close'].values.tolist(), lags=36, ax=axes[0]);
plot_pacf(x_train.stationary['Close'].values.tolist(), lags=36, ax=axes[1]);
```



```
[154]: #using auto_arima to aquire p and q value with min AIC.
from pmdarima import auto_arima
model = auto_arima(x_train.data['Close'], trace=True, error_action='ignore',
    ↳suppress_warnings=True)
model.fit(x_train.data['Close'])
```

Performing stepwise search to minimize aic

```
ARIMA(2,1,2)(0,0,0)[0] intercept : AIC=22406.770, Time=0.74 sec
ARIMA(0,1,0)(0,0,0)[0] intercept : AIC=22400.729, Time=0.05 sec
ARIMA(1,1,0)(0,0,0)[0] intercept : AIC=22402.090, Time=0.09 sec
ARIMA(0,1,1)(0,0,0)[0] intercept : AIC=22402.065, Time=0.13 sec
ARIMA(0,1,0)(0,0,0)[0]          : AIC=22406.532, Time=0.04 sec
ARIMA(1,1,1)(0,0,0)[0] intercept : AIC=22393.839, Time=1.27 sec
ARIMA(2,1,1)(0,0,0)[0] intercept : AIC=22404.619, Time=0.61 sec
ARIMA(1,1,2)(0,0,0)[0] intercept : AIC=22404.702, Time=0.83 sec
ARIMA(0,1,2)(0,0,0)[0] intercept : AIC=22402.822, Time=0.43 sec
ARIMA(2,1,0)(0,0,0)[0] intercept : AIC=22402.801, Time=0.16 sec
ARIMA(1,1,1)(0,0,0)[0]          : AIC=22406.446, Time=0.28 sec
```

Best model: ARIMA(1,1,1)(0,0,0)[0] intercept

Total fit time: 4.629 seconds

```
[154]: ARIMA(maxiter=50, method='lbfgs', order=(1, 1, 1), out_of_sample_size=0,
           scoring='mse', scoring_args={}, seasonal_order=(0, 0, 0, 0),
           start_params=None, suppress_warnings=True, trend=None,
           with_intercept=True)
```

```
[155]: model_arima = ARIMA(x_train.data['Close'].values, order=(1,1,1))
```

```
[156]: result_arima = model_arima.fit(dispatch=-1)
```

```
[157]: print(result_arima.summary())
```

```

                        ARIMA Model Results
=====
Dep. Variable:          D.y      No. Observations:          2163
Model:                  ARIMA(1, 1, 1)      Log Likelihood          -11192.925
Method:                  css-mle      S.D. of innovations          42.767
Date:                   Fri, 04 Dec 2020      AIC          22393.851
Time:                   19:12:02      BIC          22416.568
Sample:                  1      HQIC          22402.159

=====
              coef      std err          z      P>|z|      [0.025      0.975]
-----
const          2.5691      0.570        4.506      0.000        1.452        3.687
ar.L1.D.y       0.9330      0.027       34.756      0.000        0.880        0.986
ma.L1.D.y      -0.9587      0.021      -45.615      0.000       -1.000       -0.917

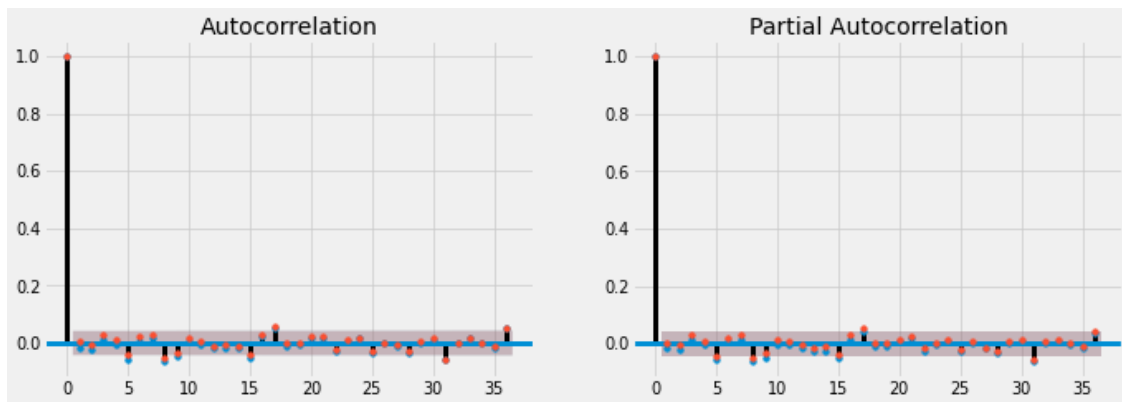
                        Roots
=====
              Real      Imaginary      Modulus      Frequency
-----
AR.1          1.0718      +0.0000j          1.0718          0.0000
MA.1          1.0431      +0.0000j          1.0431          0.0000
=====

```

```
[158]: #understand residual
residuals = pd.DataFrame(result_arima.resid)
```

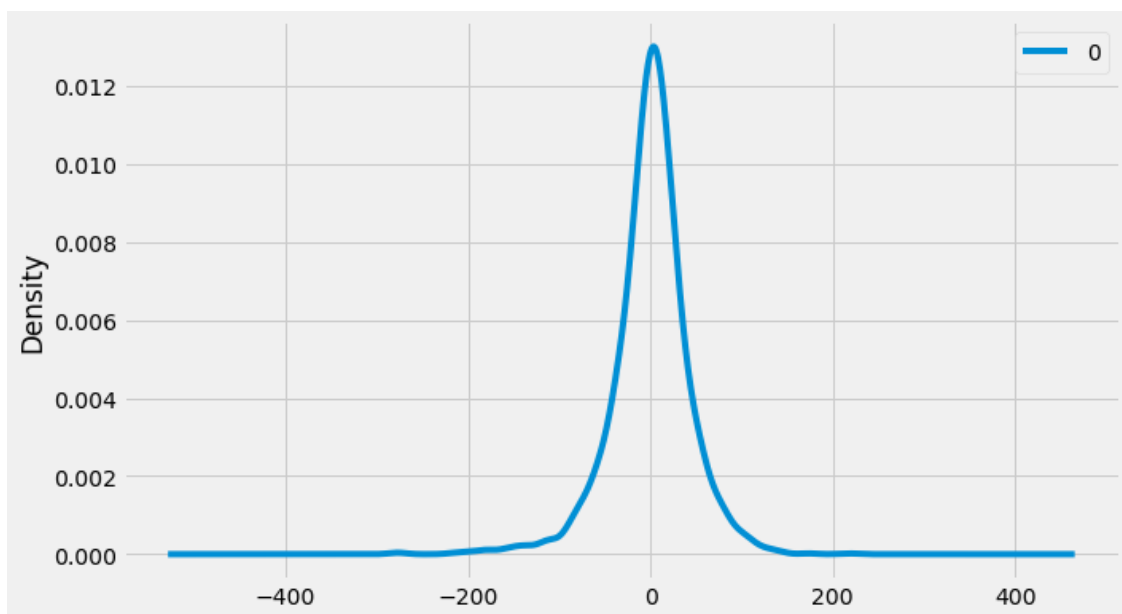
```
[159]: plot_acf(residuals, lags=36, ax=axes[0])
plot_pacf(residuals, lags=36, ax=axes[1])
```

```
[159]:
```

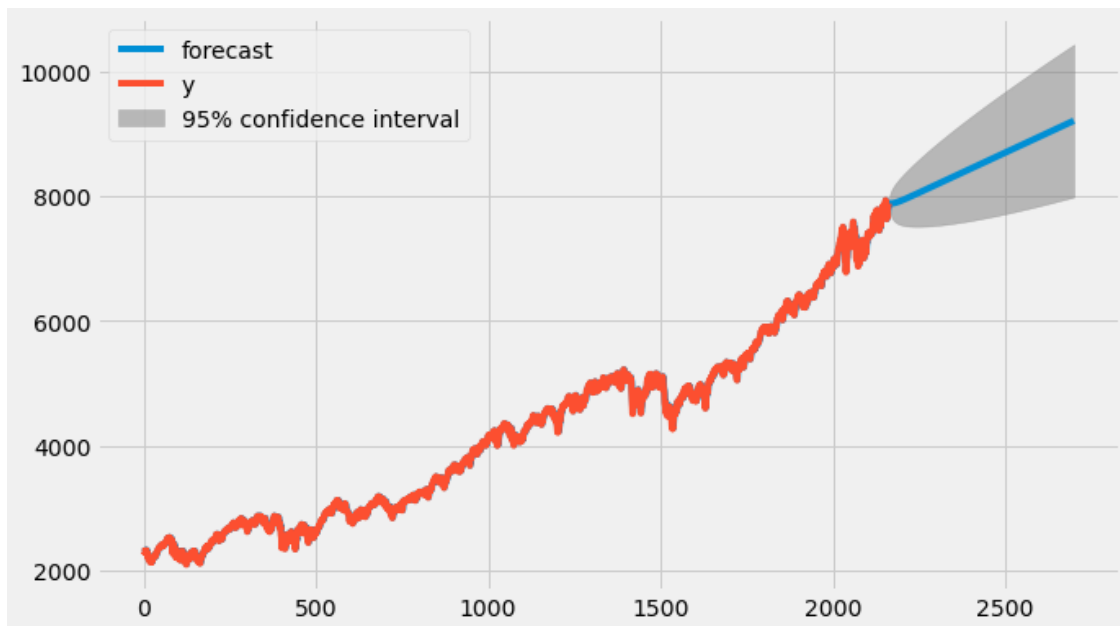


```
[160]: residuals.plot(kind='kde')
```

```
[160]: <matplotlib.axes._subplots.AxesSubplot at 0x7fde848bcd90>
```



```
[161]: result_arima.plot_predict(1,2700);
```



```
[162]: prediction = result_arma.predict(len(df)-200, len(df)-1)
```

```
[163]: from sklearn.metrics import mean_absolute_error
from sklearn.metrics import mean_squared_error
from sklearn.metrics import r2_score
mae = mean_absolute_error(x_test.data['Close'], np.append(x_train.data.iloc[-1,:
→ ['Close'], prediction).cumsum()[1:])
mse = mean_squared_error(x_test.data['Close'], np.append(x_train.data.iloc[-1,:
→ ['Close'], prediction).cumsum()[1:])
rmse = np.sqrt(mse)

print("Results of sklearn.metrics:")
print("MAE:", mae)
print("MSE:", mse)
print("RMSE:", rmse)
```

Results of sklearn.metrics:

MAE: 690.3840484817343

MSE: 791528.2196244474

RMSE: 889.678717079625

```
[164]: def smape(a, f):
    return 1/len(a) * np.sum(2 * np.abs(f-a) / (np.abs(a) + np.abs(f))*100)
smape(x_test.data['Close'], np.append(x_train.data.iloc[-1,:]['Close'],
→ prediction).cumsum()[1:])
```

[164]: 7.997544256633192

```
[165]: elapsed_time = time.process_time() - t  
print(elapsed_time)
```

18.974526218007668

[]:

[]:

[]:

[]:

[]:

[]:

```
[37]: #same analysis for TSX price
```

```
[166]: #upload TSX price  
df=pd.read_csv("GSPTSE_v1.csv", sep=",")
```

```
[167]: #understand the data and covert date format  
from datetime import datetime  
con=df['Date']  
df['Date']=pd.to_datetime(df['Date'])  
df.set_index('Date', inplace=True)  
#check datatype of index  
df.index
```

```
[167]: DatetimeIndex(['2010-01-04', '2010-01-05', '2010-01-06', '2010-01-07',  
                    '2010-01-08', '2010-01-11', '2010-01-12', '2010-01-13',  
                    '2010-01-14', '2010-01-15',  
                    ...,  
                    '2020-09-17', '2020-09-18', '2020-09-21', '2020-09-22',  
                    '2020-09-23', '2020-09-24', '2020-09-25', '2020-09-28',  
                    '2020-09-29', '2020-09-30'],  
                    dtype='datetime64[ns]', name='Date', length=2697, freq=None)
```

```
[168]: df['year'] = df.index.year  
df['month'] = df.index.month  
df['day'] = df.index.day
```

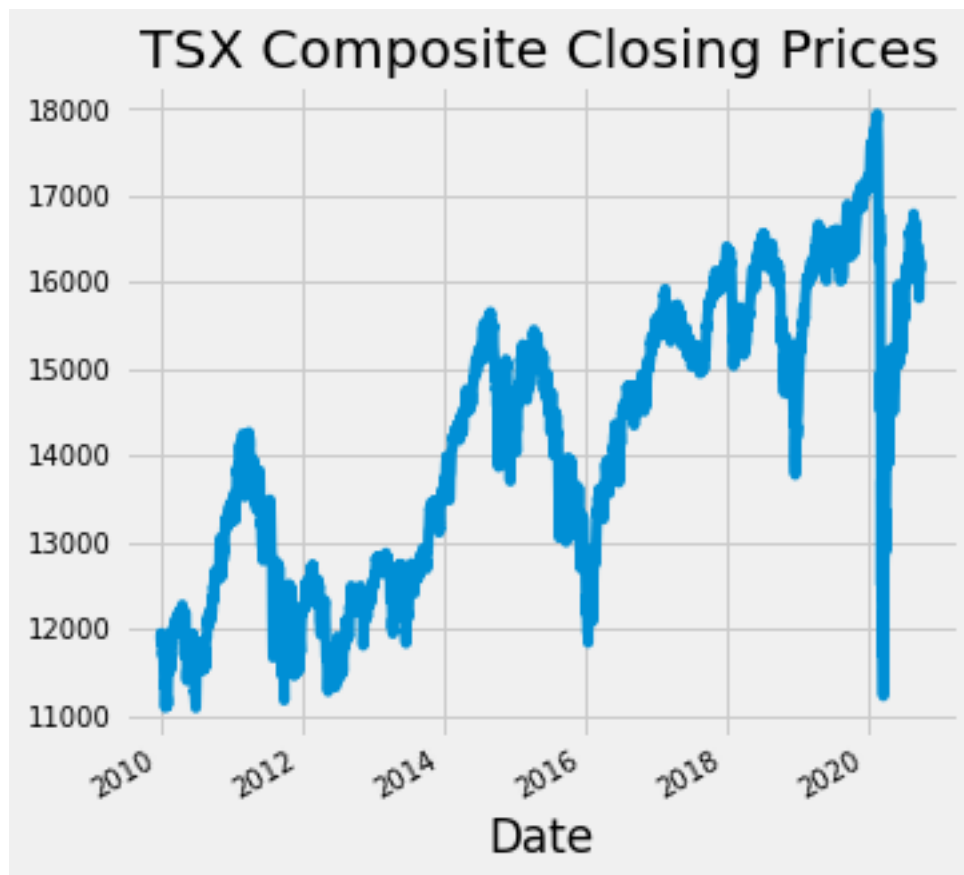
```
[169]: df.head()
```

```
[169]:
```

	Close	year	month	day
Date				
2010-01-04	11866.90039	2010	1	4
2010-01-05	11888.09961	2010	1	5
2010-01-06	11944.50000	2010	1	6
2010-01-07	11887.50000	2010	1	7
2010-01-08	11953.79981	2010	1	8

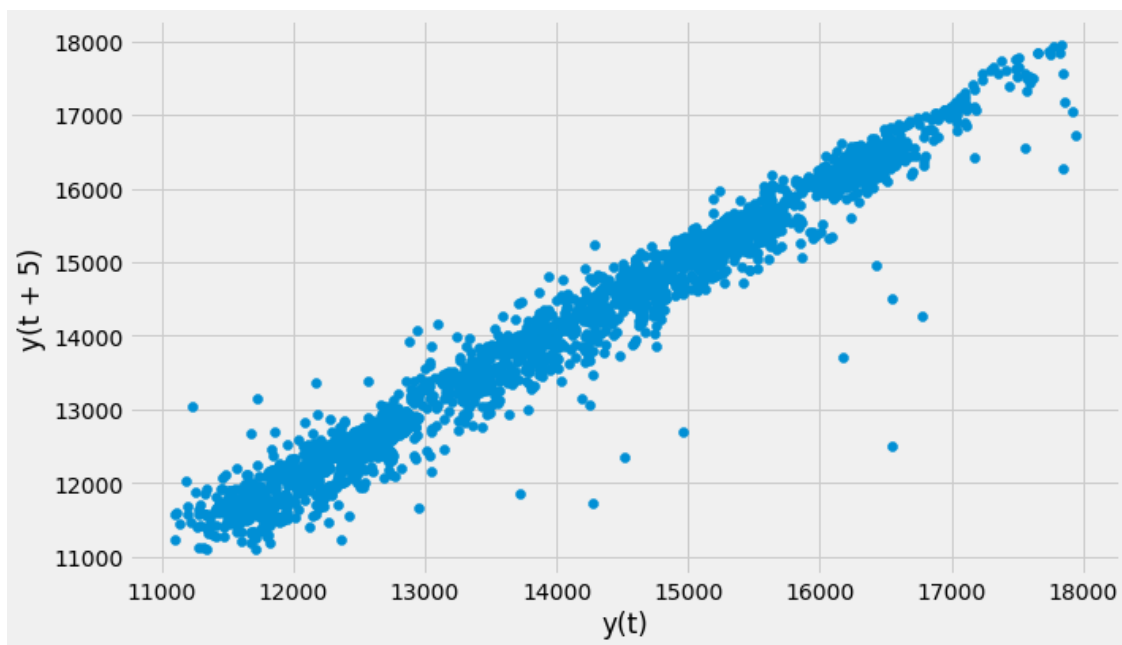
```
[170]: #plot TSX trend
temp=df.groupby(['Date'])['Close'].mean()
temp.plot(figsize=(5,5), title= 'TSX Composite Closing Prices', fontsize=10)
```

```
[170]: <matplotlib.axes._subplots.AxesSubplot at 0x7fde86da99d0>
```



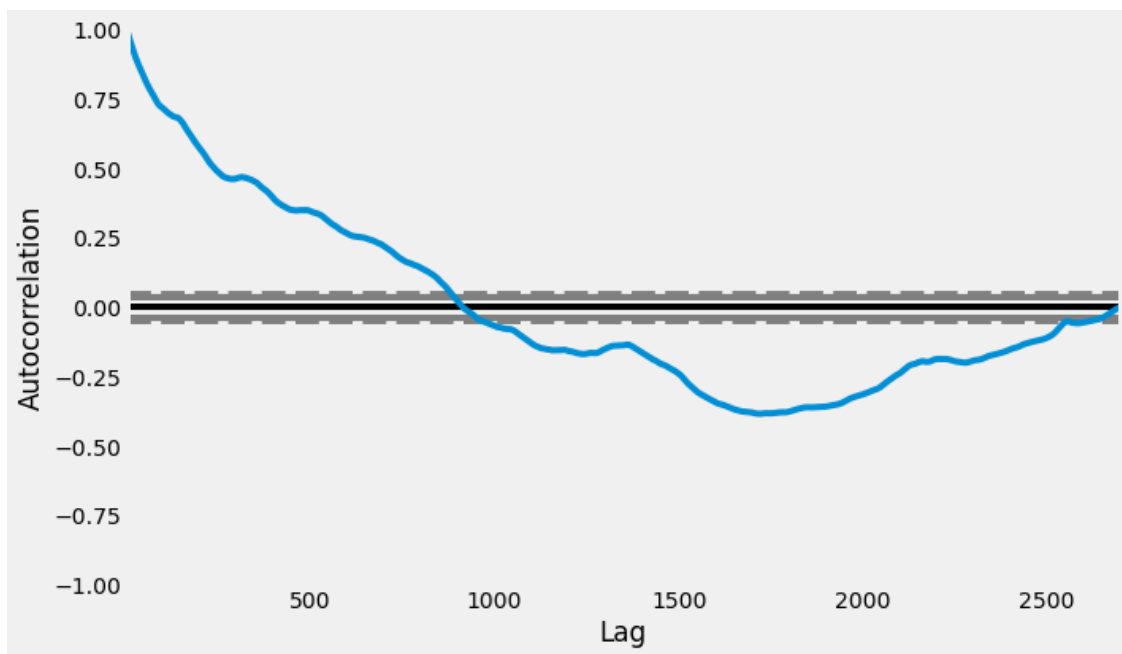
```
[171]: #lag plot
from pandas.plotting import lag_plot
lag_plot(df['Close'],lag=5)
#a linear plot also indicates non random dataset
```

```
[171]: <matplotlib.axes._subplots.AxesSubplot at 0x7fde848dc550>
```



```
[172]: from pandas.plotting import autocorrelation_plot
autocorrelation_plot(df['Close'])
#autocorrelation suggests arima might be a good model
```

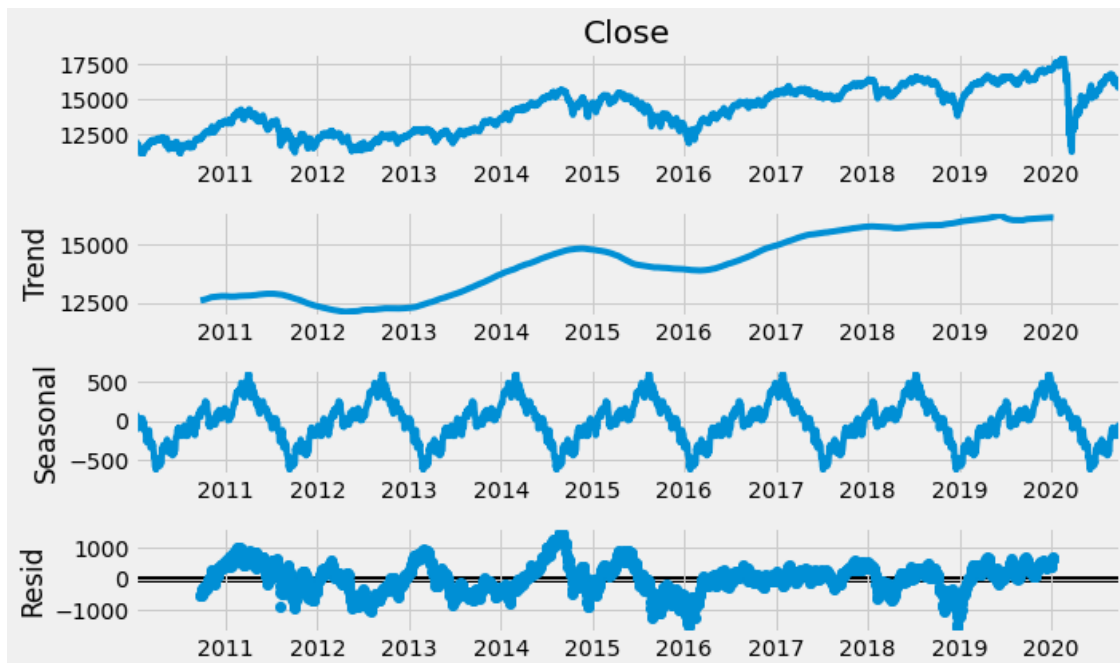
```
[172]: <matplotlib.axes._subplots.AxesSubplot at 0x7fde8459c410>
```



```
[173]: #original data shows as not stationary due to high p level
from statsmodels.tsa.stattools import adfuller
result = adfuller(df.Close.dropna())
print(f"ADF Statistic: {result[0]}")
print(f"p-value:{result[1]}")
```

ADF Statistic: -2.1272017170757755
p-value:0.23371823999228158

```
[174]: #decompose data
import statsmodels.api as sm
res = sm.tsa.seasonal_decompose(df['Close'],model= 'addictive',period = 365)
resplot = res.plot()
#upward trend
```



```
[175]: def plot_df(df,x,y,title= "", xlabel = "Date", ylabel='Value',dpi=50):
plt.plot(x,y)
plt.show()
```

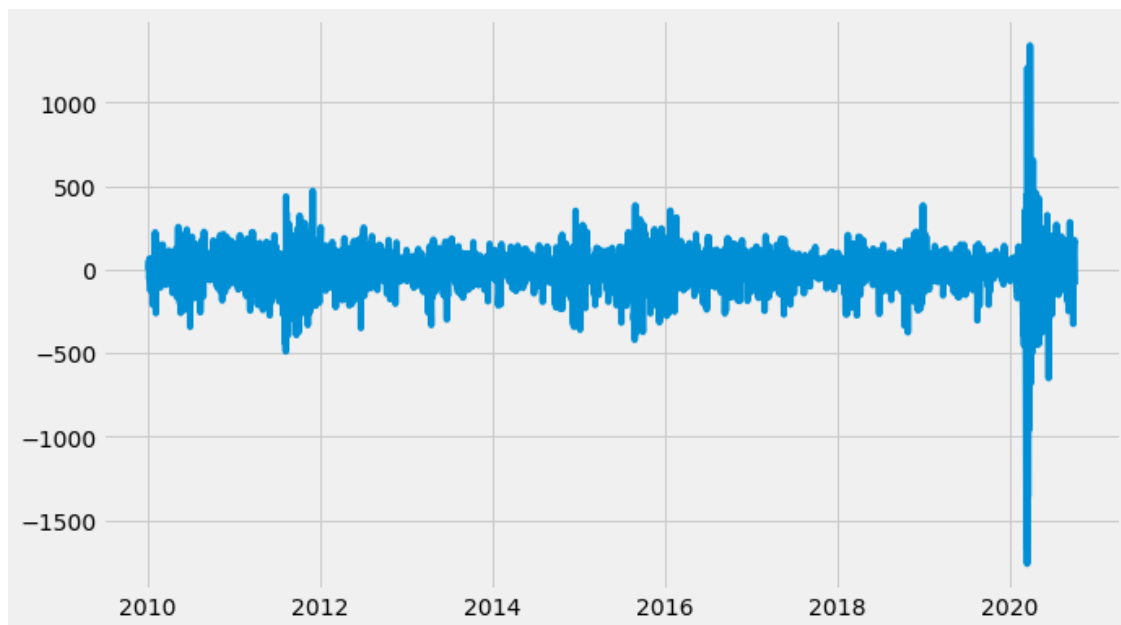
```
[176]: #apply log transformation to stablize data
plt.plot(df.apply(np.log)['Close'])
```

```
[176]: [<matplotlib.lines.Line2D at 0x7fde843b21d0>]
```




```
[177]: #To covert data into stationary dataset, first differencing has to be applied.
      ↪ With first differencing, empty field needs to be filled as 0.
      plt.plot(df['Close'].diff(1).fillna(0))
```

```
[177]: [<matplotlib.lines.Line2D at 0x7fde84391e50>]
```



```
[178]: #confirm stationarity
from statsmodels.tsa.stattools import adfuller
result = adfuller(np.log(df['Close']).diff(1).fillna(0))
print(f"ADF Statstic: {result[0]}")
print(f"p-value:{result[1]}")
```

ADF Statstic: -10.92108896454532
p-value:1.037610106877016e-19

```
[179]: import time

t = time.process_time()
```

```
[180]: df_st= df.diff(1).fillna(0)
```

```
[181]: #understand the structure of the stationary dataset
df_st.head()
```

```
[181]:
```

	Close	year	month	day
Date				
2010-01-04	0.00000	0.0	0.0	0.0
2010-01-05	21.19922	0.0	0.0	1.0
2010-01-06	56.40039	0.0	0.0	1.0
2010-01-07	-57.00000	0.0	0.0	1.0
2010-01-08	66.29981	0.0	0.0	1.0

```
[182]: #With transformation to maintain stationarity, we need to be model back to the
↳original dataset in order to predict stock price.
df_revert=df_st.copy()
df_revert=df_revert.cumsum()
```

```
[183]: df_revert.iloc[0,:]=df.iloc[0,:]
df_revert = df_revert.cumsum()
```

```
[184]: #define data
class TimeSeriesData():
    def __init__(self, df):
        self.data = df
        self.stationary = self.stationarize(df)
        self.revert = self.revert(self.stationary, self.data)

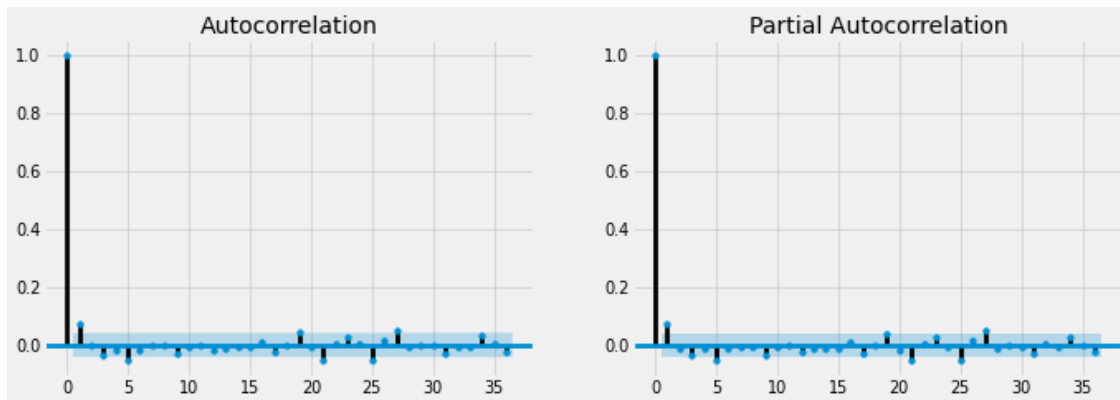
    def revert(self, st, org):
        x = st.copy()
        x.iloc[0,:] = org.iloc[0,:]
        return x.cumsum()

    def stationarize(self, data):
```

```
return data.diff(1).fillna(0)
```

```
[185]: #split dataset
x_train = TimeSeriesData(df[:int((len(df)*0.85))])
x_test = TimeSeriesData(df[int((len(df)*0.85)):])
```

```
[186]: #plot ACF and PACF for the stationary dataset
from statsmodels.graphics.tsaplots import plot_acf, plot_pacf
fig, axes = plt.subplots(1,2,figsize=(15,5), dpi= 50)
plot_acf(x_train.stationary['Close'].values.tolist(), lags=36,ax=axes[0]);
plot_pacf(x_train.stationary['Close'].values.tolist(), lags=36,ax=axes[1]);
```



```
[187]: #using auto_arima to aquire p and q value with min AIC.
from pmdarima import auto_arima
model = auto_arima(x_train.data['Close'], trace=True, error_action='ignore',
↳suppress_warnings=True)
model.fit(x_train.data['Close'])
```

Performing stepwise search to minimize aic

```
ARIMA(2,1,2)(0,0,0)[0] intercept : AIC=27707.940, Time=1.33 sec
ARIMA(0,1,0)(0,0,0)[0] intercept : AIC=27722.152, Time=0.05 sec
ARIMA(1,1,0)(0,0,0)[0] intercept : AIC=27711.070, Time=0.10 sec
ARIMA(0,1,1)(0,0,0)[0] intercept : AIC=27711.001, Time=0.13 sec
ARIMA(0,1,0)(0,0,0)[0] : AIC=27720.872, Time=0.03 sec
ARIMA(1,1,2)(0,0,0)[0] intercept : AIC=27714.994, Time=0.23 sec
ARIMA(2,1,1)(0,0,0)[0] intercept : AIC=27707.115, Time=1.35 sec
ARIMA(1,1,1)(0,0,0)[0] intercept : AIC=27712.993, Time=0.13 sec
ARIMA(2,1,0)(0,0,0)[0] intercept : AIC=27712.917, Time=0.16 sec
ARIMA(3,1,1)(0,0,0)[0] intercept : AIC=27707.866, Time=1.59 sec
ARIMA(3,1,0)(0,0,0)[0] intercept : AIC=27712.282, Time=0.22 sec
ARIMA(3,1,2)(0,0,0)[0] intercept : AIC=27708.220, Time=2.16 sec
ARIMA(2,1,1)(0,0,0)[0] : AIC=27706.090, Time=0.43 sec
ARIMA(1,1,1)(0,0,0)[0] : AIC=27711.613, Time=0.19 sec
```

```

ARIMA(2,1,0)(0,0,0)[0]      : AIC=27711.544, Time=0.06 sec
ARIMA(3,1,1)(0,0,0)[0]      : AIC=27706.835, Time=0.42 sec
ARIMA(2,1,2)(0,0,0)[0]      : AIC=27706.903, Time=0.47 sec
ARIMA(1,1,0)(0,0,0)[0]      : AIC=27709.688, Time=0.05 sec
ARIMA(1,1,2)(0,0,0)[0]      : AIC=27713.616, Time=0.11 sec
ARIMA(3,1,0)(0,0,0)[0]      : AIC=27710.951, Time=0.09 sec
ARIMA(3,1,2)(0,0,0)[0]      : AIC=27707.194, Time=0.73 sec

```

Best model: ARIMA(2,1,1)(0,0,0)[0]

Total fit time: 10.038 seconds

```

[187]: ARIMA(maxiter=50, method='lbfgs', order=(2, 1, 1), out_of_sample_size=0,
          scoring='mse', scoring_args={}, seasonal_order=(0, 0, 0, 0),
          start_params=None, suppress_warnings=True, trend=None,
          with_intercept=False)

```

```

[188]: model_arima = ARIMA(x_train.data['Close'].values, order=(2,1,1))

```

```

[189]: result_arima = model_arima.fit(dispatch=-1)

```

```

[190]: print(result_arima.summary())

```

ARIMA Model Results

```

=====
Dep. Variable:          D.y      No. Observations:          2291
Model:                  ARIMA(2, 1, 1)  Log Likelihood          -13848.621
Method:                 css-mle    S.D. of innovations          102.089
Date:                   Fri, 04 Dec 2020  AIC          27707.242
Time:                   19:12:38    BIC          27735.926
Sample:                 1      HQIC          27717.702

```

```

=====
              coef      std err          z      P>|z|      [0.025      0.975]
-----
const          1.7918         1.819         0.985      0.325      -1.773         5.357
ar.L1.D.y       0.9619         0.058        16.567      0.000         0.848         1.076
ar.L2.D.y      -0.0939         0.021        -4.491      0.000        -0.135        -0.053
ma.L1.D.y      -0.8876         0.055       -16.179      0.000        -0.995        -0.780

```

Roots

```

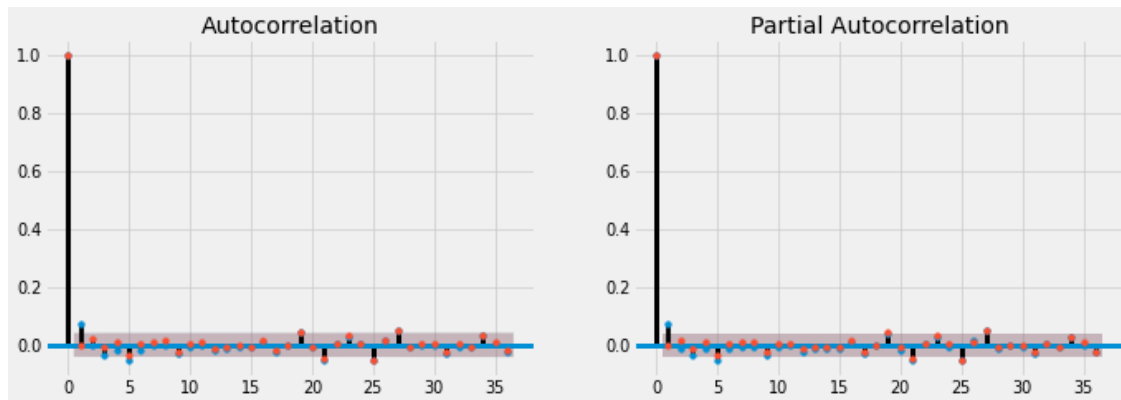
=====
              Real      Imaginary      Modulus      Frequency
-----
AR.1          1.1741         +0.0000j         1.1741         0.0000
AR.2          9.0727         +0.0000j         9.0727         0.0000
MA.1          1.1267         +0.0000j         1.1267         0.0000

```

```
[191]: #understand residual
residuals = pd.DataFrame(result_arima.resid)
```

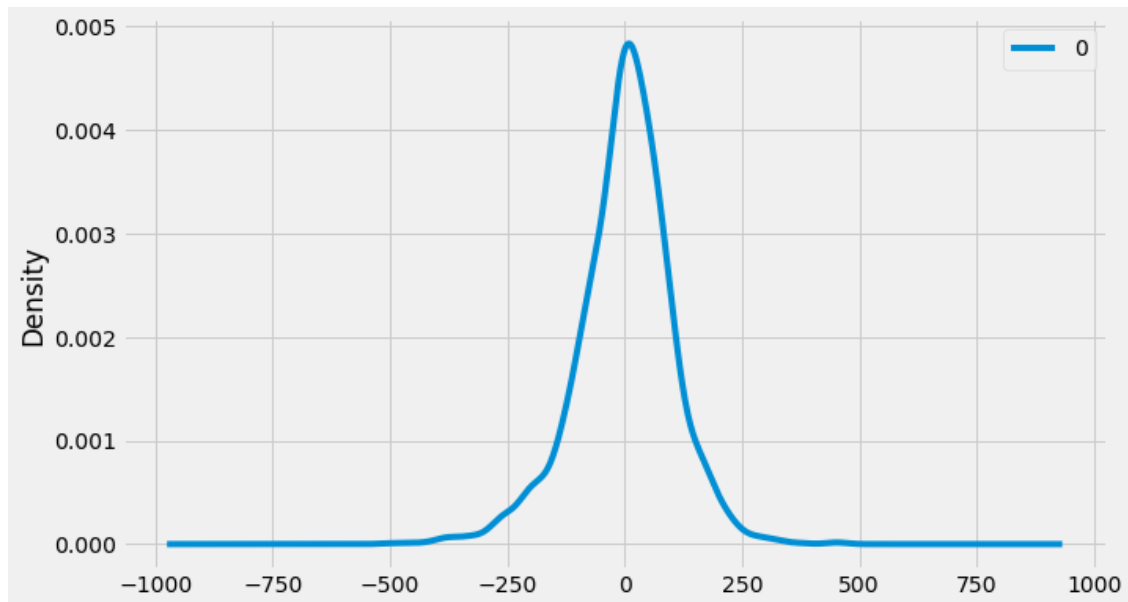
```
[192]: plot_acf(residuals, lags=36, ax=axes[0])
plot_pacf(residuals, lags=36, ax=axes[1])
```

[192]:

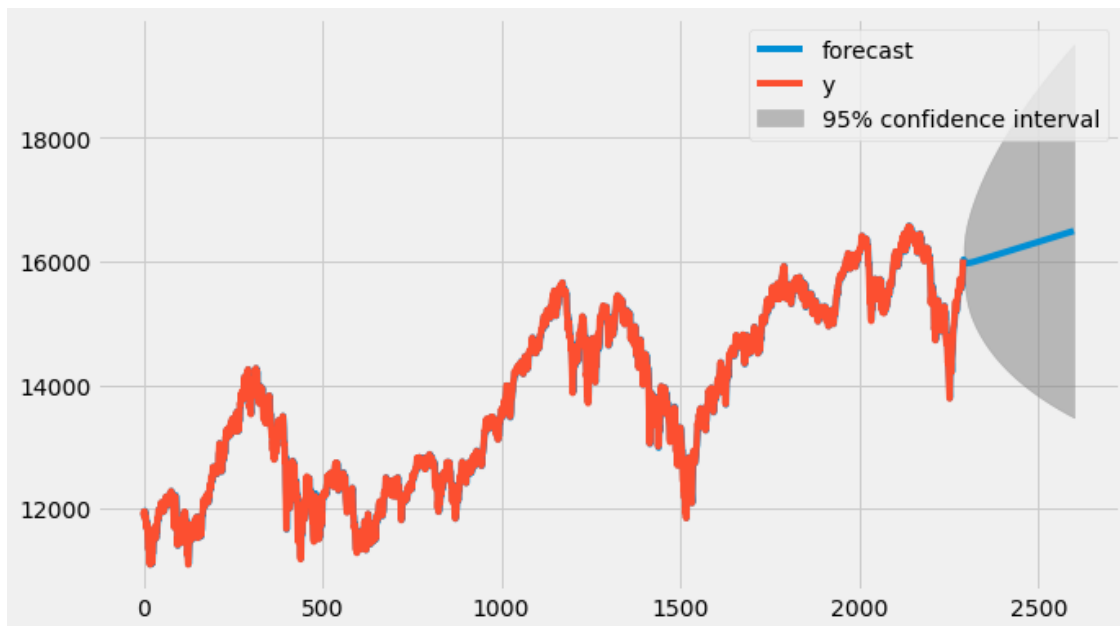


```
[193]: residuals.plot(kind='kde')
```

[193]: <matplotlib.axes._subplots.AxesSubplot at 0x7fde8422d150>



```
[194]: result_arima.plot_predict(1,2600);
```



```
[195]: prediction = result_arma.predict(len(df)-208,len(df)-1)
```

```
[196]: from sklearn.metrics import mean_absolute_error
from sklearn.metrics import mean_squared_error
from sklearn.metrics import r2_score
mae = mean_absolute_error(x_test.data['Close'], np.append(x_train.data.iloc[-1,:
→] ['Close'], prediction).cumsum()[1:])
mse = mean_squared_error(x_test.data['Close'], np.append(x_train.data.iloc[-1,:
→] ['Close'], prediction).cumsum()[1:])
rmse = np.sqrt(mse)

print("Results of sklearn.metrics:")
print("MAE:", mae)
print("MSE:", mse)
print("RMSE:", rmse)
```

Results of sklearn.metrics:

MAE: 767.5063223410224

MSE: 1313293.7357536359

RMSE: 1145.9902860642562

```
[197]: def smape(a, f):
    return 1/len(a) * np.sum(2 * np.abs(f-a) / (np.abs(a) + np.abs(f))*100)
smape(x_test.data['Close'], np.append(x_train.data.iloc[-1,:]['Close'],
→prediction).cumsum()[1:])
```

[197]: 4.863946788376522

```
[198]: elapsed_time = time.process_time() - t  
       print(elapsed_time)
```

34.980218798998976

[]:

[]:

```
[70]: #using LSTM to predict stock price
```

```
[71]: pip install tensorflow
```

Requirement already satisfied: tensorflow in /opt/conda/lib/python3.7/site-packages (2.3.1)

Requirement already satisfied: gast==0.3.3 in /opt/conda/lib/python3.7/site-packages (from tensorflow) (0.3.3)

Requirement already satisfied: numpy<1.19.0,>=1.16.0 in /opt/conda/lib/python3.7/site-packages (from tensorflow) (1.18.4)

Requirement already satisfied: opt-einsum>=2.3.2 in /opt/conda/lib/python3.7/site-packages (from tensorflow) (3.3.0)

Requirement already satisfied: tensorflow-estimator<2.4.0,>=2.3.0 in /opt/conda/lib/python3.7/site-packages (from tensorflow) (2.3.0)

Requirement already satisfied: termcolor>=1.1.0 in /opt/conda/lib/python3.7/site-packages (from tensorflow) (1.1.0)

Requirement already satisfied: wrapt>=1.11.1 in /opt/conda/lib/python3.7/site-packages (from tensorflow) (1.12.1)

Requirement already satisfied: wheel>=0.26 in /opt/conda/lib/python3.7/site-packages (from tensorflow) (0.34.2)

Requirement already satisfied: astunparse==1.6.3 in /opt/conda/lib/python3.7/site-packages (from tensorflow) (1.6.3)

Requirement already satisfied: absl-py>=0.7.0 in /opt/conda/lib/python3.7/site-packages (from tensorflow) (0.11.0)

Requirement already satisfied: h5py<2.11.0,>=2.10.0 in /opt/conda/lib/python3.7/site-packages (from tensorflow) (2.10.0)

Requirement already satisfied: keras-preprocessing<1.2,>=1.1.1 in /opt/conda/lib/python3.7/site-packages (from tensorflow) (1.1.2)

Requirement already satisfied: protobuf>=3.9.2 in /opt/conda/lib/python3.7/site-packages (from tensorflow) (3.11.4)

Requirement already satisfied: google-pasta>=0.1.8 in /opt/conda/lib/python3.7/site-packages (from tensorflow) (0.2.0)

Requirement already satisfied: tensorboard<3,>=2.3.0 in /opt/conda/lib/python3.7/site-packages (from tensorflow) (2.4.0)

Requirement already satisfied: grpcio>=1.8.6 in /opt/conda/lib/python3.7/site-packages (from tensorflow) (1.33.2)

Requirement already satisfied: six>=1.12.0 in /opt/conda/lib/python3.7/site-

packages (from tensorflow) (1.14.0)

Requirement already satisfied: setuptools in /opt/conda/lib/python3.7/site-packages (from protobuf>=3.9.2->tensorflow) (46.1.3.post20200325)

Requirement already satisfied: markdown>=2.6.8 in /opt/conda/lib/python3.7/site-packages (from tensorboard<3,>=2.3.0->tensorflow) (3.3.3)

Requirement already satisfied: tensorboard-plugin-wit>=1.6.0 in /opt/conda/lib/python3.7/site-packages (from tensorboard<3,>=2.3.0->tensorflow) (1.7.0)

Requirement already satisfied: requests<3,>=2.21.0 in /opt/conda/lib/python3.7/site-packages (from tensorboard<3,>=2.3.0->tensorflow) (2.23.0)

Requirement already satisfied: google-auth<2,>=1.6.3 in /opt/conda/lib/python3.7/site-packages (from tensorboard<3,>=2.3.0->tensorflow) (1.16.1)

Requirement already satisfied: werkzeug>=0.11.15 in /opt/conda/lib/python3.7/site-packages (from tensorboard<3,>=2.3.0->tensorflow) (1.0.1)

Requirement already satisfied: google-auth-oauthlib<0.5,>=0.4.1 in /opt/conda/lib/python3.7/site-packages (from tensorboard<3,>=2.3.0->tensorflow) (0.4.2)

Requirement already satisfied: importlib-metadata; python_version < "3.8" in /opt/conda/lib/python3.7/site-packages (from markdown>=2.6.8->tensorboard<3,>=2.3.0->tensorflow) (1.6.0)

Requirement already satisfied: certifi>=2017.4.17 in /opt/conda/lib/python3.7/site-packages (from requests<3,>=2.21.0->tensorboard<3,>=2.3.0->tensorflow) (2020.4.5.2)

Requirement already satisfied: chardet<4,>=3.0.2 in /opt/conda/lib/python3.7/site-packages (from requests<3,>=2.21.0->tensorboard<3,>=2.3.0->tensorflow) (3.0.4)

Requirement already satisfied: urllib3!=1.25.0,!1.25.1,<1.26,>=1.21.1 in /opt/conda/lib/python3.7/site-packages (from requests<3,>=2.21.0->tensorboard<3,>=2.3.0->tensorflow) (1.25.9)

Requirement already satisfied: idna<3,>=2.5 in /opt/conda/lib/python3.7/site-packages (from requests<3,>=2.21.0->tensorboard<3,>=2.3.0->tensorflow) (2.9)

Requirement already satisfied: cachetools<5.0,>=2.0.0 in /opt/conda/lib/python3.7/site-packages (from google-auth<2,>=1.6.3->tensorboard<3,>=2.3.0->tensorflow) (4.1.0)

Requirement already satisfied: rsa<4.1,>=3.1.4 in /opt/conda/lib/python3.7/site-packages (from google-auth<2,>=1.6.3->tensorboard<3,>=2.3.0->tensorflow) (4.0)

Requirement already satisfied: pyasn1-modules>=0.2.1 in /opt/conda/lib/python3.7/site-packages (from google-auth<2,>=1.6.3->tensorboard<3,>=2.3.0->tensorflow) (0.2.8)

Requirement already satisfied: requests-oauthlib>=0.7.0 in /opt/conda/lib/python3.7/site-packages (from google-auth-oauthlib<0.5,>=0.4.1->tensorboard<3,>=2.3.0->tensorflow) (1.3.0)

Requirement already satisfied: zipp>=0.5 in /opt/conda/lib/python3.7/site-packages (from importlib-metadata; python_version < "3.8"->markdown>=2.6.8->tensorboard<3,>=2.3.0->tensorflow) (3.1.0)

Requirement already satisfied: pyasn1>=0.1.3 in /opt/conda/lib/python3.7/site-packages (from rsa<4.1,>=3.1.4->google-auth<2,>=1.6.3->tensorboard<3,>=2.3.0->tensorflow) (0.4.8)
Requirement already satisfied: oauthlib>=3.0.0 in /opt/conda/lib/python3.7/site-packages (from requests-oauthlib>=0.7.0->google-auth-oauthlib<0.5,>=0.4.1->tensorboard<3,>=2.3.0->tensorflow) (3.0.1)
Note: you may need to restart the kernel to use updated packages.

[72]: `pip install keras`

Requirement already satisfied: keras in /opt/conda/lib/python3.7/site-packages (2.4.3)
Requirement already satisfied: h5py in /opt/conda/lib/python3.7/site-packages (from keras) (2.10.0)
Requirement already satisfied: numpy>=1.9.1 in /opt/conda/lib/python3.7/site-packages (from keras) (1.18.4)
Requirement already satisfied: scipy>=0.14 in /opt/conda/lib/python3.7/site-packages (from keras) (1.4.1)
Requirement already satisfied: pyyaml in /opt/conda/lib/python3.7/site-packages (from keras) (5.3.1)
Requirement already satisfied: six in /opt/conda/lib/python3.7/site-packages (from h5py->keras) (1.14.0)
Note: you may need to restart the kernel to use updated packages.

[73]: `pip install pandas-datareader`

Requirement already satisfied: pandas-datareader in /opt/conda/lib/python3.7/site-packages (0.9.0)
Requirement already satisfied: lxml in /opt/conda/lib/python3.7/site-packages (from pandas-datareader) (4.5.1)
Requirement already satisfied: requests>=2.19.0 in /opt/conda/lib/python3.7/site-packages (from pandas-datareader) (2.23.0)
Requirement already satisfied: pandas>=0.23 in /opt/conda/lib/python3.7/site-packages (from pandas-datareader) (1.0.3)
Requirement already satisfied: urllib3!=1.25.0,!1.25.1,<1.26,>=1.21.1 in /opt/conda/lib/python3.7/site-packages (from requests>=2.19.0->pandas-datareader) (1.25.9)
Requirement already satisfied: certifi>=2017.4.17 in /opt/conda/lib/python3.7/site-packages (from requests>=2.19.0->pandas-datareader) (2020.4.5.2)
Requirement already satisfied: idna<3,>=2.5 in /opt/conda/lib/python3.7/site-packages (from requests>=2.19.0->pandas-datareader) (2.9)
Requirement already satisfied: chardet<4,>=3.0.2 in /opt/conda/lib/python3.7/site-packages (from requests>=2.19.0->pandas-datareader) (3.0.4)
Requirement already satisfied: numpy>=1.13.3 in /opt/conda/lib/python3.7/site-packages (from pandas>=0.23->pandas-datareader) (1.18.4)
Requirement already satisfied: pytz>=2017.2 in /opt/conda/lib/python3.7/site-

```
packages (from pandas>=0.23->pandas-datareader) (2020.1)
Requirement already satisfied: python-dateutil>=2.6.1 in
/opt/conda/lib/python3.7/site-packages (from pandas>=0.23->pandas-datareader)
(2.8.1)
Requirement already satisfied: six>=1.5 in /opt/conda/lib/python3.7/site-
packages (from python-dateutil>=2.6.1->pandas>=0.23->pandas-datareader) (1.14.0)
Note: you may need to restart the kernel to use updated packages.
```

```
[74]: pip install scikit-learn
```

```
Requirement already satisfied: scikit-learn in /opt/conda/lib/python3.7/site-
packages (0.22.2.post1)
Requirement already satisfied: joblib>=0.11 in /opt/conda/lib/python3.7/site-
packages (from scikit-learn) (0.15.1)
Requirement already satisfied: scipy>=0.17.0 in /opt/conda/lib/python3.7/site-
packages (from scikit-learn) (1.4.1)
Requirement already satisfied: numpy>=1.11.0 in /opt/conda/lib/python3.7/site-
packages (from scikit-learn) (1.18.4)
Note: you may need to restart the kernel to use updated packages.
```

```
[75]: from pandas_datareader import data
import datetime as dt
from matplotlib import pyplot as plt
from sklearn import model_selection
from sklearn.metrics import confusion_matrix
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
import numpy as np
import pandas as pd
from sklearn.preprocessing import MinMaxScaler
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import LSTM
from keras.layers import GRU
from keras.layers import Dropout
```

```
[76]: #similar to before, upload NASDAQ data
df=pd.read_csv("IXIC_v1.csv", sep=",")
from datetime import datetime
con=df['Date']
df['Date']=pd.to_datetime(df['Date'])
df.set_index('Date', inplace=True)
test = df[2164:]
train = df[:2163]
```

```
[77]: df['Date'] = df.index
data2 = pd.DataFrame(columns = ['Date', 'Close'])
```

```
data2['Date'] = df['Date']
data2['Close'] = df['Close']
```

```
[78]: #start calculating runtime in seconds
import time

t = time.process_time()
```

```
[79]: #scale and reshape data
train_set = data2.iloc[:, 1:2].values
sc = MinMaxScaler(feature_range = (0, 1))
training_set_scaled = sc.fit_transform(train_set)
X_train = []
y_train = []
for i in range(60, training_set_scaled.shape[0]):
    X_train.append(training_set_scaled[i-60:i, 0])
    y_train.append(training_set_scaled[i, 0])
X_train, y_train = np.array(X_train), np.array(y_train)
X_train = np.reshape(X_train, (X_train.shape[0], X_train.shape[1], 1))
```

```
[80]: #add layers
regressor = Sequential()
regressor.add(LSTM(units = 50, return_sequences = True, input_shape = (X_train.
↪shape[1], 1)))
regressor.add(Dropout(0.15))
regressor.add(LSTM(units = 50, return_sequences = True))
regressor.add(Dropout(0.15))
regressor.add(LSTM(units = 50, return_sequences = True))
regressor.add(Dropout(0.15))
regressor.add(LSTM(units = 50))
regressor.add(Dropout(0.15))
regressor.add(Dense(units = 1))
```

```
[81]: #add optimizer and build model
regressor.compile(optimizer = 'adam', loss = 'mean_squared_error')
regressor.fit(X_train, y_train, epochs = 1000, batch_size = 80)
```

```
Epoch 1/1000
34/34 [=====] - 6s 163ms/step - loss: 0.0205
Epoch 2/1000
34/34 [=====] - 5s 154ms/step - loss: 0.0024
Epoch 3/1000
34/34 [=====] - 5s 151ms/step - loss: 0.0017
Epoch 4/1000
34/34 [=====] - 5s 151ms/step - loss: 0.0015
Epoch 5/1000
34/34 [=====] - 5s 152ms/step - loss: 0.0016
```

```

Epoch 6/1000
34/34 [=====] - 5s 151ms/step - loss: 0.0015
Epoch 7/1000
34/34 [=====] - 5s 152ms/step - loss: 0.0017
Epoch 8/1000
34/34 [=====] - 5s 152ms/step - loss: 0.0016
Epoch 9/1000
34/34 [=====] - 5s 151ms/step - loss: 0.0015
Epoch 10/1000
34/34 [=====] - 5s 152ms/step - loss: 0.0013
Epoch 11/1000
34/34 [=====] - 5s 152ms/step - loss: 0.0013
Epoch 12/1000
34/34 [=====] - 5s 152ms/step - loss: 0.0014
Epoch 13/1000
34/34 [=====] - 5s 152ms/step - loss: 0.0013
Epoch 14/1000
34/34 [=====] - 5s 151ms/step - loss: 0.0013
Epoch 15/1000
34/34 [=====] - 5s 151ms/step - loss: 0.0011
Epoch 16/1000
34/34 [=====] - 5s 152ms/step - loss: 0.0011
Epoch 17/1000
34/34 [=====] - 5s 152ms/step - loss: 0.0011
Epoch 18/1000
34/34 [=====] - 5s 151ms/step - loss: 0.0012
Epoch 19/1000
34/34 [=====] - 5s 150ms/step - loss: 9.5887e-04
Epoch 20/1000
34/34 [=====] - 5s 152ms/step - loss: 9.6538e-04
Epoch 21/1000
34/34 [=====] - 5s 152ms/step - loss: 0.0016
Epoch 22/1000
34/34 [=====] - 5s 152ms/step - loss: 9.7421e-04
Epoch 23/1000
34/34 [=====] - 5s 152ms/step - loss: 0.0011
Epoch 24/1000
34/34 [=====] - 5s 151ms/step - loss: 0.0011
Epoch 25/1000
34/34 [=====] - 5s 149ms/step - loss: 9.4600e-04
Epoch 26/1000
34/34 [=====] - 5s 148ms/step - loss: 0.0012
Epoch 27/1000
34/34 [=====] - 5s 151ms/step - loss: 9.0647e-04
Epoch 28/1000
34/34 [=====] - 5s 150ms/step - loss: 8.6321e-04
Epoch 29/1000
34/34 [=====] - 5s 148ms/step - loss: 8.6474e-04

```

Epoch 30/1000
34/34 [=====] - 5s 150ms/step - loss: 0.0014
Epoch 31/1000
34/34 [=====] - 5s 151ms/step - loss: 9.7050e-04
Epoch 32/1000
34/34 [=====] - 5s 148ms/step - loss: 0.0012
Epoch 33/1000
34/34 [=====] - 5s 148ms/step - loss: 8.2260e-04
Epoch 34/1000
34/34 [=====] - 5s 148ms/step - loss: 8.5902e-04
Epoch 35/1000
34/34 [=====] - 5s 151ms/step - loss: 8.6987e-04
Epoch 36/1000
34/34 [=====] - 5s 148ms/step - loss: 7.8306e-04
Epoch 37/1000
34/34 [=====] - 5s 147ms/step - loss: 7.9846e-04
Epoch 38/1000
34/34 [=====] - 5s 149ms/step - loss: 7.7654e-04
Epoch 39/1000
34/34 [=====] - 5s 148ms/step - loss: 6.7745e-04
Epoch 40/1000
34/34 [=====] - 5s 149ms/step - loss: 8.1981e-04
Epoch 41/1000
34/34 [=====] - 5s 148ms/step - loss: 7.9105e-04
Epoch 42/1000
34/34 [=====] - 5s 149ms/step - loss: 9.8635e-04
Epoch 43/1000
34/34 [=====] - 5s 150ms/step - loss: 8.0795e-04
Epoch 44/1000
34/34 [=====] - 5s 148ms/step - loss: 7.5662e-04
Epoch 45/1000
34/34 [=====] - 6s 162ms/step - loss: 7.4450e-04
Epoch 46/1000
34/34 [=====] - 6s 162ms/step - loss: 6.6633e-04
Epoch 47/1000
34/34 [=====] - 5s 149ms/step - loss: 6.6932e-04
Epoch 48/1000
34/34 [=====] - 5s 149ms/step - loss: 7.1821e-04
Epoch 49/1000
34/34 [=====] - 5s 147ms/step - loss: 7.3150e-04
Epoch 50/1000
34/34 [=====] - 5s 149ms/step - loss: 6.7119e-04
Epoch 51/1000
34/34 [=====] - 5s 149ms/step - loss: 7.1843e-04
Epoch 52/1000
34/34 [=====] - 5s 148ms/step - loss: 0.0011
Epoch 53/1000
34/34 [=====] - 5s 147ms/step - loss: 7.3493e-04

Epoch 54/1000
34/34 [=====] - 5s 156ms/step - loss: 7.0084e-04
Epoch 55/1000
34/34 [=====] - 6s 178ms/step - loss: 6.6174e-04
Epoch 56/1000
34/34 [=====] - 5s 159ms/step - loss: 6.7048e-04
Epoch 57/1000
34/34 [=====] - 5s 147ms/step - loss: 6.9542e-04
Epoch 58/1000
34/34 [=====] - 5s 148ms/step - loss: 6.6462e-04
Epoch 59/1000
34/34 [=====] - 5s 147ms/step - loss: 6.3604e-04
Epoch 60/1000
34/34 [=====] - 5s 147ms/step - loss: 6.7802e-04
Epoch 61/1000
34/34 [=====] - 5s 147ms/step - loss: 6.1679e-04
Epoch 62/1000
34/34 [=====] - 5s 146ms/step - loss: 0.0010
Epoch 63/1000
34/34 [=====] - 5s 147ms/step - loss: 7.1299e-04
Epoch 64/1000
34/34 [=====] - 5s 146ms/step - loss: 6.3053e-04
Epoch 65/1000
34/34 [=====] - 5s 146ms/step - loss: 6.5916e-04
Epoch 66/1000
34/34 [=====] - 5s 147ms/step - loss: 6.5299e-04
Epoch 67/1000
34/34 [=====] - 5s 147ms/step - loss: 6.9246e-04
Epoch 68/1000
34/34 [=====] - 5s 147ms/step - loss: 5.9175e-04
Epoch 69/1000
34/34 [=====] - 5s 147ms/step - loss: 6.6687e-04
Epoch 70/1000
34/34 [=====] - 5s 145ms/step - loss: 6.1994e-04
Epoch 71/1000
34/34 [=====] - 5s 146ms/step - loss: 7.1528e-04
Epoch 72/1000
34/34 [=====] - 5s 145ms/step - loss: 6.1344e-04
Epoch 73/1000
34/34 [=====] - 5s 147ms/step - loss: 7.3738e-04
Epoch 74/1000
34/34 [=====] - 5s 147ms/step - loss: 6.1840e-04
Epoch 75/1000
34/34 [=====] - 5s 146ms/step - loss: 5.1817e-04
Epoch 76/1000
34/34 [=====] - 5s 147ms/step - loss: 5.3819e-04
Epoch 77/1000
34/34 [=====] - 5s 146ms/step - loss: 5.5069e-04

Epoch 78/1000
34/34 [=====] - 5s 145ms/step - loss: 5.3065e-04
Epoch 79/1000
34/34 [=====] - 5s 146ms/step - loss: 5.5258e-04
Epoch 80/1000
34/34 [=====] - 5s 146ms/step - loss: 6.7984e-04
Epoch 81/1000
34/34 [=====] - 5s 148ms/step - loss: 5.5905e-04
Epoch 82/1000
34/34 [=====] - 5s 148ms/step - loss: 5.9659e-04
Epoch 83/1000
34/34 [=====] - 5s 146ms/step - loss: 5.0197e-04
Epoch 84/1000
34/34 [=====] - 5s 147ms/step - loss: 5.5496e-04
Epoch 85/1000
34/34 [=====] - 5s 145ms/step - loss: 5.7839e-04
Epoch 86/1000
34/34 [=====] - 5s 144ms/step - loss: 5.0456e-04
Epoch 87/1000
34/34 [=====] - 5s 146ms/step - loss: 5.4454e-04
Epoch 88/1000
34/34 [=====] - 5s 145ms/step - loss: 6.0780e-04
Epoch 89/1000
34/34 [=====] - 5s 145ms/step - loss: 5.6392e-04
Epoch 90/1000
34/34 [=====] - 5s 147ms/step - loss: 5.9029e-04
Epoch 91/1000
34/34 [=====] - 5s 145ms/step - loss: 5.1701e-04
Epoch 92/1000
34/34 [=====] - 5s 145ms/step - loss: 5.4413e-04
Epoch 93/1000
34/34 [=====] - 5s 145ms/step - loss: 5.2392e-04
Epoch 94/1000
34/34 [=====] - 5s 146ms/step - loss: 5.3385e-04
Epoch 95/1000
34/34 [=====] - 5s 146ms/step - loss: 4.9799e-04
Epoch 96/1000
34/34 [=====] - 5s 145ms/step - loss: 5.6198e-04
Epoch 97/1000
34/34 [=====] - 5s 145ms/step - loss: 5.2710e-04
Epoch 98/1000
34/34 [=====] - 5s 145ms/step - loss: 5.6650e-04
Epoch 99/1000
34/34 [=====] - 5s 142ms/step - loss: 4.9484e-04
Epoch 100/1000
34/34 [=====] - 5s 145ms/step - loss: 4.7913e-04
Epoch 101/1000
34/34 [=====] - 5s 145ms/step - loss: 4.7632e-04

Epoch 102/1000
34/34 [=====] - 5s 146ms/step - loss: 4.6099e-04
Epoch 103/1000
34/34 [=====] - 5s 147ms/step - loss: 5.4352e-04
Epoch 104/1000
34/34 [=====] - 5s 153ms/step - loss: 5.3517e-04
Epoch 105/1000
34/34 [=====] - 6s 167ms/step - loss: 4.8087e-04
Epoch 106/1000
34/34 [=====] - 5s 145ms/step - loss: 5.2159e-04
Epoch 107/1000
34/34 [=====] - 5s 145ms/step - loss: 4.5120e-04
Epoch 108/1000
34/34 [=====] - 5s 145ms/step - loss: 4.8357e-04
Epoch 109/1000
34/34 [=====] - 5s 146ms/step - loss: 4.9398e-04
Epoch 110/1000
34/34 [=====] - 5s 143ms/step - loss: 5.1579e-04
Epoch 111/1000
34/34 [=====] - 5s 145ms/step - loss: 4.3120e-04
Epoch 112/1000
34/34 [=====] - 5s 145ms/step - loss: 5.3057e-04
Epoch 113/1000
34/34 [=====] - 5s 146ms/step - loss: 5.6988e-04
Epoch 114/1000
34/34 [=====] - 5s 146ms/step - loss: 6.0632e-04
Epoch 115/1000
34/34 [=====] - 6s 179ms/step - loss: 5.5588e-04
Epoch 116/1000
34/34 [=====] - 6s 165ms/step - loss: 5.1234e-04
Epoch 117/1000
34/34 [=====] - 5s 146ms/step - loss: 4.6070e-04
Epoch 118/1000
34/34 [=====] - 5s 146ms/step - loss: 4.6679e-04
Epoch 119/1000
34/34 [=====] - 5s 145ms/step - loss: 5.3693e-04
Epoch 120/1000
34/34 [=====] - 5s 145ms/step - loss: 4.8845e-04
Epoch 121/1000
34/34 [=====] - 5s 145ms/step - loss: 4.5954e-04
Epoch 122/1000
34/34 [=====] - 5s 147ms/step - loss: 5.0753e-04
Epoch 123/1000
34/34 [=====] - 5s 145ms/step - loss: 4.9010e-04
Epoch 124/1000
34/34 [=====] - 5s 146ms/step - loss: 5.3392e-04
Epoch 125/1000
34/34 [=====] - 5s 147ms/step - loss: 4.7685e-04

Epoch 126/1000
34/34 [=====] - 5s 147ms/step - loss: 4.2756e-04
Epoch 127/1000
34/34 [=====] - 5s 145ms/step - loss: 4.6501e-04
Epoch 128/1000
34/34 [=====] - 5s 147ms/step - loss: 4.3924e-04
Epoch 129/1000
34/34 [=====] - 5s 144ms/step - loss: 4.8060e-04
Epoch 130/1000
34/34 [=====] - 5s 145ms/step - loss: 4.1034e-04
Epoch 131/1000
34/34 [=====] - 5s 144ms/step - loss: 4.6734e-04
Epoch 132/1000
34/34 [=====] - 5s 147ms/step - loss: 4.4904e-04
Epoch 133/1000
34/34 [=====] - 5s 147ms/step - loss: 3.9306e-04
Epoch 134/1000
34/34 [=====] - 5s 144ms/step - loss: 3.9569e-04
Epoch 135/1000
34/34 [=====] - 5s 142ms/step - loss: 4.0056e-04
Epoch 136/1000
34/34 [=====] - 5s 145ms/step - loss: 4.4948e-04
Epoch 137/1000
34/34 [=====] - 5s 142ms/step - loss: 4.6617e-04
Epoch 138/1000
34/34 [=====] - 5s 145ms/step - loss: 5.3565e-04
Epoch 139/1000
34/34 [=====] - 5s 143ms/step - loss: 4.4372e-04
Epoch 140/1000
34/34 [=====] - 5s 146ms/step - loss: 7.2141e-04
Epoch 141/1000
34/34 [=====] - 5s 143ms/step - loss: 4.9541e-04
Epoch 142/1000
34/34 [=====] - 5s 144ms/step - loss: 4.9877e-04
Epoch 143/1000
34/34 [=====] - 5s 144ms/step - loss: 5.0497e-04
Epoch 144/1000
34/34 [=====] - 5s 145ms/step - loss: 4.3946e-04
Epoch 145/1000
34/34 [=====] - 5s 144ms/step - loss: 4.2427e-04
Epoch 146/1000
34/34 [=====] - 5s 145ms/step - loss: 3.6243e-04
Epoch 147/1000
34/34 [=====] - 5s 144ms/step - loss: 4.7101e-04
Epoch 148/1000
34/34 [=====] - 5s 145ms/step - loss: 4.0195e-04
Epoch 149/1000
34/34 [=====] - 5s 145ms/step - loss: 4.1970e-04

Epoch 150/1000
34/34 [=====] - 5s 146ms/step - loss: 4.2704e-04
Epoch 151/1000
34/34 [=====] - 5s 145ms/step - loss: 6.3813e-04
Epoch 152/1000
34/34 [=====] - 5s 144ms/step - loss: 5.5996e-04
Epoch 153/1000
34/34 [=====] - 5s 145ms/step - loss: 4.1537e-04
Epoch 154/1000
34/34 [=====] - 5s 145ms/step - loss: 3.9184e-04
Epoch 155/1000
34/34 [=====] - 5s 144ms/step - loss: 4.1074e-04
Epoch 156/1000
34/34 [=====] - 5s 143ms/step - loss: 4.0084e-04
Epoch 157/1000
34/34 [=====] - 5s 143ms/step - loss: 3.7691e-04
Epoch 158/1000
34/34 [=====] - 5s 144ms/step - loss: 5.3454e-04
Epoch 159/1000
34/34 [=====] - 5s 144ms/step - loss: 4.3150e-04
Epoch 160/1000
34/34 [=====] - 5s 143ms/step - loss: 6.0574e-04
Epoch 161/1000
34/34 [=====] - 5s 144ms/step - loss: 4.0917e-04
Epoch 162/1000
34/34 [=====] - 5s 145ms/step - loss: 4.6837e-04
Epoch 163/1000
34/34 [=====] - 5s 143ms/step - loss: 4.4131e-04
Epoch 164/1000
34/34 [=====] - 5s 157ms/step - loss: 4.0889e-04
Epoch 165/1000
34/34 [=====] - 5s 155ms/step - loss: 4.0094e-04
Epoch 166/1000
34/34 [=====] - 5s 144ms/step - loss: 3.7267e-04
Epoch 167/1000
34/34 [=====] - 5s 143ms/step - loss: 3.8624e-04
Epoch 168/1000
34/34 [=====] - 5s 144ms/step - loss: 4.2292e-04
Epoch 169/1000
34/34 [=====] - 5s 145ms/step - loss: 4.5461e-04
Epoch 170/1000
34/34 [=====] - 5s 144ms/step - loss: 3.7421e-04
Epoch 171/1000
34/34 [=====] - 5s 142ms/step - loss: 4.2396e-04
Epoch 172/1000
34/34 [=====] - 5s 145ms/step - loss: 3.9311e-04
Epoch 173/1000
34/34 [=====] - 5s 143ms/step - loss: 4.3898e-04

Epoch 174/1000
34/34 [=====] - 5s 143ms/step - loss: 3.8053e-04
Epoch 175/1000
34/34 [=====] - 5s 148ms/step - loss: 4.2229e-04
Epoch 176/1000
34/34 [=====] - 6s 171ms/step - loss: 3.9051e-04
Epoch 177/1000
34/34 [=====] - 5s 159ms/step - loss: 3.8627e-04
Epoch 178/1000
34/34 [=====] - 5s 143ms/step - loss: 4.7499e-04
Epoch 179/1000
34/34 [=====] - 5s 144ms/step - loss: 4.1292e-04
Epoch 180/1000
34/34 [=====] - 5s 143ms/step - loss: 5.1488e-04
Epoch 181/1000
34/34 [=====] - 5s 141ms/step - loss: 3.5866e-04
Epoch 182/1000
34/34 [=====] - 5s 144ms/step - loss: 3.5081e-04
Epoch 183/1000
34/34 [=====] - 5s 145ms/step - loss: 3.5942e-04
Epoch 184/1000
34/34 [=====] - 5s 144ms/step - loss: 4.0970e-04
Epoch 185/1000
34/34 [=====] - 5s 147ms/step - loss: 3.9142e-04
Epoch 186/1000
34/34 [=====] - 5s 146ms/step - loss: 4.2567e-04
Epoch 187/1000
34/34 [=====] - 5s 146ms/step - loss: 3.7757e-04
Epoch 188/1000
34/34 [=====] - 5s 141ms/step - loss: 3.8109e-04
Epoch 189/1000
34/34 [=====] - 5s 142ms/step - loss: 4.6780e-04
Epoch 190/1000
34/34 [=====] - 5s 143ms/step - loss: 3.9521e-04
Epoch 191/1000
34/34 [=====] - 5s 142ms/step - loss: 5.6482e-04
Epoch 192/1000
34/34 [=====] - 5s 143ms/step - loss: 3.7343e-04
Epoch 193/1000
34/34 [=====] - 5s 145ms/step - loss: 3.8457e-04
Epoch 194/1000
34/34 [=====] - 5s 142ms/step - loss: 3.4884e-04
Epoch 195/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5583e-04
Epoch 196/1000
34/34 [=====] - 5s 144ms/step - loss: 3.8916e-04
Epoch 197/1000
34/34 [=====] - 5s 144ms/step - loss: 3.7386e-04

Epoch 198/1000
34/34 [=====] - 5s 145ms/step - loss: 4.0520e-04
Epoch 199/1000
34/34 [=====] - 5s 145ms/step - loss: 3.4538e-04
Epoch 200/1000
34/34 [=====] - 5s 142ms/step - loss: 3.9177e-04
Epoch 201/1000
34/34 [=====] - 5s 142ms/step - loss: 3.6880e-04
Epoch 202/1000
34/34 [=====] - 5s 142ms/step - loss: 3.5894e-04
Epoch 203/1000
34/34 [=====] - 5s 143ms/step - loss: 3.7925e-04
Epoch 204/1000
34/34 [=====] - 5s 144ms/step - loss: 3.8828e-04
Epoch 205/1000
34/34 [=====] - 5s 142ms/step - loss: 4.0682e-04
Epoch 206/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3862e-04
Epoch 207/1000
34/34 [=====] - 5s 145ms/step - loss: 7.0564e-04
Epoch 208/1000
34/34 [=====] - 5s 144ms/step - loss: 4.9430e-04
Epoch 209/1000
34/34 [=====] - 5s 145ms/step - loss: 3.6231e-04
Epoch 210/1000
34/34 [=====] - 5s 146ms/step - loss: 4.1201e-04
Epoch 211/1000
34/34 [=====] - 5s 145ms/step - loss: 3.8410e-04
Epoch 212/1000
34/34 [=====] - 5s 143ms/step - loss: 4.2275e-04
Epoch 213/1000
34/34 [=====] - 5s 143ms/step - loss: 3.7201e-04
Epoch 214/1000
34/34 [=====] - 5s 144ms/step - loss: 4.0524e-04
Epoch 215/1000
34/34 [=====] - 5s 143ms/step - loss: 4.0319e-04
Epoch 216/1000
34/34 [=====] - 5s 144ms/step - loss: 3.4667e-04
Epoch 217/1000
34/34 [=====] - 5s 145ms/step - loss: 4.5162e-04
Epoch 218/1000
34/34 [=====] - 5s 146ms/step - loss: 4.8240e-04
Epoch 219/1000
34/34 [=====] - 5s 144ms/step - loss: 3.9033e-04
Epoch 220/1000
34/34 [=====] - 5s 144ms/step - loss: 3.9805e-04
Epoch 221/1000
34/34 [=====] - 5s 146ms/step - loss: 5.0043e-04

Epoch 222/1000
34/34 [=====] - 5s 145ms/step - loss: 3.9008e-04
Epoch 223/1000
34/34 [=====] - 5s 146ms/step - loss: 3.8570e-04
Epoch 224/1000
34/34 [=====] - 5s 148ms/step - loss: 3.8131e-04
Epoch 225/1000
34/34 [=====] - 6s 166ms/step - loss: 3.8944e-04
Epoch 226/1000
34/34 [=====] - 5s 146ms/step - loss: 4.0290e-04
Epoch 227/1000
34/34 [=====] - 5s 146ms/step - loss: 4.2303e-04
Epoch 228/1000
34/34 [=====] - 5s 145ms/step - loss: 3.4672e-04
Epoch 229/1000
34/34 [=====] - 5s 145ms/step - loss: 4.2199e-04
Epoch 230/1000
34/34 [=====] - 5s 145ms/step - loss: 4.3759e-04
Epoch 231/1000
34/34 [=====] - 5s 145ms/step - loss: 4.1110e-04
Epoch 232/1000
34/34 [=====] - 5s 145ms/step - loss: 3.5753e-04
Epoch 233/1000
34/34 [=====] - 5s 145ms/step - loss: 4.0728e-04
Epoch 234/1000
34/34 [=====] - 5s 144ms/step - loss: 3.5371e-04
Epoch 235/1000
34/34 [=====] - 5s 145ms/step - loss: 3.7726e-04
Epoch 236/1000
34/34 [=====] - 5s 145ms/step - loss: 3.9825e-04
Epoch 237/1000
34/34 [=====] - 6s 169ms/step - loss: 4.0213e-04
Epoch 238/1000
34/34 [=====] - 5s 161ms/step - loss: 3.5392e-04
Epoch 239/1000
34/34 [=====] - 5s 143ms/step - loss: 3.7965e-04
Epoch 240/1000
34/34 [=====] - 5s 144ms/step - loss: 4.0014e-04
Epoch 241/1000
34/34 [=====] - 5s 142ms/step - loss: 3.3152e-04
Epoch 242/1000
34/34 [=====] - 5s 144ms/step - loss: 3.6340e-04
Epoch 243/1000
34/34 [=====] - 5s 144ms/step - loss: 3.5620e-04
Epoch 244/1000
34/34 [=====] - 5s 145ms/step - loss: 3.6415e-04
Epoch 245/1000
34/34 [=====] - 5s 144ms/step - loss: 3.9790e-04

Epoch 246/1000
34/34 [=====] - 5s 146ms/step - loss: 3.9460e-04
Epoch 247/1000
34/34 [=====] - 5s 142ms/step - loss: 3.5916e-04
Epoch 248/1000
34/34 [=====] - 5s 142ms/step - loss: 3.8996e-04
Epoch 249/1000
34/34 [=====] - 5s 142ms/step - loss: 3.9650e-04
Epoch 250/1000
34/34 [=====] - 5s 142ms/step - loss: 3.4852e-04
Epoch 251/1000
34/34 [=====] - 5s 142ms/step - loss: 4.3056e-04
Epoch 252/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4360e-04
Epoch 253/1000
34/34 [=====] - 5s 142ms/step - loss: 3.9664e-04
Epoch 254/1000
34/34 [=====] - 5s 144ms/step - loss: 3.6687e-04
Epoch 255/1000
34/34 [=====] - 5s 144ms/step - loss: 3.5027e-04
Epoch 256/1000
34/34 [=====] - 5s 145ms/step - loss: 3.7237e-04
Epoch 257/1000
34/34 [=====] - 5s 145ms/step - loss: 3.7054e-04
Epoch 258/1000
34/34 [=====] - 5s 143ms/step - loss: 3.8030e-04
Epoch 259/1000
34/34 [=====] - 5s 142ms/step - loss: 3.7903e-04
Epoch 260/1000
34/34 [=====] - 5s 142ms/step - loss: 3.6387e-04
Epoch 261/1000
34/34 [=====] - 5s 143ms/step - loss: 3.6878e-04
Epoch 262/1000
34/34 [=====] - 5s 144ms/step - loss: 3.6328e-04
Epoch 263/1000
34/34 [=====] - 5s 142ms/step - loss: 3.4945e-04
Epoch 264/1000
34/34 [=====] - 5s 144ms/step - loss: 3.9925e-04
Epoch 265/1000
34/34 [=====] - 5s 142ms/step - loss: 5.8018e-04
Epoch 266/1000
34/34 [=====] - 5s 144ms/step - loss: 3.9740e-04
Epoch 267/1000
34/34 [=====] - 5s 142ms/step - loss: 3.8333e-04
Epoch 268/1000
34/34 [=====] - 5s 146ms/step - loss: 3.4352e-04
Epoch 269/1000
34/34 [=====] - 5s 145ms/step - loss: 4.0693e-04

Epoch 270/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3479e-04
Epoch 271/1000
34/34 [=====] - 5s 146ms/step - loss: 3.4742e-04
Epoch 272/1000
34/34 [=====] - 5s 146ms/step - loss: 3.7367e-04
Epoch 273/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5659e-04
Epoch 274/1000
34/34 [=====] - 5s 144ms/step - loss: 3.6747e-04
Epoch 275/1000
34/34 [=====] - 5s 146ms/step - loss: 3.4240e-04
Epoch 276/1000
34/34 [=====] - 5s 144ms/step - loss: 4.1749e-04
Epoch 277/1000
34/34 [=====] - 5s 142ms/step - loss: 3.6198e-04
Epoch 278/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5654e-04
Epoch 279/1000
34/34 [=====] - 5s 145ms/step - loss: 3.6511e-04
Epoch 280/1000
34/34 [=====] - 5s 145ms/step - loss: 3.7408e-04
Epoch 281/1000
34/34 [=====] - 5s 146ms/step - loss: 3.3037e-04
Epoch 282/1000
34/34 [=====] - 5s 145ms/step - loss: 3.3423e-04
Epoch 283/1000
34/34 [=====] - 5s 143ms/step - loss: 3.8679e-04
Epoch 284/1000
34/34 [=====] - 5s 142ms/step - loss: 4.0828e-04
Epoch 285/1000
34/34 [=====] - 6s 169ms/step - loss: 3.8687e-04
Epoch 286/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0640e-04
Epoch 287/1000
34/34 [=====] - 5s 142ms/step - loss: 4.9353e-04
Epoch 288/1000
34/34 [=====] - 5s 144ms/step - loss: 3.5658e-04
Epoch 289/1000
34/34 [=====] - 5s 145ms/step - loss: 3.8122e-04
Epoch 290/1000
34/34 [=====] - 5s 144ms/step - loss: 3.7070e-04
Epoch 291/1000
34/34 [=====] - 5s 145ms/step - loss: 3.5031e-04
Epoch 292/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5393e-04
Epoch 293/1000
34/34 [=====] - 5s 144ms/step - loss: 3.5141e-04

Epoch 294/1000
34/34 [=====] - 5s 143ms/step - loss: 4.3879e-04
Epoch 295/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1265e-04
Epoch 296/1000
34/34 [=====] - 5s 144ms/step - loss: 4.7998e-04
Epoch 297/1000
34/34 [=====] - 5s 141ms/step - loss: 3.6624e-04
Epoch 298/1000
34/34 [=====] - 6s 162ms/step - loss: 3.4987e-04
Epoch 299/1000
34/34 [=====] - 6s 169ms/step - loss: 3.4612e-04
Epoch 300/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2786e-04
Epoch 301/1000
34/34 [=====] - 5s 143ms/step - loss: 3.8630e-04
Epoch 302/1000
34/34 [=====] - 5s 144ms/step - loss: 3.6539e-04
Epoch 303/1000
34/34 [=====] - 5s 144ms/step - loss: 3.6606e-04
Epoch 304/1000
34/34 [=====] - 5s 146ms/step - loss: 3.5310e-04
Epoch 305/1000
34/34 [=====] - 5s 145ms/step - loss: 3.5695e-04
Epoch 306/1000
34/34 [=====] - 5s 143ms/step - loss: 3.2428e-04
Epoch 307/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3704e-04
Epoch 308/1000
34/34 [=====] - 5s 145ms/step - loss: 3.4773e-04
Epoch 309/1000
34/34 [=====] - 5s 141ms/step - loss: 3.9174e-04
Epoch 310/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0366e-04
Epoch 311/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1228e-04
Epoch 312/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3098e-04
Epoch 313/1000
34/34 [=====] - 5s 144ms/step - loss: 3.6009e-04
Epoch 314/1000
34/34 [=====] - 5s 143ms/step - loss: 3.6244e-04
Epoch 315/1000
34/34 [=====] - 5s 143ms/step - loss: 3.9309e-04
Epoch 316/1000
34/34 [=====] - 5s 145ms/step - loss: 3.8126e-04
Epoch 317/1000
34/34 [=====] - 5s 143ms/step - loss: 3.7714e-04

Epoch 318/1000
34/34 [=====] - 5s 145ms/step - loss: 3.7198e-04
Epoch 319/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4076e-04
Epoch 320/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5298e-04
Epoch 321/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5294e-04
Epoch 322/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4011e-04
Epoch 323/1000
34/34 [=====] - 5s 142ms/step - loss: 3.3063e-04
Epoch 324/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3812e-04
Epoch 325/1000
34/34 [=====] - 5s 144ms/step - loss: 3.4963e-04
Epoch 326/1000
34/34 [=====] - 5s 142ms/step - loss: 3.4569e-04
Epoch 327/1000
34/34 [=====] - 5s 142ms/step - loss: 3.5424e-04
Epoch 328/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2823e-04
Epoch 329/1000
34/34 [=====] - 5s 144ms/step - loss: 3.6643e-04
Epoch 330/1000
34/34 [=====] - 5s 143ms/step - loss: 3.7657e-04
Epoch 331/1000
34/34 [=====] - 5s 142ms/step - loss: 3.2168e-04
Epoch 332/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5892e-04
Epoch 333/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3025e-04
Epoch 334/1000
34/34 [=====] - 5s 142ms/step - loss: 3.2394e-04
Epoch 335/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2645e-04
Epoch 336/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3294e-04
Epoch 337/1000
34/34 [=====] - 5s 145ms/step - loss: 3.3698e-04
Epoch 338/1000
34/34 [=====] - 5s 145ms/step - loss: 3.2424e-04
Epoch 339/1000
34/34 [=====] - 5s 145ms/step - loss: 3.7323e-04
Epoch 340/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0806e-04
Epoch 341/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4050e-04

Epoch 342/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3447e-04
Epoch 343/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4804e-04
Epoch 344/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3648e-04
Epoch 345/1000
34/34 [=====] - 5s 156ms/step - loss: 3.6497e-04
Epoch 346/1000
34/34 [=====] - 5s 154ms/step - loss: 3.3633e-04
Epoch 347/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1427e-04
Epoch 348/1000
34/34 [=====] - 5s 141ms/step - loss: 3.4620e-04
Epoch 349/1000
34/34 [=====] - 5s 142ms/step - loss: 3.3523e-04
Epoch 350/1000
34/34 [=====] - 5s 146ms/step - loss: 3.7005e-04
Epoch 351/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4728e-04
Epoch 352/1000
34/34 [=====] - 5s 143ms/step - loss: 3.7233e-04
Epoch 353/1000
34/34 [=====] - 5s 142ms/step - loss: 3.7357e-04
Epoch 354/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3051e-04
Epoch 355/1000
34/34 [=====] - 5s 141ms/step - loss: 3.1027e-04
Epoch 356/1000
34/34 [=====] - 5s 142ms/step - loss: 3.8002e-04
Epoch 357/1000
34/34 [=====] - 5s 143ms/step - loss: 4.5321e-04
Epoch 358/1000
34/34 [=====] - 5s 141ms/step - loss: 3.1598e-04
Epoch 359/1000
34/34 [=====] - 5s 151ms/step - loss: 4.6301e-04
Epoch 360/1000
34/34 [=====] - 6s 169ms/step - loss: 3.1300e-04
Epoch 361/1000
34/34 [=====] - 5s 156ms/step - loss: 3.2163e-04
Epoch 362/1000
34/34 [=====] - 5s 144ms/step - loss: 3.7727e-04
Epoch 363/1000
34/34 [=====] - 5s 145ms/step - loss: 3.2862e-04
Epoch 364/1000
34/34 [=====] - 5s 145ms/step - loss: 3.4611e-04
Epoch 365/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4017e-04

Epoch 366/1000
34/34 [=====] - 5s 144ms/step - loss: 3.4227e-04
Epoch 367/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1734e-04
Epoch 368/1000
34/34 [=====] - 5s 144ms/step - loss: 3.1946e-04
Epoch 369/1000
34/34 [=====] - 5s 143ms/step - loss: 3.7246e-04
Epoch 370/1000
34/34 [=====] - 5s 143ms/step - loss: 3.6759e-04
Epoch 371/1000
34/34 [=====] - 5s 143ms/step - loss: 3.7261e-04
Epoch 372/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2358e-04
Epoch 373/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0721e-04
Epoch 374/1000
34/34 [=====] - 5s 145ms/step - loss: 3.2171e-04
Epoch 375/1000
34/34 [=====] - 5s 144ms/step - loss: 2.9696e-04
Epoch 376/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9798e-04
Epoch 377/1000
34/34 [=====] - 5s 142ms/step - loss: 3.6881e-04
Epoch 378/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3085e-04
Epoch 379/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3965e-04
Epoch 380/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3919e-04
Epoch 381/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4328e-04
Epoch 382/1000
34/34 [=====] - 5s 146ms/step - loss: 3.2319e-04
Epoch 383/1000
34/34 [=====] - 5s 145ms/step - loss: 3.5063e-04
Epoch 384/1000
34/34 [=====] - 5s 143ms/step - loss: 3.6918e-04
Epoch 385/1000
34/34 [=====] - 5s 144ms/step - loss: 4.0705e-04
Epoch 386/1000
34/34 [=====] - 5s 145ms/step - loss: 3.7935e-04
Epoch 387/1000
34/34 [=====] - 5s 145ms/step - loss: 3.6931e-04
Epoch 388/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1390e-04
Epoch 389/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0360e-04

Epoch 390/1000
34/34 [=====] - 5s 144ms/step - loss: 3.4628e-04
Epoch 391/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0408e-04
Epoch 392/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0041e-04
Epoch 393/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3184e-04
Epoch 394/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4863e-04
Epoch 395/1000
34/34 [=====] - 5s 144ms/step - loss: 3.1613e-04
Epoch 396/1000
34/34 [=====] - 5s 145ms/step - loss: 3.2089e-04
Epoch 397/1000
34/34 [=====] - 5s 144ms/step - loss: 3.6341e-04
Epoch 398/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0316e-04
Epoch 399/1000
34/34 [=====] - 5s 145ms/step - loss: 3.4297e-04
Epoch 400/1000
34/34 [=====] - 5s 145ms/step - loss: 4.2359e-04
Epoch 401/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4512e-04
Epoch 402/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1496e-04
Epoch 403/1000
34/34 [=====] - 5s 143ms/step - loss: 3.2183e-04
Epoch 404/1000
34/34 [=====] - 5s 144ms/step - loss: 3.8055e-04
Epoch 405/1000
34/34 [=====] - 5s 147ms/step - loss: 3.4412e-04
Epoch 406/1000
34/34 [=====] - 6s 164ms/step - loss: 3.1718e-04
Epoch 407/1000
34/34 [=====] - 5s 144ms/step - loss: 3.4057e-04
Epoch 408/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4064e-04
Epoch 409/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0823e-04
Epoch 410/1000
34/34 [=====] - 5s 146ms/step - loss: 3.9213e-04
Epoch 411/1000
34/34 [=====] - 5s 145ms/step - loss: 3.3744e-04
Epoch 412/1000
34/34 [=====] - 5s 144ms/step - loss: 3.4444e-04
Epoch 413/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0440e-04

Epoch 414/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3508e-04
Epoch 415/1000
34/34 [=====] - 5s 142ms/step - loss: 3.4794e-04
Epoch 416/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0526e-04
Epoch 417/1000
34/34 [=====] - 5s 142ms/step - loss: 3.3277e-04
Epoch 418/1000
34/34 [=====] - 5s 144ms/step - loss: 5.0581e-04
Epoch 419/1000
34/34 [=====] - 5s 144ms/step - loss: 4.2606e-04
Epoch 420/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2959e-04
Epoch 421/1000
34/34 [=====] - 6s 168ms/step - loss: 3.1104e-04
Epoch 422/1000
34/34 [=====] - 6s 164ms/step - loss: 3.0820e-04
Epoch 423/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3707e-04
Epoch 424/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8247e-04
Epoch 425/1000
34/34 [=====] - 5s 142ms/step - loss: 3.2085e-04
Epoch 426/1000
34/34 [=====] - 5s 141ms/step - loss: 3.2593e-04
Epoch 427/1000
34/34 [=====] - 5s 143ms/step - loss: 5.6393e-04
Epoch 428/1000
34/34 [=====] - 5s 142ms/step - loss: 3.3726e-04
Epoch 429/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5333e-04
Epoch 430/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2421e-04
Epoch 431/1000
34/34 [=====] - 5s 145ms/step - loss: 3.3865e-04
Epoch 432/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3605e-04
Epoch 433/1000
34/34 [=====] - 5s 145ms/step - loss: 3.5590e-04
Epoch 434/1000
34/34 [=====] - 5s 145ms/step - loss: 3.4358e-04
Epoch 435/1000
34/34 [=====] - 5s 148ms/step - loss: 3.2615e-04
Epoch 436/1000
34/34 [=====] - 5s 145ms/step - loss: 2.9530e-04
Epoch 437/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0809e-04

Epoch 438/1000
34/34 [=====] - 5s 145ms/step - loss: 3.2902e-04
Epoch 439/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2400e-04
Epoch 440/1000
34/34 [=====] - 5s 144ms/step - loss: 3.7215e-04
Epoch 441/1000
34/34 [=====] - 5s 144ms/step - loss: 3.5150e-04
Epoch 442/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2273e-04
Epoch 443/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5481e-04
Epoch 444/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0887e-04
Epoch 445/1000
34/34 [=====] - 5s 145ms/step - loss: 3.0218e-04
Epoch 446/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0383e-04
Epoch 447/1000
34/34 [=====] - 5s 146ms/step - loss: 3.2703e-04
Epoch 448/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3990e-04
Epoch 449/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0909e-04
Epoch 450/1000
34/34 [=====] - 5s 142ms/step - loss: 3.9237e-04
Epoch 451/1000
34/34 [=====] - 5s 145ms/step - loss: 3.3447e-04
Epoch 452/1000
34/34 [=====] - 5s 141ms/step - loss: 3.2925e-04
Epoch 453/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4662e-04
Epoch 454/1000
34/34 [=====] - 5s 142ms/step - loss: 3.4768e-04
Epoch 455/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0614e-04
Epoch 456/1000
34/34 [=====] - 5s 145ms/step - loss: 3.2435e-04
Epoch 457/1000
34/34 [=====] - 5s 145ms/step - loss: 3.1277e-04
Epoch 458/1000
34/34 [=====] - 5s 143ms/step - loss: 2.6631e-04
Epoch 459/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4542e-04
Epoch 460/1000
34/34 [=====] - 5s 145ms/step - loss: 3.1785e-04
Epoch 461/1000
34/34 [=====] - 5s 145ms/step - loss: 3.0384e-04

Epoch 462/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0397e-04
Epoch 463/1000
34/34 [=====] - 5s 144ms/step - loss: 3.4097e-04
Epoch 464/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4639e-04
Epoch 465/1000
34/34 [=====] - 5s 142ms/step - loss: 3.5329e-04
Epoch 466/1000
34/34 [=====] - 6s 163ms/step - loss: 3.5180e-04
Epoch 467/1000
34/34 [=====] - 5s 149ms/step - loss: 3.3324e-04
Epoch 468/1000
34/34 [=====] - 5s 144ms/step - loss: 4.6892e-04
Epoch 469/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2528e-04
Epoch 470/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0434e-04
Epoch 471/1000
34/34 [=====] - 5s 146ms/step - loss: 3.1874e-04
Epoch 472/1000
34/34 [=====] - 5s 142ms/step - loss: 3.4266e-04
Epoch 473/1000
34/34 [=====] - 5s 142ms/step - loss: 3.5597e-04
Epoch 474/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4517e-04
Epoch 475/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4297e-04
Epoch 476/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5922e-04
Epoch 477/1000
34/34 [=====] - 5s 142ms/step - loss: 3.1908e-04
Epoch 478/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9177e-04
Epoch 479/1000
34/34 [=====] - 5s 144ms/step - loss: 2.9689e-04
Epoch 480/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0402e-04
Epoch 481/1000
34/34 [=====] - 5s 145ms/step - loss: 3.2344e-04
Epoch 482/1000
34/34 [=====] - 6s 164ms/step - loss: 3.3342e-04
Epoch 483/1000
34/34 [=====] - 6s 171ms/step - loss: 3.9264e-04
Epoch 484/1000
34/34 [=====] - 5s 145ms/step - loss: 3.2049e-04
Epoch 485/1000
34/34 [=====] - 5s 142ms/step - loss: 3.8358e-04

Epoch 486/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4223e-04
Epoch 487/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1029e-04
Epoch 488/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4254e-04
Epoch 489/1000
34/34 [=====] - 5s 142ms/step - loss: 3.0711e-04
Epoch 490/1000
34/34 [=====] - 5s 143ms/step - loss: 3.7789e-04
Epoch 491/1000
34/34 [=====] - 5s 142ms/step - loss: 3.2031e-04
Epoch 492/1000
34/34 [=====] - 5s 145ms/step - loss: 2.9988e-04
Epoch 493/1000
34/34 [=====] - 5s 143ms/step - loss: 3.2748e-04
Epoch 494/1000
34/34 [=====] - 5s 142ms/step - loss: 3.1763e-04
Epoch 495/1000
34/34 [=====] - 5s 145ms/step - loss: 3.3303e-04
Epoch 496/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0636e-04
Epoch 497/1000
34/34 [=====] - 5s 143ms/step - loss: 4.6246e-04
Epoch 498/1000
34/34 [=====] - 5s 143ms/step - loss: 3.6354e-04
Epoch 499/1000
34/34 [=====] - 5s 144ms/step - loss: 3.5177e-04
Epoch 500/1000
34/34 [=====] - 5s 145ms/step - loss: 3.0617e-04
Epoch 501/1000
34/34 [=====] - 5s 141ms/step - loss: 3.4205e-04
Epoch 502/1000
34/34 [=====] - 5s 143ms/step - loss: 4.5727e-04
Epoch 503/1000
34/34 [=====] - 5s 145ms/step - loss: 3.1496e-04
Epoch 504/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0767e-04
Epoch 505/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0712e-04
Epoch 506/1000
34/34 [=====] - 5s 145ms/step - loss: 3.1655e-04
Epoch 507/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0517e-04
Epoch 508/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2285e-04
Epoch 509/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3624e-04

Epoch 510/1000
34/34 [=====] - 5s 144ms/step - loss: 3.1495e-04
Epoch 511/1000
34/34 [=====] - 5s 143ms/step - loss: 3.6508e-04
Epoch 512/1000
34/34 [=====] - 5s 142ms/step - loss: 3.2680e-04
Epoch 513/1000
34/34 [=====] - 5s 142ms/step - loss: 3.1428e-04
Epoch 514/1000
34/34 [=====] - 5s 144ms/step - loss: 3.1594e-04
Epoch 515/1000
34/34 [=====] - 5s 142ms/step - loss: 3.9303e-04
Epoch 516/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5491e-04
Epoch 517/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5206e-04
Epoch 518/1000
34/34 [=====] - 5s 145ms/step - loss: 3.1904e-04
Epoch 519/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9220e-04
Epoch 520/1000
34/34 [=====] - 5s 144ms/step - loss: 3.7193e-04
Epoch 521/1000
34/34 [=====] - 5s 144ms/step - loss: 4.3571e-04
Epoch 522/1000
34/34 [=====] - 5s 142ms/step - loss: 3.3549e-04
Epoch 523/1000
34/34 [=====] - 5s 142ms/step - loss: 3.4779e-04
Epoch 524/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8687e-04
Epoch 525/1000
34/34 [=====] - 5s 141ms/step - loss: 3.1719e-04
Epoch 526/1000
34/34 [=====] - 5s 151ms/step - loss: 3.2071e-04
Epoch 527/1000
34/34 [=====] - 5s 159ms/step - loss: 3.3622e-04
Epoch 528/1000
34/34 [=====] - 5s 145ms/step - loss: 3.3297e-04
Epoch 529/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9365e-04
Epoch 530/1000
34/34 [=====] - 5s 146ms/step - loss: 3.7023e-04
Epoch 531/1000
34/34 [=====] - 5s 142ms/step - loss: 3.0353e-04
Epoch 532/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1951e-04
Epoch 533/1000
34/34 [=====] - 5s 141ms/step - loss: 3.4656e-04

Epoch 534/1000
34/34 [=====] - 5s 141ms/step - loss: 3.8124e-04
Epoch 535/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1600e-04
Epoch 536/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1741e-04
Epoch 537/1000
34/34 [=====] - 5s 142ms/step - loss: 3.2914e-04
Epoch 538/1000
34/34 [=====] - 5s 141ms/step - loss: 3.1384e-04
Epoch 539/1000
34/34 [=====] - 5s 141ms/step - loss: 3.2752e-04
Epoch 540/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1607e-04
Epoch 541/1000
34/34 [=====] - 5s 142ms/step - loss: 2.8553e-04
Epoch 542/1000
34/34 [=====] - 5s 145ms/step - loss: 3.1983e-04
Epoch 543/1000
34/34 [=====] - 5s 147ms/step - loss: 2.9546e-04
Epoch 544/1000
34/34 [=====] - 6s 167ms/step - loss: 3.2422e-04
Epoch 545/1000
34/34 [=====] - 5s 158ms/step - loss: 2.8044e-04
Epoch 546/1000
34/34 [=====] - 5s 142ms/step - loss: 2.8599e-04
Epoch 547/1000
34/34 [=====] - 5s 142ms/step - loss: 3.0813e-04
Epoch 548/1000
34/34 [=====] - 5s 147ms/step - loss: 2.7641e-04
Epoch 549/1000
34/34 [=====] - 5s 152ms/step - loss: 4.2662e-04
Epoch 550/1000
34/34 [=====] - 5s 149ms/step - loss: 3.4625e-04
Epoch 551/1000
34/34 [=====] - 5s 146ms/step - loss: 4.5123e-04
Epoch 552/1000
34/34 [=====] - 5s 152ms/step - loss: 3.1236e-04
Epoch 553/1000
34/34 [=====] - 5s 152ms/step - loss: 3.3302e-04
Epoch 554/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2783e-04
Epoch 555/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0695e-04
Epoch 556/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2531e-04
Epoch 557/1000
34/34 [=====] - 5s 141ms/step - loss: 2.9395e-04

Epoch 558/1000
34/34 [=====] - 5s 143ms/step - loss: 3.7823e-04
Epoch 559/1000
34/34 [=====] - 5s 140ms/step - loss: 3.0368e-04
Epoch 560/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3749e-04
Epoch 561/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0455e-04
Epoch 562/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9679e-04
Epoch 563/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9391e-04
Epoch 564/1000
34/34 [=====] - 5s 144ms/step - loss: 2.9575e-04
Epoch 565/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1563e-04
Epoch 566/1000
34/34 [=====] - 5s 144ms/step - loss: 3.9464e-04
Epoch 567/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3957e-04
Epoch 568/1000
34/34 [=====] - 5s 151ms/step - loss: 3.5421e-04
Epoch 569/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0970e-04
Epoch 570/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3986e-04
Epoch 571/1000
34/34 [=====] - 5s 145ms/step - loss: 3.2720e-04
Epoch 572/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0801e-04
Epoch 573/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4849e-04
Epoch 574/1000
34/34 [=====] - 5s 146ms/step - loss: 3.0856e-04
Epoch 575/1000
34/34 [=====] - 5s 144ms/step - loss: 2.7277e-04
Epoch 576/1000
34/34 [=====] - 5s 145ms/step - loss: 2.8383e-04
Epoch 577/1000
34/34 [=====] - 5s 151ms/step - loss: 3.0171e-04
Epoch 578/1000
34/34 [=====] - 5s 144ms/step - loss: 3.5786e-04
Epoch 579/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3271e-04
Epoch 580/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3892e-04
Epoch 581/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2687e-04

Epoch 582/1000
34/34 [=====] - 5s 144ms/step - loss: 2.9762e-04
Epoch 583/1000
34/34 [=====] - 5s 142ms/step - loss: 3.1596e-04
Epoch 584/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0715e-04
Epoch 585/1000
34/34 [=====] - 5s 146ms/step - loss: 3.0913e-04
Epoch 586/1000
34/34 [=====] - 5s 148ms/step - loss: 3.1663e-04
Epoch 587/1000
34/34 [=====] - 6s 166ms/step - loss: 3.1486e-04
Epoch 588/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0297e-04
Epoch 589/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3218e-04
Epoch 590/1000
34/34 [=====] - 5s 142ms/step - loss: 3.0557e-04
Epoch 591/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9557e-04
Epoch 592/1000
34/34 [=====] - 5s 144ms/step - loss: 3.9096e-04
Epoch 593/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9344e-04
Epoch 594/1000
34/34 [=====] - 5s 142ms/step - loss: 3.3093e-04
Epoch 595/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3019e-04
Epoch 596/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9318e-04
Epoch 597/1000
34/34 [=====] - 5s 145ms/step - loss: 3.1376e-04
Epoch 598/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9574e-04
Epoch 599/1000
34/34 [=====] - 5s 146ms/step - loss: 3.3266e-04
Epoch 600/1000
34/34 [=====] - 5s 143ms/step - loss: 3.2767e-04
Epoch 601/1000
34/34 [=====] - 5s 145ms/step - loss: 3.1145e-04
Epoch 602/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0943e-04
Epoch 603/1000
34/34 [=====] - 5s 142ms/step - loss: 3.1481e-04
Epoch 604/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3746e-04
Epoch 605/1000
34/34 [=====] - 6s 167ms/step - loss: 3.1418e-04

Epoch 606/1000
34/34 [=====] - 5s 159ms/step - loss: 2.9154e-04
Epoch 607/1000
34/34 [=====] - 5s 144ms/step - loss: 3.5078e-04
Epoch 608/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2286e-04
Epoch 609/1000
34/34 [=====] - 5s 145ms/step - loss: 3.2275e-04
Epoch 610/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0965e-04
Epoch 611/1000
34/34 [=====] - 5s 145ms/step - loss: 3.3459e-04
Epoch 612/1000
34/34 [=====] - 5s 144ms/step - loss: 3.1674e-04
Epoch 613/1000
34/34 [=====] - 5s 145ms/step - loss: 3.0060e-04
Epoch 614/1000
34/34 [=====] - 5s 142ms/step - loss: 3.1011e-04
Epoch 615/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0800e-04
Epoch 616/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9387e-04
Epoch 617/1000
34/34 [=====] - 5s 143ms/step - loss: 3.2766e-04
Epoch 618/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1731e-04
Epoch 619/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4861e-04
Epoch 620/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1144e-04
Epoch 621/1000
34/34 [=====] - 5s 145ms/step - loss: 3.0241e-04
Epoch 622/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9226e-04
Epoch 623/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8959e-04
Epoch 624/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0911e-04
Epoch 625/1000
34/34 [=====] - 5s 145ms/step - loss: 3.0900e-04
Epoch 626/1000
34/34 [=====] - 5s 146ms/step - loss: 3.0156e-04
Epoch 627/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0193e-04
Epoch 628/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5268e-04
Epoch 629/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1350e-04

Epoch 630/1000
34/34 [=====] - 5s 141ms/step - loss: 2.9043e-04
Epoch 631/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0126e-04
Epoch 632/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3473e-04
Epoch 633/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0950e-04
Epoch 634/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8990e-04
Epoch 635/1000
34/34 [=====] - 5s 145ms/step - loss: 2.8776e-04
Epoch 636/1000
34/34 [=====] - 5s 142ms/step - loss: 3.0085e-04
Epoch 637/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9672e-04
Epoch 638/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3338e-04
Epoch 639/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9116e-04
Epoch 640/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0819e-04
Epoch 641/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1009e-04
Epoch 642/1000
34/34 [=====] - 5s 145ms/step - loss: 3.0105e-04
Epoch 643/1000
34/34 [=====] - 5s 142ms/step - loss: 3.0868e-04
Epoch 644/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1948e-04
Epoch 645/1000
34/34 [=====] - 5s 146ms/step - loss: 3.0656e-04
Epoch 646/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0148e-04
Epoch 647/1000
34/34 [=====] - 5s 161ms/step - loss: 3.1133e-04
Epoch 648/1000
34/34 [=====] - 5s 153ms/step - loss: 2.7425e-04
Epoch 649/1000
34/34 [=====] - 5s 145ms/step - loss: 2.9745e-04
Epoch 650/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2985e-04
Epoch 651/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9101e-04
Epoch 652/1000
34/34 [=====] - 5s 145ms/step - loss: 2.6411e-04
Epoch 653/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2623e-04

Epoch 654/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0550e-04
Epoch 655/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4612e-04
Epoch 656/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1365e-04
Epoch 657/1000
34/34 [=====] - 5s 145ms/step - loss: 3.2739e-04
Epoch 658/1000
34/34 [=====] - 5s 145ms/step - loss: 5.2745e-04
Epoch 659/1000
34/34 [=====] - 5s 143ms/step - loss: 4.2215e-04
Epoch 660/1000
34/34 [=====] - 5s 146ms/step - loss: 2.7916e-04
Epoch 661/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9574e-04
Epoch 662/1000
34/34 [=====] - 5s 142ms/step - loss: 2.8751e-04
Epoch 663/1000
34/34 [=====] - 5s 145ms/step - loss: 3.0990e-04
Epoch 664/1000
34/34 [=====] - 5s 144ms/step - loss: 3.1453e-04
Epoch 665/1000
34/34 [=====] - 5s 142ms/step - loss: 2.8553e-04
Epoch 666/1000
34/34 [=====] - 6s 166ms/step - loss: 2.8496e-04
Epoch 667/1000
34/34 [=====] - 6s 169ms/step - loss: 3.2067e-04
Epoch 668/1000
34/34 [=====] - 5s 142ms/step - loss: 3.3945e-04
Epoch 669/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0058e-04
Epoch 670/1000
34/34 [=====] - 5s 145ms/step - loss: 2.9930e-04
Epoch 671/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9935e-04
Epoch 672/1000
34/34 [=====] - 5s 143ms/step - loss: 3.2082e-04
Epoch 673/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1960e-04
Epoch 674/1000
34/34 [=====] - 5s 145ms/step - loss: 3.5924e-04
Epoch 675/1000
34/34 [=====] - 5s 141ms/step - loss: 3.6407e-04
Epoch 676/1000
34/34 [=====] - 5s 145ms/step - loss: 3.3315e-04
Epoch 677/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8193e-04

Epoch 678/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2862e-04
Epoch 679/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0892e-04
Epoch 680/1000
34/34 [=====] - 5s 141ms/step - loss: 2.8464e-04
Epoch 681/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8818e-04
Epoch 682/1000
34/34 [=====] - 5s 142ms/step - loss: 3.1743e-04
Epoch 683/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9070e-04
Epoch 684/1000
34/34 [=====] - 5s 144ms/step - loss: 2.9332e-04
Epoch 685/1000
34/34 [=====] - 5s 141ms/step - loss: 3.1692e-04
Epoch 686/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8014e-04
Epoch 687/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0327e-04
Epoch 688/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0698e-04
Epoch 689/1000
34/34 [=====] - 5s 143ms/step - loss: 4.0558e-04
Epoch 690/1000
34/34 [=====] - 5s 144ms/step - loss: 2.9669e-04
Epoch 691/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4609e-04
Epoch 692/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0170e-04
Epoch 693/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8964e-04
Epoch 694/1000
34/34 [=====] - 5s 143ms/step - loss: 3.2962e-04
Epoch 695/1000
34/34 [=====] - 5s 143ms/step - loss: 3.7542e-04
Epoch 696/1000
34/34 [=====] - 5s 145ms/step - loss: 2.8936e-04
Epoch 697/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3805e-04
Epoch 698/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8975e-04
Epoch 699/1000
34/34 [=====] - 5s 145ms/step - loss: 3.0180e-04
Epoch 700/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8271e-04
Epoch 701/1000
34/34 [=====] - 5s 142ms/step - loss: 3.0797e-04

Epoch 702/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5441e-04
Epoch 703/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0567e-04
Epoch 704/1000
34/34 [=====] - 5s 145ms/step - loss: 3.0104e-04
Epoch 705/1000
34/34 [=====] - 5s 144ms/step - loss: 3.1438e-04
Epoch 706/1000
34/34 [=====] - 5s 144ms/step - loss: 3.1928e-04
Epoch 707/1000
34/34 [=====] - 5s 151ms/step - loss: 3.6783e-04
Epoch 708/1000
34/34 [=====] - 5s 161ms/step - loss: 3.0352e-04
Epoch 709/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1486e-04
Epoch 710/1000
34/34 [=====] - 5s 143ms/step - loss: 2.7089e-04
Epoch 711/1000
34/34 [=====] - 5s 141ms/step - loss: 3.4543e-04
Epoch 712/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3948e-04
Epoch 713/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0072e-04
Epoch 714/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0867e-04
Epoch 715/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9054e-04
Epoch 716/1000
34/34 [=====] - 5s 141ms/step - loss: 2.9004e-04
Epoch 717/1000
34/34 [=====] - 5s 142ms/step - loss: 2.8616e-04
Epoch 718/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5671e-04
Epoch 719/1000
34/34 [=====] - 5s 145ms/step - loss: 3.6370e-04
Epoch 720/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8962e-04
Epoch 721/1000
34/34 [=====] - 5s 142ms/step - loss: 2.6788e-04
Epoch 722/1000
34/34 [=====] - 5s 141ms/step - loss: 2.8514e-04
Epoch 723/1000
34/34 [=====] - 5s 142ms/step - loss: 3.0565e-04
Epoch 724/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0468e-04
Epoch 725/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9356e-04

Epoch 726/1000
34/34 [=====] - 5s 142ms/step - loss: 3.1938e-04
Epoch 727/1000
34/34 [=====] - 5s 150ms/step - loss: 3.4416e-04
Epoch 728/1000
34/34 [=====] - 6s 169ms/step - loss: 3.2851e-04
Epoch 729/1000
34/34 [=====] - 5s 155ms/step - loss: 2.9955e-04
Epoch 730/1000
34/34 [=====] - 5s 144ms/step - loss: 2.7046e-04
Epoch 731/1000
34/34 [=====] - 5s 145ms/step - loss: 3.3348e-04
Epoch 732/1000
34/34 [=====] - 5s 141ms/step - loss: 3.4740e-04
Epoch 733/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9710e-04
Epoch 734/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1604e-04
Epoch 735/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0723e-04
Epoch 736/1000
34/34 [=====] - 5s 144ms/step - loss: 3.1787e-04
Epoch 737/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1133e-04
Epoch 738/1000
34/34 [=====] - 5s 143ms/step - loss: 2.7736e-04
Epoch 739/1000
34/34 [=====] - 5s 143ms/step - loss: 2.7859e-04
Epoch 740/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9762e-04
Epoch 741/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4329e-04
Epoch 742/1000
34/34 [=====] - 5s 142ms/step - loss: 2.8537e-04
Epoch 743/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8345e-04
Epoch 744/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0758e-04
Epoch 745/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8339e-04
Epoch 746/1000
34/34 [=====] - 5s 141ms/step - loss: 2.9397e-04
Epoch 747/1000
34/34 [=====] - 5s 141ms/step - loss: 2.7454e-04
Epoch 748/1000
34/34 [=====] - 5s 141ms/step - loss: 3.2362e-04
Epoch 749/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3981e-04

Epoch 750/1000
34/34 [=====] - 5s 141ms/step - loss: 2.8980e-04
Epoch 751/1000
34/34 [=====] - 5s 142ms/step - loss: 3.0476e-04
Epoch 752/1000
34/34 [=====] - 5s 144ms/step - loss: 3.5073e-04
Epoch 753/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2504e-04
Epoch 754/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8823e-04
Epoch 755/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8441e-04
Epoch 756/1000
34/34 [=====] - 5s 144ms/step - loss: 3.1062e-04
Epoch 757/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4561e-04
Epoch 758/1000
34/34 [=====] - 5s 143ms/step - loss: 3.2312e-04
Epoch 759/1000
34/34 [=====] - 5s 145ms/step - loss: 2.9463e-04
Epoch 760/1000
34/34 [=====] - 5s 147ms/step - loss: 3.3312e-04
Epoch 761/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8130e-04
Epoch 762/1000
34/34 [=====] - 5s 146ms/step - loss: 2.9847e-04
Epoch 763/1000
34/34 [=====] - 5s 146ms/step - loss: 2.7730e-04
Epoch 764/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8358e-04
Epoch 765/1000
34/34 [=====] - 5s 147ms/step - loss: 2.9987e-04
Epoch 766/1000
34/34 [=====] - 5s 145ms/step - loss: 3.1795e-04
Epoch 767/1000
34/34 [=====] - 5s 145ms/step - loss: 2.8809e-04
Epoch 768/1000
34/34 [=====] - 5s 160ms/step - loss: 2.9844e-04
Epoch 769/1000
34/34 [=====] - 5s 150ms/step - loss: 2.6328e-04
Epoch 770/1000
34/34 [=====] - 5s 144ms/step - loss: 2.9280e-04
Epoch 771/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0154e-04
Epoch 772/1000
34/34 [=====] - 5s 143ms/step - loss: 3.2230e-04
Epoch 773/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8403e-04

Epoch 774/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8652e-04
Epoch 775/1000
34/34 [=====] - 5s 142ms/step - loss: 3.2739e-04
Epoch 776/1000
34/34 [=====] - 5s 144ms/step - loss: 2.9951e-04
Epoch 777/1000
34/34 [=====] - 5s 145ms/step - loss: 2.9773e-04
Epoch 778/1000
34/34 [=====] - 5s 142ms/step - loss: 2.8302e-04
Epoch 779/1000
34/34 [=====] - 5s 143ms/step - loss: 2.6835e-04
Epoch 780/1000
34/34 [=====] - 5s 141ms/step - loss: 2.9028e-04
Epoch 781/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9408e-04
Epoch 782/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3898e-04
Epoch 783/1000
34/34 [=====] - 5s 142ms/step - loss: 3.0376e-04
Epoch 784/1000
34/34 [=====] - 5s 145ms/step - loss: 2.8162e-04
Epoch 785/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2380e-04
Epoch 786/1000
34/34 [=====] - 5s 142ms/step - loss: 2.6816e-04
Epoch 787/1000
34/34 [=====] - 5s 144ms/step - loss: 2.6224e-04
Epoch 788/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0434e-04
Epoch 789/1000
34/34 [=====] - 6s 164ms/step - loss: 3.6124e-04
Epoch 790/1000
34/34 [=====] - 6s 166ms/step - loss: 3.0956e-04
Epoch 791/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1237e-04
Epoch 792/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8417e-04
Epoch 793/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9950e-04
Epoch 794/1000
34/34 [=====] - 5s 143ms/step - loss: 2.7722e-04
Epoch 795/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9300e-04
Epoch 796/1000
34/34 [=====] - 5s 141ms/step - loss: 3.3394e-04
Epoch 797/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9680e-04

Epoch 798/1000
34/34 [=====] - 5s 142ms/step - loss: 2.8509e-04
Epoch 799/1000
34/34 [=====] - 5s 143ms/step - loss: 2.7727e-04
Epoch 800/1000
34/34 [=====] - 5s 142ms/step - loss: 2.8894e-04
Epoch 801/1000
34/34 [=====] - 5s 142ms/step - loss: 2.7228e-04
Epoch 802/1000
34/34 [=====] - 5s 145ms/step - loss: 3.0995e-04
Epoch 803/1000
34/34 [=====] - 5s 142ms/step - loss: 3.2305e-04
Epoch 804/1000
34/34 [=====] - 5s 143ms/step - loss: 3.2877e-04
Epoch 805/1000
34/34 [=====] - 5s 144ms/step - loss: 3.3824e-04
Epoch 806/1000
34/34 [=====] - 5s 145ms/step - loss: 3.1293e-04
Epoch 807/1000
34/34 [=====] - 5s 142ms/step - loss: 3.3800e-04
Epoch 808/1000
34/34 [=====] - 5s 141ms/step - loss: 2.9411e-04
Epoch 809/1000
34/34 [=====] - 5s 142ms/step - loss: 3.6109e-04
Epoch 810/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0893e-04
Epoch 811/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8449e-04
Epoch 812/1000
34/34 [=====] - 5s 143ms/step - loss: 2.7317e-04
Epoch 813/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8647e-04
Epoch 814/1000
34/34 [=====] - 5s 144ms/step - loss: 3.1212e-04
Epoch 815/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9579e-04
Epoch 816/1000
34/34 [=====] - 5s 145ms/step - loss: 3.0889e-04
Epoch 817/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0182e-04
Epoch 818/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8451e-04
Epoch 819/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0592e-04
Epoch 820/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9380e-04
Epoch 821/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0396e-04

Epoch 822/1000
34/34 [=====] - 5s 145ms/step - loss: 2.9809e-04
Epoch 823/1000
34/34 [=====] - 5s 144ms/step - loss: 2.7971e-04
Epoch 824/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2278e-04
Epoch 825/1000
34/34 [=====] - 5s 142ms/step - loss: 3.1757e-04
Epoch 826/1000
34/34 [=====] - 5s 145ms/step - loss: 3.0508e-04
Epoch 827/1000
34/34 [=====] - 5s 145ms/step - loss: 2.9584e-04
Epoch 828/1000
34/34 [=====] - 5s 147ms/step - loss: 3.0081e-04
Epoch 829/1000
34/34 [=====] - 6s 165ms/step - loss: 3.1260e-04
Epoch 830/1000
34/34 [=====] - 5s 144ms/step - loss: 3.1373e-04
Epoch 831/1000
34/34 [=====] - 5s 144ms/step - loss: 4.2121e-04
Epoch 832/1000
34/34 [=====] - 5s 142ms/step - loss: 3.5414e-04
Epoch 833/1000
34/34 [=====] - 5s 143ms/step - loss: 3.2919e-04
Epoch 834/1000
34/34 [=====] - 5s 143ms/step - loss: 2.7810e-04
Epoch 835/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8198e-04
Epoch 836/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1437e-04
Epoch 837/1000
34/34 [=====] - 5s 142ms/step - loss: 2.8281e-04
Epoch 838/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8708e-04
Epoch 839/1000
34/34 [=====] - 5s 141ms/step - loss: 3.1506e-04
Epoch 840/1000
34/34 [=====] - 5s 142ms/step - loss: 2.8897e-04
Epoch 841/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9931e-04
Epoch 842/1000
34/34 [=====] - 5s 144ms/step - loss: 2.9408e-04
Epoch 843/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9530e-04
Epoch 844/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9507e-04
Epoch 845/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1339e-04

Epoch 846/1000
34/34 [=====] - 5s 141ms/step - loss: 3.0571e-04
Epoch 847/1000
34/34 [=====] - 5s 142ms/step - loss: 3.3076e-04
Epoch 848/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0165e-04
Epoch 849/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0395e-04
Epoch 850/1000
34/34 [=====] - 5s 152ms/step - loss: 2.7826e-04
Epoch 851/1000
34/34 [=====] - 6s 169ms/step - loss: 3.1022e-04
Epoch 852/1000
34/34 [=====] - 5s 153ms/step - loss: 3.1883e-04
Epoch 853/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9762e-04
Epoch 854/1000
34/34 [=====] - 5s 142ms/step - loss: 2.8095e-04
Epoch 855/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0762e-04
Epoch 856/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0519e-04
Epoch 857/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8824e-04
Epoch 858/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0264e-04
Epoch 859/1000
34/34 [=====] - 5s 144ms/step - loss: 2.7816e-04
Epoch 860/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8696e-04
Epoch 861/1000
34/34 [=====] - 5s 144ms/step - loss: 2.7933e-04
Epoch 862/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9146e-04
Epoch 863/1000
34/34 [=====] - 5s 142ms/step - loss: 2.7477e-04
Epoch 864/1000
34/34 [=====] - 5s 142ms/step - loss: 3.3436e-04
Epoch 865/1000
34/34 [=====] - 5s 141ms/step - loss: 3.1816e-04
Epoch 866/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1810e-04
Epoch 867/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9519e-04
Epoch 868/1000
34/34 [=====] - 5s 143ms/step - loss: 2.7369e-04
Epoch 869/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3069e-04

Epoch 870/1000
34/34 [=====] - 5s 146ms/step - loss: 2.7713e-04
Epoch 871/1000
34/34 [=====] - 5s 144ms/step - loss: 2.7553e-04
Epoch 872/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0575e-04
Epoch 873/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9269e-04
Epoch 874/1000
34/34 [=====] - 5s 145ms/step - loss: 2.9225e-04
Epoch 875/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9770e-04
Epoch 876/1000
34/34 [=====] - 5s 142ms/step - loss: 3.1020e-04
Epoch 877/1000
34/34 [=====] - 5s 145ms/step - loss: 3.1302e-04
Epoch 878/1000
34/34 [=====] - 5s 144ms/step - loss: 3.1304e-04
Epoch 879/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8696e-04
Epoch 880/1000
34/34 [=====] - 5s 144ms/step - loss: 3.1965e-04
Epoch 881/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8786e-04
Epoch 882/1000
34/34 [=====] - 5s 146ms/step - loss: 2.7916e-04
Epoch 883/1000
34/34 [=====] - 5s 142ms/step - loss: 2.8496e-04
Epoch 884/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8094e-04
Epoch 885/1000
34/34 [=====] - 5s 144ms/step - loss: 3.6770e-04
Epoch 886/1000
34/34 [=====] - 5s 143ms/step - loss: 3.4517e-04
Epoch 887/1000
34/34 [=====] - 5s 142ms/step - loss: 2.7976e-04
Epoch 888/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9497e-04
Epoch 889/1000
34/34 [=====] - 5s 153ms/step - loss: 2.6755e-04
Epoch 890/1000
34/34 [=====] - 5s 154ms/step - loss: 2.9928e-04
Epoch 891/1000
34/34 [=====] - 5s 146ms/step - loss: 2.9744e-04
Epoch 892/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5676e-04
Epoch 893/1000
34/34 [=====] - 5s 145ms/step - loss: 3.0074e-04

Epoch 894/1000
34/34 [=====] - 5s 142ms/step - loss: 3.1776e-04
Epoch 895/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9936e-04
Epoch 896/1000
34/34 [=====] - 5s 142ms/step - loss: 3.2033e-04
Epoch 897/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8326e-04
Epoch 898/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8430e-04
Epoch 899/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9435e-04
Epoch 900/1000
34/34 [=====] - 5s 142ms/step - loss: 2.4583e-04
Epoch 901/1000
34/34 [=====] - 5s 142ms/step - loss: 2.8010e-04
Epoch 902/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8928e-04
Epoch 903/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8323e-04
Epoch 904/1000
34/34 [=====] - 5s 142ms/step - loss: 2.5999e-04
Epoch 905/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1139e-04
Epoch 906/1000
34/34 [=====] - 5s 146ms/step - loss: 2.8188e-04
Epoch 907/1000
34/34 [=====] - 5s 144ms/step - loss: 2.5378e-04
Epoch 908/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9531e-04
Epoch 909/1000
34/34 [=====] - 5s 144ms/step - loss: 2.9770e-04
Epoch 910/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8494e-04
Epoch 911/1000
34/34 [=====] - 5s 146ms/step - loss: 2.9079e-04
Epoch 912/1000
34/34 [=====] - 6s 165ms/step - loss: 2.9422e-04
Epoch 913/1000
34/34 [=====] - 6s 167ms/step - loss: 2.8449e-04
Epoch 914/1000
34/34 [=====] - 5s 143ms/step - loss: 2.7938e-04
Epoch 915/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9276e-04
Epoch 916/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9746e-04
Epoch 917/1000
34/34 [=====] - 5s 143ms/step - loss: 2.7052e-04

Epoch 918/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8762e-04
Epoch 919/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9462e-04
Epoch 920/1000
34/34 [=====] - 5s 144ms/step - loss: 3.1155e-04
Epoch 921/1000
34/34 [=====] - 5s 143ms/step - loss: 3.2100e-04
Epoch 922/1000
34/34 [=====] - 5s 142ms/step - loss: 3.3191e-04
Epoch 923/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2750e-04
Epoch 924/1000
34/34 [=====] - 5s 143ms/step - loss: 2.8180e-04
Epoch 925/1000
34/34 [=====] - 5s 141ms/step - loss: 2.7730e-04
Epoch 926/1000
34/34 [=====] - 5s 143ms/step - loss: 2.7742e-04
Epoch 927/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0761e-04
Epoch 928/1000
34/34 [=====] - 5s 144ms/step - loss: 2.9967e-04
Epoch 929/1000
34/34 [=====] - 5s 145ms/step - loss: 2.7137e-04
Epoch 930/1000
34/34 [=====] - 5s 145ms/step - loss: 2.7604e-04
Epoch 931/1000
34/34 [=====] - 5s 146ms/step - loss: 2.9068e-04
Epoch 932/1000
34/34 [=====] - 5s 146ms/step - loss: 2.5713e-04
Epoch 933/1000
34/34 [=====] - 5s 146ms/step - loss: 2.9993e-04
Epoch 934/1000
34/34 [=====] - 5s 145ms/step - loss: 3.0054e-04
Epoch 935/1000
34/34 [=====] - 5s 145ms/step - loss: 3.1462e-04
Epoch 936/1000
34/34 [=====] - 5s 144ms/step - loss: 2.9207e-04
Epoch 937/1000
34/34 [=====] - 5s 146ms/step - loss: 2.7927e-04
Epoch 938/1000
34/34 [=====] - 5s 147ms/step - loss: 3.0003e-04
Epoch 939/1000
34/34 [=====] - 5s 147ms/step - loss: 2.9245e-04
Epoch 940/1000
34/34 [=====] - 5s 146ms/step - loss: 3.0037e-04
Epoch 941/1000
34/34 [=====] - 5s 147ms/step - loss: 3.4602e-04

Epoch 942/1000
34/34 [=====] - 5s 146ms/step - loss: 2.8744e-04
Epoch 943/1000
34/34 [=====] - 5s 144ms/step - loss: 2.9403e-04
Epoch 944/1000
34/34 [=====] - 5s 146ms/step - loss: 3.1332e-04
Epoch 945/1000
34/34 [=====] - 5s 144ms/step - loss: 3.1982e-04
Epoch 946/1000
34/34 [=====] - 5s 142ms/step - loss: 2.7802e-04
Epoch 947/1000
34/34 [=====] - 5s 144ms/step - loss: 2.7853e-04
Epoch 948/1000
34/34 [=====] - 5s 144ms/step - loss: 2.9644e-04
Epoch 949/1000
34/34 [=====] - 5s 153ms/step - loss: 3.1260e-04
Epoch 950/1000
34/34 [=====] - 6s 164ms/step - loss: 3.0480e-04
Epoch 951/1000
34/34 [=====] - 5s 146ms/step - loss: 3.0883e-04
Epoch 952/1000
34/34 [=====] - 5s 146ms/step - loss: 2.7528e-04
Epoch 953/1000
34/34 [=====] - 5s 145ms/step - loss: 2.9833e-04
Epoch 954/1000
34/34 [=====] - 5s 145ms/step - loss: 2.8543e-04
Epoch 955/1000
34/34 [=====] - 5s 145ms/step - loss: 2.9128e-04
Epoch 956/1000
34/34 [=====] - 5s 145ms/step - loss: 3.4400e-04
Epoch 957/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0111e-04
Epoch 958/1000
34/34 [=====] - 5s 143ms/step - loss: 2.6411e-04
Epoch 959/1000
34/34 [=====] - 5s 144ms/step - loss: 3.5021e-04
Epoch 960/1000
34/34 [=====] - 5s 143ms/step - loss: 2.7879e-04
Epoch 961/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9116e-04
Epoch 962/1000
34/34 [=====] - 5s 142ms/step - loss: 2.7635e-04
Epoch 963/1000
34/34 [=====] - 5s 145ms/step - loss: 3.2157e-04
Epoch 964/1000
34/34 [=====] - 5s 142ms/step - loss: 2.8211e-04
Epoch 965/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8978e-04

Epoch 966/1000
34/34 [=====] - 5s 146ms/step - loss: 3.0895e-04
Epoch 967/1000
34/34 [=====] - 5s 143ms/step - loss: 2.5964e-04
Epoch 968/1000
34/34 [=====] - 5s 145ms/step - loss: 2.7009e-04
Epoch 969/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9487e-04
Epoch 970/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0303e-04
Epoch 971/1000
34/34 [=====] - 5s 146ms/step - loss: 2.8102e-04
Epoch 972/1000
34/34 [=====] - 5s 143ms/step - loss: 3.0503e-04
Epoch 973/1000
34/34 [=====] - 6s 165ms/step - loss: 3.1510e-04
Epoch 974/1000
34/34 [=====] - 6s 167ms/step - loss: 2.7785e-04
Epoch 975/1000
34/34 [=====] - 5s 141ms/step - loss: 2.6371e-04
Epoch 976/1000
34/34 [=====] - 5s 142ms/step - loss: 2.5843e-04
Epoch 977/1000
34/34 [=====] - 5s 142ms/step - loss: 2.6992e-04
Epoch 978/1000
34/34 [=====] - 5s 145ms/step - loss: 2.9733e-04
Epoch 979/1000
34/34 [=====] - 5s 143ms/step - loss: 3.5024e-04
Epoch 980/1000
34/34 [=====] - 5s 143ms/step - loss: 3.1307e-04
Epoch 981/1000
34/34 [=====] - 5s 144ms/step - loss: 3.0180e-04
Epoch 982/1000
34/34 [=====] - 5s 143ms/step - loss: 2.6037e-04
Epoch 983/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2839e-04
Epoch 984/1000
34/34 [=====] - 5s 143ms/step - loss: 3.6074e-04
Epoch 985/1000
34/34 [=====] - 5s 141ms/step - loss: 3.2822e-04
Epoch 986/1000
34/34 [=====] - 5s 143ms/step - loss: 3.2425e-04
Epoch 987/1000
34/34 [=====] - 5s 144ms/step - loss: 2.7430e-04
Epoch 988/1000
34/34 [=====] - 5s 144ms/step - loss: 2.6436e-04
Epoch 989/1000
34/34 [=====] - 5s 143ms/step - loss: 2.9409e-04

```

Epoch 990/1000
34/34 [=====] - 5s 144ms/step - loss: 2.6230e-04
Epoch 991/1000
34/34 [=====] - 5s 144ms/step - loss: 2.9267e-04
Epoch 992/1000
34/34 [=====] - 5s 144ms/step - loss: 3.2134e-04
Epoch 993/1000
34/34 [=====] - 5s 146ms/step - loss: 3.2331e-04
Epoch 994/1000
34/34 [=====] - 5s 145ms/step - loss: 3.0097e-04
Epoch 995/1000
34/34 [=====] - 5s 144ms/step - loss: 2.8368e-04
Epoch 996/1000
34/34 [=====] - 5s 145ms/step - loss: 2.9308e-04
Epoch 997/1000
34/34 [=====] - 5s 142ms/step - loss: 2.9715e-04
Epoch 998/1000
34/34 [=====] - 5s 143ms/step - loss: 3.3480e-04
Epoch 999/1000
34/34 [=====] - 5s 144ms/step - loss: 2.6673e-04
Epoch 1000/1000
34/34 [=====] - 5s 144ms/step - loss: 2.9082e-04

```

[81]: <tensorflow.python.keras.callbacks.History at 0x7fdf1871cad0>

```

[82]: #train the model
testdataframe= test
testdataframe['Date'] = testdataframe.index
testdata = pd.DataFrame(columns = ['Date', 'Close'])
testdata['Date'] = testdataframe['Date']
testdata['Close'] = testdataframe['Close']
real_stock_price = testdata.iloc[:, 1:2].values
dataset_total = pd.concat((data2['Close'], testdata['Close']), axis = 0)
inputs = dataset_total[len(dataset_total) - len(testdata) - 60:].values
inputs = inputs.reshape(-1,1)
inputs = sc.transform(inputs)
X_test = []
for i in range(60, inputs.shape[0]):
    X_test.append(inputs[i-60:i, 0])
X_test = np.array(X_test)
X_test = np.reshape(X_test, (X_test.shape[0], X_test.shape[1], 1))

```

```

[83]: predicted_stock_price = regressor.predict(X_test)
predicted_stock_price = sc.inverse_transform(predicted_stock_price)

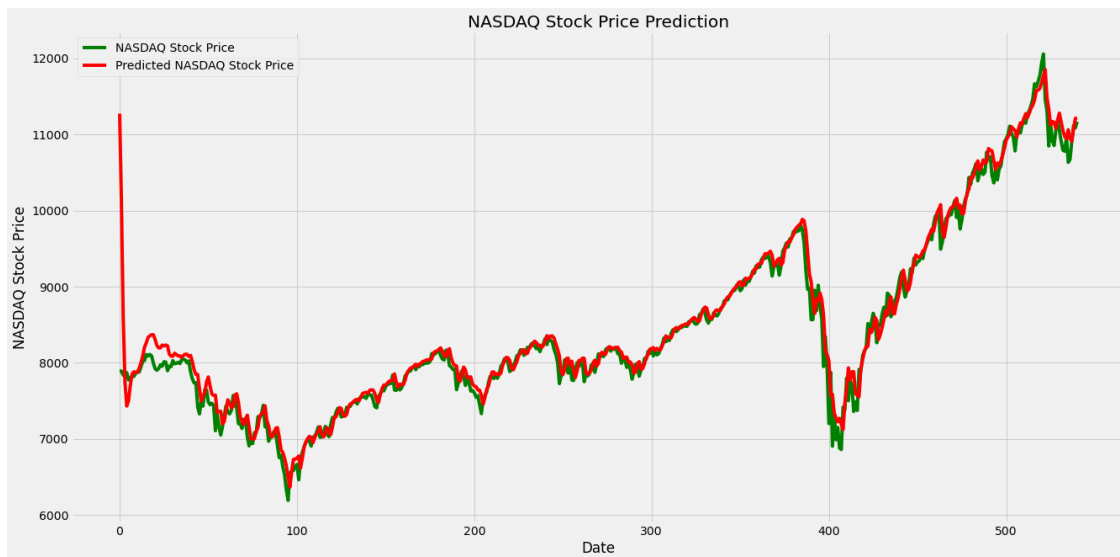
```

```

[84]: plt.figure(figsize=(20,10))
plt.plot(real_stock_price, color = 'green', label = 'NASDAQ Stock Price')

```

```
plt.plot(predicted_stock_price, color = 'red', label = 'Predicted NASDAQ Stock Price')
plt.title('NASDAQ Stock Price Prediction')
plt.xlabel('Date')
plt.ylabel('NASDAQ Stock Price')
plt.legend()
plt.show()
```



```
[85]: rmse_predict= np.reshape(predicted_stock_price,541)
```

```
[86]: def smape(a, f):
        return 1/len(a) * np.sum(2 * np.abs(f-a) / (np.abs(a) + np.abs(f))*100)
smape(test["Close"].values,rmse_predict)
```

```
[86]: 1.3944491323928099
```

```
[87]: from sklearn.metrics import mean_absolute_error
from sklearn.metrics import mean_squared_error
from sklearn.metrics import r2_score
mae = mean_absolute_error(test["Close"].values, rmse_predict)
mse = mean_squared_error(test["Close"].values, rmse_predict)
rmse = np.sqrt(mse)

print("Results of sklearn.metrics:")
print("MAE:",mae)
print("MSE:", mse)
print("RMSE:", rmse)
```

Results of sklearn.metrics:
MAE: 117.05387249162432
MSE: 55267.551367822314
RMSE: 235.09051739239146

```
[88]: elapsed_time = time.process_time() - t  
      print(elapsed_time)
```

15092.296083494

```
[ ]: #using GRU to predict NASDAQ
```

```
[89]: import time
```

```
      t = time.process_time()
```

```
[90]: regressorGRU = Sequential()  
      regressorGRU.add(GRU(units = 50, return_sequences = True, input_shape =  
          ↪ (X_train.shape[1],1)))  
      regressorGRU.add(Dropout(0.15))  
      regressorGRU.add(GRU(units = 50, return_sequences = True))  
      regressorGRU.add(Dropout(0.15))  
      regressorGRU.add(GRU(units = 50, return_sequences = True))  
      regressorGRU.add(Dropout(0.15))  
      regressorGRU.add(GRU(units = 50))  
      regressorGRU.add(Dropout(0.15))  
      regressorGRU.add(Dense(units = 1))
```

```
[91]: regressorGRU.compile(optimizer='adam',loss='mean_squared_error')
```

```
[92]: regressorGRU.fit(X_train, y_train, epochs = 1000, batch_size = 32)
```

```
Epoch 1/1000  
83/83 [=====] - 13s 154ms/step - loss: 0.0093  
Epoch 2/1000  
83/83 [=====] - 12s 145ms/step - loss: 0.0015  
Epoch 3/1000  
83/83 [=====] - 12s 142ms/step - loss: 0.0013  
Epoch 4/1000  
83/83 [=====] - 13s 153ms/step - loss: 0.0012  
Epoch 5/1000  
83/83 [=====] - 12s 142ms/step - loss: 0.0010  
Epoch 6/1000  
83/83 [=====] - 12s 141ms/step - loss: 0.0010  
Epoch 7/1000  
83/83 [=====] - 12s 140ms/step - loss: 9.9972e-04  
Epoch 8/1000  
83/83 [=====] - 12s 139ms/step - loss: 0.0011
```

Epoch 9/1000
83/83 [=====] - 12s 139ms/step - loss: 9.3036e-04
Epoch 10/1000
83/83 [=====] - 12s 139ms/step - loss: 9.1217e-04
Epoch 11/1000
83/83 [=====] - 12s 139ms/step - loss: 9.8571e-04
Epoch 12/1000
83/83 [=====] - 11s 137ms/step - loss: 9.7454e-04
Epoch 13/1000
83/83 [=====] - 11s 136ms/step - loss: 9.7557e-04
Epoch 14/1000
83/83 [=====] - 13s 153ms/step - loss: 8.0553e-04
Epoch 15/1000
83/83 [=====] - 12s 143ms/step - loss: 9.3369e-04
Epoch 16/1000
83/83 [=====] - 11s 134ms/step - loss: 8.2896e-04
Epoch 17/1000
83/83 [=====] - 11s 135ms/step - loss: 8.0969e-04
Epoch 18/1000
83/83 [=====] - 11s 134ms/step - loss: 8.1228e-04
Epoch 19/1000
83/83 [=====] - 11s 133ms/step - loss: 7.0505e-04
Epoch 20/1000
83/83 [=====] - 11s 134ms/step - loss: 7.6414e-04
Epoch 21/1000
83/83 [=====] - 11s 134ms/step - loss: 8.4814e-04
Epoch 22/1000
83/83 [=====] - 11s 133ms/step - loss: 6.9420e-04
Epoch 23/1000
83/83 [=====] - 11s 133ms/step - loss: 7.3026e-04
Epoch 24/1000
83/83 [=====] - 11s 133ms/step - loss: 6.3649e-04
Epoch 25/1000
83/83 [=====] - 11s 134ms/step - loss: 6.6359e-04
Epoch 26/1000
83/83 [=====] - 11s 133ms/step - loss: 7.2362e-04
Epoch 27/1000
83/83 [=====] - 11s 134ms/step - loss: 6.5603e-04
Epoch 28/1000
83/83 [=====] - 11s 133ms/step - loss: 5.9888e-04
Epoch 29/1000
83/83 [=====] - 11s 132ms/step - loss: 7.4384e-04
Epoch 30/1000
83/83 [=====] - 12s 145ms/step - loss: 6.3618e-04
Epoch 31/1000
83/83 [=====] - 11s 132ms/step - loss: 6.1175e-04
Epoch 32/1000
83/83 [=====] - 11s 132ms/step - loss: 5.6128e-04

Epoch 33/1000
83/83 [=====] - 11s 132ms/step - loss: 6.0583e-04
Epoch 34/1000
83/83 [=====] - 11s 132ms/step - loss: 5.6658e-04
Epoch 35/1000
83/83 [=====] - 11s 131ms/step - loss: 7.6608e-04
Epoch 36/1000
83/83 [=====] - 11s 132ms/step - loss: 6.5446e-04
Epoch 37/1000
83/83 [=====] - 11s 133ms/step - loss: 6.6565e-04
Epoch 38/1000
83/83 [=====] - 11s 133ms/step - loss: 5.9113e-04
Epoch 39/1000
83/83 [=====] - 11s 132ms/step - loss: 5.9376e-04
Epoch 40/1000
83/83 [=====] - 11s 132ms/step - loss: 4.9179e-04
Epoch 41/1000
83/83 [=====] - 11s 133ms/step - loss: 4.9620e-04
Epoch 42/1000
83/83 [=====] - 13s 156ms/step - loss: 5.5843e-04
Epoch 43/1000
83/83 [=====] - 11s 132ms/step - loss: 5.2272e-04
Epoch 44/1000
83/83 [=====] - 11s 132ms/step - loss: 5.1409e-04
Epoch 45/1000
83/83 [=====] - 11s 132ms/step - loss: 6.0424e-04
Epoch 46/1000
83/83 [=====] - 11s 132ms/step - loss: 4.9414e-04
Epoch 47/1000
83/83 [=====] - 11s 133ms/step - loss: 5.4123e-04
Epoch 48/1000
83/83 [=====] - 11s 132ms/step - loss: 5.3561e-04
Epoch 49/1000
83/83 [=====] - 11s 133ms/step - loss: 5.3293e-04
Epoch 50/1000
83/83 [=====] - 11s 132ms/step - loss: 5.0929e-04
Epoch 51/1000
83/83 [=====] - 11s 132ms/step - loss: 4.9497e-04
Epoch 52/1000
83/83 [=====] - 11s 132ms/step - loss: 4.7641e-04
Epoch 53/1000
83/83 [=====] - 11s 133ms/step - loss: 5.1140e-04
Epoch 54/1000
83/83 [=====] - 11s 132ms/step - loss: 4.6749e-04
Epoch 55/1000
83/83 [=====] - 11s 131ms/step - loss: 5.1311e-04
Epoch 56/1000
83/83 [=====] - 11s 131ms/step - loss: 4.7225e-04

Epoch 57/1000
83/83 [=====] - 11s 136ms/step - loss: 4.1903e-04
Epoch 58/1000
83/83 [=====] - 12s 139ms/step - loss: 4.1313e-04
Epoch 59/1000
83/83 [=====] - 11s 131ms/step - loss: 4.6516e-04
Epoch 60/1000
83/83 [=====] - 11s 131ms/step - loss: 4.5039e-04
Epoch 61/1000
83/83 [=====] - 11s 131ms/step - loss: 5.1077e-04
Epoch 62/1000
83/83 [=====] - 11s 132ms/step - loss: 4.3690e-04
Epoch 63/1000
83/83 [=====] - 11s 132ms/step - loss: 5.1304e-04
Epoch 64/1000
83/83 [=====] - 11s 132ms/step - loss: 4.2934e-04
Epoch 65/1000
83/83 [=====] - 11s 132ms/step - loss: 4.2905e-04
Epoch 66/1000
83/83 [=====] - 11s 131ms/step - loss: 3.9575e-04
Epoch 67/1000
83/83 [=====] - 11s 132ms/step - loss: 4.3972e-04
Epoch 68/1000
83/83 [=====] - 11s 131ms/step - loss: 4.0942e-04
Epoch 69/1000
83/83 [=====] - 11s 137ms/step - loss: 4.8307e-04
Epoch 70/1000
83/83 [=====] - 12s 151ms/step - loss: 3.9974e-04
Epoch 71/1000
83/83 [=====] - 11s 132ms/step - loss: 5.2934e-04
Epoch 72/1000
83/83 [=====] - 11s 132ms/step - loss: 3.9116e-04
Epoch 73/1000
83/83 [=====] - 11s 132ms/step - loss: 4.1183e-04
Epoch 74/1000
83/83 [=====] - 11s 133ms/step - loss: 4.7459e-04
Epoch 75/1000
83/83 [=====] - 11s 133ms/step - loss: 3.4957e-04
Epoch 76/1000
83/83 [=====] - 11s 131ms/step - loss: 4.8811e-04
Epoch 77/1000
83/83 [=====] - 11s 129ms/step - loss: 4.4243e-04
Epoch 78/1000
83/83 [=====] - 11s 129ms/step - loss: 4.4328e-04
Epoch 79/1000
83/83 [=====] - 11s 129ms/step - loss: 4.3200e-04
Epoch 80/1000
83/83 [=====] - 11s 130ms/step - loss: 4.6217e-04

Epoch 81/1000
83/83 [=====] - 11s 129ms/step - loss: 4.2889e-04
Epoch 82/1000
83/83 [=====] - 11s 129ms/step - loss: 3.6329e-04
Epoch 83/1000
83/83 [=====] - 11s 130ms/step - loss: 4.3494e-04
Epoch 84/1000
83/83 [=====] - 11s 129ms/step - loss: 4.2858e-04
Epoch 85/1000
83/83 [=====] - 12s 142ms/step - loss: 4.7881e-04
Epoch 86/1000
83/83 [=====] - 11s 129ms/step - loss: 3.4577e-04
Epoch 87/1000
83/83 [=====] - 11s 128ms/step - loss: 3.7583e-04
Epoch 88/1000
83/83 [=====] - 11s 128ms/step - loss: 4.2939e-04
Epoch 89/1000
83/83 [=====] - 11s 129ms/step - loss: 4.6446e-04
Epoch 90/1000
83/83 [=====] - 11s 129ms/step - loss: 3.8035e-04
Epoch 91/1000
83/83 [=====] - 11s 129ms/step - loss: 3.8696e-04
Epoch 92/1000
83/83 [=====] - 11s 128ms/step - loss: 3.8184e-04
Epoch 93/1000
83/83 [=====] - 11s 127ms/step - loss: 4.2892e-04
Epoch 94/1000
83/83 [=====] - 11s 128ms/step - loss: 4.5008e-04
Epoch 95/1000
83/83 [=====] - 11s 128ms/step - loss: 3.9547e-04
Epoch 96/1000
83/83 [=====] - 11s 128ms/step - loss: 4.2206e-04
Epoch 97/1000
83/83 [=====] - 11s 129ms/step - loss: 4.0686e-04
Epoch 98/1000
83/83 [=====] - 13s 154ms/step - loss: 4.2765e-04
Epoch 99/1000
83/83 [=====] - 11s 128ms/step - loss: 3.9927e-04
Epoch 100/1000
83/83 [=====] - 11s 128ms/step - loss: 4.0277e-04
Epoch 101/1000
83/83 [=====] - 11s 128ms/step - loss: 4.1453e-04
Epoch 102/1000
83/83 [=====] - 11s 129ms/step - loss: 3.9438e-04
Epoch 103/1000
83/83 [=====] - 11s 129ms/step - loss: 4.5464e-04
Epoch 104/1000
83/83 [=====] - 11s 128ms/step - loss: 3.9042e-04

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Epoch 105/1000
83/83 [=====] - 10s 126ms/step - loss: 3.4455e-04
Epoch 106/1000
83/83 [=====] - 11s 127ms/step - loss: 3.6218e-04
Epoch 107/1000
83/83 [=====] - 10s 126ms/step - loss: 4.3026e-04
Epoch 108/1000
83/83 [=====] - 10s 126ms/step - loss: 4.0477e-04
Epoch 109/1000
83/83 [=====] - 10s 126ms/step - loss: 3.9803e-04
Epoch 110/1000
83/83 [=====] - 10s 126ms/step - loss: 3.8238e-04
Epoch 111/1000
83/83 [=====] - 10s 126ms/step - loss: 3.5614e-04
Epoch 112/1000
83/83 [=====] - 11s 127ms/step - loss: 3.4942e-04
Epoch 113/1000
83/83 [=====] - 11s 136ms/step - loss: 4.1503e-04
Epoch 114/1000
83/83 [=====] - 11s 128ms/step - loss: 3.6433e-04
Epoch 115/1000
83/83 [=====] - 10s 126ms/step - loss: 3.7860e-04
Epoch 116/1000
83/83 [=====] - 11s 127ms/step - loss: 3.7441e-04
Epoch 117/1000
83/83 [=====] - 10s 126ms/step - loss: 3.8602e-04
Epoch 118/1000
83/83 [=====] - 10s 126ms/step - loss: 3.4473e-04
Epoch 119/1000
83/83 [=====] - 10s 126ms/step - loss: 4.1008e-04
Epoch 120/1000
83/83 [=====] - 10s 125ms/step - loss: 4.0911e-04
Epoch 121/1000
83/83 [=====] - 11s 127ms/step - loss: 4.2328e-04
Epoch 122/1000
83/83 [=====] - 10s 125ms/step - loss: 4.1468e-04
Epoch 123/1000
83/83 [=====] - 10s 125ms/step - loss: 3.9530e-04
Epoch 124/1000
83/83 [=====] - 10s 126ms/step - loss: 4.0256e-04
Epoch 125/1000
83/83 [=====] - 10s 126ms/step - loss: 4.0494e-04
Epoch 126/1000
83/83 [=====] - 10s 126ms/step - loss: 3.3897e-04
Epoch 127/1000
83/83 [=====] - 12s 149ms/step - loss: 3.3943e-04
Epoch 128/1000
83/83 [=====] - 10s 125ms/step - loss: 4.0048e-04

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Epoch 129/1000
83/83 [=====] - 10s 126ms/step - loss: 4.1912e-04
Epoch 130/1000
83/83 [=====] - 10s 126ms/step - loss: 4.5261e-04
Epoch 131/1000
83/83 [=====] - 10s 125ms/step - loss: 3.8671e-04
Epoch 132/1000
83/83 [=====] - 10s 126ms/step - loss: 3.6490e-04
Epoch 133/1000
83/83 [=====] - 10s 125ms/step - loss: 3.6518e-04
Epoch 134/1000
83/83 [=====] - 10s 126ms/step - loss: 3.5716e-04
Epoch 135/1000
83/83 [=====] - 10s 126ms/step - loss: 3.4341e-04
Epoch 136/1000
83/83 [=====] - 11s 127ms/step - loss: 3.4403e-04
Epoch 137/1000
83/83 [=====] - 10s 125ms/step - loss: 3.7591e-04
Epoch 138/1000
83/83 [=====] - 10s 126ms/step - loss: 3.8945e-04
Epoch 139/1000
83/83 [=====] - 10s 126ms/step - loss: 3.3864e-04
Epoch 140/1000
83/83 [=====] - 10s 125ms/step - loss: 3.6485e-04
Epoch 141/1000
83/83 [=====] - 10s 124ms/step - loss: 3.5885e-04
Epoch 142/1000
83/83 [=====] - 11s 138ms/step - loss: 3.6380e-04
Epoch 143/1000
83/83 [=====] - 10s 125ms/step - loss: 3.4615e-04
Epoch 144/1000
83/83 [=====] - 10s 124ms/step - loss: 3.0916e-04
Epoch 145/1000
83/83 [=====] - 10s 124ms/step - loss: 3.4309e-04
Epoch 146/1000
83/83 [=====] - 10s 125ms/step - loss: 3.8588e-04
Epoch 147/1000
83/83 [=====] - 10s 125ms/step - loss: 4.1419e-04
Epoch 148/1000
83/83 [=====] - 10s 124ms/step - loss: 3.3592e-04
Epoch 149/1000
83/83 [=====] - 10s 125ms/step - loss: 3.5400e-04
Epoch 150/1000
83/83 [=====] - 10s 124ms/step - loss: 3.4655e-04
Epoch 151/1000
83/83 [=====] - 10s 125ms/step - loss: 3.4191e-04
Epoch 152/1000
83/83 [=====] - 10s 125ms/step - loss: 3.5007e-04

Epoch 153/1000
83/83 [=====] - 10s 126ms/step - loss: 3.1823e-04
Epoch 154/1000
83/83 [=====] - 10s 125ms/step - loss: 3.3499e-04
Epoch 155/1000
83/83 [=====] - 10s 124ms/step - loss: 3.4041e-04
Epoch 156/1000
83/83 [=====] - 12s 142ms/step - loss: 3.1609e-04
Epoch 157/1000
83/83 [=====] - 11s 132ms/step - loss: 3.3122e-04
Epoch 158/1000
83/83 [=====] - 11s 133ms/step - loss: 3.6605e-04
Epoch 159/1000
83/83 [=====] - 11s 132ms/step - loss: 3.2927e-04
Epoch 160/1000
83/83 [=====] - 10s 126ms/step - loss: 3.3052e-04
Epoch 161/1000
83/83 [=====] - 10s 124ms/step - loss: 2.9417e-04
Epoch 162/1000
83/83 [=====] - 10s 125ms/step - loss: 4.0627e-04
Epoch 163/1000
83/83 [=====] - 10s 126ms/step - loss: 3.2221e-04
Epoch 164/1000
83/83 [=====] - 10s 125ms/step - loss: 3.3900e-04
Epoch 165/1000
83/83 [=====] - 10s 125ms/step - loss: 3.1505e-04
Epoch 166/1000
83/83 [=====] - 10s 125ms/step - loss: 3.2216e-04
Epoch 167/1000
83/83 [=====] - 10s 125ms/step - loss: 3.0207e-04
Epoch 168/1000
83/83 [=====] - 10s 126ms/step - loss: 3.6144e-04
Epoch 169/1000
83/83 [=====] - 10s 126ms/step - loss: 3.7769e-04
Epoch 170/1000
83/83 [=====] - 10s 126ms/step - loss: 3.8462e-04
Epoch 171/1000
83/83 [=====] - 12s 139ms/step - loss: 3.5687e-04
Epoch 172/1000
83/83 [=====] - 11s 131ms/step - loss: 3.3651e-04
Epoch 173/1000
83/83 [=====] - 10s 124ms/step - loss: 2.6693e-04
Epoch 174/1000
83/83 [=====] - 10s 125ms/step - loss: 3.0655e-04
Epoch 175/1000
83/83 [=====] - 11s 131ms/step - loss: 3.2208e-04
Epoch 176/1000
83/83 [=====] - 10s 124ms/step - loss: 2.9877e-04

Epoch 177/1000
83/83 [=====] - 10s 125ms/step - loss: 3.1596e-04
Epoch 178/1000
83/83 [=====] - 10s 124ms/step - loss: 3.6670e-04
Epoch 179/1000
83/83 [=====] - 10s 125ms/step - loss: 3.2452e-04
Epoch 180/1000
83/83 [=====] - 10s 126ms/step - loss: 3.0587e-04
Epoch 181/1000
83/83 [=====] - 10s 124ms/step - loss: 3.1799e-04
Epoch 182/1000
83/83 [=====] - 10s 126ms/step - loss: 4.5205e-04
Epoch 183/1000
83/83 [=====] - 10s 125ms/step - loss: 3.3836e-04
Epoch 184/1000
83/83 [=====] - 10s 125ms/step - loss: 3.2083e-04
Epoch 185/1000
83/83 [=====] - 12s 142ms/step - loss: 3.4432e-04
Epoch 186/1000
83/83 [=====] - 11s 135ms/step - loss: 3.2231e-04
Epoch 187/1000
83/83 [=====] - 10s 124ms/step - loss: 3.6504e-04
Epoch 188/1000
83/83 [=====] - 10s 124ms/step - loss: 3.3724e-04
Epoch 189/1000
83/83 [=====] - 10s 125ms/step - loss: 3.5010e-04
Epoch 190/1000
83/83 [=====] - 10s 124ms/step - loss: 3.1638e-04
Epoch 191/1000
83/83 [=====] - 10s 125ms/step - loss: 3.6870e-04
Epoch 192/1000
83/83 [=====] - 10s 125ms/step - loss: 2.9677e-04
Epoch 193/1000
83/83 [=====] - 10s 125ms/step - loss: 3.4237e-04
Epoch 194/1000
83/83 [=====] - 10s 125ms/step - loss: 3.4187e-04
Epoch 195/1000
83/83 [=====] - 10s 125ms/step - loss: 3.1959e-04
Epoch 196/1000
83/83 [=====] - 10s 125ms/step - loss: 3.1561e-04
Epoch 197/1000
83/83 [=====] - 10s 126ms/step - loss: 3.4629e-04
Epoch 198/1000
83/83 [=====] - 10s 125ms/step - loss: 3.8239e-04
Epoch 199/1000
83/83 [=====] - 11s 127ms/step - loss: 3.7013e-04
Epoch 200/1000
83/83 [=====] - 11s 136ms/step - loss: 3.0993e-04

Epoch 201/1000
83/83 [=====] - 10s 125ms/step - loss: 3.0415e-04
Epoch 202/1000
83/83 [=====] - 10s 126ms/step - loss: 2.9362e-04
Epoch 203/1000
83/83 [=====] - 10s 125ms/step - loss: 3.1401e-04
Epoch 204/1000
83/83 [=====] - 10s 125ms/step - loss: 2.9891e-04
Epoch 205/1000
83/83 [=====] - 10s 124ms/step - loss: 3.7498e-04
Epoch 206/1000
83/83 [=====] - 10s 125ms/step - loss: 2.9793e-04
Epoch 207/1000
83/83 [=====] - 10s 122ms/step - loss: 2.9151e-04
Epoch 208/1000
83/83 [=====] - 10s 125ms/step - loss: 3.4500e-04
Epoch 209/1000
83/83 [=====] - 10s 124ms/step - loss: 3.0975e-04
Epoch 210/1000
83/83 [=====] - 10s 123ms/step - loss: 3.8221e-04
Epoch 211/1000
83/83 [=====] - 10s 123ms/step - loss: 3.0981e-04
Epoch 212/1000
83/83 [=====] - 10s 123ms/step - loss: 3.0054e-04
Epoch 213/1000
83/83 [=====] - 10s 124ms/step - loss: 3.1767e-04
Epoch 214/1000
83/83 [=====] - 11s 127ms/step - loss: 3.1098e-04
Epoch 215/1000
83/83 [=====] - 12s 145ms/step - loss: 3.4579e-04
Epoch 216/1000
83/83 [=====] - 10s 126ms/step - loss: 3.2460e-04
Epoch 217/1000
83/83 [=====] - 10s 124ms/step - loss: 3.8200e-04
Epoch 218/1000
83/83 [=====] - 10s 125ms/step - loss: 3.2018e-04
Epoch 219/1000
83/83 [=====] - 10s 124ms/step - loss: 2.9556e-04
Epoch 220/1000
83/83 [=====] - 10s 125ms/step - loss: 3.1322e-04
Epoch 221/1000
83/83 [=====] - 10s 124ms/step - loss: 3.2210e-04
Epoch 222/1000
83/83 [=====] - 10s 122ms/step - loss: 3.0888e-04
Epoch 223/1000
83/83 [=====] - 10s 122ms/step - loss: 3.2461e-04
Epoch 224/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0775e-04

Epoch 225/1000
83/83 [=====] - 10s 123ms/step - loss: 3.1009e-04
Epoch 226/1000
83/83 [=====] - 10s 122ms/step - loss: 2.9813e-04
Epoch 227/1000
83/83 [=====] - 10s 122ms/step - loss: 3.2630e-04
Epoch 228/1000
83/83 [=====] - 10s 123ms/step - loss: 2.9996e-04
Epoch 229/1000
83/83 [=====] - 11s 134ms/step - loss: 3.3485e-04
Epoch 230/1000
83/83 [=====] - 10s 122ms/step - loss: 2.9304e-04
Epoch 231/1000
83/83 [=====] - 10s 123ms/step - loss: 3.2144e-04
Epoch 232/1000
83/83 [=====] - 10s 121ms/step - loss: 3.2725e-04
Epoch 233/1000
83/83 [=====] - 10s 122ms/step - loss: 3.3808e-04
Epoch 234/1000
83/83 [=====] - 10s 122ms/step - loss: 3.1759e-04
Epoch 235/1000
83/83 [=====] - 10s 122ms/step - loss: 3.4669e-04
Epoch 236/1000
83/83 [=====] - 10s 122ms/step - loss: 3.2588e-04
Epoch 237/1000
83/83 [=====] - 10s 123ms/step - loss: 3.0200e-04
Epoch 238/1000
83/83 [=====] - 10s 122ms/step - loss: 3.2507e-04
Epoch 239/1000
83/83 [=====] - 10s 122ms/step - loss: 3.0099e-04
Epoch 240/1000
83/83 [=====] - 10s 121ms/step - loss: 3.2685e-04
Epoch 241/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7979e-04
Epoch 242/1000
83/83 [=====] - 10s 122ms/step - loss: 2.9321e-04
Epoch 243/1000
83/83 [=====] - 10s 122ms/step - loss: 3.1917e-04
Epoch 244/1000
83/83 [=====] - 11s 127ms/step - loss: 2.8162e-04
Epoch 245/1000
83/83 [=====] - 12s 141ms/step - loss: 2.9013e-04
Epoch 246/1000
83/83 [=====] - 10s 122ms/step - loss: 3.0542e-04
Epoch 247/1000
83/83 [=====] - 10s 123ms/step - loss: 3.5523e-04
Epoch 248/1000
83/83 [=====] - 10s 123ms/step - loss: 3.0230e-04

Epoch 249/1000
83/83 [=====] - 10s 123ms/step - loss: 3.6773e-04
Epoch 250/1000
83/83 [=====] - 10s 124ms/step - loss: 3.4222e-04
Epoch 251/1000
83/83 [=====] - 10s 124ms/step - loss: 2.8657e-04
Epoch 252/1000
83/83 [=====] - 10s 124ms/step - loss: 2.7689e-04
Epoch 253/1000
83/83 [=====] - 10s 123ms/step - loss: 3.0323e-04
Epoch 254/1000
83/83 [=====] - 10s 124ms/step - loss: 2.8754e-04
Epoch 255/1000
83/83 [=====] - 10s 124ms/step - loss: 2.9983e-04
Epoch 256/1000
83/83 [=====] - 11s 128ms/step - loss: 3.0290e-04
Epoch 257/1000
83/83 [=====] - 10s 126ms/step - loss: 3.3363e-04
Epoch 258/1000
83/83 [=====] - 11s 135ms/step - loss: 2.7673e-04
Epoch 259/1000
83/83 [=====] - 10s 123ms/step - loss: 3.5849e-04
Epoch 260/1000
83/83 [=====] - 10s 124ms/step - loss: 3.1873e-04
Epoch 261/1000
83/83 [=====] - 10s 123ms/step - loss: 2.9864e-04
Epoch 262/1000
83/83 [=====] - 10s 124ms/step - loss: 3.1303e-04
Epoch 263/1000
83/83 [=====] - 10s 122ms/step - loss: 2.9485e-04
Epoch 264/1000
83/83 [=====] - 10s 122ms/step - loss: 3.2568e-04
Epoch 265/1000
83/83 [=====] - 10s 122ms/step - loss: 3.3228e-04
Epoch 266/1000
83/83 [=====] - 10s 123ms/step - loss: 3.2310e-04
Epoch 267/1000
83/83 [=====] - 10s 123ms/step - loss: 3.2809e-04
Epoch 268/1000
83/83 [=====] - 10s 122ms/step - loss: 3.0821e-04
Epoch 269/1000
83/83 [=====] - 10s 123ms/step - loss: 3.1030e-04
Epoch 270/1000
83/83 [=====] - 10s 122ms/step - loss: 3.7850e-04
Epoch 271/1000
83/83 [=====] - 10s 123ms/step - loss: 3.0675e-04
Epoch 272/1000
83/83 [=====] - 10s 124ms/step - loss: 3.1348e-04

Epoch 273/1000
83/83 [=====] - 10s 123ms/step - loss: 2.9347e-04
Epoch 274/1000
83/83 [=====] - 11s 133ms/step - loss: 2.9205e-04
Epoch 275/1000
83/83 [=====] - 11s 137ms/step - loss: 3.8240e-04
Epoch 276/1000
83/83 [=====] - 10s 122ms/step - loss: 3.0970e-04
Epoch 277/1000
83/83 [=====] - 10s 123ms/step - loss: 2.8770e-04
Epoch 278/1000
83/83 [=====] - 10s 124ms/step - loss: 3.0363e-04
Epoch 279/1000
83/83 [=====] - 10s 124ms/step - loss: 3.0919e-04
Epoch 280/1000
83/83 [=====] - 10s 124ms/step - loss: 2.9671e-04
Epoch 281/1000
83/83 [=====] - 10s 122ms/step - loss: 3.0994e-04
Epoch 282/1000
83/83 [=====] - 10s 122ms/step - loss: 3.1101e-04
Epoch 283/1000
83/83 [=====] - 10s 123ms/step - loss: 2.9607e-04
Epoch 284/1000
83/83 [=====] - 10s 123ms/step - loss: 3.1431e-04
Epoch 285/1000
83/83 [=====] - 10s 122ms/step - loss: 2.9348e-04
Epoch 286/1000
83/83 [=====] - 10s 123ms/step - loss: 3.0104e-04
Epoch 287/1000
83/83 [=====] - 10s 126ms/step - loss: 3.3993e-04
Epoch 288/1000
83/83 [=====] - 11s 131ms/step - loss: 3.0033e-04
Epoch 289/1000
83/83 [=====] - 10s 123ms/step - loss: 3.1468e-04
Epoch 290/1000
83/83 [=====] - 10s 123ms/step - loss: 3.2645e-04
Epoch 291/1000
83/83 [=====] - 10s 122ms/step - loss: 3.2174e-04
Epoch 292/1000
83/83 [=====] - 10s 121ms/step - loss: 3.1317e-04
Epoch 293/1000
83/83 [=====] - 10s 121ms/step - loss: 3.4212e-04
Epoch 294/1000
83/83 [=====] - 10s 121ms/step - loss: 3.1087e-04
Epoch 295/1000
83/83 [=====] - 10s 121ms/step - loss: 3.2917e-04
Epoch 296/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0908e-04

Epoch 297/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9115e-04
Epoch 298/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0750e-04
Epoch 299/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8967e-04
Epoch 300/1000
83/83 [=====] - 10s 122ms/step - loss: 3.0750e-04
Epoch 301/1000
83/83 [=====] - 10s 121ms/step - loss: 3.3915e-04
Epoch 302/1000
83/83 [=====] - 10s 122ms/step - loss: 3.1928e-04
Epoch 303/1000
83/83 [=====] - 10s 122ms/step - loss: 2.8916e-04
Epoch 304/1000
83/83 [=====] - 11s 131ms/step - loss: 3.2994e-04
Epoch 305/1000
83/83 [=====] - 11s 134ms/step - loss: 3.2643e-04
Epoch 306/1000
83/83 [=====] - 10s 122ms/step - loss: 3.3014e-04
Epoch 307/1000
83/83 [=====] - 10s 121ms/step - loss: 3.1788e-04
Epoch 308/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8307e-04
Epoch 309/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8285e-04
Epoch 310/1000
83/83 [=====] - 10s 120ms/step - loss: 3.3309e-04
Epoch 311/1000
83/83 [=====] - 10s 120ms/step - loss: 3.2206e-04
Epoch 312/1000
83/83 [=====] - 10s 121ms/step - loss: 3.1130e-04
Epoch 313/1000
83/83 [=====] - 10s 122ms/step - loss: 3.0728e-04
Epoch 314/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8024e-04
Epoch 315/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8002e-04
Epoch 316/1000
83/83 [=====] - 10s 119ms/step - loss: 2.8509e-04
Epoch 317/1000
83/83 [=====] - 11s 129ms/step - loss: 2.4884e-04
Epoch 318/1000
83/83 [=====] - 10s 125ms/step - loss: 2.9486e-04
Epoch 319/1000
83/83 [=====] - 11s 129ms/step - loss: 2.9345e-04
Epoch 320/1000
83/83 [=====] - 10s 121ms/step - loss: 3.2007e-04

Epoch 321/1000
83/83 [=====] - 10s 120ms/step - loss: 3.0500e-04
Epoch 322/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8347e-04
Epoch 323/1000
83/83 [=====] - 10s 121ms/step - loss: 3.1313e-04
Epoch 324/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0594e-04
Epoch 325/1000
83/83 [=====] - 10s 121ms/step - loss: 3.2346e-04
Epoch 326/1000
83/83 [=====] - 10s 121ms/step - loss: 3.1017e-04
Epoch 327/1000
83/83 [=====] - 10s 120ms/step - loss: 3.1794e-04
Epoch 328/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7953e-04
Epoch 329/1000
83/83 [=====] - 10s 120ms/step - loss: 3.0505e-04
Epoch 330/1000
83/83 [=====] - 10s 122ms/step - loss: 3.0727e-04
Epoch 331/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9692e-04
Epoch 332/1000
83/83 [=====] - 10s 123ms/step - loss: 3.2481e-04
Epoch 333/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0718e-04
Epoch 334/1000
83/83 [=====] - 10s 124ms/step - loss: 2.8431e-04
Epoch 335/1000
83/83 [=====] - 12s 142ms/step - loss: 2.9821e-04
Epoch 336/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8208e-04
Epoch 337/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8912e-04
Epoch 338/1000
83/83 [=====] - 10s 120ms/step - loss: 3.1765e-04
Epoch 339/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7684e-04
Epoch 340/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8984e-04
Epoch 341/1000
83/83 [=====] - 10s 120ms/step - loss: 3.0487e-04
Epoch 342/1000
83/83 [=====] - 10s 121ms/step - loss: 3.1111e-04
Epoch 343/1000
83/83 [=====] - 10s 120ms/step - loss: 3.2031e-04
Epoch 344/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0583e-04

Epoch 345/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7031e-04
Epoch 346/1000
83/83 [=====] - 10s 122ms/step - loss: 2.8857e-04
Epoch 347/1000
83/83 [=====] - 11s 131ms/step - loss: 3.0566e-04
Epoch 348/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9183e-04
Epoch 349/1000
83/83 [=====] - 10s 120ms/step - loss: 3.2055e-04
Epoch 350/1000
83/83 [=====] - 10s 120ms/step - loss: 2.6738e-04
Epoch 351/1000
83/83 [=====] - 10s 120ms/step - loss: 3.2586e-04
Epoch 352/1000
83/83 [=====] - 10s 120ms/step - loss: 2.6439e-04
Epoch 353/1000
83/83 [=====] - 10s 119ms/step - loss: 3.1574e-04
Epoch 354/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7323e-04
Epoch 355/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7770e-04
Epoch 356/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7251e-04
Epoch 357/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8180e-04
Epoch 358/1000
83/83 [=====] - 10s 121ms/step - loss: 3.1209e-04
Epoch 359/1000
83/83 [=====] - 10s 120ms/step - loss: 3.0776e-04
Epoch 360/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7337e-04
Epoch 361/1000
83/83 [=====] - 10s 120ms/step - loss: 3.1895e-04
Epoch 362/1000
83/83 [=====] - 10s 121ms/step - loss: 3.2140e-04
Epoch 363/1000
83/83 [=====] - 10s 120ms/step - loss: 2.6880e-04
Epoch 364/1000
83/83 [=====] - 10s 121ms/step - loss: 3.2242e-04
Epoch 365/1000
83/83 [=====] - 11s 137ms/step - loss: 2.8772e-04
Epoch 366/1000
83/83 [=====] - 11s 127ms/step - loss: 3.1552e-04
Epoch 367/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0362e-04
Epoch 368/1000
83/83 [=====] - 10s 120ms/step - loss: 3.1620e-04

Epoch 369/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9231e-04
Epoch 370/1000
83/83 [=====] - 10s 120ms/step - loss: 3.2808e-04
Epoch 371/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7988e-04
Epoch 372/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6155e-04
Epoch 373/1000
83/83 [=====] - 10s 120ms/step - loss: 3.2552e-04
Epoch 374/1000
83/83 [=====] - 10s 120ms/step - loss: 2.6705e-04
Epoch 375/1000
83/83 [=====] - 10s 120ms/step - loss: 3.0424e-04
Epoch 376/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8562e-04
Epoch 377/1000
83/83 [=====] - 11s 133ms/step - loss: 3.1213e-04
Epoch 378/1000
83/83 [=====] - 10s 122ms/step - loss: 3.1158e-04
Epoch 379/1000
83/83 [=====] - 10s 122ms/step - loss: 2.8604e-04
Epoch 380/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8714e-04
Epoch 381/1000
83/83 [=====] - 10s 121ms/step - loss: 2.5901e-04
Epoch 382/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0143e-04
Epoch 383/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8517e-04
Epoch 384/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7766e-04
Epoch 385/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7917e-04
Epoch 386/1000
83/83 [=====] - 10s 119ms/step - loss: 2.7371e-04
Epoch 387/1000
83/83 [=====] - 10s 120ms/step - loss: 3.2434e-04
Epoch 388/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7786e-04
Epoch 389/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8307e-04
Epoch 390/1000
83/83 [=====] - 10s 120ms/step - loss: 3.0709e-04
Epoch 391/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9545e-04
Epoch 392/1000
83/83 [=====] - 10s 122ms/step - loss: 2.7558e-04

Epoch 393/1000
83/83 [=====] - 10s 122ms/step - loss: 2.6828e-04
Epoch 394/1000
83/83 [=====] - 10s 122ms/step - loss: 2.8476e-04
Epoch 395/1000
83/83 [=====] - 10s 126ms/step - loss: 2.6344e-04
Epoch 396/1000
83/83 [=====] - 11s 136ms/step - loss: 2.9428e-04
Epoch 397/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7655e-04
Epoch 398/1000
83/83 [=====] - 10s 120ms/step - loss: 3.0763e-04
Epoch 399/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7403e-04
Epoch 400/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6312e-04
Epoch 401/1000
83/83 [=====] - 10s 120ms/step - loss: 2.5181e-04
Epoch 402/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9543e-04
Epoch 403/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0652e-04
Epoch 404/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8899e-04
Epoch 405/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8743e-04
Epoch 406/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9569e-04
Epoch 407/1000
83/83 [=====] - 11s 134ms/step - loss: 2.8874e-04
Epoch 408/1000
83/83 [=====] - 10s 120ms/step - loss: 3.1931e-04
Epoch 409/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0862e-04
Epoch 410/1000
83/83 [=====] - 10s 119ms/step - loss: 2.5723e-04
Epoch 411/1000
83/83 [=====] - 10s 120ms/step - loss: 3.1180e-04
Epoch 412/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7932e-04
Epoch 413/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7160e-04
Epoch 414/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9436e-04
Epoch 415/1000
83/83 [=====] - 10s 120ms/step - loss: 3.2604e-04
Epoch 416/1000
83/83 [=====] - 10s 120ms/step - loss: 3.1477e-04

Epoch 417/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8828e-04
Epoch 418/1000
83/83 [=====] - 10s 121ms/step - loss: 2.5481e-04
Epoch 419/1000
83/83 [=====] - 10s 119ms/step - loss: 3.0311e-04
Epoch 420/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7161e-04
Epoch 421/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7651e-04
Epoch 422/1000
83/83 [=====] - 10s 121ms/step - loss: 3.1125e-04
Epoch 423/1000
83/83 [=====] - 10s 121ms/step - loss: 3.1685e-04
Epoch 424/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9359e-04
Epoch 425/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7848e-04
Epoch 426/1000
83/83 [=====] - 11s 137ms/step - loss: 3.2613e-04
Epoch 427/1000
83/83 [=====] - 10s 125ms/step - loss: 2.8619e-04
Epoch 428/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8842e-04
Epoch 429/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9537e-04
Epoch 430/1000
83/83 [=====] - 10s 122ms/step - loss: 3.1666e-04
Epoch 431/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7628e-04
Epoch 432/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8260e-04
Epoch 433/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8810e-04
Epoch 434/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9223e-04
Epoch 435/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6695e-04
Epoch 436/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8499e-04
Epoch 437/1000
83/83 [=====] - 11s 133ms/step - loss: 2.9295e-04
Epoch 438/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8140e-04
Epoch 439/1000
83/83 [=====] - 10s 120ms/step - loss: 3.0114e-04
Epoch 440/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8651e-04

Epoch 441/1000
83/83 [=====] - 10s 120ms/step - loss: 2.5669e-04
Epoch 442/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8582e-04
Epoch 443/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9106e-04
Epoch 444/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8046e-04
Epoch 445/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7958e-04
Epoch 446/1000
83/83 [=====] - 10s 122ms/step - loss: 2.7125e-04
Epoch 447/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8479e-04
Epoch 448/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9034e-04
Epoch 449/1000
83/83 [=====] - 10s 120ms/step - loss: 3.0681e-04
Epoch 450/1000
83/83 [=====] - 10s 121ms/step - loss: 3.1847e-04
Epoch 451/1000
83/83 [=====] - 10s 122ms/step - loss: 2.7202e-04
Epoch 452/1000
83/83 [=====] - 10s 122ms/step - loss: 2.8648e-04
Epoch 453/1000
83/83 [=====] - 10s 123ms/step - loss: 2.9197e-04
Epoch 454/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0892e-04
Epoch 455/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8154e-04
Epoch 456/1000
83/83 [=====] - 11s 130ms/step - loss: 2.8379e-04
Epoch 457/1000
83/83 [=====] - 11s 135ms/step - loss: 2.8217e-04
Epoch 458/1000
83/83 [=====] - 10s 120ms/step - loss: 2.6166e-04
Epoch 459/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6538e-04
Epoch 460/1000
83/83 [=====] - 10s 122ms/step - loss: 2.7276e-04
Epoch 461/1000
83/83 [=====] - 10s 122ms/step - loss: 3.0435e-04
Epoch 462/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7339e-04
Epoch 463/1000
83/83 [=====] - 10s 123ms/step - loss: 2.6529e-04
Epoch 464/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9825e-04

Epoch 465/1000
83/83 [=====] - 10s 122ms/step - loss: 2.8624e-04
Epoch 466/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8148e-04
Epoch 467/1000
83/83 [=====] - 11s 132ms/step - loss: 2.7205e-04
Epoch 468/1000
83/83 [=====] - 10s 121ms/step - loss: 3.3095e-04
Epoch 469/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8847e-04
Epoch 470/1000
83/83 [=====] - 10s 122ms/step - loss: 3.1150e-04
Epoch 471/1000
83/83 [=====] - 10s 122ms/step - loss: 2.7885e-04
Epoch 472/1000
83/83 [=====] - 10s 121ms/step - loss: 3.1784e-04
Epoch 473/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6991e-04
Epoch 474/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6933e-04
Epoch 475/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6881e-04
Epoch 476/1000
83/83 [=====] - 10s 122ms/step - loss: 2.9471e-04
Epoch 477/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9874e-04
Epoch 478/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6552e-04
Epoch 479/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6636e-04
Epoch 480/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8673e-04
Epoch 481/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7473e-04
Epoch 482/1000
83/83 [=====] - 10s 121ms/step - loss: 3.1338e-04
Epoch 483/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9213e-04
Epoch 484/1000
83/83 [=====] - 10s 120ms/step - loss: 2.6383e-04
Epoch 485/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7697e-04
Epoch 486/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8294e-04
Epoch 487/1000
83/83 [=====] - 12s 142ms/step - loss: 2.8982e-04
Epoch 488/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0571e-04

Epoch 489/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6766e-04
Epoch 490/1000
83/83 [=====] - 10s 120ms/step - loss: 2.6276e-04
Epoch 491/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7244e-04
Epoch 492/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9288e-04
Epoch 493/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8785e-04
Epoch 494/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7452e-04
Epoch 495/1000
83/83 [=====] - 10s 122ms/step - loss: 3.2860e-04
Epoch 496/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7437e-04
Epoch 497/1000
83/83 [=====] - 11s 133ms/step - loss: 2.7185e-04
Epoch 498/1000
83/83 [=====] - 10s 122ms/step - loss: 3.0313e-04
Epoch 499/1000
83/83 [=====] - 10s 122ms/step - loss: 2.7529e-04
Epoch 500/1000
83/83 [=====] - 10s 122ms/step - loss: 2.8732e-04
Epoch 501/1000
83/83 [=====] - 10s 121ms/step - loss: 3.1426e-04
Epoch 502/1000
83/83 [=====] - 10s 121ms/step - loss: 2.5268e-04
Epoch 503/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0873e-04
Epoch 504/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6407e-04
Epoch 505/1000
83/83 [=====] - 10s 122ms/step - loss: 2.8245e-04
Epoch 506/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8982e-04
Epoch 507/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7066e-04
Epoch 508/1000
83/83 [=====] - 10s 122ms/step - loss: 2.8756e-04
Epoch 509/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7359e-04
Epoch 510/1000
83/83 [=====] - 10s 120ms/step - loss: 2.4928e-04
Epoch 511/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7472e-04
Epoch 512/1000
83/83 [=====] - 10s 122ms/step - loss: 2.8544e-04

Epoch 513/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9414e-04
Epoch 514/1000
83/83 [=====] - 10s 120ms/step - loss: 2.5593e-04
Epoch 515/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8287e-04
Epoch 516/1000
83/83 [=====] - 10s 121ms/step - loss: 3.1312e-04
Epoch 517/1000
83/83 [=====] - 12s 139ms/step - loss: 2.7266e-04
Epoch 518/1000
83/83 [=====] - 10s 124ms/step - loss: 3.0842e-04
Epoch 519/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9294e-04
Epoch 520/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9085e-04
Epoch 521/1000
83/83 [=====] - 10s 121ms/step - loss: 3.2488e-04
Epoch 522/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8209e-04
Epoch 523/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9386e-04
Epoch 524/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6622e-04
Epoch 525/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9369e-04
Epoch 526/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7408e-04
Epoch 527/1000
83/83 [=====] - 11s 131ms/step - loss: 2.7359e-04
Epoch 528/1000
83/83 [=====] - 10s 121ms/step - loss: 2.5388e-04
Epoch 529/1000
83/83 [=====] - 11s 128ms/step - loss: 2.8341e-04
Epoch 530/1000
83/83 [=====] - 11s 127ms/step - loss: 2.7922e-04
Epoch 531/1000
83/83 [=====] - 11s 127ms/step - loss: 2.7560e-04
Epoch 532/1000
83/83 [=====] - 10s 126ms/step - loss: 2.5692e-04
Epoch 533/1000
83/83 [=====] - 10s 124ms/step - loss: 2.8872e-04
Epoch 534/1000
83/83 [=====] - 10s 125ms/step - loss: 2.8343e-04
Epoch 535/1000
83/83 [=====] - 11s 127ms/step - loss: 2.7328e-04
Epoch 536/1000
83/83 [=====] - 10s 125ms/step - loss: 2.7215e-04

Epoch 537/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6656e-04
Epoch 538/1000
83/83 [=====] - 10s 121ms/step - loss: 2.5416e-04
Epoch 539/1000
83/83 [=====] - 10s 123ms/step - loss: 2.4470e-04
Epoch 540/1000
83/83 [=====] - 10s 122ms/step - loss: 3.1143e-04
Epoch 541/1000
83/83 [=====] - 10s 122ms/step - loss: 3.0269e-04
Epoch 542/1000
83/83 [=====] - 10s 125ms/step - loss: 2.6301e-04
Epoch 543/1000
83/83 [=====] - 10s 122ms/step - loss: 2.7980e-04
Epoch 544/1000
83/83 [=====] - 10s 122ms/step - loss: 2.6222e-04
Epoch 545/1000
83/83 [=====] - 10s 122ms/step - loss: 3.2286e-04
Epoch 546/1000
83/83 [=====] - 10s 122ms/step - loss: 2.7377e-04
Epoch 547/1000
83/83 [=====] - 13s 158ms/step - loss: 2.8285e-04
Epoch 548/1000
83/83 [=====] - 10s 122ms/step - loss: 2.7432e-04
Epoch 549/1000
83/83 [=====] - 10s 122ms/step - loss: 2.8094e-04
Epoch 550/1000
83/83 [=====] - 10s 122ms/step - loss: 2.9211e-04
Epoch 551/1000
83/83 [=====] - 10s 122ms/step - loss: 2.8943e-04
Epoch 552/1000
83/83 [=====] - 10s 122ms/step - loss: 2.6102e-04
Epoch 553/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7791e-04
Epoch 554/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6194e-04
Epoch 555/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7765e-04
Epoch 556/1000
83/83 [=====] - 11s 132ms/step - loss: 2.5927e-04
Epoch 557/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0803e-04
Epoch 558/1000
83/83 [=====] - 10s 122ms/step - loss: 2.5945e-04
Epoch 559/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8087e-04
Epoch 560/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9804e-04

Epoch 561/1000
83/83 [=====] - 10s 122ms/step - loss: 2.7939e-04
Epoch 562/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7238e-04
Epoch 563/1000
83/83 [=====] - 10s 122ms/step - loss: 2.9925e-04
Epoch 564/1000
83/83 [=====] - 10s 122ms/step - loss: 2.8865e-04
Epoch 565/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8775e-04
Epoch 566/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7082e-04
Epoch 567/1000
83/83 [=====] - 10s 121ms/step - loss: 2.5919e-04
Epoch 568/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0970e-04
Epoch 569/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6900e-04
Epoch 570/1000
83/83 [=====] - 11s 133ms/step - loss: 2.3704e-04
Epoch 571/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6223e-04
Epoch 572/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7019e-04
Epoch 573/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8366e-04
Epoch 574/1000
83/83 [=====] - 10s 119ms/step - loss: 3.1253e-04
Epoch 575/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8470e-04
Epoch 576/1000
83/83 [=====] - 10s 119ms/step - loss: 2.8020e-04
Epoch 577/1000
83/83 [=====] - 11s 135ms/step - loss: 2.5707e-04
Epoch 578/1000
83/83 [=====] - 10s 126ms/step - loss: 3.0124e-04
Epoch 579/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7643e-04
Epoch 580/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6192e-04
Epoch 581/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8528e-04
Epoch 582/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7719e-04
Epoch 583/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7400e-04
Epoch 584/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7073e-04

Epoch 585/1000
83/83 [=====] - 10s 119ms/step - loss: 2.7485e-04
Epoch 586/1000
83/83 [=====] - 11s 134ms/step - loss: 2.5959e-04
Epoch 587/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8346e-04
Epoch 588/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9729e-04
Epoch 589/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9456e-04
Epoch 590/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9531e-04
Epoch 591/1000
83/83 [=====] - 10s 121ms/step - loss: 2.5771e-04
Epoch 592/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8468e-04
Epoch 593/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7822e-04
Epoch 594/1000
83/83 [=====] - 10s 124ms/step - loss: 2.5041e-04
Epoch 595/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7933e-04
Epoch 596/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6739e-04
Epoch 597/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7830e-04
Epoch 598/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8294e-04
Epoch 599/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8264e-04
Epoch 600/1000
83/83 [=====] - 11s 133ms/step - loss: 2.7402e-04
Epoch 601/1000
83/83 [=====] - 13s 154ms/step - loss: 3.0219e-04
Epoch 602/1000
83/83 [=====] - 13s 156ms/step - loss: 3.0756e-04
Epoch 603/1000
83/83 [=====] - 12s 150ms/step - loss: 2.6367e-04
Epoch 604/1000
83/83 [=====] - 13s 155ms/step - loss: 2.6094e-04
Epoch 605/1000
83/83 [=====] - 13s 152ms/step - loss: 2.6988e-04
Epoch 606/1000
83/83 [=====] - 14s 168ms/step - loss: 2.8818e-04
Epoch 607/1000
83/83 [=====] - 12s 150ms/step - loss: 3.0980e-04
Epoch 608/1000
83/83 [=====] - 13s 154ms/step - loss: 2.7305e-04

Epoch 609/1000
83/83 [=====] - 12s 150ms/step - loss: 2.6828e-04
Epoch 610/1000
83/83 [=====] - 12s 149ms/step - loss: 2.8462e-04
Epoch 611/1000
83/83 [=====] - 13s 151ms/step - loss: 2.9665e-04
Epoch 612/1000
83/83 [=====] - 13s 153ms/step - loss: 2.9420e-04
Epoch 613/1000
83/83 [=====] - 13s 155ms/step - loss: 2.9915e-04
Epoch 614/1000
83/83 [=====] - 13s 154ms/step - loss: 2.8534e-04
Epoch 615/1000
83/83 [=====] - 13s 156ms/step - loss: 2.5314e-04
Epoch 616/1000
83/83 [=====] - 13s 160ms/step - loss: 2.6437e-04
Epoch 617/1000
83/83 [=====] - 12s 148ms/step - loss: 2.6854e-04
Epoch 618/1000
83/83 [=====] - 13s 155ms/step - loss: 2.7720e-04
Epoch 619/1000
83/83 [=====] - 13s 151ms/step - loss: 2.8534e-04
Epoch 620/1000
83/83 [=====] - 12s 149ms/step - loss: 2.6725e-04
Epoch 621/1000
83/83 [=====] - 13s 151ms/step - loss: 2.8962e-04
Epoch 622/1000
83/83 [=====] - 13s 157ms/step - loss: 2.7987e-04
Epoch 623/1000
83/83 [=====] - 13s 162ms/step - loss: 2.8519e-04
Epoch 624/1000
83/83 [=====] - 12s 146ms/step - loss: 2.6421e-04
Epoch 625/1000
83/83 [=====] - 12s 148ms/step - loss: 2.5401e-04
Epoch 626/1000
83/83 [=====] - 12s 150ms/step - loss: 2.9390e-04
Epoch 627/1000
83/83 [=====] - 12s 149ms/step - loss: 2.8810e-04
Epoch 628/1000
83/83 [=====] - 13s 153ms/step - loss: 2.8390e-04
Epoch 629/1000
83/83 [=====] - 11s 133ms/step - loss: 2.5436e-04
Epoch 630/1000
83/83 [=====] - 10s 124ms/step - loss: 3.0933e-04
Epoch 631/1000
83/83 [=====] - 11s 138ms/step - loss: 2.9008e-04
Epoch 632/1000
83/83 [=====] - 10s 122ms/step - loss: 3.0670e-04

Epoch 633/1000
83/83 [=====] - 10s 122ms/step - loss: 2.7031e-04
Epoch 634/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7055e-04
Epoch 635/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9040e-04
Epoch 636/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8466e-04
Epoch 637/1000
83/83 [=====] - 10s 120ms/step - loss: 2.6115e-04
Epoch 638/1000
83/83 [=====] - 11s 135ms/step - loss: 2.5846e-04
Epoch 639/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8113e-04
Epoch 640/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9124e-04
Epoch 641/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6468e-04
Epoch 642/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9194e-04
Epoch 643/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7268e-04
Epoch 644/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6260e-04
Epoch 645/1000
83/83 [=====] - 10s 121ms/step - loss: 2.5525e-04
Epoch 646/1000
83/83 [=====] - 10s 120ms/step - loss: 2.6997e-04
Epoch 647/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7624e-04
Epoch 648/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7554e-04
Epoch 649/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6196e-04
Epoch 650/1000
83/83 [=====] - 10s 123ms/step - loss: 2.7163e-04
Epoch 651/1000
83/83 [=====] - 10s 124ms/step - loss: 2.7204e-04
Epoch 652/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7852e-04
Epoch 653/1000
83/83 [=====] - 10s 119ms/step - loss: 2.7964e-04
Epoch 654/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9287e-04
Epoch 655/1000
83/83 [=====] - 10s 119ms/step - loss: 2.5773e-04
Epoch 656/1000
83/83 [=====] - 10s 119ms/step - loss: 2.6611e-04

Epoch 657/1000
83/83 [=====] - 10s 119ms/step - loss: 2.9407e-04
Epoch 658/1000
83/83 [=====] - 10s 119ms/step - loss: 2.5179e-04
Epoch 659/1000
83/83 [=====] - 10s 118ms/step - loss: 2.7675e-04
Epoch 660/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6458e-04
Epoch 661/1000
83/83 [=====] - 12s 141ms/step - loss: 2.5684e-04
Epoch 662/1000
83/83 [=====] - 10s 122ms/step - loss: 2.7786e-04
Epoch 663/1000
83/83 [=====] - 10s 121ms/step - loss: 2.4679e-04
Epoch 664/1000
83/83 [=====] - 10s 120ms/step - loss: 2.5930e-04
Epoch 665/1000
83/83 [=====] - 10s 118ms/step - loss: 2.9804e-04
Epoch 666/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8195e-04
Epoch 667/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6907e-04
Epoch 668/1000
83/83 [=====] - 11s 132ms/step - loss: 2.5599e-04
Epoch 669/1000
83/83 [=====] - 10s 122ms/step - loss: 2.8910e-04
Epoch 670/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7970e-04
Epoch 671/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8271e-04
Epoch 672/1000
83/83 [=====] - 10s 121ms/step - loss: 2.5685e-04
Epoch 673/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7088e-04
Epoch 674/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0124e-04
Epoch 675/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7573e-04
Epoch 676/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9101e-04
Epoch 677/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6504e-04
Epoch 678/1000
83/83 [=====] - 10s 121ms/step - loss: 2.5852e-04
Epoch 679/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8887e-04
Epoch 680/1000
83/83 [=====] - 10s 126ms/step - loss: 2.5825e-04

Epoch 681/1000
83/83 [=====] - 13s 160ms/step - loss: 2.7240e-04
Epoch 682/1000
83/83 [=====] - 13s 160ms/step - loss: 3.4772e-04
Epoch 683/1000
83/83 [=====] - 11s 130ms/step - loss: 2.9600e-04
Epoch 684/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9371e-04
Epoch 685/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8702e-04
Epoch 686/1000
83/83 [=====] - 10s 121ms/step - loss: 3.1229e-04
Epoch 687/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9563e-04
Epoch 688/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8206e-04
Epoch 689/1000
83/83 [=====] - 10s 120ms/step - loss: 2.5353e-04
Epoch 690/1000
83/83 [=====] - 10s 126ms/step - loss: 2.8231e-04
Epoch 691/1000
83/83 [=====] - 12s 139ms/step - loss: 3.2127e-04
Epoch 692/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7480e-04
Epoch 693/1000
83/83 [=====] - 10s 121ms/step - loss: 2.5119e-04
Epoch 694/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9629e-04
Epoch 695/1000
83/83 [=====] - 10s 120ms/step - loss: 2.3961e-04
Epoch 696/1000
83/83 [=====] - 10s 121ms/step - loss: 3.0085e-04
Epoch 697/1000
83/83 [=====] - 11s 128ms/step - loss: 2.7676e-04
Epoch 698/1000
83/83 [=====] - 10s 125ms/step - loss: 2.4518e-04
Epoch 699/1000
83/83 [=====] - 10s 121ms/step - loss: 2.9083e-04
Epoch 700/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6980e-04
Epoch 701/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8168e-04
Epoch 702/1000
83/83 [=====] - 10s 122ms/step - loss: 2.8896e-04
Epoch 703/1000
83/83 [=====] - 10s 120ms/step - loss: 2.4892e-04
Epoch 704/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6464e-04

Epoch 705/1000
83/83 [=====] - 10s 121ms/step - loss: 2.5559e-04
Epoch 706/1000
83/83 [=====] - 10s 121ms/step - loss: 2.8672e-04
Epoch 707/1000
83/83 [=====] - 10s 121ms/step - loss: 2.5305e-04
Epoch 708/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7187e-04
Epoch 709/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6054e-04
Epoch 710/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8286e-04
Epoch 711/1000
83/83 [=====] - 10s 122ms/step - loss: 2.6216e-04
Epoch 712/1000
83/83 [=====] - 10s 119ms/step - loss: 2.7154e-04
Epoch 713/1000
83/83 [=====] - 10s 120ms/step - loss: 2.5999e-04
Epoch 714/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9006e-04
Epoch 715/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7400e-04
Epoch 716/1000
83/83 [=====] - 10s 119ms/step - loss: 2.7247e-04
Epoch 717/1000
83/83 [=====] - 10s 120ms/step - loss: 2.6218e-04
Epoch 718/1000
83/83 [=====] - 10s 119ms/step - loss: 2.8958e-04
Epoch 719/1000
83/83 [=====] - 10s 119ms/step - loss: 2.9553e-04
Epoch 720/1000
83/83 [=====] - 10s 120ms/step - loss: 2.4977e-04
Epoch 721/1000
83/83 [=====] - 11s 136ms/step - loss: 2.4580e-04
Epoch 722/1000
83/83 [=====] - 10s 125ms/step - loss: 2.9822e-04
Epoch 723/1000
83/83 [=====] - 10s 119ms/step - loss: 2.6230e-04
Epoch 724/1000
83/83 [=====] - 10s 119ms/step - loss: 2.5969e-04
Epoch 725/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7290e-04
Epoch 726/1000
83/83 [=====] - 10s 119ms/step - loss: 2.7165e-04
Epoch 727/1000
83/83 [=====] - 10s 121ms/step - loss: 2.7744e-04
Epoch 728/1000
83/83 [=====] - 10s 126ms/step - loss: 2.6784e-04

Epoch 729/1000
83/83 [=====] - 10s 119ms/step - loss: 2.8932e-04
Epoch 730/1000
83/83 [=====] - 10s 119ms/step - loss: 2.5428e-04
Epoch 731/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7886e-04
Epoch 732/1000
83/83 [=====] - 10s 119ms/step - loss: 2.6917e-04
Epoch 733/1000
83/83 [=====] - 10s 119ms/step - loss: 2.4908e-04
Epoch 734/1000
83/83 [=====] - 10s 119ms/step - loss: 2.7041e-04
Epoch 735/1000
83/83 [=====] - 10s 118ms/step - loss: 2.8967e-04
Epoch 736/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7512e-04
Epoch 737/1000
83/83 [=====] - 10s 118ms/step - loss: 2.7015e-04
Epoch 738/1000
83/83 [=====] - 10s 119ms/step - loss: 2.5410e-04
Epoch 739/1000
83/83 [=====] - 10s 119ms/step - loss: 2.3259e-04
Epoch 740/1000
83/83 [=====] - 10s 119ms/step - loss: 2.5278e-04
Epoch 741/1000
83/83 [=====] - 10s 118ms/step - loss: 2.8068e-04
Epoch 742/1000
83/83 [=====] - 10s 118ms/step - loss: 2.7441e-04
Epoch 743/1000
83/83 [=====] - 10s 120ms/step - loss: 2.5839e-04
Epoch 744/1000
83/83 [=====] - 10s 125ms/step - loss: 2.7894e-04
Epoch 745/1000
83/83 [=====] - 12s 141ms/step - loss: 2.5810e-04
Epoch 746/1000
83/83 [=====] - 10s 119ms/step - loss: 2.4861e-04
Epoch 747/1000
83/83 [=====] - 10s 119ms/step - loss: 2.8206e-04
Epoch 748/1000
83/83 [=====] - 11s 136ms/step - loss: 2.9287e-04
Epoch 749/1000
83/83 [=====] - 13s 159ms/step - loss: 2.6729e-04
Epoch 750/1000
83/83 [=====] - 13s 152ms/step - loss: 2.5286e-04
Epoch 751/1000
83/83 [=====] - 14s 171ms/step - loss: 2.5010e-04
Epoch 752/1000
83/83 [=====] - 13s 156ms/step - loss: 2.8200e-04

Epoch 753/1000
83/83 [=====] - 13s 154ms/step - loss: 2.6807e-04
Epoch 754/1000
83/83 [=====] - 13s 157ms/step - loss: 2.5900e-04
Epoch 755/1000
83/83 [=====] - 13s 161ms/step - loss: 2.9284e-04
Epoch 756/1000
83/83 [=====] - 11s 127ms/step - loss: 2.6343e-04
Epoch 757/1000
83/83 [=====] - 10s 119ms/step - loss: 2.8095e-04
Epoch 758/1000
83/83 [=====] - 10s 119ms/step - loss: 2.6999e-04
Epoch 759/1000
83/83 [=====] - 10s 120ms/step - loss: 2.5377e-04
Epoch 760/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7780e-04
Epoch 761/1000
83/83 [=====] - 10s 118ms/step - loss: 3.0378e-04
Epoch 762/1000
83/83 [=====] - 10s 119ms/step - loss: 2.5729e-04
Epoch 763/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6697e-04
Epoch 764/1000
83/83 [=====] - 10s 121ms/step - loss: 2.6758e-04
Epoch 765/1000
83/83 [=====] - 10s 120ms/step - loss: 3.3151e-04
Epoch 766/1000
83/83 [=====] - 10s 119ms/step - loss: 2.8150e-04
Epoch 767/1000
83/83 [=====] - 10s 119ms/step - loss: 2.4508e-04
Epoch 768/1000
83/83 [=====] - 10s 119ms/step - loss: 2.5305e-04
Epoch 769/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7211e-04
Epoch 770/1000
83/83 [=====] - 10s 118ms/step - loss: 2.8783e-04
Epoch 771/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9546e-04
Epoch 772/1000
83/83 [=====] - 10s 118ms/step - loss: 2.4337e-04
Epoch 773/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5527e-04
Epoch 774/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6015e-04
Epoch 775/1000
83/83 [=====] - 10s 118ms/step - loss: 2.8607e-04
Epoch 776/1000
83/83 [=====] - 10s 119ms/step - loss: 2.8365e-04

Epoch 777/1000
83/83 [=====] - 10s 119ms/step - loss: 2.7673e-04
Epoch 778/1000
83/83 [=====] - 10s 120ms/step - loss: 2.4453e-04
Epoch 779/1000
83/83 [=====] - 10s 118ms/step - loss: 2.8857e-04
Epoch 780/1000
83/83 [=====] - 11s 132ms/step - loss: 2.7233e-04
Epoch 781/1000
83/83 [=====] - 11s 129ms/step - loss: 2.5218e-04
Epoch 782/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7611e-04
Epoch 783/1000
83/83 [=====] - 10s 119ms/step - loss: 2.5863e-04
Epoch 784/1000
83/83 [=====] - 10s 118ms/step - loss: 2.8107e-04
Epoch 785/1000
83/83 [=====] - 10s 119ms/step - loss: 2.6385e-04
Epoch 786/1000
83/83 [=====] - 11s 130ms/step - loss: 2.5986e-04
Epoch 787/1000
83/83 [=====] - 11s 130ms/step - loss: 2.4881e-04
Epoch 788/1000
83/83 [=====] - 10s 122ms/step - loss: 2.7238e-04
Epoch 789/1000
83/83 [=====] - 12s 149ms/step - loss: 2.6147e-04
Epoch 790/1000
83/83 [=====] - 12s 150ms/step - loss: 2.7600e-04
Epoch 791/1000
83/83 [=====] - 12s 150ms/step - loss: 2.7155e-04
Epoch 792/1000
83/83 [=====] - 12s 148ms/step - loss: 2.5921e-04
Epoch 793/1000
83/83 [=====] - 12s 149ms/step - loss: 2.6505e-04
Epoch 794/1000
83/83 [=====] - 12s 148ms/step - loss: 2.8986e-04
Epoch 795/1000
83/83 [=====] - 12s 147ms/step - loss: 2.7542e-04
Epoch 796/1000
83/83 [=====] - 12s 148ms/step - loss: 2.5841e-04
Epoch 797/1000
83/83 [=====] - 12s 148ms/step - loss: 2.7967e-04
Epoch 798/1000
83/83 [=====] - 11s 136ms/step - loss: 2.6929e-04
Epoch 799/1000
83/83 [=====] - 10s 118ms/step - loss: 2.3534e-04
Epoch 800/1000
83/83 [=====] - 10s 118ms/step - loss: 2.7616e-04

Epoch 801/1000
83/83 [=====] - 10s 119ms/step - loss: 2.9075e-04
Epoch 802/1000
83/83 [=====] - 10s 120ms/step - loss: 2.7398e-04
Epoch 803/1000
83/83 [=====] - 10s 118ms/step - loss: 2.3529e-04
Epoch 804/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8049e-04
Epoch 805/1000
83/83 [=====] - 10s 119ms/step - loss: 2.7901e-04
Epoch 806/1000
83/83 [=====] - 10s 119ms/step - loss: 2.6857e-04
Epoch 807/1000
83/83 [=====] - 10s 118ms/step - loss: 2.8190e-04
Epoch 808/1000
83/83 [=====] - 10s 120ms/step - loss: 2.6473e-04
Epoch 809/1000
83/83 [=====] - 11s 139ms/step - loss: 2.8892e-04
Epoch 810/1000
83/83 [=====] - 10s 119ms/step - loss: 2.7287e-04
Epoch 811/1000
83/83 [=====] - 10s 119ms/step - loss: 2.6443e-04
Epoch 812/1000
83/83 [=====] - 10s 119ms/step - loss: 2.4939e-04
Epoch 813/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5720e-04
Epoch 814/1000
83/83 [=====] - 11s 129ms/step - loss: 2.6027e-04
Epoch 815/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6226e-04
Epoch 816/1000
83/83 [=====] - 10s 120ms/step - loss: 2.9686e-04
Epoch 817/1000
83/83 [=====] - 10s 117ms/step - loss: 2.7952e-04
Epoch 818/1000
83/83 [=====] - 10s 118ms/step - loss: 2.8397e-04
Epoch 819/1000
83/83 [=====] - 10s 119ms/step - loss: 2.6078e-04
Epoch 820/1000
83/83 [=====] - 10s 119ms/step - loss: 2.6661e-04
Epoch 821/1000
83/83 [=====] - 10s 120ms/step - loss: 2.8903e-04
Epoch 822/1000
83/83 [=====] - 10s 119ms/step - loss: 2.3138e-04
Epoch 823/1000
83/83 [=====] - 10s 118ms/step - loss: 2.7695e-04
Epoch 824/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5765e-04

Epoch 825/1000
83/83 [=====] - 10s 119ms/step - loss: 2.6053e-04
Epoch 826/1000
83/83 [=====] - 10s 119ms/step - loss: 2.7192e-04
Epoch 827/1000
83/83 [=====] - 10s 119ms/step - loss: 2.7983e-04
Epoch 828/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5680e-04
Epoch 829/1000
83/83 [=====] - 10s 119ms/step - loss: 2.8495e-04
Epoch 830/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6976e-04
Epoch 831/1000
83/83 [=====] - 10s 119ms/step - loss: 2.5955e-04
Epoch 832/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5423e-04
Epoch 833/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6587e-04
Epoch 834/1000
83/83 [=====] - 10s 120ms/step - loss: 2.5086e-04
Epoch 835/1000
83/83 [=====] - 10s 118ms/step - loss: 2.7228e-04
Epoch 836/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6886e-04
Epoch 837/1000
83/83 [=====] - 10s 119ms/step - loss: 2.8293e-04
Epoch 838/1000
83/83 [=====] - 10s 119ms/step - loss: 2.4324e-04
Epoch 839/1000
83/83 [=====] - 10s 122ms/step - loss: 2.7301e-04
Epoch 840/1000
83/83 [=====] - 11s 137ms/step - loss: 2.5002e-04
Epoch 841/1000
83/83 [=====] - 10s 119ms/step - loss: 2.7009e-04
Epoch 842/1000
83/83 [=====] - 10s 118ms/step - loss: 2.7179e-04
Epoch 843/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5822e-04
Epoch 844/1000
83/83 [=====] - 11s 130ms/step - loss: 2.4372e-04
Epoch 845/1000
83/83 [=====] - 10s 119ms/step - loss: 2.6714e-04
Epoch 846/1000
83/83 [=====] - 10s 122ms/step - loss: 2.9166e-04
Epoch 847/1000
83/83 [=====] - 12s 141ms/step - loss: 3.0744e-04
Epoch 848/1000
83/83 [=====] - 10s 119ms/step - loss: 2.4448e-04

Epoch 849/1000
83/83 [=====] - 10s 119ms/step - loss: 2.4685e-04
Epoch 850/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6210e-04
Epoch 851/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6671e-04
Epoch 852/1000
83/83 [=====] - 10s 119ms/step - loss: 2.9517e-04
Epoch 853/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6347e-04
Epoch 854/1000
83/83 [=====] - 10s 119ms/step - loss: 2.8894e-04
Epoch 855/1000
83/83 [=====] - 10s 118ms/step - loss: 2.8413e-04
Epoch 856/1000
83/83 [=====] - 10s 119ms/step - loss: 2.5366e-04
Epoch 857/1000
83/83 [=====] - 10s 119ms/step - loss: 2.7951e-04
Epoch 858/1000
83/83 [=====] - 10s 119ms/step - loss: 2.6531e-04
Epoch 859/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6852e-04
Epoch 860/1000
83/83 [=====] - 10s 119ms/step - loss: 2.6595e-04
Epoch 861/1000
83/83 [=====] - 10s 119ms/step - loss: 2.6052e-04
Epoch 862/1000
83/83 [=====] - 10s 119ms/step - loss: 2.3435e-04
Epoch 863/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6396e-04
Epoch 864/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5112e-04
Epoch 865/1000
83/83 [=====] - 10s 117ms/step - loss: 2.7263e-04
Epoch 866/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6691e-04
Epoch 867/1000
83/83 [=====] - 10s 117ms/step - loss: 2.5643e-04
Epoch 868/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5697e-04
Epoch 869/1000
83/83 [=====] - 10s 118ms/step - loss: 2.8149e-04
Epoch 870/1000
83/83 [=====] - 10s 125ms/step - loss: 2.5796e-04
Epoch 871/1000
83/83 [=====] - 11s 131ms/step - loss: 2.9056e-04
Epoch 872/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6069e-04

Epoch 873/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5685e-04
Epoch 874/1000
83/83 [=====] - 10s 122ms/step - loss: 2.7639e-04
Epoch 875/1000
83/83 [=====] - 10s 124ms/step - loss: 2.7124e-04
Epoch 876/1000
83/83 [=====] - 10s 117ms/step - loss: 3.2340e-04
Epoch 877/1000
83/83 [=====] - 10s 118ms/step - loss: 2.7430e-04
Epoch 878/1000
83/83 [=====] - 10s 117ms/step - loss: 2.4553e-04
Epoch 879/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6535e-04
Epoch 880/1000
83/83 [=====] - 10s 118ms/step - loss: 2.4605e-04
Epoch 881/1000
83/83 [=====] - 10s 118ms/step - loss: 2.4761e-04
Epoch 882/1000
83/83 [=====] - 10s 117ms/step - loss: 2.8101e-04
Epoch 883/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6978e-04
Epoch 884/1000
83/83 [=====] - 10s 117ms/step - loss: 2.8045e-04
Epoch 885/1000
83/83 [=====] - 10s 117ms/step - loss: 2.7130e-04
Epoch 886/1000
83/83 [=====] - 10s 118ms/step - loss: 2.7014e-04
Epoch 887/1000
83/83 [=====] - 10s 118ms/step - loss: 2.4573e-04
Epoch 888/1000
83/83 [=====] - 10s 118ms/step - loss: 2.7483e-04
Epoch 889/1000
83/83 [=====] - 10s 117ms/step - loss: 2.7325e-04
Epoch 890/1000
83/83 [=====] - 10s 116ms/step - loss: 2.6472e-04
Epoch 891/1000
83/83 [=====] - 10s 117ms/step - loss: 2.8642e-04
Epoch 892/1000
83/83 [=====] - 10s 118ms/step - loss: 2.9610e-04
Epoch 893/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6387e-04
Epoch 894/1000
83/83 [=====] - 10s 117ms/step - loss: 2.4456e-04
Epoch 895/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6253e-04
Epoch 896/1000
83/83 [=====] - 10s 117ms/step - loss: 2.4489e-04

Epoch 897/1000
83/83 [=====] - 10s 117ms/step - loss: 2.7537e-04
Epoch 898/1000
83/83 [=====] - 10s 117ms/step - loss: 2.8883e-04
Epoch 899/1000
83/83 [=====] - 10s 117ms/step - loss: 2.7410e-04
Epoch 900/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6123e-04
Epoch 901/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5988e-04
Epoch 902/1000
83/83 [=====] - 11s 138ms/step - loss: 2.7351e-04
Epoch 903/1000
83/83 [=====] - 10s 117ms/step - loss: 2.5068e-04
Epoch 904/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6277e-04
Epoch 905/1000
83/83 [=====] - 10s 125ms/step - loss: 2.9662e-04
Epoch 906/1000
83/83 [=====] - 10s 121ms/step - loss: 2.3482e-04
Epoch 907/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6480e-04
Epoch 908/1000
83/83 [=====] - 10s 118ms/step - loss: 2.7610e-04
Epoch 909/1000
83/83 [=====] - 10s 117ms/step - loss: 2.9001e-04
Epoch 910/1000
83/83 [=====] - 10s 117ms/step - loss: 2.7422e-04
Epoch 911/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6111e-04
Epoch 912/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6189e-04
Epoch 913/1000
83/83 [=====] - 10s 117ms/step - loss: 2.3819e-04
Epoch 914/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6873e-04
Epoch 915/1000
83/83 [=====] - 10s 117ms/step - loss: 2.7941e-04
Epoch 916/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6602e-04
Epoch 917/1000
83/83 [=====] - 10s 118ms/step - loss: 2.8872e-04
Epoch 918/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5109e-04
Epoch 919/1000
83/83 [=====] - 10s 117ms/step - loss: 2.9932e-04
Epoch 920/1000
83/83 [=====] - 10s 117ms/step - loss: 2.8356e-04

Epoch 921/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6865e-04
Epoch 922/1000
83/83 [=====] - 10s 117ms/step - loss: 2.4661e-04
Epoch 923/1000
83/83 [=====] - 10s 118ms/step - loss: 2.8348e-04
Epoch 924/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6440e-04
Epoch 925/1000
83/83 [=====] - 10s 118ms/step - loss: 2.8530e-04
Epoch 926/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6382e-04
Epoch 927/1000
83/83 [=====] - 10s 117ms/step - loss: 2.5761e-04
Epoch 928/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6267e-04
Epoch 929/1000
83/83 [=====] - 10s 117ms/step - loss: 2.4505e-04
Epoch 930/1000
83/83 [=====] - 10s 118ms/step - loss: 2.4670e-04
Epoch 931/1000
83/83 [=====] - 10s 117ms/step - loss: 2.9544e-04
Epoch 932/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6036e-04
Epoch 933/1000
83/83 [=====] - 11s 134ms/step - loss: 2.6098e-04
Epoch 934/1000
83/83 [=====] - 10s 122ms/step - loss: 2.5750e-04
Epoch 935/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5774e-04
Epoch 936/1000
83/83 [=====] - 11s 130ms/step - loss: 2.3909e-04
Epoch 937/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6249e-04
Epoch 938/1000
83/83 [=====] - 10s 117ms/step - loss: 2.7471e-04
Epoch 939/1000
83/83 [=====] - 10s 117ms/step - loss: 2.7178e-04
Epoch 940/1000
83/83 [=====] - 10s 118ms/step - loss: 2.4160e-04
Epoch 941/1000
83/83 [=====] - 10s 118ms/step - loss: 2.7916e-04
Epoch 942/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6647e-04
Epoch 943/1000
83/83 [=====] - 10s 117ms/step - loss: 2.7589e-04
Epoch 944/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6133e-04

Epoch 945/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6430e-04
Epoch 946/1000
83/83 [=====] - 10s 117ms/step - loss: 2.4453e-04
Epoch 947/1000
83/83 [=====] - 10s 119ms/step - loss: 2.6815e-04
Epoch 948/1000
83/83 [=====] - 10s 119ms/step - loss: 2.5816e-04
Epoch 949/1000
83/83 [=====] - 10s 116ms/step - loss: 2.6270e-04
Epoch 950/1000
83/83 [=====] - 10s 115ms/step - loss: 2.5812e-04
Epoch 951/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6968e-04
Epoch 952/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6778e-04
Epoch 953/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6209e-04
Epoch 954/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5776e-04
Epoch 955/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5966e-04
Epoch 956/1000
83/83 [=====] - 10s 118ms/step - loss: 2.7351e-04
Epoch 957/1000
83/83 [=====] - 10s 117ms/step - loss: 2.4788e-04
Epoch 958/1000
83/83 [=====] - 10s 117ms/step - loss: 2.5296e-04
Epoch 959/1000
83/83 [=====] - 10s 117ms/step - loss: 2.7650e-04
Epoch 960/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6821e-04
Epoch 961/1000
83/83 [=====] - 10s 118ms/step - loss: 2.7495e-04
Epoch 962/1000
83/83 [=====] - 10s 117ms/step - loss: 2.8791e-04
Epoch 963/1000
83/83 [=====] - 10s 117ms/step - loss: 2.3983e-04
Epoch 964/1000
83/83 [=====] - 11s 130ms/step - loss: 2.6311e-04
Epoch 965/1000
83/83 [=====] - 11s 127ms/step - loss: 2.6712e-04
Epoch 966/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6795e-04
Epoch 967/1000
83/83 [=====] - 11s 128ms/step - loss: 2.4989e-04
Epoch 968/1000
83/83 [=====] - 10s 117ms/step - loss: 2.7213e-04

Epoch 969/1000
83/83 [=====] - 10s 117ms/step - loss: 2.8120e-04
Epoch 970/1000
83/83 [=====] - 10s 118ms/step - loss: 2.8675e-04
Epoch 971/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6434e-04
Epoch 972/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5331e-04
Epoch 973/1000
83/83 [=====] - 10s 116ms/step - loss: 2.4506e-04
Epoch 974/1000
83/83 [=====] - 10s 118ms/step - loss: 2.8428e-04
Epoch 975/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6989e-04
Epoch 976/1000
83/83 [=====] - 10s 117ms/step - loss: 2.3763e-04
Epoch 977/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5093e-04
Epoch 978/1000
83/83 [=====] - 10s 118ms/step - loss: 2.4874e-04
Epoch 979/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6704e-04
Epoch 980/1000
83/83 [=====] - 10s 117ms/step - loss: 2.4184e-04
Epoch 981/1000
83/83 [=====] - 10s 117ms/step - loss: 2.5728e-04
Epoch 982/1000
83/83 [=====] - 10s 118ms/step - loss: 2.7406e-04
Epoch 983/1000
83/83 [=====] - 10s 117ms/step - loss: 2.6473e-04
Epoch 984/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5679e-04
Epoch 985/1000
83/83 [=====] - 10s 118ms/step - loss: 2.5138e-04
Epoch 986/1000
83/83 [=====] - 10s 117ms/step - loss: 2.4321e-04
Epoch 987/1000
83/83 [=====] - 10s 117ms/step - loss: 2.7630e-04
Epoch 988/1000
83/83 [=====] - 10s 117ms/step - loss: 2.9669e-04
Epoch 989/1000
83/83 [=====] - 10s 118ms/step - loss: 2.8496e-04
Epoch 990/1000
83/83 [=====] - 10s 117ms/step - loss: 2.5325e-04
Epoch 991/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6623e-04
Epoch 992/1000
83/83 [=====] - 10s 117ms/step - loss: 2.5282e-04


```

Epoch 993/1000
83/83 [=====] - 10s 117ms/step - loss: 2.5099e-04
Epoch 994/1000
83/83 [=====] - 10s 118ms/step - loss: 2.4943e-04
Epoch 995/1000
83/83 [=====] - 10s 124ms/step - loss: 2.6835e-04
Epoch 996/1000
83/83 [=====] - 11s 134ms/step - loss: 2.2954e-04
Epoch 997/1000
83/83 [=====] - 10s 120ms/step - loss: 2.6350e-04
Epoch 998/1000
83/83 [=====] - 11s 128ms/step - loss: 2.6901e-04
Epoch 999/1000
83/83 [=====] - 10s 117ms/step - loss: 2.5074e-04
Epoch 1000/1000
83/83 [=====] - 10s 118ms/step - loss: 2.6360e-04

```

[92]: <tensorflow.python.keras.callbacks.History at 0x7fdeb1bae190>

```

[93]: testdataframe= test
testdataframe['Date'] = testdataframe.index
testdata = pd.DataFrame(columns = ['Date', 'Close'])
testdata['Date'] = testdataframe['Date']
testdata['Close'] = testdataframe['Close']
real_stock_price = testdata.iloc[:, 1:2].values
dataset_total = pd.concat((data2['Close'], testdata['Close']), axis = 0)
inputs = dataset_total[len(dataset_total) - len(testdata) - 60:].values
inputs = inputs.reshape(-1,1)
inputs = sc.transform(inputs)
X_test = []
for i in range(60, inputs.shape[0]):
    X_test.append(inputs[i-60:i, 0])
X_test = np.array(X_test)
X_test = np.reshape(X_test, (X_test.shape[0], X_test.shape[1], 1))

```

```

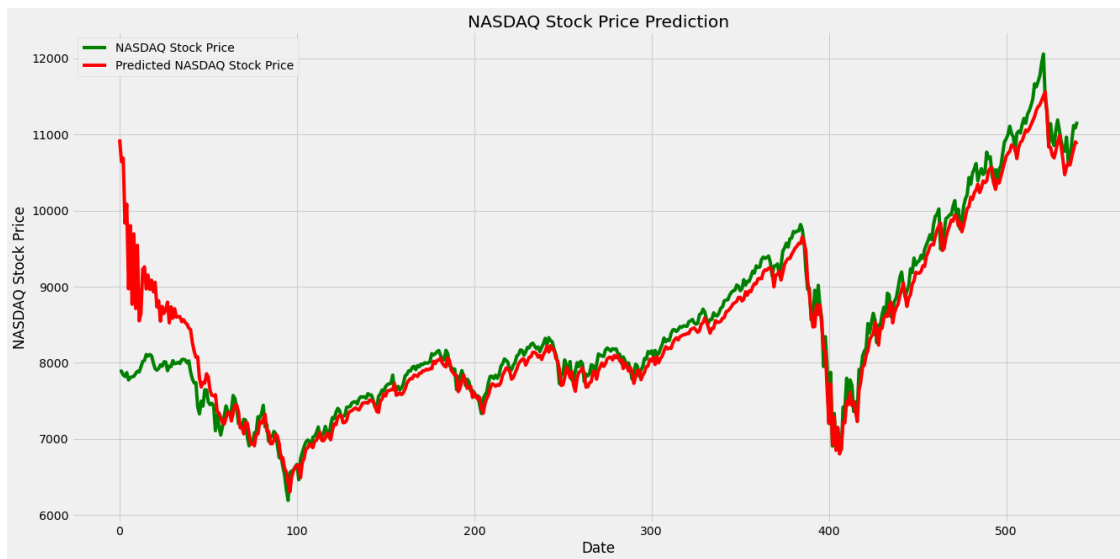
[94]: predicted_with_gru = regressorGRU.predict(X_test)
predicted_with_gru = sc.inverse_transform(predicted_with_gru)

```

```

[95]: plt.figure(figsize=(20,10))
plt.plot(real_stock_price, color = 'green', label = 'NASDAQ Stock Price')
plt.plot(predicted_with_gru, color = 'red', label = 'Predicted NASDAQ Stock_
↪Price')
plt.title('NASDAQ Stock Price Prediction')
plt.xlabel('Date')
plt.ylabel('NASDAQ Stock Price')
plt.legend()
plt.show()

```



```
[96]: rmse_predict1= np.reshape(predicted_with_gru,541)
```

```
[97]: #forecast metrics
def smape(a, f):
    return 1/len(a) * np.sum(2 * np.abs(f-a) / (np.abs(a) + np.abs(f))*100)
smape(test["Close"].values,rmse_predict1)
```

```
[97]: 2.4953968614719706
```

```
[98]: #forecast metrics
from sklearn.metrics import mean_absolute_error
from sklearn.metrics import mean_squared_error
from sklearn.metrics import r2_score
mae = mean_absolute_error(test["Close"].values, rmse_predict1)
mse = mean_squared_error(test["Close"].values, rmse_predict1)
rmse = np.sqrt(mse)

print("Results of sklearn.metrics:")
print("MAE:",mae)
print("MSE:", mse)
print("RMSE:", rmse)
```

```
Results of sklearn.metrics:
MAE: 214.1805178292514
MSE: 148283.06866175527
RMSE: 385.07540646184515
```

```
[99]: elapsed_time = time.process_time() - t
      print(elapsed_time)
```

31677.686889071

```
[ ]:
```

```
[ ]:
```

```
[100]: #repeat the same process for TSX
      df=pd.read_csv("GSPTSE_v1.csv", sep=",")
      from datetime import datetime
      con=df['Date']
      df['Date']=pd.to_datetime(df['Date'])
      df.set_index('Date', inplace=True)
      test = df[2164:]
      train = df[:2163]
```

```
[101]: df['Date'] = df.index
      data2 = pd.DataFrame(columns = ['Date', 'Close'])
      data2['Date'] = df['Date']
      data2['Close'] = df['Close']
```

```
[102]: import time

      t = time.process_time()
```

```
[103]: train_set = data2.iloc[:, 1:2].values
      sc = MinMaxScaler(feature_range = (0, 1))
      training_set_scaled = sc.fit_transform(train_set)
      X_train = []
      y_train = []
      for i in range(60, training_set_scaled.shape[0]):
          X_train.append(training_set_scaled[i-60:i, 0])
          y_train.append(training_set_scaled[i, 0])
      X_train, y_train = np.array(X_train), np.array(y_train)
      X_train = np.reshape(X_train, (X_train.shape[0], X_train.shape[1], 1))
```

```
[104]: regressor = Sequential()
      regressor.add(LSTM(units = 50, return_sequences = True, input_shape = (X_train.
      ↪shape[1], 1)))
      regressor.add(Dropout(0.15))
      regressor.add(LSTM(units = 50, return_sequences = True))
      regressor.add(Dropout(0.15))
      regressor.add(LSTM(units = 50, return_sequences = True))
      regressor.add(Dropout(0.15))
      regressor.add(LSTM(units = 50))
```

```
regressor.add(Dropout(0.15))
regressor.add(Dense(units = 1))
```

```
[105]: regressor.compile(optimizer = 'adam', loss = 'mean_squared_error')
regressor.fit(X_train, y_train, epochs = 1000, batch_size = 32)
```

```
Epoch 1/1000
83/83 [=====] - 11s 134ms/step - loss: 0.0201
Epoch 2/1000
83/83 [=====] - 11s 129ms/step - loss: 0.0061
Epoch 3/1000
83/83 [=====] - 11s 129ms/step - loss: 0.0059
Epoch 4/1000
83/83 [=====] - 11s 129ms/step - loss: 0.0048
Epoch 5/1000
83/83 [=====] - 11s 129ms/step - loss: 0.0042
Epoch 6/1000
83/83 [=====] - 11s 127ms/step - loss: 0.0041
Epoch 7/1000
83/83 [=====] - 11s 127ms/step - loss: 0.0035
Epoch 8/1000
83/83 [=====] - 10s 126ms/step - loss: 0.0033
Epoch 9/1000
83/83 [=====] - 10s 124ms/step - loss: 0.0034
Epoch 10/1000
83/83 [=====] - 10s 124ms/step - loss: 0.0032
Epoch 11/1000
83/83 [=====] - 10s 125ms/step - loss: 0.0029
Epoch 12/1000
83/83 [=====] - 10s 126ms/step - loss: 0.0027
Epoch 13/1000
83/83 [=====] - 10s 125ms/step - loss: 0.0028
Epoch 14/1000
83/83 [=====] - 10s 126ms/step - loss: 0.0027
Epoch 15/1000
83/83 [=====] - 10s 124ms/step - loss: 0.0024
Epoch 16/1000
83/83 [=====] - 10s 123ms/step - loss: 0.0024
Epoch 17/1000
83/83 [=====] - 10s 123ms/step - loss: 0.0023
Epoch 18/1000
83/83 [=====] - 10s 124ms/step - loss: 0.0025
Epoch 19/1000
83/83 [=====] - 10s 123ms/step - loss: 0.0022
Epoch 20/1000
83/83 [=====] - 10s 122ms/step - loss: 0.0023
Epoch 21/1000
```

83/83 [=====] - 10s 122ms/step - loss: 0.0020
 Epoch 22/1000
 83/83 [=====] - 10s 122ms/step - loss: 0.0021
 Epoch 23/1000
 83/83 [=====] - 10s 123ms/step - loss: 0.0019
 Epoch 24/1000
 83/83 [=====] - 11s 136ms/step - loss: 0.0021
 Epoch 25/1000
 83/83 [=====] - 11s 130ms/step - loss: 0.0018
 Epoch 26/1000
 83/83 [=====] - 11s 134ms/step - loss: 0.0018
 Epoch 27/1000
 83/83 [=====] - 10s 123ms/step - loss: 0.0019
 Epoch 28/1000
 83/83 [=====] - 10s 123ms/step - loss: 0.0017
 Epoch 29/1000
 83/83 [=====] - 10s 122ms/step - loss: 0.0018
 Epoch 30/1000
 83/83 [=====] - 10s 122ms/step - loss: 0.0016
 Epoch 31/1000
 83/83 [=====] - 10s 122ms/step - loss: 0.0016
 Epoch 32/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0016
 Epoch 33/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0015
 Epoch 34/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0016
 Epoch 35/1000
 83/83 [=====] - 10s 120ms/step - loss: 0.0014
 Epoch 36/1000
 83/83 [=====] - 10s 120ms/step - loss: 0.0013
 Epoch 37/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0014
 Epoch 38/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0013
 Epoch 39/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0014
 Epoch 40/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0013
 Epoch 41/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0013
 Epoch 42/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0012
 Epoch 43/1000
 83/83 [=====] - 10s 120ms/step - loss: 0.0012
 Epoch 44/1000
 83/83 [=====] - 10s 120ms/step - loss: 0.0013
 Epoch 45/1000

83/83 [=====] - 10s 120ms/step - loss: 0.0012
 Epoch 46/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0013
 Epoch 47/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0011
 Epoch 48/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0011
 Epoch 49/1000
 83/83 [=====] - 10s 120ms/step - loss: 0.0011
 Epoch 50/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0011
 Epoch 51/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0011
 Epoch 52/1000
 83/83 [=====] - 10s 122ms/step - loss: 0.0011
 Epoch 53/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0011
 Epoch 54/1000
 83/83 [=====] - 10s 125ms/step - loss: 0.0012
 Epoch 55/1000
 83/83 [=====] - 11s 136ms/step - loss: 0.0010
 Epoch 56/1000
 83/83 [=====] - 11s 130ms/step - loss: 0.0011
 Epoch 57/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0011
 Epoch 58/1000
 83/83 [=====] - 10s 122ms/step - loss: 9.2234e-04
 Epoch 59/1000
 83/83 [=====] - 10s 121ms/step - loss: 0.0010
 Epoch 60/1000
 83/83 [=====] - 10s 119ms/step - loss: 9.8041e-04
 Epoch 61/1000
 83/83 [=====] - 10s 119ms/step - loss: 0.0011
 Epoch 62/1000
 83/83 [=====] - 10s 120ms/step - loss: 9.3630e-04
 Epoch 63/1000
 83/83 [=====] - 10s 120ms/step - loss: 9.6224e-04
 Epoch 64/1000
 83/83 [=====] - 10s 120ms/step - loss: 9.2293e-04
 Epoch 65/1000
 83/83 [=====] - 10s 121ms/step - loss: 9.3035e-04
 Epoch 66/1000
 83/83 [=====] - 10s 118ms/step - loss: 0.0011
 Epoch 67/1000
 83/83 [=====] - 10s 119ms/step - loss: 8.9804e-04
 Epoch 68/1000
 83/83 [=====] - 10s 119ms/step - loss: 8.5550e-04
 Epoch 69/1000

83/83 [=====] - 10s 119ms/step - loss: 9.0105e-04
 Epoch 70/1000
 83/83 [=====] - 10s 120ms/step - loss: 9.0170e-04
 Epoch 71/1000
 83/83 [=====] - 10s 120ms/step - loss: 8.6015e-04
 Epoch 72/1000
 83/83 [=====] - 10s 119ms/step - loss: 8.8053e-04
 Epoch 73/1000
 83/83 [=====] - 10s 119ms/step - loss: 9.9165e-04
 Epoch 74/1000
 83/83 [=====] - 10s 119ms/step - loss: 8.5034e-04
 Epoch 75/1000
 83/83 [=====] - 10s 120ms/step - loss: 8.5961e-04
 Epoch 76/1000
 83/83 [=====] - 10s 119ms/step - loss: 8.8449e-04
 Epoch 77/1000
 83/83 [=====] - 10s 120ms/step - loss: 8.9617e-04
 Epoch 78/1000
 83/83 [=====] - 10s 118ms/step - loss: 8.5349e-04
 Epoch 79/1000
 83/83 [=====] - 10s 118ms/step - loss: 9.0756e-04
 Epoch 80/1000
 83/83 [=====] - 10s 118ms/step - loss: 8.3467e-04
 Epoch 81/1000
 83/83 [=====] - 10s 119ms/step - loss: 8.5819e-04
 Epoch 82/1000
 83/83 [=====] - 10s 119ms/step - loss: 9.3777e-04
 Epoch 83/1000
 83/83 [=====] - 10s 119ms/step - loss: 8.6895e-04
 Epoch 84/1000
 83/83 [=====] - 10s 119ms/step - loss: 8.4191e-04
 Epoch 85/1000
 83/83 [=====] - 11s 128ms/step - loss: 8.3172e-04
 Epoch 86/1000
 83/83 [=====] - 12s 139ms/step - loss: 8.3397e-04
 Epoch 87/1000
 83/83 [=====] - 10s 119ms/step - loss: 8.3987e-04
 Epoch 88/1000
 83/83 [=====] - 10s 117ms/step - loss: 8.0085e-04
 Epoch 89/1000
 83/83 [=====] - 10s 118ms/step - loss: 8.6622e-04
 Epoch 90/1000
 83/83 [=====] - 10s 117ms/step - loss: 8.9549e-04
 Epoch 91/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.9828e-04
 Epoch 92/1000
 83/83 [=====] - 10s 117ms/step - loss: 8.1232e-04
 Epoch 93/1000

83/83 [=====] - 10s 119ms/step - loss: 7.7030e-04
 Epoch 94/1000
 83/83 [=====] - 10s 118ms/step - loss: 8.1061e-04
 Epoch 95/1000
 83/83 [=====] - 10s 118ms/step - loss: 8.6319e-04
 Epoch 96/1000
 83/83 [=====] - 10s 121ms/step - loss: 8.2122e-04
 Epoch 97/1000
 83/83 [=====] - 10s 118ms/step - loss: 8.0365e-04
 Epoch 98/1000
 83/83 [=====] - 10s 118ms/step - loss: 8.6133e-04
 Epoch 99/1000
 83/83 [=====] - 10s 118ms/step - loss: 8.2906e-04
 Epoch 100/1000
 83/83 [=====] - 10s 119ms/step - loss: 8.0088e-04
 Epoch 101/1000
 83/83 [=====] - 10s 119ms/step - loss: 7.1892e-04
 Epoch 102/1000
 83/83 [=====] - 10s 117ms/step - loss: 7.7461e-04
 Epoch 103/1000
 83/83 [=====] - 10s 117ms/step - loss: 9.4621e-04
 Epoch 104/1000
 83/83 [=====] - 10s 117ms/step - loss: 7.8689e-04
 Epoch 105/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.9931e-04
 Epoch 106/1000
 83/83 [=====] - 10s 118ms/step - loss: 8.1283e-04
 Epoch 107/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.4832e-04
 Epoch 108/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.7135e-04
 Epoch 109/1000
 83/83 [=====] - 10s 118ms/step - loss: 8.0832e-04
 Epoch 110/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.7854e-04
 Epoch 111/1000
 83/83 [=====] - 10s 118ms/step - loss: 8.3543e-04
 Epoch 112/1000
 83/83 [=====] - 10s 117ms/step - loss: 7.7903e-04
 Epoch 113/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.5915e-04
 Epoch 114/1000
 83/83 [=====] - 10s 117ms/step - loss: 7.8662e-04
 Epoch 115/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.1497e-04
 Epoch 116/1000
 83/83 [=====] - 10s 125ms/step - loss: 7.3314e-04
 Epoch 117/1000

83/83 [=====] - 12s 142ms/step - loss: 7.1607e-04
Epoch 118/1000
83/83 [=====] - 10s 118ms/step - loss: 7.6271e-04
Epoch 119/1000
83/83 [=====] - 10s 118ms/step - loss: 7.7346e-04
Epoch 120/1000
83/83 [=====] - 10s 118ms/step - loss: 7.3702e-04
Epoch 121/1000
83/83 [=====] - 10s 118ms/step - loss: 7.1258e-04
Epoch 122/1000
83/83 [=====] - 10s 117ms/step - loss: 7.8391e-04
Epoch 123/1000
83/83 [=====] - 10s 118ms/step - loss: 7.9714e-04
Epoch 124/1000
83/83 [=====] - 10s 118ms/step - loss: 7.4669e-04
Epoch 125/1000
83/83 [=====] - 10s 118ms/step - loss: 7.7505e-04
Epoch 126/1000
83/83 [=====] - 10s 117ms/step - loss: 7.7422e-04
Epoch 127/1000
83/83 [=====] - 10s 117ms/step - loss: 7.4646e-04
Epoch 128/1000
83/83 [=====] - 10s 117ms/step - loss: 7.2644e-04
Epoch 129/1000
83/83 [=====] - 10s 119ms/step - loss: 6.6909e-04
Epoch 130/1000
83/83 [=====] - 10s 118ms/step - loss: 6.9741e-04
Epoch 131/1000
83/83 [=====] - 10s 118ms/step - loss: 7.9972e-04
Epoch 132/1000
83/83 [=====] - 10s 118ms/step - loss: 7.2050e-04
Epoch 133/1000
83/83 [=====] - 10s 118ms/step - loss: 7.4406e-04
Epoch 134/1000
83/83 [=====] - 10s 118ms/step - loss: 7.1614e-04
Epoch 135/1000
83/83 [=====] - 10s 119ms/step - loss: 6.9818e-04
Epoch 136/1000
83/83 [=====] - 10s 118ms/step - loss: 7.1361e-04
Epoch 137/1000
83/83 [=====] - 10s 119ms/step - loss: 7.5462e-04
Epoch 138/1000
83/83 [=====] - 10s 118ms/step - loss: 7.2612e-04
Epoch 139/1000
83/83 [=====] - 10s 117ms/step - loss: 7.2662e-04
Epoch 140/1000
83/83 [=====] - 10s 118ms/step - loss: 7.5742e-04
Epoch 141/1000

83/83 [=====] - 10s 119ms/step - loss: 7.3675e-04
 Epoch 142/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.6824e-04
 Epoch 143/1000
 83/83 [=====] - 10s 119ms/step - loss: 7.6734e-04
 Epoch 144/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.4558e-04
 Epoch 145/1000
 83/83 [=====] - 10s 119ms/step - loss: 7.3200e-04
 Epoch 146/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.5881e-04
 Epoch 147/1000
 83/83 [=====] - 11s 131ms/step - loss: 8.2589e-04
 Epoch 148/1000
 83/83 [=====] - 11s 138ms/step - loss: 7.8709e-04
 Epoch 149/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.3495e-04
 Epoch 150/1000
 83/83 [=====] - 10s 119ms/step - loss: 7.2466e-04
 Epoch 151/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.2525e-04
 Epoch 152/1000
 83/83 [=====] - 10s 117ms/step - loss: 7.3307e-04
 Epoch 153/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.8958e-04
 Epoch 154/1000
 83/83 [=====] - 10s 121ms/step - loss: 7.2875e-04
 Epoch 155/1000
 83/83 [=====] - 10s 121ms/step - loss: 7.7571e-04
 Epoch 156/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.9797e-04
 Epoch 157/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.8994e-04
 Epoch 158/1000
 83/83 [=====] - 10s 119ms/step - loss: 7.2222e-04
 Epoch 159/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.2675e-04
 Epoch 160/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.8250e-04
 Epoch 161/1000
 83/83 [=====] - 10s 120ms/step - loss: 7.5753e-04
 Epoch 162/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.9502e-04
 Epoch 163/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.8476e-04
 Epoch 164/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.8835e-04
 Epoch 165/1000

83/83 [=====] - 10s 118ms/step - loss: 7.6949e-04
 Epoch 166/1000
 83/83 [=====] - 10s 119ms/step - loss: 7.0755e-04
 Epoch 167/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.9485e-04
 Epoch 168/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.7756e-04
 Epoch 169/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.7617e-04
 Epoch 170/1000
 83/83 [=====] - 10s 119ms/step - loss: 7.5420e-04
 Epoch 171/1000
 83/83 [=====] - 10s 124ms/step - loss: 7.7513e-04
 Epoch 172/1000
 83/83 [=====] - 10s 124ms/step - loss: 7.2122e-04
 Epoch 173/1000
 83/83 [=====] - 10s 126ms/step - loss: 7.2563e-04
 Epoch 174/1000
 83/83 [=====] - 10s 121ms/step - loss: 7.0856e-04
 Epoch 175/1000
 83/83 [=====] - 10s 121ms/step - loss: 6.9820e-04
 Epoch 176/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.6837e-04
 Epoch 177/1000
 83/83 [=====] - 10s 125ms/step - loss: 6.7777e-04
 Epoch 178/1000
 83/83 [=====] - 12s 141ms/step - loss: 7.8626e-04
 Epoch 179/1000
 83/83 [=====] - 10s 126ms/step - loss: 7.2199e-04
 Epoch 180/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.3521e-04
 Epoch 181/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.3941e-04
 Epoch 182/1000
 83/83 [=====] - 10s 122ms/step - loss: 6.9398e-04
 Epoch 183/1000
 83/83 [=====] - 10s 124ms/step - loss: 6.8941e-04
 Epoch 184/1000
 83/83 [=====] - 10s 125ms/step - loss: 7.2118e-04
 Epoch 185/1000
 83/83 [=====] - 10s 122ms/step - loss: 7.3533e-04
 Epoch 186/1000
 83/83 [=====] - 10s 120ms/step - loss: 7.1053e-04
 Epoch 187/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.4451e-04
 Epoch 188/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.9105e-04
 Epoch 189/1000

83/83 [=====] - 10s 123ms/step - loss: 7.0824e-04
 Epoch 190/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.2219e-04
 Epoch 191/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.7092e-04
 Epoch 192/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.4951e-04
 Epoch 193/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.2457e-04
 Epoch 194/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.7898e-04
 Epoch 195/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.1535e-04
 Epoch 196/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.9474e-04
 Epoch 197/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.5702e-04
 Epoch 198/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.7591e-04
 Epoch 199/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.6853e-04
 Epoch 200/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.9176e-04
 Epoch 201/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.8958e-04
 Epoch 202/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.8282e-04
 Epoch 203/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.8156e-04
 Epoch 204/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.3010e-04
 Epoch 205/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.6137e-04
 Epoch 206/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.8496e-04
 Epoch 207/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.4270e-04
 Epoch 208/1000
 83/83 [=====] - 11s 129ms/step - loss: 6.9414e-04
 Epoch 209/1000
 83/83 [=====] - 11s 132ms/step - loss: 6.5869e-04
 Epoch 210/1000
 83/83 [=====] - 10s 123ms/step - loss: 6.9673e-04
 Epoch 211/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.8482e-04
 Epoch 212/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.8674e-04
 Epoch 213/1000

83/83 [=====] - 10s 120ms/step - loss: 6.8224e-04
 Epoch 214/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.7254e-04
 Epoch 215/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.8508e-04
 Epoch 216/1000
 83/83 [=====] - 10s 123ms/step - loss: 6.4717e-04
 Epoch 217/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.9141e-04
 Epoch 218/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.5587e-04
 Epoch 219/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.9221e-04
 Epoch 220/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.5273e-04
 Epoch 221/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.6231e-04
 Epoch 222/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.8916e-04
 Epoch 223/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.5003e-04
 Epoch 224/1000
 83/83 [=====] - 10s 119ms/step - loss: 7.2763e-04
 Epoch 225/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.1627e-04
 Epoch 226/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.4975e-04
 Epoch 227/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.7724e-04
 Epoch 228/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.6182e-04
 Epoch 229/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.4913e-04
 Epoch 230/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.5054e-04
 Epoch 231/1000
 83/83 [=====] - 10s 121ms/step - loss: 6.4931e-04
 Epoch 232/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.6165e-04
 Epoch 233/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.2986e-04
 Epoch 234/1000
 83/83 [=====] - 10s 123ms/step - loss: 6.3774e-04
 Epoch 235/1000
 83/83 [=====] - 10s 124ms/step - loss: 6.6377e-04
 Epoch 236/1000
 83/83 [=====] - 10s 125ms/step - loss: 6.3157e-04
 Epoch 237/1000

83/83 [=====] - 10s 121ms/step - loss: 6.3366e-04
Epoch 238/1000
83/83 [=====] - 10s 124ms/step - loss: 6.3867e-04
Epoch 239/1000
83/83 [=====] - 10s 125ms/step - loss: 6.3080e-04
Epoch 240/1000
83/83 [=====] - 11s 137ms/step - loss: 6.1287e-04
Epoch 241/1000
83/83 [=====] - 10s 119ms/step - loss: 6.0972e-04
Epoch 242/1000
83/83 [=====] - 10s 118ms/step - loss: 6.2973e-04
Epoch 243/1000
83/83 [=====] - 10s 118ms/step - loss: 6.7872e-04
Epoch 244/1000
83/83 [=====] - 10s 119ms/step - loss: 6.9278e-04
Epoch 245/1000
83/83 [=====] - 10s 118ms/step - loss: 6.2232e-04
Epoch 246/1000
83/83 [=====] - 10s 117ms/step - loss: 6.1349e-04
Epoch 247/1000
83/83 [=====] - 10s 117ms/step - loss: 6.5693e-04
Epoch 248/1000
83/83 [=====] - 10s 118ms/step - loss: 6.7402e-04
Epoch 249/1000
83/83 [=====] - 10s 118ms/step - loss: 6.9103e-04
Epoch 250/1000
83/83 [=====] - 10s 118ms/step - loss: 6.2839e-04
Epoch 251/1000
83/83 [=====] - 10s 117ms/step - loss: 6.0865e-04
Epoch 252/1000
83/83 [=====] - 10s 116ms/step - loss: 6.1222e-04
Epoch 253/1000
83/83 [=====] - 10s 117ms/step - loss: 6.1396e-04
Epoch 254/1000
83/83 [=====] - 10s 119ms/step - loss: 6.3647e-04
Epoch 255/1000
83/83 [=====] - 10s 118ms/step - loss: 6.4896e-04
Epoch 256/1000
83/83 [=====] - 10s 118ms/step - loss: 6.5889e-04
Epoch 257/1000
83/83 [=====] - 10s 118ms/step - loss: 6.2189e-04
Epoch 258/1000
83/83 [=====] - 10s 118ms/step - loss: 6.4124e-04
Epoch 259/1000
83/83 [=====] - 10s 117ms/step - loss: 6.5490e-04
Epoch 260/1000
83/83 [=====] - 10s 118ms/step - loss: 7.4940e-04
Epoch 261/1000

83/83 [=====] - 10s 119ms/step - loss: 6.8732e-04
Epoch 262/1000
83/83 [=====] - 10s 118ms/step - loss: 6.0888e-04
Epoch 263/1000
83/83 [=====] - 10s 118ms/step - loss: 6.3534e-04
Epoch 264/1000
83/83 [=====] - 10s 118ms/step - loss: 6.0693e-04
Epoch 265/1000
83/83 [=====] - 10s 118ms/step - loss: 6.1123e-04
Epoch 266/1000
83/83 [=====] - 10s 119ms/step - loss: 5.6160e-04
Epoch 267/1000
83/83 [=====] - 10s 119ms/step - loss: 6.4619e-04
Epoch 268/1000
83/83 [=====] - 10s 119ms/step - loss: 6.2684e-04
Epoch 269/1000
83/83 [=====] - 11s 127ms/step - loss: 6.1358e-04
Epoch 270/1000
83/83 [=====] - 10s 117ms/step - loss: 6.0373e-04
Epoch 271/1000
83/83 [=====] - 11s 132ms/step - loss: 6.2461e-04
Epoch 272/1000
83/83 [=====] - 10s 121ms/step - loss: 6.0298e-04
Epoch 273/1000
83/83 [=====] - 10s 117ms/step - loss: 6.3854e-04
Epoch 274/1000
83/83 [=====] - 10s 117ms/step - loss: 6.4770e-04
Epoch 275/1000
83/83 [=====] - 10s 117ms/step - loss: 5.8267e-04
Epoch 276/1000
83/83 [=====] - 10s 116ms/step - loss: 6.3770e-04
Epoch 277/1000
83/83 [=====] - 10s 117ms/step - loss: 5.8108e-04
Epoch 278/1000
83/83 [=====] - 10s 116ms/step - loss: 5.9598e-04
Epoch 279/1000
83/83 [=====] - 10s 118ms/step - loss: 6.2228e-04
Epoch 280/1000
83/83 [=====] - 10s 117ms/step - loss: 6.1077e-04
Epoch 281/1000
83/83 [=====] - 10s 116ms/step - loss: 5.8760e-04
Epoch 282/1000
83/83 [=====] - 10s 117ms/step - loss: 5.9146e-04
Epoch 283/1000
83/83 [=====] - 10s 116ms/step - loss: 5.7948e-04
Epoch 284/1000
83/83 [=====] - 10s 117ms/step - loss: 6.3426e-04
Epoch 285/1000

83/83 [=====] - 10s 117ms/step - loss: 5.9993e-04
 Epoch 286/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.6412e-04
 Epoch 287/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.2413e-04
 Epoch 288/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.3098e-04
 Epoch 289/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.1764e-04
 Epoch 290/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.9162e-04
 Epoch 291/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.1910e-04
 Epoch 292/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.2553e-04
 Epoch 293/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.0518e-04
 Epoch 294/1000
 83/83 [=====] - 10s 116ms/step - loss: 6.0913e-04
 Epoch 295/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.1696e-04
 Epoch 296/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.9857e-04
 Epoch 297/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.0252e-04
 Epoch 298/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.2619e-04
 Epoch 299/1000
 83/83 [=====] - 10s 116ms/step - loss: 6.5904e-04
 Epoch 300/1000
 83/83 [=====] - 11s 127ms/step - loss: 5.8051e-04
 Epoch 301/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.9458e-04
 Epoch 302/1000
 83/83 [=====] - 10s 122ms/step - loss: 5.7288e-04
 Epoch 303/1000
 83/83 [=====] - 11s 131ms/step - loss: 6.2110e-04
 Epoch 304/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.7174e-04
 Epoch 305/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.2141e-04
 Epoch 306/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.1918e-04
 Epoch 307/1000
 83/83 [=====] - 10s 116ms/step - loss: 6.1375e-04
 Epoch 308/1000
 83/83 [=====] - 10s 116ms/step - loss: 6.0575e-04
 Epoch 309/1000

83/83 [=====] - 10s 118ms/step - loss: 6.1743e-04
 Epoch 310/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.7754e-04
 Epoch 311/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.8226e-04
 Epoch 312/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.9937e-04
 Epoch 313/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.8950e-04
 Epoch 314/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.3404e-04
 Epoch 315/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.5806e-04
 Epoch 316/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.9803e-04
 Epoch 317/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.6810e-04
 Epoch 318/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.7767e-04
 Epoch 319/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.7309e-04
 Epoch 320/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.2825e-04
 Epoch 321/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.9458e-04
 Epoch 322/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.1127e-04
 Epoch 323/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.5754e-04
 Epoch 324/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.9729e-04
 Epoch 325/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.9477e-04
 Epoch 326/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.3241e-04
 Epoch 327/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.0288e-04
 Epoch 328/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.5798e-04
 Epoch 329/1000
 83/83 [=====] - 10s 117ms/step - loss: 6.0600e-04
 Epoch 330/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.7614e-04
 Epoch 331/1000
 83/83 [=====] - 11s 127ms/step - loss: 5.9784e-04
 Epoch 332/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.8860e-04
 Epoch 333/1000

83/83 [=====] - 10s 117ms/step - loss: 5.7449e-04
Epoch 334/1000
83/83 [=====] - 11s 137ms/step - loss: 5.5890e-04
Epoch 335/1000
83/83 [=====] - 10s 118ms/step - loss: 5.5504e-04
Epoch 336/1000
83/83 [=====] - 10s 117ms/step - loss: 5.9384e-04
Epoch 337/1000
83/83 [=====] - 10s 116ms/step - loss: 5.6396e-04
Epoch 338/1000
83/83 [=====] - 10s 117ms/step - loss: 5.6903e-04
Epoch 339/1000
83/83 [=====] - 10s 118ms/step - loss: 5.7622e-04
Epoch 340/1000
83/83 [=====] - 10s 118ms/step - loss: 5.6324e-04
Epoch 341/1000
83/83 [=====] - 10s 117ms/step - loss: 5.7731e-04
Epoch 342/1000
83/83 [=====] - 10s 117ms/step - loss: 5.5430e-04
Epoch 343/1000
83/83 [=====] - 10s 117ms/step - loss: 5.9380e-04
Epoch 344/1000
83/83 [=====] - 10s 116ms/step - loss: 5.9680e-04
Epoch 345/1000
83/83 [=====] - 10s 118ms/step - loss: 5.8271e-04
Epoch 346/1000
83/83 [=====] - 10s 118ms/step - loss: 5.5473e-04
Epoch 347/1000
83/83 [=====] - 10s 118ms/step - loss: 5.6208e-04
Epoch 348/1000
83/83 [=====] - 10s 118ms/step - loss: 5.3752e-04
Epoch 349/1000
83/83 [=====] - 10s 117ms/step - loss: 6.0175e-04
Epoch 350/1000
83/83 [=====] - 10s 117ms/step - loss: 6.1488e-04
Epoch 351/1000
83/83 [=====] - 10s 118ms/step - loss: 5.4214e-04
Epoch 352/1000
83/83 [=====] - 10s 119ms/step - loss: 5.6995e-04
Epoch 353/1000
83/83 [=====] - 10s 118ms/step - loss: 5.8467e-04
Epoch 354/1000
83/83 [=====] - 10s 118ms/step - loss: 6.3868e-04
Epoch 355/1000
83/83 [=====] - 10s 118ms/step - loss: 5.9969e-04
Epoch 356/1000
83/83 [=====] - 10s 118ms/step - loss: 5.6948e-04
Epoch 357/1000

83/83 [=====] - 10s 119ms/step - loss: 5.7951e-04
 Epoch 358/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.6579e-04
 Epoch 359/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.6516e-04
 Epoch 360/1000
 83/83 [=====] - 10s 121ms/step - loss: 5.3889e-04
 Epoch 361/1000
 83/83 [=====] - 10s 121ms/step - loss: 5.6103e-04
 Epoch 362/1000
 83/83 [=====] - 11s 128ms/step - loss: 5.4739e-04
 Epoch 363/1000
 83/83 [=====] - 10s 121ms/step - loss: 6.1080e-04
 Epoch 364/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.6311e-04
 Epoch 365/1000
 83/83 [=====] - 12s 139ms/step - loss: 6.1942e-04
 Epoch 366/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.3040e-04
 Epoch 367/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.8448e-04
 Epoch 368/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.3965e-04
 Epoch 369/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.4815e-04
 Epoch 370/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.6870e-04
 Epoch 371/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.4724e-04
 Epoch 372/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.4843e-04
 Epoch 373/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.6048e-04
 Epoch 374/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.1878e-04
 Epoch 375/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.6054e-04
 Epoch 376/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3915e-04
 Epoch 377/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2299e-04
 Epoch 378/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.8505e-04
 Epoch 379/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.6523e-04
 Epoch 380/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.4629e-04
 Epoch 381/1000

83/83 [=====] - 10s 120ms/step - loss: 5.2912e-04
 Epoch 382/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.1792e-04
 Epoch 383/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.4913e-04
 Epoch 384/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.9224e-04
 Epoch 385/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.6819e-04
 Epoch 386/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.7561e-04
 Epoch 387/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.5347e-04
 Epoch 388/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.7626e-04
 Epoch 389/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3709e-04
 Epoch 390/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.6976e-04
 Epoch 391/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.8898e-04
 Epoch 392/1000
 83/83 [=====] - 11s 128ms/step - loss: 5.6586e-04
 Epoch 393/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.5246e-04
 Epoch 394/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.6805e-04
 Epoch 395/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.6788e-04
 Epoch 396/1000
 83/83 [=====] - 11s 135ms/step - loss: 5.3182e-04
 Epoch 397/1000
 83/83 [=====] - 10s 121ms/step - loss: 5.5596e-04
 Epoch 398/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.4200e-04
 Epoch 399/1000
 83/83 [=====] - 10s 121ms/step - loss: 5.6159e-04
 Epoch 400/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.6894e-04
 Epoch 401/1000
 83/83 [=====] - 10s 121ms/step - loss: 5.7456e-04
 Epoch 402/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.5775e-04
 Epoch 403/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.4997e-04
 Epoch 404/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.6271e-04
 Epoch 405/1000

83/83 [=====] - 10s 119ms/step - loss: 6.2454e-04
 Epoch 406/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.3708e-04
 Epoch 407/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3218e-04
 Epoch 408/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.4070e-04
 Epoch 409/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.5607e-04
 Epoch 410/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.6299e-04
 Epoch 411/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.7910e-04
 Epoch 412/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.0298e-04
 Epoch 413/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.4619e-04
 Epoch 414/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.5328e-04
 Epoch 415/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3266e-04
 Epoch 416/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.7091e-04
 Epoch 417/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.6597e-04
 Epoch 418/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3607e-04
 Epoch 419/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.4720e-04
 Epoch 420/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1313e-04
 Epoch 421/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.8682e-04
 Epoch 422/1000
 83/83 [=====] - 10s 122ms/step - loss: 5.2149e-04
 Epoch 423/1000
 83/83 [=====] - 10s 126ms/step - loss: 5.6674e-04
 Epoch 424/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.6125e-04
 Epoch 425/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.5283e-04
 Epoch 426/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.5692e-04
 Epoch 427/1000
 83/83 [=====] - 11s 137ms/step - loss: 5.7165e-04
 Epoch 428/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.1771e-04
 Epoch 429/1000

83/83 [=====] - 10s 119ms/step - loss: 5.2789e-04
Epoch 430/1000
83/83 [=====] - 10s 119ms/step - loss: 5.4773e-04
Epoch 431/1000
83/83 [=====] - 10s 119ms/step - loss: 5.5975e-04
Epoch 432/1000
83/83 [=====] - 10s 118ms/step - loss: 5.7065e-04
Epoch 433/1000
83/83 [=====] - 10s 119ms/step - loss: 5.5024e-04
Epoch 434/1000
83/83 [=====] - 10s 118ms/step - loss: 5.4459e-04
Epoch 435/1000
83/83 [=====] - 10s 119ms/step - loss: 5.6415e-04
Epoch 436/1000
83/83 [=====] - 10s 119ms/step - loss: 5.1531e-04
Epoch 437/1000
83/83 [=====] - 10s 119ms/step - loss: 5.3487e-04
Epoch 438/1000
83/83 [=====] - 10s 118ms/step - loss: 5.6706e-04
Epoch 439/1000
83/83 [=====] - 10s 117ms/step - loss: 5.9260e-04
Epoch 440/1000
83/83 [=====] - 10s 118ms/step - loss: 5.7732e-04
Epoch 441/1000
83/83 [=====] - 10s 122ms/step - loss: 5.1379e-04
Epoch 442/1000
83/83 [=====] - 11s 128ms/step - loss: 5.3049e-04
Epoch 443/1000
83/83 [=====] - 10s 120ms/step - loss: 5.9095e-04
Epoch 444/1000
83/83 [=====] - 10s 121ms/step - loss: 5.7350e-04
Epoch 445/1000
83/83 [=====] - 10s 120ms/step - loss: 5.5606e-04
Epoch 446/1000
83/83 [=====] - 10s 119ms/step - loss: 5.6142e-04
Epoch 447/1000
83/83 [=====] - 10s 121ms/step - loss: 5.1138e-04
Epoch 448/1000
83/83 [=====] - 10s 119ms/step - loss: 5.4936e-04
Epoch 449/1000
83/83 [=====] - 10s 117ms/step - loss: 5.6487e-04
Epoch 450/1000
83/83 [=====] - 10s 118ms/step - loss: 5.4619e-04
Epoch 451/1000
83/83 [=====] - 10s 118ms/step - loss: 5.3933e-04
Epoch 452/1000
83/83 [=====] - 10s 118ms/step - loss: 5.5626e-04
Epoch 453/1000

83/83 [=====] - 11s 130ms/step - loss: 5.3468e-04
 Epoch 454/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.6309e-04
 Epoch 455/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.4916e-04
 Epoch 456/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.7064e-04
 Epoch 457/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.4575e-04
 Epoch 458/1000
 83/83 [=====] - 12s 139ms/step - loss: 5.5398e-04
 Epoch 459/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.3737e-04
 Epoch 460/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.1443e-04
 Epoch 461/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.1019e-04
 Epoch 462/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.7092e-04
 Epoch 463/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3325e-04
 Epoch 464/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.2538e-04
 Epoch 465/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.6025e-04
 Epoch 466/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.4113e-04
 Epoch 467/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.2553e-04
 Epoch 468/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.5543e-04
 Epoch 469/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.3276e-04
 Epoch 470/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.5500e-04
 Epoch 471/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.4735e-04
 Epoch 472/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.7207e-04
 Epoch 473/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.5089e-04
 Epoch 474/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.4905e-04
 Epoch 475/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.3449e-04
 Epoch 476/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.5044e-04
 Epoch 477/1000

83/83 [=====] - 10s 118ms/step - loss: 5.3884e-04
Epoch 478/1000
83/83 [=====] - 10s 119ms/step - loss: 5.0191e-04
Epoch 479/1000
83/83 [=====] - 10s 118ms/step - loss: 5.2763e-04
Epoch 480/1000
83/83 [=====] - 10s 118ms/step - loss: 5.3843e-04
Epoch 481/1000
83/83 [=====] - 10s 118ms/step - loss: 5.1852e-04
Epoch 482/1000
83/83 [=====] - 10s 118ms/step - loss: 5.4390e-04
Epoch 483/1000
83/83 [=====] - 10s 124ms/step - loss: 5.3029e-04
Epoch 484/1000
83/83 [=====] - 10s 124ms/step - loss: 5.1125e-04
Epoch 485/1000
83/83 [=====] - 10s 118ms/step - loss: 5.4809e-04
Epoch 486/1000
83/83 [=====] - 10s 118ms/step - loss: 5.0676e-04
Epoch 487/1000
83/83 [=====] - 10s 117ms/step - loss: 5.5177e-04
Epoch 488/1000
83/83 [=====] - 10s 118ms/step - loss: 5.4156e-04
Epoch 489/1000
83/83 [=====] - 12s 139ms/step - loss: 5.3977e-04
Epoch 490/1000
83/83 [=====] - 10s 118ms/step - loss: 5.9672e-04
Epoch 491/1000
83/83 [=====] - 10s 118ms/step - loss: 5.5137e-04
Epoch 492/1000
83/83 [=====] - 10s 118ms/step - loss: 5.4568e-04
Epoch 493/1000
83/83 [=====] - 10s 117ms/step - loss: 5.4169e-04
Epoch 494/1000
83/83 [=====] - 10s 118ms/step - loss: 5.0197e-04
Epoch 495/1000
83/83 [=====] - 10s 118ms/step - loss: 5.7085e-04
Epoch 496/1000
83/83 [=====] - 10s 118ms/step - loss: 5.2072e-04
Epoch 497/1000
83/83 [=====] - 10s 118ms/step - loss: 5.2042e-04
Epoch 498/1000
83/83 [=====] - 10s 117ms/step - loss: 5.5028e-04
Epoch 499/1000
83/83 [=====] - 10s 117ms/step - loss: 5.6135e-04
Epoch 500/1000
83/83 [=====] - 10s 118ms/step - loss: 5.4743e-04
Epoch 501/1000

83/83 [=====] - 10s 119ms/step - loss: 5.1586e-04
Epoch 502/1000
83/83 [=====] - 10s 118ms/step - loss: 5.3304e-04
Epoch 503/1000
83/83 [=====] - 10s 118ms/step - loss: 5.4861e-04
Epoch 504/1000
83/83 [=====] - 10s 118ms/step - loss: 5.5500e-04
Epoch 505/1000
83/83 [=====] - 10s 119ms/step - loss: 5.2857e-04
Epoch 506/1000
83/83 [=====] - 10s 119ms/step - loss: 5.3738e-04
Epoch 507/1000
83/83 [=====] - 10s 119ms/step - loss: 5.3681e-04
Epoch 508/1000
83/83 [=====] - 10s 119ms/step - loss: 5.7040e-04
Epoch 509/1000
83/83 [=====] - 10s 119ms/step - loss: 5.2384e-04
Epoch 510/1000
83/83 [=====] - 10s 119ms/step - loss: 5.3484e-04
Epoch 511/1000
83/83 [=====] - 10s 117ms/step - loss: 5.5278e-04
Epoch 512/1000
83/83 [=====] - 10s 119ms/step - loss: 4.8486e-04
Epoch 513/1000
83/83 [=====] - 10s 120ms/step - loss: 5.4043e-04
Epoch 514/1000
83/83 [=====] - 11s 131ms/step - loss: 5.0532e-04
Epoch 515/1000
83/83 [=====] - 10s 119ms/step - loss: 5.0806e-04
Epoch 516/1000
83/83 [=====] - 10s 119ms/step - loss: 4.9554e-04
Epoch 517/1000
83/83 [=====] - 10s 119ms/step - loss: 5.2896e-04
Epoch 518/1000
83/83 [=====] - 10s 118ms/step - loss: 5.1908e-04
Epoch 519/1000
83/83 [=====] - 10s 119ms/step - loss: 5.3559e-04
Epoch 520/1000
83/83 [=====] - 12s 139ms/step - loss: 5.4794e-04
Epoch 521/1000
83/83 [=====] - 10s 118ms/step - loss: 5.4862e-04
Epoch 522/1000
83/83 [=====] - 10s 119ms/step - loss: 5.0627e-04
Epoch 523/1000
83/83 [=====] - 10s 118ms/step - loss: 5.4325e-04
Epoch 524/1000
83/83 [=====] - 10s 119ms/step - loss: 5.5372e-04
Epoch 525/1000

83/83 [=====] - 10s 119ms/step - loss: 5.4347e-04
 Epoch 526/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.1293e-04
 Epoch 527/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0502e-04
 Epoch 528/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.2042e-04
 Epoch 529/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2658e-04
 Epoch 530/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0821e-04
 Epoch 531/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2620e-04
 Epoch 532/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.4836e-04
 Epoch 533/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8211e-04
 Epoch 534/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.4371e-04
 Epoch 535/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3309e-04
 Epoch 536/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2804e-04
 Epoch 537/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.3496e-04
 Epoch 538/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.4079e-04
 Epoch 539/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.4402e-04
 Epoch 540/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1467e-04
 Epoch 541/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0927e-04
 Epoch 542/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.1521e-04
 Epoch 543/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0768e-04
 Epoch 544/1000
 83/83 [=====] - 10s 121ms/step - loss: 5.3282e-04
 Epoch 545/1000
 83/83 [=====] - 10s 126ms/step - loss: 5.4317e-04
 Epoch 546/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1745e-04
 Epoch 547/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.5054e-04
 Epoch 548/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.4959e-04
 Epoch 549/1000

83/83 [=====] - 10s 119ms/step - loss: 5.5581e-04
 Epoch 550/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.2969e-04
 Epoch 551/1000
 83/83 [=====] - 12s 141ms/step - loss: 5.2551e-04
 Epoch 552/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.1292e-04
 Epoch 553/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.3310e-04
 Epoch 554/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.4966e-04
 Epoch 555/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.5196e-04
 Epoch 556/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.2474e-04
 Epoch 557/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.4711e-04
 Epoch 558/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.4110e-04
 Epoch 559/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.2486e-04
 Epoch 560/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.0514e-04
 Epoch 561/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.2768e-04
 Epoch 562/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.0967e-04
 Epoch 563/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.4346e-04
 Epoch 564/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9912e-04
 Epoch 565/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0737e-04
 Epoch 566/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.1923e-04
 Epoch 567/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.0518e-04
 Epoch 568/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0853e-04
 Epoch 569/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1936e-04
 Epoch 570/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2579e-04
 Epoch 571/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.4576e-04
 Epoch 572/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.4177e-04
 Epoch 573/1000

83/83 [=====] - 10s 118ms/step - loss: 5.2381e-04
 Epoch 574/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1148e-04
 Epoch 575/1000
 83/83 [=====] - 11s 129ms/step - loss: 5.0755e-04
 Epoch 576/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3596e-04
 Epoch 577/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0242e-04
 Epoch 578/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9402e-04
 Epoch 579/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.0675e-04
 Epoch 580/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.1721e-04
 Epoch 581/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.6321e-04
 Epoch 582/1000
 83/83 [=====] - 12s 139ms/step - loss: 5.0622e-04
 Epoch 583/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3756e-04
 Epoch 584/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.2568e-04
 Epoch 585/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.0396e-04
 Epoch 586/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.1948e-04
 Epoch 587/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.3785e-04
 Epoch 588/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3512e-04
 Epoch 589/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2040e-04
 Epoch 590/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.2442e-04
 Epoch 591/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.2241e-04
 Epoch 592/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.3076e-04
 Epoch 593/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.3186e-04
 Epoch 594/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9483e-04
 Epoch 595/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0721e-04
 Epoch 596/1000
 83/83 [=====] - 10s 121ms/step - loss: 5.1215e-04
 Epoch 597/1000

83/83 [=====] - 10s 119ms/step - loss: 4.9998e-04
 Epoch 598/1000
 83/83 [=====] - 10s 120ms/step - loss: 4.8201e-04
 Epoch 599/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3588e-04
 Epoch 600/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3994e-04
 Epoch 601/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.5712e-04
 Epoch 602/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2916e-04
 Epoch 603/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1076e-04
 Epoch 604/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1699e-04
 Epoch 605/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.2822e-04
 Epoch 606/1000
 83/83 [=====] - 10s 126ms/step - loss: 5.3596e-04
 Epoch 607/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0418e-04
 Epoch 608/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3811e-04
 Epoch 609/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.4184e-04
 Epoch 610/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0206e-04
 Epoch 611/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2713e-04
 Epoch 612/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2016e-04
 Epoch 613/1000
 83/83 [=====] - 11s 138ms/step - loss: 5.0356e-04
 Epoch 614/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.2137e-04
 Epoch 615/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.2848e-04
 Epoch 616/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.2389e-04
 Epoch 617/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9508e-04
 Epoch 618/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2617e-04
 Epoch 619/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8427e-04
 Epoch 620/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.3114e-04
 Epoch 621/1000

83/83 [=====] - 10s 120ms/step - loss: 5.5914e-04
 Epoch 622/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.5334e-04
 Epoch 623/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.3455e-04
 Epoch 624/1000
 83/83 [=====] - 10s 119ms/step - loss: 4.8744e-04
 Epoch 625/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.1667e-04
 Epoch 626/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.2542e-04
 Epoch 627/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.1983e-04
 Epoch 628/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.4490e-04
 Epoch 629/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1122e-04
 Epoch 630/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.3892e-04
 Epoch 631/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.4318e-04
 Epoch 632/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.4609e-04
 Epoch 633/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0957e-04
 Epoch 634/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3123e-04
 Epoch 635/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.0935e-04
 Epoch 636/1000
 83/83 [=====] - 11s 129ms/step - loss: 5.2736e-04
 Epoch 637/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.2510e-04
 Epoch 638/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.3648e-04
 Epoch 639/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9215e-04
 Epoch 640/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.0555e-04
 Epoch 641/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.3878e-04
 Epoch 642/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.4738e-04
 Epoch 643/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2041e-04
 Epoch 644/1000
 83/83 [=====] - 12s 139ms/step - loss: 5.1566e-04
 Epoch 645/1000

83/83 [=====] - 10s 117ms/step - loss: 5.0058e-04
 Epoch 646/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0999e-04
 Epoch 647/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.7425e-04
 Epoch 648/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0545e-04
 Epoch 649/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1838e-04
 Epoch 650/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8129e-04
 Epoch 651/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.7061e-04
 Epoch 652/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.7892e-04
 Epoch 653/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.1415e-04
 Epoch 654/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0728e-04
 Epoch 655/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2679e-04
 Epoch 656/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1700e-04
 Epoch 657/1000
 83/83 [=====] - 10s 119ms/step - loss: 4.9405e-04
 Epoch 658/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9816e-04
 Epoch 659/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9494e-04
 Epoch 660/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1765e-04
 Epoch 661/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9742e-04
 Epoch 662/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3424e-04
 Epoch 663/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0920e-04
 Epoch 664/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0084e-04
 Epoch 665/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2695e-04
 Epoch 666/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0580e-04
 Epoch 667/1000
 83/83 [=====] - 11s 127ms/step - loss: 5.3309e-04
 Epoch 668/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9274e-04
 Epoch 669/1000

83/83 [=====] - 10s 119ms/step - loss: 4.8051e-04
 Epoch 670/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2528e-04
 Epoch 671/1000
 83/83 [=====] - 10s 122ms/step - loss: 4.9733e-04
 Epoch 672/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.0285e-04
 Epoch 673/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2098e-04
 Epoch 674/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9338e-04
 Epoch 675/1000
 83/83 [=====] - 11s 137ms/step - loss: 4.9289e-04
 Epoch 676/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.1960e-04
 Epoch 677/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2269e-04
 Epoch 678/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9717e-04
 Epoch 679/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9474e-04
 Epoch 680/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1287e-04
 Epoch 681/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.0007e-04
 Epoch 682/1000
 83/83 [=====] - 10s 120ms/step - loss: 4.9036e-04
 Epoch 683/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9386e-04
 Epoch 684/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9418e-04
 Epoch 685/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3835e-04
 Epoch 686/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.8974e-04
 Epoch 687/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9757e-04
 Epoch 688/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0340e-04
 Epoch 689/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1901e-04
 Epoch 690/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.3181e-04
 Epoch 691/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0769e-04
 Epoch 692/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1125e-04
 Epoch 693/1000

83/83 [=====] - 10s 119ms/step - loss: 5.2066e-04
 Epoch 694/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1683e-04
 Epoch 695/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0678e-04
 Epoch 696/1000
 83/83 [=====] - 10s 116ms/step - loss: 4.8562e-04
 Epoch 697/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.2801e-04
 Epoch 698/1000
 83/83 [=====] - 10s 121ms/step - loss: 5.3122e-04
 Epoch 699/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0807e-04
 Epoch 700/1000
 83/83 [=====] - 10s 119ms/step - loss: 4.6689e-04
 Epoch 701/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1427e-04
 Epoch 702/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1590e-04
 Epoch 703/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8877e-04
 Epoch 704/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2178e-04
 Epoch 705/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2165e-04
 Epoch 706/1000
 83/83 [=====] - 11s 131ms/step - loss: 5.2534e-04
 Epoch 707/1000
 83/83 [=====] - 10s 123ms/step - loss: 5.3351e-04
 Epoch 708/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1260e-04
 Epoch 709/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8124e-04
 Epoch 710/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.4237e-04
 Epoch 711/1000
 83/83 [=====] - 10s 119ms/step - loss: 4.8925e-04
 Epoch 712/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9762e-04
 Epoch 713/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8958e-04
 Epoch 714/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2597e-04
 Epoch 715/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2414e-04
 Epoch 716/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.2879e-04
 Epoch 717/1000

83/83 [=====] - 10s 118ms/step - loss: 5.1810e-04
 Epoch 718/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8549e-04
 Epoch 719/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0216e-04
 Epoch 720/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.6876e-04
 Epoch 721/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8754e-04
 Epoch 722/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9909e-04
 Epoch 723/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2606e-04
 Epoch 724/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0702e-04
 Epoch 725/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.6900e-04
 Epoch 726/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8018e-04
 Epoch 727/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0157e-04
 Epoch 728/1000
 83/83 [=====] - 11s 127ms/step - loss: 5.4063e-04
 Epoch 729/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9068e-04
 Epoch 730/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0007e-04
 Epoch 731/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2706e-04
 Epoch 732/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3868e-04
 Epoch 733/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.7923e-04
 Epoch 734/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0358e-04
 Epoch 735/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2372e-04
 Epoch 736/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1021e-04
 Epoch 737/1000
 83/83 [=====] - 11s 128ms/step - loss: 5.2768e-04
 Epoch 738/1000
 83/83 [=====] - 11s 128ms/step - loss: 4.9176e-04
 Epoch 739/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9886e-04
 Epoch 740/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2567e-04
 Epoch 741/1000

83/83 [=====] - 10s 118ms/step - loss: 4.9398e-04
 Epoch 742/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8185e-04
 Epoch 743/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1049e-04
 Epoch 744/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9052e-04
 Epoch 745/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1696e-04
 Epoch 746/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.6959e-04
 Epoch 747/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9106e-04
 Epoch 748/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0991e-04
 Epoch 749/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0004e-04
 Epoch 750/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0123e-04
 Epoch 751/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0929e-04
 Epoch 752/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2493e-04
 Epoch 753/1000
 83/83 [=====] - 10s 124ms/step - loss: 4.8497e-04
 Epoch 754/1000
 83/83 [=====] - 11s 127ms/step - loss: 5.1705e-04
 Epoch 755/1000
 83/83 [=====] - 11s 127ms/step - loss: 5.0919e-04
 Epoch 756/1000
 83/83 [=====] - 11s 128ms/step - loss: 5.1507e-04
 Epoch 757/1000
 83/83 [=====] - 11s 128ms/step - loss: 5.0581e-04
 Epoch 758/1000
 83/83 [=====] - 11s 132ms/step - loss: 5.1276e-04
 Epoch 759/1000
 83/83 [=====] - 11s 132ms/step - loss: 5.1327e-04
 Epoch 760/1000
 83/83 [=====] - 10s 126ms/step - loss: 5.0551e-04
 Epoch 761/1000
 83/83 [=====] - 11s 128ms/step - loss: 5.0363e-04
 Epoch 762/1000
 83/83 [=====] - 11s 127ms/step - loss: 5.1630e-04
 Epoch 763/1000
 83/83 [=====] - 11s 127ms/step - loss: 5.0990e-04
 Epoch 764/1000
 83/83 [=====] - 10s 123ms/step - loss: 5.4720e-04
 Epoch 765/1000

83/83 [=====] - 10s 124ms/step - loss: 5.1723e-04
 Epoch 766/1000
 83/83 [=====] - 10s 123ms/step - loss: 5.2322e-04
 Epoch 767/1000
 83/83 [=====] - 11s 128ms/step - loss: 5.3649e-04
 Epoch 768/1000
 83/83 [=====] - 11s 137ms/step - loss: 4.8352e-04
 Epoch 769/1000
 83/83 [=====] - 10s 124ms/step - loss: 4.9617e-04
 Epoch 770/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.0523e-04
 Epoch 771/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.3052e-04
 Epoch 772/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.0980e-04
 Epoch 773/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9697e-04
 Epoch 774/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.1800e-04
 Epoch 775/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1893e-04
 Epoch 776/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1793e-04
 Epoch 777/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2934e-04
 Epoch 778/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.0310e-04
 Epoch 779/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1863e-04
 Epoch 780/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2897e-04
 Epoch 781/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.7544e-04
 Epoch 782/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8926e-04
 Epoch 783/1000
 83/83 [=====] - 10s 116ms/step - loss: 4.9794e-04
 Epoch 784/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1203e-04
 Epoch 785/1000
 83/83 [=====] - 10s 116ms/step - loss: 4.9643e-04
 Epoch 786/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1011e-04
 Epoch 787/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.5510e-04
 Epoch 788/1000
 83/83 [=====] - 10s 121ms/step - loss: 4.9020e-04
 Epoch 789/1000

83/83 [=====] - 10s 124ms/step - loss: 5.1689e-04
 Epoch 790/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9472e-04
 Epoch 791/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8515e-04
 Epoch 792/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1761e-04
 Epoch 793/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9561e-04
 Epoch 794/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2380e-04
 Epoch 795/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.7856e-04
 Epoch 796/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9353e-04
 Epoch 797/1000
 83/83 [=====] - 10s 116ms/step - loss: 4.9553e-04
 Epoch 798/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8457e-04
 Epoch 799/1000
 83/83 [=====] - 11s 137ms/step - loss: 4.9929e-04
 Epoch 800/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.7942e-04
 Epoch 801/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9725e-04
 Epoch 802/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.7492e-04
 Epoch 803/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.2440e-04
 Epoch 804/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0279e-04
 Epoch 805/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1655e-04
 Epoch 806/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8600e-04
 Epoch 807/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0955e-04
 Epoch 808/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0994e-04
 Epoch 809/1000
 83/83 [=====] - 10s 116ms/step - loss: 4.7930e-04
 Epoch 810/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.0029e-04
 Epoch 811/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8840e-04
 Epoch 812/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2089e-04
 Epoch 813/1000

83/83 [=====] - 10s 118ms/step - loss: 4.6470e-04
Epoch 814/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9540e-04
Epoch 815/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0103e-04
Epoch 816/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1030e-04
Epoch 817/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9227e-04
Epoch 818/1000
83/83 [=====] - 10s 118ms/step - loss: 4.7627e-04
Epoch 819/1000
83/83 [=====] - 10s 124ms/step - loss: 4.9343e-04
Epoch 820/1000
83/83 [=====] - 10s 122ms/step - loss: 4.6819e-04
Epoch 821/1000
83/83 [=====] - 10s 116ms/step - loss: 5.1834e-04
Epoch 822/1000
83/83 [=====] - 10s 116ms/step - loss: 5.1120e-04
Epoch 823/1000
83/83 [=====] - 10s 118ms/step - loss: 4.9169e-04
Epoch 824/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9404e-04
Epoch 825/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9976e-04
Epoch 826/1000
83/83 [=====] - 10s 116ms/step - loss: 5.2146e-04
Epoch 827/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8589e-04
Epoch 828/1000
83/83 [=====] - 10s 118ms/step - loss: 5.0695e-04
Epoch 829/1000
83/83 [=====] - 10s 118ms/step - loss: 5.2410e-04
Epoch 830/1000
83/83 [=====] - 11s 133ms/step - loss: 4.8798e-04
Epoch 831/1000
83/83 [=====] - 10s 123ms/step - loss: 5.2710e-04
Epoch 832/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8616e-04
Epoch 833/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9697e-04
Epoch 834/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0048e-04
Epoch 835/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0430e-04
Epoch 836/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8336e-04
Epoch 837/1000

83/83 [=====] - 10s 117ms/step - loss: 5.0678e-04
Epoch 838/1000
83/83 [=====] - 10s 116ms/step - loss: 4.7718e-04
Epoch 839/1000
83/83 [=====] - 10s 117ms/step - loss: 5.2936e-04
Epoch 840/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8720e-04
Epoch 841/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0146e-04
Epoch 842/1000
83/83 [=====] - 10s 118ms/step - loss: 5.2948e-04
Epoch 843/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0077e-04
Epoch 844/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0564e-04
Epoch 845/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7725e-04
Epoch 846/1000
83/83 [=====] - 10s 116ms/step - loss: 5.0049e-04
Epoch 847/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7898e-04
Epoch 848/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8827e-04
Epoch 849/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0390e-04
Epoch 850/1000
83/83 [=====] - 10s 125ms/step - loss: 5.1177e-04
Epoch 851/1000
83/83 [=====] - 10s 119ms/step - loss: 5.2442e-04
Epoch 852/1000
83/83 [=====] - 10s 116ms/step - loss: 4.9108e-04
Epoch 853/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7038e-04
Epoch 854/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9735e-04
Epoch 855/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0753e-04
Epoch 856/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1569e-04
Epoch 857/1000
83/83 [=====] - 10s 116ms/step - loss: 4.8427e-04
Epoch 858/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7088e-04
Epoch 859/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8344e-04
Epoch 860/1000
83/83 [=====] - 10s 118ms/step - loss: 4.7285e-04
Epoch 861/1000

83/83 [=====] - 10s 124ms/step - loss: 5.1856e-04
Epoch 862/1000
83/83 [=====] - 11s 130ms/step - loss: 5.2004e-04
Epoch 863/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8039e-04
Epoch 864/1000
83/83 [=====] - 10s 116ms/step - loss: 4.8927e-04
Epoch 865/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9651e-04
Epoch 866/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0131e-04
Epoch 867/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8264e-04
Epoch 868/1000
83/83 [=====] - 10s 116ms/step - loss: 5.0177e-04
Epoch 869/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0574e-04
Epoch 870/1000
83/83 [=====] - 10s 116ms/step - loss: 4.7292e-04
Epoch 871/1000
83/83 [=====] - 10s 116ms/step - loss: 5.3495e-04
Epoch 872/1000
83/83 [=====] - 10s 118ms/step - loss: 4.7213e-04
Epoch 873/1000
83/83 [=====] - 10s 116ms/step - loss: 4.6214e-04
Epoch 874/1000
83/83 [=====] - 10s 117ms/step - loss: 4.6660e-04
Epoch 875/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8719e-04
Epoch 876/1000
83/83 [=====] - 10s 117ms/step - loss: 5.3218e-04
Epoch 877/1000
83/83 [=====] - 10s 116ms/step - loss: 4.8545e-04
Epoch 878/1000
83/83 [=====] - 10s 118ms/step - loss: 4.8053e-04
Epoch 879/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1985e-04
Epoch 880/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9121e-04
Epoch 881/1000
83/83 [=====] - 10s 126ms/step - loss: 5.1901e-04
Epoch 882/1000
83/83 [=====] - 10s 118ms/step - loss: 4.7678e-04
Epoch 883/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0712e-04
Epoch 884/1000
83/83 [=====] - 10s 118ms/step - loss: 4.7115e-04
Epoch 885/1000

83/83 [=====] - 10s 118ms/step - loss: 4.8405e-04
 Epoch 886/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.7545e-04
 Epoch 887/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8580e-04
 Epoch 888/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6682e-04
 Epoch 889/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8682e-04
 Epoch 890/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6077e-04
 Epoch 891/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8792e-04
 Epoch 892/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2308e-04
 Epoch 893/1000
 83/83 [=====] - 11s 135ms/step - loss: 5.0713e-04
 Epoch 894/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8819e-04
 Epoch 895/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6882e-04
 Epoch 896/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6285e-04
 Epoch 897/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0765e-04
 Epoch 898/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9746e-04
 Epoch 899/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.1092e-04
 Epoch 900/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.7265e-04
 Epoch 901/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.5874e-04
 Epoch 902/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.7314e-04
 Epoch 903/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.7134e-04
 Epoch 904/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.7457e-04
 Epoch 905/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9748e-04
 Epoch 906/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.0991e-04
 Epoch 907/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.0180e-04
 Epoch 908/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0492e-04
 Epoch 909/1000

83/83 [=====] - 10s 117ms/step - loss: 5.0767e-04
Epoch 910/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9386e-04
Epoch 911/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9340e-04
Epoch 912/1000
83/83 [=====] - 11s 127ms/step - loss: 4.8547e-04
Epoch 913/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1660e-04
Epoch 914/1000
83/83 [=====] - 10s 118ms/step - loss: 4.7181e-04
Epoch 915/1000
83/83 [=====] - 10s 117ms/step - loss: 4.6119e-04
Epoch 916/1000
83/83 [=====] - 10s 118ms/step - loss: 4.6232e-04
Epoch 917/1000
83/83 [=====] - 10s 116ms/step - loss: 4.8487e-04
Epoch 918/1000
83/83 [=====] - 10s 117ms/step - loss: 4.6387e-04
Epoch 919/1000
83/83 [=====] - 10s 116ms/step - loss: 4.7846e-04
Epoch 920/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1113e-04
Epoch 921/1000
83/83 [=====] - 10s 118ms/step - loss: 4.6196e-04
Epoch 922/1000
83/83 [=====] - 10s 117ms/step - loss: 4.6338e-04
Epoch 923/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9616e-04
Epoch 924/1000
83/83 [=====] - 11s 127ms/step - loss: 5.3235e-04
Epoch 925/1000
83/83 [=====] - 11s 128ms/step - loss: 4.5790e-04
Epoch 926/1000
83/83 [=====] - 10s 118ms/step - loss: 4.7424e-04
Epoch 927/1000
83/83 [=====] - 10s 118ms/step - loss: 4.9667e-04
Epoch 928/1000
83/83 [=====] - 10s 118ms/step - loss: 4.5167e-04
Epoch 929/1000
83/83 [=====] - 10s 116ms/step - loss: 4.7097e-04
Epoch 930/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7456e-04
Epoch 931/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1713e-04
Epoch 932/1000
83/83 [=====] - 10s 118ms/step - loss: 4.9964e-04
Epoch 933/1000

83/83 [=====] - 10s 118ms/step - loss: 5.0531e-04
 Epoch 934/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8660e-04
 Epoch 935/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.7827e-04
 Epoch 936/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9058e-04
 Epoch 937/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9695e-04
 Epoch 938/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9388e-04
 Epoch 939/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8720e-04
 Epoch 940/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.5138e-04
 Epoch 941/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1393e-04
 Epoch 942/1000
 83/83 [=====] - 10s 116ms/step - loss: 4.8535e-04
 Epoch 943/1000
 83/83 [=====] - 11s 128ms/step - loss: 4.5689e-04
 Epoch 944/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9117e-04
 Epoch 945/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1814e-04
 Epoch 946/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6720e-04
 Epoch 947/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.5541e-04
 Epoch 948/1000
 83/83 [=====] - 10s 116ms/step - loss: 4.8711e-04
 Epoch 949/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6431e-04
 Epoch 950/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.6675e-04
 Epoch 951/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0700e-04
 Epoch 952/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.7895e-04
 Epoch 953/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8845e-04
 Epoch 954/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.5749e-04
 Epoch 955/1000
 83/83 [=====] - 10s 120ms/step - loss: 4.9215e-04
 Epoch 956/1000
 83/83 [=====] - 11s 135ms/step - loss: 4.8196e-04
 Epoch 957/1000

83/83 [=====] - 11s 127ms/step - loss: 4.7880e-04
Epoch 958/1000
83/83 [=====] - 11s 127ms/step - loss: 4.8820e-04
Epoch 959/1000
83/83 [=====] - 11s 127ms/step - loss: 5.0730e-04
Epoch 960/1000
83/83 [=====] - 10s 126ms/step - loss: 4.7772e-04
Epoch 961/1000
83/83 [=====] - 10s 124ms/step - loss: 4.4718e-04
Epoch 962/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7601e-04
Epoch 963/1000
83/83 [=====] - 10s 118ms/step - loss: 4.9048e-04
Epoch 964/1000
83/83 [=====] - 10s 118ms/step - loss: 4.6305e-04
Epoch 965/1000
83/83 [=====] - 10s 118ms/step - loss: 5.2595e-04
Epoch 966/1000
83/83 [=====] - 10s 118ms/step - loss: 4.7231e-04
Epoch 967/1000
83/83 [=====] - 10s 117ms/step - loss: 4.6993e-04
Epoch 968/1000
83/83 [=====] - 10s 121ms/step - loss: 4.7459e-04
Epoch 969/1000
83/83 [=====] - 10s 123ms/step - loss: 4.9234e-04
Epoch 970/1000
83/83 [=====] - 10s 120ms/step - loss: 4.6607e-04
Epoch 971/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8282e-04
Epoch 972/1000
83/83 [=====] - 10s 117ms/step - loss: 4.6567e-04
Epoch 973/1000
83/83 [=====] - 10s 125ms/step - loss: 4.8145e-04
Epoch 974/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7380e-04
Epoch 975/1000
83/83 [=====] - 10s 116ms/step - loss: 4.7221e-04
Epoch 976/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8637e-04
Epoch 977/1000
83/83 [=====] - 10s 118ms/step - loss: 4.9656e-04
Epoch 978/1000
83/83 [=====] - 10s 116ms/step - loss: 4.7940e-04
Epoch 979/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8109e-04
Epoch 980/1000
83/83 [=====] - 10s 118ms/step - loss: 4.9598e-04
Epoch 981/1000

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83/83 [=====] - 10s 118ms/step - loss: 4.8998e-04
Epoch 982/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9559e-04
Epoch 983/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8256e-04
Epoch 984/1000
83/83 [=====] - 10s 118ms/step - loss: 4.9611e-04
Epoch 985/1000
83/83 [=====] - 10s 118ms/step - loss: 4.8396e-04
Epoch 986/1000
83/83 [=====] - 10s 126ms/step - loss: 4.6476e-04
Epoch 987/1000
83/83 [=====] - 11s 129ms/step - loss: 4.7333e-04
Epoch 988/1000
83/83 [=====] - 10s 118ms/step - loss: 4.7016e-04
Epoch 989/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0545e-04
Epoch 990/1000
83/83 [=====] - 10s 116ms/step - loss: 4.6727e-04
Epoch 991/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8756e-04
Epoch 992/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7229e-04
Epoch 993/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7141e-04
Epoch 994/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9710e-04
Epoch 995/1000
83/83 [=====] - 10s 116ms/step - loss: 4.6477e-04
Epoch 996/1000
83/83 [=====] - 10s 116ms/step - loss: 4.6792e-04
Epoch 997/1000
83/83 [=====] - 10s 116ms/step - loss: 4.7361e-04
Epoch 998/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7838e-04
Epoch 999/1000
83/83 [=====] - 10s 116ms/step - loss: 4.7461e-04
Epoch 1000/1000
83/83 [=====] - 10s 116ms/step - loss: 4.5478e-04

```

[105]: <tensorflow.python.keras.callbacks.History at 0x7fde97628310>

```

[106]: testdataframe= test
testdataframe['Date'] = testdataframe.index
testdata = pd.DataFrame(columns = ['Date', 'Close'])
testdata['Date'] = testdataframe['Date']
testdata['Close'] = testdataframe['Close']

```

```

real_stock_price = testdata.iloc[:, 1:2].values
dataset_total = pd.concat((data2['Close'], testdata['Close']), axis = 0)
inputs = dataset_total[len(dataset_total) - len(testdata) - 60:].values
inputs = inputs.reshape(-1,1)
inputs = sc.transform(inputs)
X_test = []
for i in range(60, 593):
    X_test.append(inputs[i-60:i, 0])
X_test = np.array(X_test)
X_test = np.reshape(X_test, (X_test.shape[0], X_test.shape[1], 1))

```

```

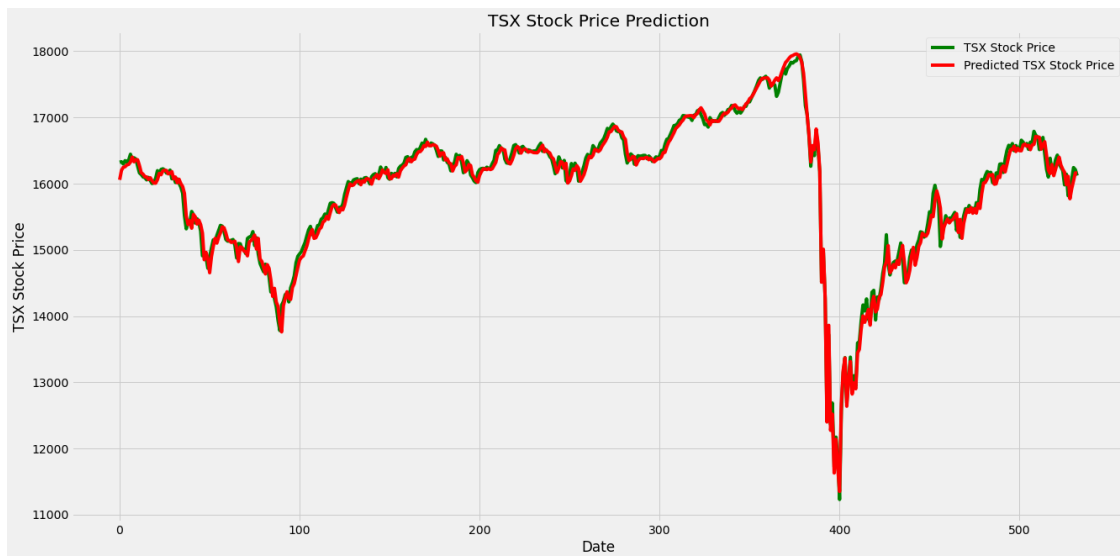
[107]: predicted_stock_price = regressor.predict(X_test)
predicted_stock_price = sc.inverse_transform(predicted_stock_price)

```

```

[108]: plt.figure(figsize=(20,10))
plt.plot(real_stock_price, color = 'green', label = 'TSX Stock Price')
plt.plot(predicted_stock_price, color = 'red', label = 'Predicted TSX Stock Price')
plt.title('TSX Stock Price Prediction')
plt.xlabel('Date')
plt.ylabel('TSX Stock Price')
plt.legend()
plt.show()

```



```

[109]: rmse_predict= np.reshape(predicted_stock_price,533)

```

```

[110]: #forecast metrics
def smape(a, f):

```

```

    return 1/len(a) * np.sum(2 * np.abs(f-a) / (np.abs(a) + np.abs(f))*100)
smape(test["Close"].values,rmse_predict)

```

[110]: 0.534842510006781

```

[111]: #forecast metrics
from sklearn.metrics import mean_absolute_error
from sklearn.metrics import mean_squared_error
from sklearn.metrics import r2_score
mae = mean_absolute_error(test["Close"].values, rmse_predict)
mse = mean_squared_error(test["Close"].values, rmse_predict)
rmse = np.sqrt(mse)

print("Results of sklearn.metrics:")
print("MAE:",mae)
print("MSE:", mse)
print("RMSE:", rmse)

```

```

Results of sklearn.metrics:
MAE: 83.77830782070818
MSE: 12129.751352569736
RMSE: 110.13515039518371

```

```

[112]: elapsed_time = time.process_time() - t
print(elapsed_time)

```

30921.342013751993

[]:

[]:

```

[113]: import time

t = time.process_time()

```

```

[114]: regressorGRU = Sequential()
regressorGRU.add(GRU(units = 50, return_sequences = True, input_shape =
    ↪(X_train.shape[1],1)))
regressorGRU.add(Dropout(0.15))
regressorGRU.add(GRU(units = 50, return_sequences = True))
regressorGRU.add(Dropout(0.15))
regressorGRU.add(GRU(units = 50, return_sequences = True))
regressorGRU.add(Dropout(0.15))
regressorGRU.add(GRU(units = 50))
regressorGRU.add(Dropout(0.15))

```

```
regressorGRU.add(Dense(units = 1))
```

```
[115]: regressorGRU.compile(optimizer='adam',loss='mean_squared_error')
```

```
[116]: regressorGRU.fit(X_train, y_train, epochs = 1000, batch_size = 32)
```

```
Epoch 1/1000
83/83 [=====] - 13s 154ms/step - loss: 0.0207
Epoch 2/1000
83/83 [=====] - 12s 145ms/step - loss: 0.0035
Epoch 3/1000
83/83 [=====] - 13s 155ms/step - loss: 0.0032
Epoch 4/1000
83/83 [=====] - 12s 141ms/step - loss: 0.0030
Epoch 5/1000
83/83 [=====] - 12s 141ms/step - loss: 0.0029
Epoch 6/1000
83/83 [=====] - 11s 138ms/step - loss: 0.0025
Epoch 7/1000
83/83 [=====] - 11s 134ms/step - loss: 0.0026
Epoch 8/1000
83/83 [=====] - 11s 132ms/step - loss: 0.0023
Epoch 9/1000
83/83 [=====] - 11s 132ms/step - loss: 0.0021
Epoch 10/1000
83/83 [=====] - 11s 132ms/step - loss: 0.0021
Epoch 11/1000
83/83 [=====] - 11s 131ms/step - loss: 0.0021
Epoch 12/1000
83/83 [=====] - 11s 130ms/step - loss: 0.0021
Epoch 13/1000
83/83 [=====] - 11s 131ms/step - loss: 0.0020
Epoch 14/1000
83/83 [=====] - 11s 135ms/step - loss: 0.0019
Epoch 15/1000
83/83 [=====] - 12s 148ms/step - loss: 0.0019
Epoch 16/1000
83/83 [=====] - 11s 128ms/step - loss: 0.0017
Epoch 17/1000
83/83 [=====] - 11s 128ms/step - loss: 0.0017
Epoch 18/1000
83/83 [=====] - 11s 127ms/step - loss: 0.0015
Epoch 19/1000
83/83 [=====] - 11s 129ms/step - loss: 0.0017
Epoch 20/1000
83/83 [=====] - 11s 128ms/step - loss: 0.0015
Epoch 21/1000
```


83/83 [=====] - 11s 128ms/step - loss: 0.0014
 Epoch 22/1000
 83/83 [=====] - 11s 129ms/step - loss: 0.0015
 Epoch 23/1000
 83/83 [=====] - 11s 128ms/step - loss: 0.0016
 Epoch 24/1000
 83/83 [=====] - 11s 129ms/step - loss: 0.0015
 Epoch 25/1000
 83/83 [=====] - 11s 129ms/step - loss: 0.0014
 Epoch 26/1000
 83/83 [=====] - 11s 128ms/step - loss: 0.0013
 Epoch 27/1000
 83/83 [=====] - 11s 127ms/step - loss: 0.0014
 Epoch 28/1000
 83/83 [=====] - 11s 127ms/step - loss: 0.0014
 Epoch 29/1000
 83/83 [=====] - 10s 126ms/step - loss: 0.0014
 Epoch 30/1000
 83/83 [=====] - 12s 139ms/step - loss: 0.0013
 Epoch 31/1000
 83/83 [=====] - 11s 128ms/step - loss: 0.0014
 Epoch 32/1000
 83/83 [=====] - 10s 126ms/step - loss: 0.0013
 Epoch 33/1000
 83/83 [=====] - 11s 127ms/step - loss: 0.0012
 Epoch 34/1000
 83/83 [=====] - 10s 125ms/step - loss: 0.0013
 Epoch 35/1000
 83/83 [=====] - 11s 127ms/step - loss: 0.0013
 Epoch 36/1000
 83/83 [=====] - 10s 126ms/step - loss: 0.0012
 Epoch 37/1000
 83/83 [=====] - 10s 125ms/step - loss: 0.0011
 Epoch 38/1000
 83/83 [=====] - 10s 125ms/step - loss: 0.0012
 Epoch 39/1000
 83/83 [=====] - 10s 125ms/step - loss: 0.0011
 Epoch 40/1000
 83/83 [=====] - 10s 125ms/step - loss: 0.0012
 Epoch 41/1000
 83/83 [=====] - 10s 126ms/step - loss: 0.0012
 Epoch 42/1000
 83/83 [=====] - 10s 126ms/step - loss: 0.0011
 Epoch 43/1000
 83/83 [=====] - 11s 134ms/step - loss: 0.0012
 Epoch 44/1000
 83/83 [=====] - 11s 138ms/step - loss: 0.0011
 Epoch 45/1000

83/83 [=====] - 10s 125ms/step - loss: 0.0010
 Epoch 46/1000
 83/83 [=====] - 10s 126ms/step - loss: 9.9763e-04
 Epoch 47/1000
 83/83 [=====] - 10s 126ms/step - loss: 0.0010
 Epoch 48/1000
 83/83 [=====] - 10s 125ms/step - loss: 0.0010
 Epoch 49/1000
 83/83 [=====] - 10s 125ms/step - loss: 0.0010
 Epoch 50/1000
 83/83 [=====] - 10s 125ms/step - loss: 0.0010
 Epoch 51/1000
 83/83 [=====] - 10s 125ms/step - loss: 0.0010
 Epoch 52/1000
 83/83 [=====] - 10s 125ms/step - loss: 9.5408e-04
 Epoch 53/1000
 83/83 [=====] - 10s 125ms/step - loss: 9.4649e-04
 Epoch 54/1000
 83/83 [=====] - 10s 125ms/step - loss: 9.3310e-04
 Epoch 55/1000
 83/83 [=====] - 10s 125ms/step - loss: 9.7447e-04
 Epoch 56/1000
 83/83 [=====] - 10s 124ms/step - loss: 9.2819e-04
 Epoch 57/1000
 83/83 [=====] - 10s 124ms/step - loss: 9.4126e-04
 Epoch 58/1000
 83/83 [=====] - 10s 125ms/step - loss: 9.5571e-04
 Epoch 59/1000
 83/83 [=====] - 11s 136ms/step - loss: 9.1012e-04
 Epoch 60/1000
 83/83 [=====] - 10s 124ms/step - loss: 9.1818e-04
 Epoch 61/1000
 83/83 [=====] - 10s 123ms/step - loss: 8.6550e-04
 Epoch 62/1000
 83/83 [=====] - 10s 124ms/step - loss: 8.7219e-04
 Epoch 63/1000
 83/83 [=====] - 10s 124ms/step - loss: 9.5998e-04
 Epoch 64/1000
 83/83 [=====] - 10s 125ms/step - loss: 9.3022e-04
 Epoch 65/1000
 83/83 [=====] - 10s 126ms/step - loss: 9.0398e-04
 Epoch 66/1000
 83/83 [=====] - 10s 126ms/step - loss: 8.1206e-04
 Epoch 67/1000
 83/83 [=====] - 10s 126ms/step - loss: 8.9825e-04
 Epoch 68/1000
 83/83 [=====] - 10s 125ms/step - loss: 8.7557e-04
 Epoch 69/1000

83/83 [=====] - 10s 126ms/step - loss: 9.6892e-04
 Epoch 70/1000
 83/83 [=====] - 11s 128ms/step - loss: 8.6691e-04
 Epoch 71/1000
 83/83 [=====] - 10s 125ms/step - loss: 8.9194e-04
 Epoch 72/1000
 83/83 [=====] - 10s 124ms/step - loss: 8.7694e-04
 Epoch 73/1000
 83/83 [=====] - 12s 146ms/step - loss: 8.8925e-04
 Epoch 74/1000
 83/83 [=====] - 10s 126ms/step - loss: 8.0419e-04
 Epoch 75/1000
 83/83 [=====] - 10s 126ms/step - loss: 8.3613e-04
 Epoch 76/1000
 83/83 [=====] - 10s 125ms/step - loss: 8.4829e-04
 Epoch 77/1000
 83/83 [=====] - 10s 124ms/step - loss: 8.5753e-04
 Epoch 78/1000
 83/83 [=====] - 10s 123ms/step - loss: 8.1004e-04
 Epoch 79/1000
 83/83 [=====] - 10s 124ms/step - loss: 8.2269e-04
 Epoch 80/1000
 83/83 [=====] - 10s 123ms/step - loss: 8.6317e-04
 Epoch 81/1000
 83/83 [=====] - 10s 125ms/step - loss: 7.9078e-04
 Epoch 82/1000
 83/83 [=====] - 10s 124ms/step - loss: 7.6600e-04
 Epoch 83/1000
 83/83 [=====] - 10s 123ms/step - loss: 8.4236e-04
 Epoch 84/1000
 83/83 [=====] - 10s 124ms/step - loss: 8.0147e-04
 Epoch 85/1000
 83/83 [=====] - 10s 123ms/step - loss: 7.6355e-04
 Epoch 86/1000
 83/83 [=====] - 10s 124ms/step - loss: 7.9614e-04
 Epoch 87/1000
 83/83 [=====] - 10s 124ms/step - loss: 7.8806e-04
 Epoch 88/1000
 83/83 [=====] - 11s 135ms/step - loss: 7.4241e-04
 Epoch 89/1000
 83/83 [=====] - 10s 123ms/step - loss: 8.9246e-04
 Epoch 90/1000
 83/83 [=====] - 10s 122ms/step - loss: 8.7443e-04
 Epoch 91/1000
 83/83 [=====] - 10s 123ms/step - loss: 7.5131e-04
 Epoch 92/1000
 83/83 [=====] - 10s 121ms/step - loss: 7.5721e-04
 Epoch 93/1000

83/83 [=====] - 10s 123ms/step - loss: 7.9221e-04
Epoch 94/1000
83/83 [=====] - 10s 124ms/step - loss: 7.6098e-04
Epoch 95/1000
83/83 [=====] - 10s 122ms/step - loss: 7.5800e-04
Epoch 96/1000
83/83 [=====] - 10s 123ms/step - loss: 7.9322e-04
Epoch 97/1000
83/83 [=====] - 10s 122ms/step - loss: 8.5190e-04
Epoch 98/1000
83/83 [=====] - 10s 123ms/step - loss: 7.9336e-04
Epoch 99/1000
83/83 [=====] - 10s 122ms/step - loss: 7.9997e-04
Epoch 100/1000
83/83 [=====] - 10s 122ms/step - loss: 7.9506e-04
Epoch 101/1000
83/83 [=====] - 10s 120ms/step - loss: 7.6356e-04
Epoch 102/1000
83/83 [=====] - 10s 125ms/step - loss: 7.9383e-04
Epoch 103/1000
83/83 [=====] - 12s 139ms/step - loss: 7.0125e-04
Epoch 104/1000
83/83 [=====] - 10s 120ms/step - loss: 7.2347e-04
Epoch 105/1000
83/83 [=====] - 10s 121ms/step - loss: 7.2604e-04
Epoch 106/1000
83/83 [=====] - 10s 120ms/step - loss: 7.8272e-04
Epoch 107/1000
83/83 [=====] - 10s 120ms/step - loss: 7.0362e-04
Epoch 108/1000
83/83 [=====] - 10s 120ms/step - loss: 7.2968e-04
Epoch 109/1000
83/83 [=====] - 10s 120ms/step - loss: 7.8561e-04
Epoch 110/1000
83/83 [=====] - 10s 120ms/step - loss: 6.8693e-04
Epoch 111/1000
83/83 [=====] - 10s 120ms/step - loss: 7.4514e-04
Epoch 112/1000
83/83 [=====] - 10s 120ms/step - loss: 7.3028e-04
Epoch 113/1000
83/83 [=====] - 10s 120ms/step - loss: 7.1056e-04
Epoch 114/1000
83/83 [=====] - 10s 120ms/step - loss: 7.7493e-04
Epoch 115/1000
83/83 [=====] - 10s 121ms/step - loss: 7.7236e-04
Epoch 116/1000
83/83 [=====] - 10s 120ms/step - loss: 7.3528e-04
Epoch 117/1000

83/83 [=====] - 10s 121ms/step - loss: 7.3925e-04
 Epoch 118/1000
 83/83 [=====] - 11s 134ms/step - loss: 7.2708e-04
 Epoch 119/1000
 83/83 [=====] - 10s 121ms/step - loss: 6.8341e-04
 Epoch 120/1000
 83/83 [=====] - 10s 121ms/step - loss: 6.8897e-04
 Epoch 121/1000
 83/83 [=====] - 10s 120ms/step - loss: 7.0248e-04
 Epoch 122/1000
 83/83 [=====] - 10s 121ms/step - loss: 6.7230e-04
 Epoch 123/1000
 83/83 [=====] - 10s 119ms/step - loss: 8.1221e-04
 Epoch 124/1000
 83/83 [=====] - 10s 121ms/step - loss: 6.8832e-04
 Epoch 125/1000
 83/83 [=====] - 10s 120ms/step - loss: 7.2522e-04
 Epoch 126/1000
 83/83 [=====] - 10s 120ms/step - loss: 7.3177e-04
 Epoch 127/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.4738e-04
 Epoch 128/1000
 83/83 [=====] - 10s 120ms/step - loss: 7.1267e-04
 Epoch 129/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.8327e-04
 Epoch 130/1000
 83/83 [=====] - 10s 120ms/step - loss: 7.0770e-04
 Epoch 131/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.9826e-04
 Epoch 132/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.7597e-04
 Epoch 133/1000
 83/83 [=====] - 11s 138ms/step - loss: 7.1288e-04
 Epoch 134/1000
 83/83 [=====] - 10s 123ms/step - loss: 6.8893e-04
 Epoch 135/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.7187e-04
 Epoch 136/1000
 83/83 [=====] - 10s 120ms/step - loss: 7.2439e-04
 Epoch 137/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.6524e-04
 Epoch 138/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.5206e-04
 Epoch 139/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.7644e-04
 Epoch 140/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.7177e-04
 Epoch 141/1000

83/83 [=====] - 10s 119ms/step - loss: 7.2618e-04
 Epoch 142/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.6124e-04
 Epoch 143/1000
 83/83 [=====] - 10s 119ms/step - loss: 7.2391e-04
 Epoch 144/1000
 83/83 [=====] - 10s 118ms/step - loss: 7.6164e-04
 Epoch 145/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.7408e-04
 Epoch 146/1000
 83/83 [=====] - 10s 119ms/step - loss: 7.3810e-04
 Epoch 147/1000
 83/83 [=====] - 10s 119ms/step - loss: 7.7058e-04
 Epoch 148/1000
 83/83 [=====] - 11s 130ms/step - loss: 6.8013e-04
 Epoch 149/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.6614e-04
 Epoch 150/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.8452e-04
 Epoch 151/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.9332e-04
 Epoch 152/1000
 83/83 [=====] - 10s 119ms/step - loss: 7.0354e-04
 Epoch 153/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.4992e-04
 Epoch 154/1000
 83/83 [=====] - 11s 128ms/step - loss: 6.3763e-04
 Epoch 155/1000
 83/83 [=====] - 11s 128ms/step - loss: 7.1962e-04
 Epoch 156/1000
 83/83 [=====] - 11s 128ms/step - loss: 6.7345e-04
 Epoch 157/1000
 83/83 [=====] - 11s 128ms/step - loss: 6.2073e-04
 Epoch 158/1000
 83/83 [=====] - 11s 128ms/step - loss: 7.1057e-04
 Epoch 159/1000
 83/83 [=====] - 11s 128ms/step - loss: 6.4774e-04
 Epoch 160/1000
 83/83 [=====] - 11s 127ms/step - loss: 6.4980e-04
 Epoch 161/1000
 83/83 [=====] - 11s 127ms/step - loss: 6.7555e-04
 Epoch 162/1000
 83/83 [=====] - 11s 128ms/step - loss: 7.2233e-04
 Epoch 163/1000
 83/83 [=====] - 12s 143ms/step - loss: 6.8503e-04
 Epoch 164/1000
 83/83 [=====] - 11s 134ms/step - loss: 6.6454e-04
 Epoch 165/1000

83/83 [=====] - 10s 119ms/step - loss: 6.6227e-04
Epoch 166/1000
83/83 [=====] - 10s 119ms/step - loss: 7.1285e-04
Epoch 167/1000
83/83 [=====] - 10s 119ms/step - loss: 6.4421e-04
Epoch 168/1000
83/83 [=====] - 10s 119ms/step - loss: 6.8975e-04
Epoch 169/1000
83/83 [=====] - 10s 120ms/step - loss: 6.3777e-04
Epoch 170/1000
83/83 [=====] - 10s 119ms/step - loss: 6.7784e-04
Epoch 171/1000
83/83 [=====] - 10s 118ms/step - loss: 6.8036e-04
Epoch 172/1000
83/83 [=====] - 10s 119ms/step - loss: 6.4707e-04
Epoch 173/1000
83/83 [=====] - 10s 119ms/step - loss: 6.6338e-04
Epoch 174/1000
83/83 [=====] - 10s 119ms/step - loss: 7.0050e-04
Epoch 175/1000
83/83 [=====] - 10s 120ms/step - loss: 7.1249e-04
Epoch 176/1000
83/83 [=====] - 10s 119ms/step - loss: 6.5191e-04
Epoch 177/1000
83/83 [=====] - 10s 121ms/step - loss: 6.5249e-04
Epoch 178/1000
83/83 [=====] - 11s 127ms/step - loss: 6.5919e-04
Epoch 179/1000
83/83 [=====] - 10s 119ms/step - loss: 6.1973e-04
Epoch 180/1000
83/83 [=====] - 10s 119ms/step - loss: 6.3158e-04
Epoch 181/1000
83/83 [=====] - 10s 118ms/step - loss: 6.7129e-04
Epoch 182/1000
83/83 [=====] - 10s 120ms/step - loss: 6.3883e-04
Epoch 183/1000
83/83 [=====] - 10s 119ms/step - loss: 6.3334e-04
Epoch 184/1000
83/83 [=====] - 10s 119ms/step - loss: 6.8856e-04
Epoch 185/1000
83/83 [=====] - 10s 119ms/step - loss: 6.4904e-04
Epoch 186/1000
83/83 [=====] - 10s 119ms/step - loss: 6.3542e-04
Epoch 187/1000
83/83 [=====] - 10s 120ms/step - loss: 6.0793e-04
Epoch 188/1000
83/83 [=====] - 10s 123ms/step - loss: 6.1783e-04
Epoch 189/1000

83/83 [=====] - 11s 128ms/step - loss: 6.2705e-04
 Epoch 190/1000
 83/83 [=====] - 11s 127ms/step - loss: 6.3651e-04
 Epoch 191/1000
 83/83 [=====] - 11s 127ms/step - loss: 6.8241e-04
 Epoch 192/1000
 83/83 [=====] - 11s 130ms/step - loss: 6.2439e-04
 Epoch 193/1000
 83/83 [=====] - 10s 125ms/step - loss: 6.1274e-04
 Epoch 194/1000
 83/83 [=====] - 11s 137ms/step - loss: 7.2260e-04
 Epoch 195/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.5449e-04
 Epoch 196/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.8331e-04
 Epoch 197/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.7697e-04
 Epoch 198/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.1031e-04
 Epoch 199/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.4896e-04
 Epoch 200/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.0128e-04
 Epoch 201/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.3821e-04
 Epoch 202/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.3139e-04
 Epoch 203/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.3510e-04
 Epoch 204/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.4907e-04
 Epoch 205/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.4509e-04
 Epoch 206/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.4589e-04
 Epoch 207/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.6640e-04
 Epoch 208/1000
 83/83 [=====] - 11s 127ms/step - loss: 6.4243e-04
 Epoch 209/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.6033e-04
 Epoch 210/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.8917e-04
 Epoch 211/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.8550e-04
 Epoch 212/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.3236e-04
 Epoch 213/1000

83/83 [=====] - 10s 119ms/step - loss: 6.3040e-04
 Epoch 214/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.1431e-04
 Epoch 215/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.0725e-04
 Epoch 216/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.0213e-04
 Epoch 217/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.8316e-04
 Epoch 218/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.0998e-04
 Epoch 219/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.3184e-04
 Epoch 220/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.3527e-04
 Epoch 221/1000
 83/83 [=====] - 10s 126ms/step - loss: 6.4427e-04
 Epoch 222/1000
 83/83 [=====] - 11s 127ms/step - loss: 6.3972e-04
 Epoch 223/1000
 83/83 [=====] - 11s 127ms/step - loss: 6.1221e-04
 Epoch 224/1000
 83/83 [=====] - 12s 141ms/step - loss: 6.3791e-04
 Epoch 225/1000
 83/83 [=====] - 11s 135ms/step - loss: 6.3069e-04
 Epoch 226/1000
 83/83 [=====] - 11s 127ms/step - loss: 6.8737e-04
 Epoch 227/1000
 83/83 [=====] - 11s 129ms/step - loss: 6.3027e-04
 Epoch 228/1000
 83/83 [=====] - 11s 128ms/step - loss: 5.9197e-04
 Epoch 229/1000
 83/83 [=====] - 11s 128ms/step - loss: 6.2676e-04
 Epoch 230/1000
 83/83 [=====] - 11s 127ms/step - loss: 6.3345e-04
 Epoch 231/1000
 83/83 [=====] - 10s 123ms/step - loss: 5.7518e-04
 Epoch 232/1000
 83/83 [=====] - 10s 125ms/step - loss: 6.2954e-04
 Epoch 233/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.5988e-04
 Epoch 234/1000
 83/83 [=====] - 10s 125ms/step - loss: 6.0986e-04
 Epoch 235/1000
 83/83 [=====] - 10s 125ms/step - loss: 6.1946e-04
 Epoch 236/1000
 83/83 [=====] - 10s 125ms/step - loss: 6.3799e-04
 Epoch 237/1000

83/83 [=====] - 11s 133ms/step - loss: 6.4943e-04
 Epoch 238/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.5484e-04
 Epoch 239/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.9655e-04
 Epoch 240/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.6018e-04
 Epoch 241/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.2245e-04
 Epoch 242/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.2872e-04
 Epoch 243/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.3567e-04
 Epoch 244/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.4444e-04
 Epoch 245/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.3147e-04
 Epoch 246/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.1047e-04
 Epoch 247/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.1789e-04
 Epoch 248/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.0024e-04
 Epoch 249/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.9539e-04
 Epoch 250/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.4537e-04
 Epoch 251/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.3976e-04
 Epoch 252/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.2872e-04
 Epoch 253/1000
 83/83 [=====] - 10s 118ms/step - loss: 6.2078e-04
 Epoch 254/1000
 83/83 [=====] - 11s 128ms/step - loss: 5.8068e-04
 Epoch 255/1000
 83/83 [=====] - 11s 130ms/step - loss: 5.8760e-04
 Epoch 256/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.3326e-04
 Epoch 257/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.6745e-04
 Epoch 258/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.4200e-04
 Epoch 259/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.8759e-04
 Epoch 260/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.7168e-04
 Epoch 261/1000

83/83 [=====] - 10s 119ms/step - loss: 6.6408e-04
Epoch 262/1000
83/83 [=====] - 10s 119ms/step - loss: 6.1911e-04
Epoch 263/1000
83/83 [=====] - 10s 118ms/step - loss: 6.8076e-04
Epoch 264/1000
83/83 [=====] - 10s 119ms/step - loss: 6.0910e-04
Epoch 265/1000
83/83 [=====] - 10s 118ms/step - loss: 6.0295e-04
Epoch 266/1000
83/83 [=====] - 10s 118ms/step - loss: 6.4497e-04
Epoch 267/1000
83/83 [=====] - 10s 126ms/step - loss: 5.9172e-04
Epoch 268/1000
83/83 [=====] - 10s 123ms/step - loss: 5.8947e-04
Epoch 269/1000
83/83 [=====] - 10s 120ms/step - loss: 6.4453e-04
Epoch 270/1000
83/83 [=====] - 10s 118ms/step - loss: 6.1174e-04
Epoch 271/1000
83/83 [=====] - 10s 120ms/step - loss: 6.2317e-04
Epoch 272/1000
83/83 [=====] - 10s 119ms/step - loss: 6.0411e-04
Epoch 273/1000
83/83 [=====] - 10s 119ms/step - loss: 5.6372e-04
Epoch 274/1000
83/83 [=====] - 10s 119ms/step - loss: 6.0915e-04
Epoch 275/1000
83/83 [=====] - 10s 120ms/step - loss: 6.9970e-04
Epoch 276/1000
83/83 [=====] - 10s 119ms/step - loss: 6.0850e-04
Epoch 277/1000
83/83 [=====] - 10s 119ms/step - loss: 6.1252e-04
Epoch 278/1000
83/83 [=====] - 10s 118ms/step - loss: 6.1100e-04
Epoch 279/1000
83/83 [=====] - 10s 118ms/step - loss: 5.6803e-04
Epoch 280/1000
83/83 [=====] - 10s 123ms/step - loss: 6.3216e-04
Epoch 281/1000
83/83 [=====] - 10s 125ms/step - loss: 6.4027e-04
Epoch 282/1000
83/83 [=====] - 10s 123ms/step - loss: 5.5797e-04
Epoch 283/1000
83/83 [=====] - 10s 119ms/step - loss: 5.6592e-04
Epoch 284/1000
83/83 [=====] - 10s 119ms/step - loss: 5.7557e-04
Epoch 285/1000

83/83 [=====] - 11s 135ms/step - loss: 6.2463e-04
 Epoch 286/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.8083e-04
 Epoch 287/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.8615e-04
 Epoch 288/1000
 83/83 [=====] - 10s 124ms/step - loss: 6.0171e-04
 Epoch 289/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.5374e-04
 Epoch 290/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.5416e-04
 Epoch 291/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.6841e-04
 Epoch 292/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.9929e-04
 Epoch 293/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.6895e-04
 Epoch 294/1000
 83/83 [=====] - 10s 120ms/step - loss: 6.0095e-04
 Epoch 295/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.9299e-04
 Epoch 296/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.7513e-04
 Epoch 297/1000
 83/83 [=====] - 10s 123ms/step - loss: 6.1058e-04
 Epoch 298/1000
 83/83 [=====] - 11s 133ms/step - loss: 5.7141e-04
 Epoch 299/1000
 83/83 [=====] - 10s 123ms/step - loss: 5.8887e-04
 Epoch 300/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.6368e-04
 Epoch 301/1000
 83/83 [=====] - 10s 119ms/step - loss: 6.2176e-04
 Epoch 302/1000
 83/83 [=====] - 10s 122ms/step - loss: 5.7538e-04
 Epoch 303/1000
 83/83 [=====] - 10s 122ms/step - loss: 5.7901e-04
 Epoch 304/1000
 83/83 [=====] - 10s 121ms/step - loss: 6.0482e-04
 Epoch 305/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.8130e-04
 Epoch 306/1000
 83/83 [=====] - 10s 121ms/step - loss: 5.9275e-04
 Epoch 307/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.8089e-04
 Epoch 308/1000
 83/83 [=====] - 11s 127ms/step - loss: 6.4922e-04
 Epoch 309/1000

83/83 [=====] - 11s 128ms/step - loss: 5.9170e-04
 Epoch 310/1000
 83/83 [=====] - 11s 127ms/step - loss: 5.5363e-04
 Epoch 311/1000
 83/83 [=====] - 11s 127ms/step - loss: 5.8879e-04
 Epoch 312/1000
 83/83 [=====] - 12s 147ms/step - loss: 6.1588e-04
 Epoch 313/1000
 83/83 [=====] - 10s 126ms/step - loss: 6.0115e-04
 Epoch 314/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.7535e-04
 Epoch 315/1000
 83/83 [=====] - 11s 134ms/step - loss: 5.6984e-04
 Epoch 316/1000
 83/83 [=====] - 10s 125ms/step - loss: 6.0560e-04
 Epoch 317/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.2123e-04
 Epoch 318/1000
 83/83 [=====] - 10s 121ms/step - loss: 5.5787e-04
 Epoch 319/1000
 83/83 [=====] - 10s 121ms/step - loss: 6.0910e-04
 Epoch 320/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.6992e-04
 Epoch 321/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.6232e-04
 Epoch 322/1000
 83/83 [=====] - 10s 123ms/step - loss: 5.5867e-04
 Epoch 323/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.9739e-04
 Epoch 324/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.7237e-04
 Epoch 325/1000
 83/83 [=====] - 10s 123ms/step - loss: 5.6256e-04
 Epoch 326/1000
 83/83 [=====] - 10s 126ms/step - loss: 5.7791e-04
 Epoch 327/1000
 83/83 [=====] - 11s 137ms/step - loss: 5.5795e-04
 Epoch 328/1000
 83/83 [=====] - 11s 130ms/step - loss: 5.3763e-04
 Epoch 329/1000
 83/83 [=====] - 13s 152ms/step - loss: 5.8202e-04
 Epoch 330/1000
 83/83 [=====] - 13s 160ms/step - loss: 5.4526e-04
 Epoch 331/1000
 83/83 [=====] - 11s 136ms/step - loss: 5.7373e-04
 Epoch 332/1000
 83/83 [=====] - 11s 133ms/step - loss: 6.0742e-04
 Epoch 333/1000

83/83 [=====] - 11s 132ms/step - loss: 5.9973e-04
 Epoch 334/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.4795e-04
 Epoch 335/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.5560e-04
 Epoch 336/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.7858e-04
 Epoch 337/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.6831e-04
 Epoch 338/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.7413e-04
 Epoch 339/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.9446e-04
 Epoch 340/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.5797e-04
 Epoch 341/1000
 83/83 [=====] - 11s 132ms/step - loss: 5.5762e-04
 Epoch 342/1000
 83/83 [=====] - 11s 136ms/step - loss: 5.8524e-04
 Epoch 343/1000
 83/83 [=====] - 11s 136ms/step - loss: 5.8988e-04
 Epoch 344/1000
 83/83 [=====] - 13s 154ms/step - loss: 6.1883e-04
 Epoch 345/1000
 83/83 [=====] - 11s 135ms/step - loss: 6.0685e-04
 Epoch 346/1000
 83/83 [=====] - 11s 135ms/step - loss: 5.6497e-04
 Epoch 347/1000
 83/83 [=====] - 11s 137ms/step - loss: 5.5532e-04
 Epoch 348/1000
 83/83 [=====] - 11s 135ms/step - loss: 5.6519e-04
 Epoch 349/1000
 83/83 [=====] - 11s 135ms/step - loss: 5.7637e-04
 Epoch 350/1000
 83/83 [=====] - 12s 146ms/step - loss: 5.7024e-04
 Epoch 351/1000
 83/83 [=====] - 19s 230ms/step - loss: 5.6404e-04
 Epoch 352/1000
 83/83 [=====] - 15s 186ms/step - loss: 5.7946e-04
 Epoch 353/1000
 83/83 [=====] - 15s 183ms/step - loss: 6.4374e-04
 Epoch 354/1000
 83/83 [=====] - 15s 181ms/step - loss: 6.0752e-04
 Epoch 355/1000
 83/83 [=====] - 14s 165ms/step - loss: 5.6335e-04
 Epoch 356/1000
 83/83 [=====] - 11s 138ms/step - loss: 5.2150e-04
 Epoch 357/1000

83/83 [=====] - 10s 125ms/step - loss: 5.9498e-04
 Epoch 358/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.3156e-04
 Epoch 359/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.5131e-04
 Epoch 360/1000
 83/83 [=====] - 10s 126ms/step - loss: 5.8243e-04
 Epoch 361/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.5118e-04
 Epoch 362/1000
 83/83 [=====] - 10s 125ms/step - loss: 6.0106e-04
 Epoch 363/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.5479e-04
 Epoch 364/1000
 83/83 [=====] - 11s 135ms/step - loss: 5.2277e-04
 Epoch 365/1000
 83/83 [=====] - 11s 135ms/step - loss: 5.8732e-04
 Epoch 366/1000
 83/83 [=====] - 11s 134ms/step - loss: 5.4889e-04
 Epoch 367/1000
 83/83 [=====] - 11s 135ms/step - loss: 5.5698e-04
 Epoch 368/1000
 83/83 [=====] - 13s 155ms/step - loss: 5.6308e-04
 Epoch 369/1000
 83/83 [=====] - 12s 145ms/step - loss: 5.7260e-04
 Epoch 370/1000
 83/83 [=====] - 11s 135ms/step - loss: 5.6311e-04
 Epoch 371/1000
 83/83 [=====] - 10s 124ms/step - loss: 6.0061e-04
 Epoch 372/1000
 83/83 [=====] - 10s 123ms/step - loss: 5.5513e-04
 Epoch 373/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.1926e-04
 Epoch 374/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.3182e-04
 Epoch 375/1000
 83/83 [=====] - 11s 134ms/step - loss: 5.5320e-04
 Epoch 376/1000
 83/83 [=====] - 12s 147ms/step - loss: 5.2850e-04
 Epoch 377/1000
 83/83 [=====] - 10s 126ms/step - loss: 5.2307e-04
 Epoch 378/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.5933e-04
 Epoch 379/1000
 83/83 [=====] - 10s 123ms/step - loss: 5.4069e-04
 Epoch 380/1000
 83/83 [=====] - 11s 133ms/step - loss: 5.5202e-04
 Epoch 381/1000

83/83 [=====] - 10s 125ms/step - loss: 5.7431e-04
 Epoch 382/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.0172e-04
 Epoch 383/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.3652e-04
 Epoch 384/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.2267e-04
 Epoch 385/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.4649e-04
 Epoch 386/1000
 83/83 [=====] - 10s 123ms/step - loss: 5.4514e-04
 Epoch 387/1000
 83/83 [=====] - 10s 123ms/step - loss: 5.0633e-04
 Epoch 388/1000
 83/83 [=====] - 12s 142ms/step - loss: 5.8451e-04
 Epoch 389/1000
 83/83 [=====] - 12s 140ms/step - loss: 5.2628e-04
 Epoch 390/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.4690e-04
 Epoch 391/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.7735e-04
 Epoch 392/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.4301e-04
 Epoch 393/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.6807e-04
 Epoch 394/1000
 83/83 [=====] - 10s 123ms/step - loss: 5.5263e-04
 Epoch 395/1000
 83/83 [=====] - 10s 123ms/step - loss: 5.7707e-04
 Epoch 396/1000
 83/83 [=====] - 11s 130ms/step - loss: 5.2483e-04
 Epoch 397/1000
 83/83 [=====] - 12s 145ms/step - loss: 5.4547e-04
 Epoch 398/1000
 83/83 [=====] - 12s 144ms/step - loss: 5.4445e-04
 Epoch 399/1000
 83/83 [=====] - 11s 130ms/step - loss: 5.1154e-04
 Epoch 400/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.5102e-04
 Epoch 401/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.4639e-04
 Epoch 402/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.5428e-04
 Epoch 403/1000
 83/83 [=====] - 10s 123ms/step - loss: 5.5210e-04
 Epoch 404/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.2273e-04
 Epoch 405/1000

83/83 [=====] - 11s 133ms/step - loss: 5.2205e-04
 Epoch 406/1000
 83/83 [=====] - 12s 148ms/step - loss: 4.9851e-04
 Epoch 407/1000
 83/83 [=====] - 11s 129ms/step - loss: 5.5864e-04
 Epoch 408/1000
 83/83 [=====] - 11s 135ms/step - loss: 6.1298e-04
 Epoch 409/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.3326e-04
 Epoch 410/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.5660e-04
 Epoch 411/1000
 83/83 [=====] - 11s 127ms/step - loss: 5.6635e-04
 Epoch 412/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.5994e-04
 Epoch 413/1000
 83/83 [=====] - 10s 123ms/step - loss: 5.6088e-04
 Epoch 414/1000
 83/83 [=====] - 12s 143ms/step - loss: 5.7781e-04
 Epoch 415/1000
 83/83 [=====] - 12s 142ms/step - loss: 5.5630e-04
 Epoch 416/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.4032e-04
 Epoch 417/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.2164e-04
 Epoch 418/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.4547e-04
 Epoch 419/1000
 83/83 [=====] - 12s 146ms/step - loss: 5.1846e-04
 Epoch 420/1000
 83/83 [=====] - 11s 138ms/step - loss: 5.2486e-04
 Epoch 421/1000
 83/83 [=====] - 10s 123ms/step - loss: 5.3566e-04
 Epoch 422/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.7054e-04
 Epoch 423/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.2920e-04
 Epoch 424/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.0933e-04
 Epoch 425/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.6343e-04
 Epoch 426/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.5183e-04
 Epoch 427/1000
 83/83 [=====] - 12s 144ms/step - loss: 4.8872e-04
 Epoch 428/1000
 83/83 [=====] - 11s 129ms/step - loss: 5.2793e-04
 Epoch 429/1000

83/83 [=====] - 12s 146ms/step - loss: 5.3782e-04
Epoch 430/1000
83/83 [=====] - 11s 128ms/step - loss: 5.4985e-04
Epoch 431/1000
83/83 [=====] - 10s 117ms/step - loss: 5.6162e-04
Epoch 432/1000
83/83 [=====] - 10s 117ms/step - loss: 5.2651e-04
Epoch 433/1000
83/83 [=====] - 10s 118ms/step - loss: 5.4696e-04
Epoch 434/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0059e-04
Epoch 435/1000
83/83 [=====] - 10s 121ms/step - loss: 5.6016e-04
Epoch 436/1000
83/83 [=====] - 10s 120ms/step - loss: 5.1433e-04
Epoch 437/1000
83/83 [=====] - 10s 125ms/step - loss: 5.5888e-04
Epoch 438/1000
83/83 [=====] - 10s 117ms/step - loss: 5.4159e-04
Epoch 439/1000
83/83 [=====] - 10s 116ms/step - loss: 5.4114e-04
Epoch 440/1000
83/83 [=====] - 10s 117ms/step - loss: 5.2273e-04
Epoch 441/1000
83/83 [=====] - 10s 118ms/step - loss: 5.4301e-04
Epoch 442/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0386e-04
Epoch 443/1000
83/83 [=====] - 10s 117ms/step - loss: 5.5956e-04
Epoch 444/1000
83/83 [=====] - 10s 117ms/step - loss: 5.2886e-04
Epoch 445/1000
83/83 [=====] - 10s 118ms/step - loss: 5.2439e-04
Epoch 446/1000
83/83 [=====] - 10s 117ms/step - loss: 5.4416e-04
Epoch 447/1000
83/83 [=====] - 10s 118ms/step - loss: 5.5332e-04
Epoch 448/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0405e-04
Epoch 449/1000
83/83 [=====] - 10s 118ms/step - loss: 5.1068e-04
Epoch 450/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0920e-04
Epoch 451/1000
83/83 [=====] - 10s 117ms/step - loss: 5.2119e-04
Epoch 452/1000
83/83 [=====] - 10s 117ms/step - loss: 5.9112e-04
Epoch 453/1000

83/83 [=====] - 10s 118ms/step - loss: 5.5663e-04
 Epoch 454/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.3070e-04
 Epoch 455/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.8792e-04
 Epoch 456/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.4710e-04
 Epoch 457/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.1710e-04
 Epoch 458/1000
 83/83 [=====] - 11s 138ms/step - loss: 5.3997e-04
 Epoch 459/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.3355e-04
 Epoch 460/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.4261e-04
 Epoch 461/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1508e-04
 Epoch 462/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.4989e-04
 Epoch 463/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1226e-04
 Epoch 464/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2819e-04
 Epoch 465/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.3209e-04
 Epoch 466/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.4431e-04
 Epoch 467/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.3782e-04
 Epoch 468/1000
 83/83 [=====] - 10s 120ms/step - loss: 4.9651e-04
 Epoch 469/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8628e-04
 Epoch 470/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.7206e-04
 Epoch 471/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.4025e-04
 Epoch 472/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.2967e-04
 Epoch 473/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9690e-04
 Epoch 474/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.3693e-04
 Epoch 475/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.5636e-04
 Epoch 476/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9489e-04
 Epoch 477/1000

83/83 [=====] - 10s 117ms/step - loss: 4.9208e-04
Epoch 478/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9783e-04
Epoch 479/1000
83/83 [=====] - 10s 116ms/step - loss: 5.1382e-04
Epoch 480/1000
83/83 [=====] - 10s 116ms/step - loss: 5.2546e-04
Epoch 481/1000
83/83 [=====] - 10s 117ms/step - loss: 5.3617e-04
Epoch 482/1000
83/83 [=====] - 10s 116ms/step - loss: 5.2057e-04
Epoch 483/1000
83/83 [=====] - 10s 118ms/step - loss: 5.1007e-04
Epoch 484/1000
83/83 [=====] - 10s 117ms/step - loss: 5.6942e-04
Epoch 485/1000
83/83 [=====] - 10s 117ms/step - loss: 5.3450e-04
Epoch 486/1000
83/83 [=====] - 10s 117ms/step - loss: 5.2765e-04
Epoch 487/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1821e-04
Epoch 488/1000
83/83 [=====] - 10s 119ms/step - loss: 4.9974e-04
Epoch 489/1000
83/83 [=====] - 11s 134ms/step - loss: 4.8941e-04
Epoch 490/1000
83/83 [=====] - 10s 120ms/step - loss: 5.1654e-04
Epoch 491/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0453e-04
Epoch 492/1000
83/83 [=====] - 10s 117ms/step - loss: 5.4930e-04
Epoch 493/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0277e-04
Epoch 494/1000
83/83 [=====] - 10s 117ms/step - loss: 5.7304e-04
Epoch 495/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9712e-04
Epoch 496/1000
83/83 [=====] - 10s 117ms/step - loss: 5.5037e-04
Epoch 497/1000
83/83 [=====] - 10s 117ms/step - loss: 5.4182e-04
Epoch 498/1000
83/83 [=====] - 10s 126ms/step - loss: 5.3458e-04
Epoch 499/1000
83/83 [=====] - 10s 120ms/step - loss: 5.2584e-04
Epoch 500/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1974e-04
Epoch 501/1000

83/83 [=====] - 10s 116ms/step - loss: 5.6092e-04
 Epoch 502/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.2844e-04
 Epoch 503/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.1017e-04
 Epoch 504/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9540e-04
 Epoch 505/1000
 83/83 [=====] - 10s 116ms/step - loss: 4.8637e-04
 Epoch 506/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.4004e-04
 Epoch 507/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.3166e-04
 Epoch 508/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9904e-04
 Epoch 509/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.4072e-04
 Epoch 510/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8837e-04
 Epoch 511/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.1662e-04
 Epoch 512/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2910e-04
 Epoch 513/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8956e-04
 Epoch 514/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.6779e-04
 Epoch 515/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.4087e-04
 Epoch 516/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.5783e-04
 Epoch 517/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9174e-04
 Epoch 518/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1938e-04
 Epoch 519/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9942e-04
 Epoch 520/1000
 83/83 [=====] - 10s 124ms/step - loss: 5.0820e-04
 Epoch 521/1000
 83/83 [=====] - 11s 130ms/step - loss: 5.2633e-04
 Epoch 522/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.8953e-04
 Epoch 523/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.4809e-04
 Epoch 524/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0393e-04
 Epoch 525/1000

83/83 [=====] - 10s 117ms/step - loss: 5.1560e-04
Epoch 526/1000
83/83 [=====] - 10s 117ms/step - loss: 5.4321e-04
Epoch 527/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1846e-04
Epoch 528/1000
83/83 [=====] - 10s 117ms/step - loss: 5.2178e-04
Epoch 529/1000
83/83 [=====] - 10s 126ms/step - loss: 5.4554e-04
Epoch 530/1000
83/83 [=====] - 10s 118ms/step - loss: 5.0378e-04
Epoch 531/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0844e-04
Epoch 532/1000
83/83 [=====] - 10s 118ms/step - loss: 5.4713e-04
Epoch 533/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1960e-04
Epoch 534/1000
83/83 [=====] - 10s 116ms/step - loss: 5.0692e-04
Epoch 535/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9794e-04
Epoch 536/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0502e-04
Epoch 537/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1423e-04
Epoch 538/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0023e-04
Epoch 539/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1569e-04
Epoch 540/1000
83/83 [=====] - 10s 118ms/step - loss: 5.4647e-04
Epoch 541/1000
83/83 [=====] - 10s 116ms/step - loss: 5.3632e-04
Epoch 542/1000
83/83 [=====] - 10s 118ms/step - loss: 5.0348e-04
Epoch 543/1000
83/83 [=====] - 10s 118ms/step - loss: 5.1040e-04
Epoch 544/1000
83/83 [=====] - 10s 119ms/step - loss: 4.8400e-04
Epoch 545/1000
83/83 [=====] - 10s 118ms/step - loss: 5.0416e-04
Epoch 546/1000
83/83 [=====] - 10s 118ms/step - loss: 5.2343e-04
Epoch 547/1000
83/83 [=====] - 10s 118ms/step - loss: 5.1378e-04
Epoch 548/1000
83/83 [=====] - 10s 119ms/step - loss: 5.2821e-04
Epoch 549/1000

83/83 [=====] - 10s 118ms/step - loss: 5.0868e-04
 Epoch 550/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.4954e-04
 Epoch 551/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8028e-04
 Epoch 552/1000
 83/83 [=====] - 12s 139ms/step - loss: 5.0050e-04
 Epoch 553/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2395e-04
 Epoch 554/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9099e-04
 Epoch 555/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8975e-04
 Epoch 556/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1726e-04
 Epoch 557/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0231e-04
 Epoch 558/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.3419e-04
 Epoch 559/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0476e-04
 Epoch 560/1000
 83/83 [=====] - 11s 129ms/step - loss: 5.2101e-04
 Epoch 561/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8794e-04
 Epoch 562/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0175e-04
 Epoch 563/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8726e-04
 Epoch 564/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9801e-04
 Epoch 565/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2331e-04
 Epoch 566/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.6780e-04
 Epoch 567/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.7946e-04
 Epoch 568/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.5238e-04
 Epoch 569/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8782e-04
 Epoch 570/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2866e-04
 Epoch 571/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2426e-04
 Epoch 572/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0622e-04
 Epoch 573/1000

83/83 [=====] - 10s 118ms/step - loss: 5.1582e-04
 Epoch 574/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0125e-04
 Epoch 575/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9818e-04
 Epoch 576/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.8004e-04
 Epoch 577/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9675e-04
 Epoch 578/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1259e-04
 Epoch 579/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0856e-04
 Epoch 580/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0709e-04
 Epoch 581/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2695e-04
 Epoch 582/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.5920e-04
 Epoch 583/1000
 83/83 [=====] - 11s 136ms/step - loss: 5.2423e-04
 Epoch 584/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.0399e-04
 Epoch 585/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9892e-04
 Epoch 586/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1672e-04
 Epoch 587/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8545e-04
 Epoch 588/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9176e-04
 Epoch 589/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8175e-04
 Epoch 590/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.1428e-04
 Epoch 591/1000
 83/83 [=====] - 11s 129ms/step - loss: 5.0313e-04
 Epoch 592/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.4153e-04
 Epoch 593/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2419e-04
 Epoch 594/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.7578e-04
 Epoch 595/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0854e-04
 Epoch 596/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9876e-04
 Epoch 597/1000

83/83 [=====] - 10s 117ms/step - loss: 5.0230e-04
 Epoch 598/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0518e-04
 Epoch 599/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8778e-04
 Epoch 600/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3809e-04
 Epoch 601/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9795e-04
 Epoch 602/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0561e-04
 Epoch 603/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.3263e-04
 Epoch 604/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0245e-04
 Epoch 605/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2137e-04
 Epoch 606/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9796e-04
 Epoch 607/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.0337e-04
 Epoch 608/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.7746e-04
 Epoch 609/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9718e-04
 Epoch 610/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.4997e-04
 Epoch 611/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0420e-04
 Epoch 612/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8102e-04
 Epoch 613/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2734e-04
 Epoch 614/1000
 83/83 [=====] - 11s 131ms/step - loss: 5.3615e-04
 Epoch 615/1000
 83/83 [=====] - 10s 124ms/step - loss: 4.9445e-04
 Epoch 616/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.7707e-04
 Epoch 617/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1283e-04
 Epoch 618/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9709e-04
 Epoch 619/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.1998e-04
 Epoch 620/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.0369e-04
 Epoch 621/1000

83/83 [=====] - 10s 123ms/step - loss: 5.3521e-04
 Epoch 622/1000
 83/83 [=====] - 11s 130ms/step - loss: 5.2076e-04
 Epoch 623/1000
 83/83 [=====] - 10s 126ms/step - loss: 4.9962e-04
 Epoch 624/1000
 83/83 [=====] - 10s 125ms/step - loss: 4.8649e-04
 Epoch 625/1000
 83/83 [=====] - 10s 126ms/step - loss: 5.0671e-04
 Epoch 626/1000
 83/83 [=====] - 10s 126ms/step - loss: 5.3349e-04
 Epoch 627/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.3047e-04
 Epoch 628/1000
 83/83 [=====] - 10s 126ms/step - loss: 4.8833e-04
 Epoch 629/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.3019e-04
 Epoch 630/1000
 83/83 [=====] - 11s 127ms/step - loss: 5.1043e-04
 Epoch 631/1000
 83/83 [=====] - 10s 126ms/step - loss: 4.9925e-04
 Epoch 632/1000
 83/83 [=====] - 10s 121ms/step - loss: 4.8590e-04
 Epoch 633/1000
 83/83 [=====] - 10s 119ms/step - loss: 5.3446e-04
 Epoch 634/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.0117e-04
 Epoch 635/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8917e-04
 Epoch 636/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.3365e-04
 Epoch 637/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8165e-04
 Epoch 638/1000
 83/83 [=====] - 10s 125ms/step - loss: 5.3134e-04
 Epoch 639/1000
 83/83 [=====] - 10s 126ms/step - loss: 4.7390e-04
 Epoch 640/1000
 83/83 [=====] - 10s 126ms/step - loss: 5.0262e-04
 Epoch 641/1000
 83/83 [=====] - 10s 125ms/step - loss: 4.8592e-04
 Epoch 642/1000
 83/83 [=====] - 10s 120ms/step - loss: 5.2271e-04
 Epoch 643/1000
 83/83 [=====] - 10s 116ms/step - loss: 4.9557e-04
 Epoch 644/1000
 83/83 [=====] - 10s 125ms/step - loss: 4.6162e-04
 Epoch 645/1000

83/83 [=====] - 11s 130ms/step - loss: 4.8471e-04
 Epoch 646/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8572e-04
 Epoch 647/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1290e-04
 Epoch 648/1000
 83/83 [=====] - 10s 116ms/step - loss: 4.8401e-04
 Epoch 649/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8664e-04
 Epoch 650/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8021e-04
 Epoch 651/1000
 83/83 [=====] - 11s 127ms/step - loss: 5.0154e-04
 Epoch 652/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0392e-04
 Epoch 653/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.0051e-04
 Epoch 654/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.2550e-04
 Epoch 655/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.6425e-04
 Epoch 656/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.3081e-04
 Epoch 657/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.7201e-04
 Epoch 658/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9661e-04
 Epoch 659/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.7909e-04
 Epoch 660/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.3161e-04
 Epoch 661/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8524e-04
 Epoch 662/1000
 83/83 [=====] - 10s 118ms/step - loss: 5.2878e-04
 Epoch 663/1000
 83/83 [=====] - 10s 117ms/step - loss: 5.1034e-04
 Epoch 664/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8499e-04
 Epoch 665/1000
 83/83 [=====] - 10s 116ms/step - loss: 4.7667e-04
 Epoch 666/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9995e-04
 Epoch 667/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8265e-04
 Epoch 668/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.9804e-04
 Epoch 669/1000

83/83 [=====] - 10s 116ms/step - loss: 5.3720e-04
Epoch 670/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0058e-04
Epoch 671/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7557e-04
Epoch 672/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1478e-04
Epoch 673/1000
83/83 [=====] - 10s 118ms/step - loss: 5.1022e-04
Epoch 674/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0268e-04
Epoch 675/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9929e-04
Epoch 676/1000
83/83 [=====] - 11s 136ms/step - loss: 4.4607e-04
Epoch 677/1000
83/83 [=====] - 10s 116ms/step - loss: 4.9702e-04
Epoch 678/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8723e-04
Epoch 679/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7856e-04
Epoch 680/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1047e-04
Epoch 681/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1169e-04
Epoch 682/1000
83/83 [=====] - 11s 127ms/step - loss: 4.8184e-04
Epoch 683/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7648e-04
Epoch 684/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8634e-04
Epoch 685/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8439e-04
Epoch 686/1000
83/83 [=====] - 10s 116ms/step - loss: 4.5679e-04
Epoch 687/1000
83/83 [=====] - 10s 117ms/step - loss: 5.5229e-04
Epoch 688/1000
83/83 [=====] - 10s 117ms/step - loss: 4.5630e-04
Epoch 689/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9175e-04
Epoch 690/1000
83/83 [=====] - 10s 117ms/step - loss: 4.3052e-04
Epoch 691/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8345e-04
Epoch 692/1000
83/83 [=====] - 10s 118ms/step - loss: 5.0530e-04
Epoch 693/1000

83/83 [=====] - 10s 118ms/step - loss: 5.0077e-04
Epoch 694/1000
83/83 [=====] - 10s 117ms/step - loss: 5.2664e-04
Epoch 695/1000
83/83 [=====] - 10s 116ms/step - loss: 5.1056e-04
Epoch 696/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0196e-04
Epoch 697/1000
83/83 [=====] - 10s 116ms/step - loss: 4.9114e-04
Epoch 698/1000
83/83 [=====] - 10s 116ms/step - loss: 5.0758e-04
Epoch 699/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0809e-04
Epoch 700/1000
83/83 [=====] - 10s 118ms/step - loss: 4.6574e-04
Epoch 701/1000
83/83 [=====] - 10s 117ms/step - loss: 4.6609e-04
Epoch 702/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9743e-04
Epoch 703/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1031e-04
Epoch 704/1000
83/83 [=====] - 10s 116ms/step - loss: 4.8289e-04
Epoch 705/1000
83/83 [=====] - 10s 117ms/step - loss: 4.6222e-04
Epoch 706/1000
83/83 [=====] - 10s 117ms/step - loss: 5.2734e-04
Epoch 707/1000
83/83 [=====] - 11s 129ms/step - loss: 4.9540e-04
Epoch 708/1000
83/83 [=====] - 10s 125ms/step - loss: 5.0815e-04
Epoch 709/1000
83/83 [=====] - 10s 116ms/step - loss: 4.8549e-04
Epoch 710/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1417e-04
Epoch 711/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9346e-04
Epoch 712/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9834e-04
Epoch 713/1000
83/83 [=====] - 10s 126ms/step - loss: 4.8096e-04
Epoch 714/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0663e-04
Epoch 715/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8268e-04
Epoch 716/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1473e-04
Epoch 717/1000

83/83 [=====] - 10s 117ms/step - loss: 4.7702e-04
Epoch 718/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8881e-04
Epoch 719/1000
83/83 [=====] - 10s 117ms/step - loss: 4.6718e-04
Epoch 720/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0007e-04
Epoch 721/1000
83/83 [=====] - 10s 116ms/step - loss: 4.5963e-04
Epoch 722/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9793e-04
Epoch 723/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7465e-04
Epoch 724/1000
83/83 [=====] - 10s 118ms/step - loss: 4.8592e-04
Epoch 725/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7315e-04
Epoch 726/1000
83/83 [=====] - 10s 118ms/step - loss: 4.6115e-04
Epoch 727/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8087e-04
Epoch 728/1000
83/83 [=====] - 10s 118ms/step - loss: 5.0256e-04
Epoch 729/1000
83/83 [=====] - 10s 118ms/step - loss: 5.1849e-04
Epoch 730/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1365e-04
Epoch 731/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1299e-04
Epoch 732/1000
83/83 [=====] - 10s 117ms/step - loss: 4.6100e-04
Epoch 733/1000
83/83 [=====] - 10s 117ms/step - loss: 4.6700e-04
Epoch 734/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8700e-04
Epoch 735/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9688e-04
Epoch 736/1000
83/83 [=====] - 10s 118ms/step - loss: 4.7168e-04
Epoch 737/1000
83/83 [=====] - 10s 119ms/step - loss: 4.9137e-04
Epoch 738/1000
83/83 [=====] - 10s 123ms/step - loss: 4.6014e-04
Epoch 739/1000
83/83 [=====] - 11s 134ms/step - loss: 5.3182e-04
Epoch 740/1000
83/83 [=====] - 10s 118ms/step - loss: 4.9881e-04
Epoch 741/1000

83/83 [=====] - 10s 117ms/step - loss: 4.9494e-04
Epoch 742/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7992e-04
Epoch 743/1000
83/83 [=====] - 10s 117ms/step - loss: 4.5402e-04
Epoch 744/1000
83/83 [=====] - 11s 127ms/step - loss: 5.1155e-04
Epoch 745/1000
83/83 [=====] - 10s 118ms/step - loss: 4.8383e-04
Epoch 746/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8330e-04
Epoch 747/1000
83/83 [=====] - 10s 117ms/step - loss: 5.0816e-04
Epoch 748/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9439e-04
Epoch 749/1000
83/83 [=====] - 10s 117ms/step - loss: 4.9415e-04
Epoch 750/1000
83/83 [=====] - 10s 118ms/step - loss: 4.9332e-04
Epoch 751/1000
83/83 [=====] - 10s 118ms/step - loss: 4.5537e-04
Epoch 752/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7318e-04
Epoch 753/1000
83/83 [=====] - 10s 118ms/step - loss: 5.0577e-04
Epoch 754/1000
83/83 [=====] - 10s 118ms/step - loss: 4.6427e-04
Epoch 755/1000
83/83 [=====] - 10s 117ms/step - loss: 4.6947e-04
Epoch 756/1000
83/83 [=====] - 10s 118ms/step - loss: 4.9916e-04
Epoch 757/1000
83/83 [=====] - 10s 116ms/step - loss: 5.1351e-04
Epoch 758/1000
83/83 [=====] - 10s 117ms/step - loss: 4.5592e-04
Epoch 759/1000
83/83 [=====] - 10s 118ms/step - loss: 4.4665e-04
Epoch 760/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8429e-04
Epoch 761/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7425e-04
Epoch 762/1000
83/83 [=====] - 10s 118ms/step - loss: 4.6227e-04
Epoch 763/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8082e-04
Epoch 764/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8574e-04
Epoch 765/1000

83/83 [=====] - 10s 119ms/step - loss: 4.6239e-04
 Epoch 766/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.7579e-04
 Epoch 767/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.7048e-04
 Epoch 768/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.5935e-04
 Epoch 769/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8256e-04
 Epoch 770/1000
 83/83 [=====] - 12s 139ms/step - loss: 4.7370e-04
 Epoch 771/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8181e-04
 Epoch 772/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6506e-04
 Epoch 773/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8768e-04
 Epoch 774/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8579e-04
 Epoch 775/1000
 83/83 [=====] - 10s 126ms/step - loss: 4.7781e-04
 Epoch 776/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.2778e-04
 Epoch 777/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.7002e-04
 Epoch 778/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8723e-04
 Epoch 779/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8865e-04
 Epoch 780/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.0994e-04
 Epoch 781/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6034e-04
 Epoch 782/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8000e-04
 Epoch 783/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.7648e-04
 Epoch 784/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.8658e-04
 Epoch 785/1000
 83/83 [=====] - 10s 116ms/step - loss: 4.6426e-04
 Epoch 786/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.7911e-04
 Epoch 787/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.5171e-04
 Epoch 788/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.8153e-04
 Epoch 789/1000

83/83 [=====] - 10s 118ms/step - loss: 4.6498e-04
Epoch 790/1000
83/83 [=====] - 10s 118ms/step - loss: 4.6583e-04
Epoch 791/1000
83/83 [=====] - 10s 117ms/step - loss: 4.5784e-04
Epoch 792/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8716e-04
Epoch 793/1000
83/83 [=====] - 10s 116ms/step - loss: 4.6035e-04
Epoch 794/1000
83/83 [=====] - 10s 117ms/step - loss: 4.6405e-04
Epoch 795/1000
83/83 [=====] - 10s 118ms/step - loss: 4.6634e-04
Epoch 796/1000
83/83 [=====] - 10s 116ms/step - loss: 5.1855e-04
Epoch 797/1000
83/83 [=====] - 10s 117ms/step - loss: 4.5988e-04
Epoch 798/1000
83/83 [=====] - 10s 117ms/step - loss: 4.4503e-04
Epoch 799/1000
83/83 [=====] - 10s 118ms/step - loss: 5.0303e-04
Epoch 800/1000
83/83 [=====] - 10s 117ms/step - loss: 4.4818e-04
Epoch 801/1000
83/83 [=====] - 11s 131ms/step - loss: 4.6193e-04
Epoch 802/1000
83/83 [=====] - 10s 124ms/step - loss: 4.9950e-04
Epoch 803/1000
83/83 [=====] - 10s 118ms/step - loss: 4.9810e-04
Epoch 804/1000
83/83 [=====] - 10s 116ms/step - loss: 4.8783e-04
Epoch 805/1000
83/83 [=====] - 10s 120ms/step - loss: 4.4813e-04
Epoch 806/1000
83/83 [=====] - 10s 122ms/step - loss: 4.5821e-04
Epoch 807/1000
83/83 [=====] - 10s 117ms/step - loss: 5.1872e-04
Epoch 808/1000
83/83 [=====] - 10s 118ms/step - loss: 4.4008e-04
Epoch 809/1000
83/83 [=====] - 10s 116ms/step - loss: 4.6284e-04
Epoch 810/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7130e-04
Epoch 811/1000
83/83 [=====] - 10s 117ms/step - loss: 4.5517e-04
Epoch 812/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8395e-04
Epoch 813/1000

83/83 [=====] - 10s 118ms/step - loss: 4.9120e-04
Epoch 814/1000
83/83 [=====] - 10s 118ms/step - loss: 4.6068e-04
Epoch 815/1000
83/83 [=====] - 10s 118ms/step - loss: 4.9639e-04
Epoch 816/1000
83/83 [=====] - 10s 117ms/step - loss: 4.4188e-04
Epoch 817/1000
83/83 [=====] - 10s 117ms/step - loss: 4.8315e-04
Epoch 818/1000
83/83 [=====] - 10s 117ms/step - loss: 4.4978e-04
Epoch 819/1000
83/83 [=====] - 10s 118ms/step - loss: 4.3589e-04
Epoch 820/1000
83/83 [=====] - 10s 117ms/step - loss: 5.3456e-04
Epoch 821/1000
83/83 [=====] - 10s 116ms/step - loss: 4.7413e-04
Epoch 822/1000
83/83 [=====] - 10s 117ms/step - loss: 4.5352e-04
Epoch 823/1000
83/83 [=====] - 10s 117ms/step - loss: 4.3094e-04
Epoch 824/1000
83/83 [=====] - 10s 116ms/step - loss: 4.8472e-04
Epoch 825/1000
83/83 [=====] - 10s 117ms/step - loss: 4.5846e-04
Epoch 826/1000
83/83 [=====] - 10s 116ms/step - loss: 4.6159e-04
Epoch 827/1000
83/83 [=====] - 10s 117ms/step - loss: 4.7090e-04
Epoch 828/1000
83/83 [=====] - 10s 118ms/step - loss: 4.4278e-04
Epoch 829/1000
83/83 [=====] - 10s 117ms/step - loss: 4.5763e-04
Epoch 830/1000
83/83 [=====] - 10s 126ms/step - loss: 4.9372e-04
Epoch 831/1000
83/83 [=====] - 10s 123ms/step - loss: 4.7827e-04
Epoch 832/1000
83/83 [=====] - 11s 136ms/step - loss: 4.7950e-04
Epoch 833/1000
83/83 [=====] - 11s 137ms/step - loss: 4.3368e-04
Epoch 834/1000
83/83 [=====] - 10s 126ms/step - loss: 4.5065e-04
Epoch 835/1000
83/83 [=====] - 10s 126ms/step - loss: 4.5315e-04
Epoch 836/1000
83/83 [=====] - 11s 135ms/step - loss: 4.8350e-04
Epoch 837/1000

83/83 [=====] - 11s 127ms/step - loss: 5.3507e-04
 Epoch 838/1000
 83/83 [=====] - 10s 126ms/step - loss: 4.5070e-04
 Epoch 839/1000
 83/83 [=====] - 10s 125ms/step - loss: 4.7371e-04
 Epoch 840/1000
 83/83 [=====] - 10s 125ms/step - loss: 4.7125e-04
 Epoch 841/1000
 83/83 [=====] - 10s 126ms/step - loss: 4.5275e-04
 Epoch 842/1000
 83/83 [=====] - 10s 123ms/step - loss: 4.5226e-04
 Epoch 843/1000
 83/83 [=====] - 10s 124ms/step - loss: 4.5897e-04
 Epoch 844/1000
 83/83 [=====] - 10s 123ms/step - loss: 4.9353e-04
 Epoch 845/1000
 83/83 [=====] - 10s 123ms/step - loss: 4.6172e-04
 Epoch 846/1000
 83/83 [=====] - 10s 124ms/step - loss: 4.7341e-04
 Epoch 847/1000
 83/83 [=====] - 10s 125ms/step - loss: 4.8223e-04
 Epoch 848/1000
 83/83 [=====] - 11s 127ms/step - loss: 4.5212e-04
 Epoch 849/1000
 83/83 [=====] - 11s 127ms/step - loss: 4.7045e-04
 Epoch 850/1000
 83/83 [=====] - 10s 126ms/step - loss: 4.5190e-04
 Epoch 851/1000
 83/83 [=====] - 10s 123ms/step - loss: 4.4918e-04
 Epoch 852/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6016e-04
 Epoch 853/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.7304e-04
 Epoch 854/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.9466e-04
 Epoch 855/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.7183e-04
 Epoch 856/1000
 83/83 [=====] - 10s 116ms/step - loss: 5.0461e-04
 Epoch 857/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.4365e-04
 Epoch 858/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6783e-04
 Epoch 859/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6931e-04
 Epoch 860/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.5228e-04
 Epoch 861/1000

83/83 [=====] - 10s 118ms/step - loss: 4.5057e-04
 Epoch 862/1000
 83/83 [=====] - 10s 124ms/step - loss: 4.5360e-04
 Epoch 863/1000
 83/83 [=====] - 11s 129ms/step - loss: 4.7437e-04
 Epoch 864/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.5627e-04
 Epoch 865/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.5897e-04
 Epoch 866/1000
 83/83 [=====] - 11s 128ms/step - loss: 4.8060e-04
 Epoch 867/1000
 83/83 [=====] - 10s 116ms/step - loss: 4.5880e-04
 Epoch 868/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.2636e-04
 Epoch 869/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6090e-04
 Epoch 870/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.2818e-04
 Epoch 871/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.4313e-04
 Epoch 872/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.4869e-04
 Epoch 873/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.7772e-04
 Epoch 874/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.3656e-04
 Epoch 875/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6852e-04
 Epoch 876/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.2578e-04
 Epoch 877/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.4644e-04
 Epoch 878/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.4354e-04
 Epoch 879/1000
 83/83 [=====] - 10s 119ms/step - loss: 4.5346e-04
 Epoch 880/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.5096e-04
 Epoch 881/1000
 83/83 [=====] - 10s 116ms/step - loss: 4.5056e-04
 Epoch 882/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.5216e-04
 Epoch 883/1000
 83/83 [=====] - 10s 116ms/step - loss: 4.2977e-04
 Epoch 884/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6067e-04
 Epoch 885/1000

83/83 [=====] - 10s 116ms/step - loss: 4.4015e-04
 Epoch 886/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.3661e-04
 Epoch 887/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.4185e-04
 Epoch 888/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.5549e-04
 Epoch 889/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.5131e-04
 Epoch 890/1000
 83/83 [=====] - 10s 119ms/step - loss: 4.5703e-04
 Epoch 891/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.3587e-04
 Epoch 892/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.5705e-04
 Epoch 893/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.0740e-04
 Epoch 894/1000
 83/83 [=====] - 11s 138ms/step - loss: 5.0560e-04
 Epoch 895/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.6543e-04
 Epoch 896/1000
 83/83 [=====] - 10s 121ms/step - loss: 4.2983e-04
 Epoch 897/1000
 83/83 [=====] - 10s 125ms/step - loss: 4.7252e-04
 Epoch 898/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6518e-04
 Epoch 899/1000
 83/83 [=====] - 10s 119ms/step - loss: 4.6881e-04
 Epoch 900/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.5781e-04
 Epoch 901/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.6591e-04
 Epoch 902/1000
 83/83 [=====] - 10s 123ms/step - loss: 4.4118e-04
 Epoch 903/1000
 83/83 [=====] - 10s 125ms/step - loss: 4.7316e-04
 Epoch 904/1000
 83/83 [=====] - 10s 122ms/step - loss: 4.6151e-04
 Epoch 905/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.5697e-04
 Epoch 906/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.2700e-04
 Epoch 907/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.2727e-04
 Epoch 908/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.3474e-04
 Epoch 909/1000

83/83 [=====] - 10s 117ms/step - loss: 4.3122e-04
 Epoch 910/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.4522e-04
 Epoch 911/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.4730e-04
 Epoch 912/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.4110e-04
 Epoch 913/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6184e-04
 Epoch 914/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.1762e-04
 Epoch 915/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.6105e-04
 Epoch 916/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.3833e-04
 Epoch 917/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.7186e-04
 Epoch 918/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.5780e-04
 Epoch 919/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.5247e-04
 Epoch 920/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.2540e-04
 Epoch 921/1000
 83/83 [=====] - 10s 119ms/step - loss: 4.6006e-04
 Epoch 922/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.2760e-04
 Epoch 923/1000
 83/83 [=====] - 10s 119ms/step - loss: 4.4761e-04
 Epoch 924/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6435e-04
 Epoch 925/1000
 83/83 [=====] - 12s 139ms/step - loss: 4.1734e-04
 Epoch 926/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.5034e-04
 Epoch 927/1000
 83/83 [=====] - 11s 128ms/step - loss: 4.3246e-04
 Epoch 928/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.5881e-04
 Epoch 929/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.5650e-04
 Epoch 930/1000
 83/83 [=====] - 10s 119ms/step - loss: 4.4952e-04
 Epoch 931/1000
 83/83 [=====] - 10s 119ms/step - loss: 4.4962e-04
 Epoch 932/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.6150e-04
 Epoch 933/1000

83/83 [=====] - 10s 118ms/step - loss: 4.3326e-04
 Epoch 934/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.5248e-04
 Epoch 935/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6672e-04
 Epoch 936/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.4030e-04
 Epoch 937/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.6767e-04
 Epoch 938/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.3620e-04
 Epoch 939/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.6643e-04
 Epoch 940/1000
 83/83 [=====] - 10s 119ms/step - loss: 4.6918e-04
 Epoch 941/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.3226e-04
 Epoch 942/1000
 83/83 [=====] - 10s 116ms/step - loss: 4.4215e-04
 Epoch 943/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.5047e-04
 Epoch 944/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.1594e-04
 Epoch 945/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.6034e-04
 Epoch 946/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.1244e-04
 Epoch 947/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.7850e-04
 Epoch 948/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.4527e-04
 Epoch 949/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.4822e-04
 Epoch 950/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.4070e-04
 Epoch 951/1000
 83/83 [=====] - 10s 119ms/step - loss: 4.4697e-04
 Epoch 952/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.6232e-04
 Epoch 953/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.4278e-04
 Epoch 954/1000
 83/83 [=====] - 10s 118ms/step - loss: 4.7685e-04
 Epoch 955/1000
 83/83 [=====] - 10s 117ms/step - loss: 4.3441e-04
 Epoch 956/1000
 83/83 [=====] - 11s 134ms/step - loss: 4.1968e-04
 Epoch 957/1000

83/83 [=====] - 10s 122ms/step - loss: 4.4440e-04
Epoch 958/1000
83/83 [=====] - 11s 128ms/step - loss: 4.3024e-04
Epoch 959/1000
83/83 [=====] - 10s 118ms/step - loss: 4.7068e-04
Epoch 960/1000
83/83 [=====] - 10s 117ms/step - loss: 4.6130e-04
Epoch 961/1000
83/83 [=====] - 10s 117ms/step - loss: 4.4832e-04
Epoch 962/1000
83/83 [=====] - 10s 117ms/step - loss: 4.3750e-04
Epoch 963/1000
83/83 [=====] - 10s 118ms/step - loss: 4.2374e-04
Epoch 964/1000
83/83 [=====] - 10s 117ms/step - loss: 4.2463e-04
Epoch 965/1000
83/83 [=====] - 10s 118ms/step - loss: 4.2591e-04
Epoch 966/1000
83/83 [=====] - 10s 117ms/step - loss: 4.1674e-04
Epoch 967/1000
83/83 [=====] - 10s 117ms/step - loss: 4.0610e-04
Epoch 968/1000
83/83 [=====] - 10s 117ms/step - loss: 4.5316e-04
Epoch 969/1000
83/83 [=====] - 10s 118ms/step - loss: 4.5527e-04
Epoch 970/1000
83/83 [=====] - 10s 118ms/step - loss: 4.1441e-04
Epoch 971/1000
83/83 [=====] - 10s 117ms/step - loss: 4.6680e-04
Epoch 972/1000
83/83 [=====] - 10s 118ms/step - loss: 4.3068e-04
Epoch 973/1000
83/83 [=====] - 10s 117ms/step - loss: 4.4184e-04
Epoch 974/1000
83/83 [=====] - 10s 118ms/step - loss: 4.5958e-04
Epoch 975/1000
83/83 [=====] - 10s 117ms/step - loss: 4.4523e-04
Epoch 976/1000
83/83 [=====] - 10s 117ms/step - loss: 4.3266e-04
Epoch 977/1000
83/83 [=====] - 10s 117ms/step - loss: 4.1795e-04
Epoch 978/1000
83/83 [=====] - 10s 117ms/step - loss: 4.4031e-04
Epoch 979/1000
83/83 [=====] - 10s 117ms/step - loss: 3.9937e-04
Epoch 980/1000
83/83 [=====] - 10s 124ms/step - loss: 4.3957e-04
Epoch 981/1000


```

83/83 [=====] - 12s 144ms/step - loss: 4.3195e-04
Epoch 982/1000
83/83 [=====] - 11s 133ms/step - loss: 4.1918e-04
Epoch 983/1000
83/83 [=====] - 10s 125ms/step - loss: 4.5627e-04
Epoch 984/1000
83/83 [=====] - 10s 123ms/step - loss: 4.3575e-04
Epoch 985/1000
83/83 [=====] - 10s 124ms/step - loss: 4.2868e-04
Epoch 986/1000
83/83 [=====] - 10s 125ms/step - loss: 4.2723e-04
Epoch 987/1000
83/83 [=====] - 12s 141ms/step - loss: 4.3634e-04
Epoch 988/1000
83/83 [=====] - 11s 134ms/step - loss: 4.7727e-04
Epoch 989/1000
83/83 [=====] - 10s 123ms/step - loss: 4.1693e-04
Epoch 990/1000
83/83 [=====] - 10s 123ms/step - loss: 4.7190e-04
Epoch 991/1000
83/83 [=====] - 10s 123ms/step - loss: 4.3234e-04
Epoch 992/1000
83/83 [=====] - 10s 122ms/step - loss: 4.3060e-04
Epoch 993/1000
83/83 [=====] - 10s 125ms/step - loss: 4.3583e-04
Epoch 994/1000
83/83 [=====] - 10s 123ms/step - loss: 4.4812e-04
Epoch 995/1000
83/83 [=====] - 10s 123ms/step - loss: 4.4050e-04
Epoch 996/1000
83/83 [=====] - 10s 122ms/step - loss: 4.2301e-04
Epoch 997/1000
83/83 [=====] - 10s 124ms/step - loss: 4.1787e-04
Epoch 998/1000
83/83 [=====] - 10s 124ms/step - loss: 4.4783e-04
Epoch 999/1000
83/83 [=====] - 10s 122ms/step - loss: 4.3943e-04
Epoch 1000/1000
83/83 [=====] - 10s 124ms/step - loss: 4.3359e-04

```

[116]: <tensorflow.python.keras.callbacks.History at 0x7fde9518ac10>

```

[117]: testdataframe= test
testdataframe['Date'] = testdataframe.index
testdata = pd.DataFrame(columns = ['Date', 'Close'])
testdata['Date'] = testdataframe['Date']
testdata['Close'] = testdataframe['Close']

```

```

real_stock_price = testdata.iloc[:, 1:2].values
dataset_total = pd.concat((data2['Close'], testdata['Close']), axis = 0)
inputs = dataset_total[len(dataset_total) - len(testdata) - 60:].values
inputs = inputs.reshape(-1,1)
inputs = sc.transform(inputs)
X_test = []
for i in range(60, inputs.shape[0]):
    X_test.append(inputs[i-60:i, 0])
X_test = np.array(X_test)
X_test = np.reshape(X_test, (X_test.shape[0], X_test.shape[1], 1))

```

```

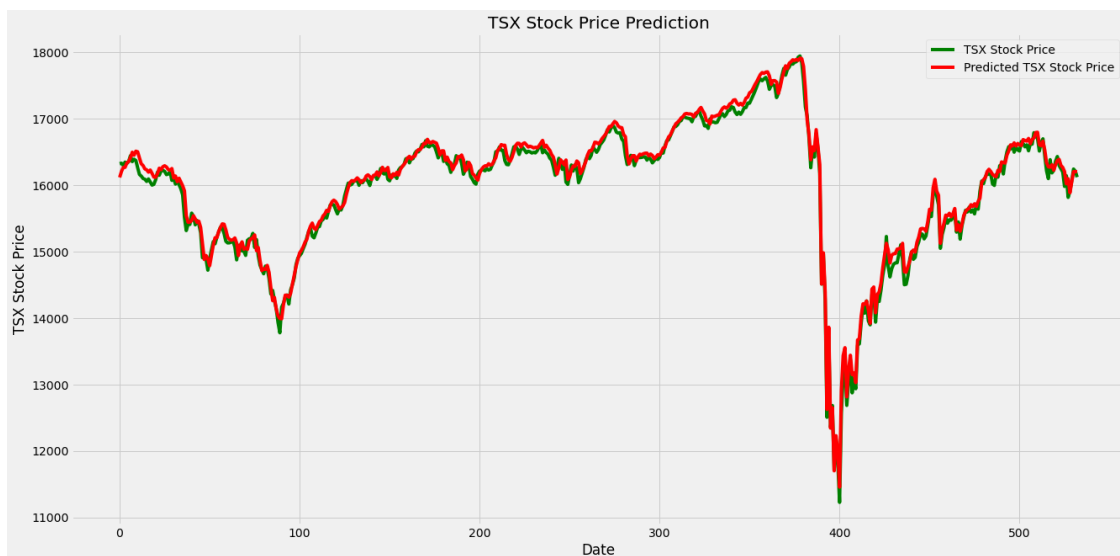
[118]: predicted_with_gru = regressorGRU.predict(X_test)
predicted_with_gru = sc.inverse_transform(predicted_with_gru)

```

```

[119]: plt.figure(figsize=(20,10))
plt.plot(real_stock_price, color = 'green', label = 'TSX Stock Price')
plt.plot(predicted_with_gru, color = 'red', label = 'Predicted TSX Stock Price')
plt.title('TSX Stock Price Prediction')
plt.xlabel('Date')
plt.ylabel('TSX Stock Price')
plt.legend()
plt.show()

```



```

[120]: rmse_predict1= np.reshape(predicted_with_gru,533)

```

```

[121]: #forecast metrics
def smape(a, f):
    return 1/len(a) * np.sum(2 * np.abs(f-a) / (np.abs(a) + np.abs(f))*100)

```

```
smape(test["Close"].values,rmse_predict1)
```

```
[121]: 0.5143041587306517
```

```
[122]: #forecast metrics
from sklearn.metrics import mean_absolute_error
from sklearn.metrics import mean_squared_error
from sklearn.metrics import r2_score
mae = mean_absolute_error(test["Close"].values, rmse_predict1)
mse = mean_squared_error(test["Close"].values, rmse_predict1)
rmse = np.sqrt(mse)

print("Results of sklearn.metrics:")
print("MAE:",mae)
print("MSE:", mse)
print("RMSE:", rmse)
```

Results of sklearn.metrics:

MAE: 81.20319763660898

MSE: 10585.447468399412

RMSE: 102.88560379566916

```
[123]: elapsed_time = time.process_time() - t
print(elapsed_time)
```

30051.340034676992

```
[ ]:
```

```
[ ]:
```

```
[124]: #upload data to understand the relationship between canada's new covid cases,
      ↪and TSX price
#split data into 2 sections, test -> recent data from sept 8th onwards, train
      ↪-> feb 1 to march 23rd
df=pd.read_csv("Canada Covid New Cases & Stock Price.csv", sep=",")
from datetime import datetime
con=df['Date']
df['Date']=pd.to_datetime(df['Date'])
df.set_index('Date', inplace=True)
test = df[150:]
train = df[:35]
```

```
[125]: import seaborn as sb
```

```
[126]: # when covid first started around feb, there was a relatively strong negative
        ↳relationship between covid new cases vs stock price
        pearsoncorr = train.corr(method='pearson')
        pearsoncorr
```

```
[126]:
```

	Sum of new_cases	TSX Price
Sum of new_cases	1.000000	-0.677857
TSX Price	-0.677857	1.000000

```
[127]: # as covid impact continues, there still is a egative relationship between
        ↳covid new cases vs stock price, however the relationship is not as strong as
        ↳the beginning of covid
        pearsoncorr = test.corr(method='pearson')
        pearsoncorr
```

```
[127]:
```

	Sum of new_cases	TSX Price
Sum of new_cases	1.000000	-0.340568
TSX Price	-0.340568	1.000000

```
[128]: #upload data to understand the relationship between US's new covid cases and
        ↳NASDAQ price
        #split data into 2 sections, test -> recent data from sept 8th onwards, train
        ↳-> feb 1 to march 23rd
        df=pd.read_csv("USA Covid New Cases & Stock Price.csv", sep=",")
        from datetime import datetime
        con=df['Date']
        df['Date']=pd.to_datetime(df['Date'])
        df.set_index('Date', inplace=True)
        test = df[150:]
        train = df[:35]
```

```
[129]: # when covid first started around feb, there was a relatively strong negative
        ↳relationship between covid new cases vs stock price
        pearsoncorr = train.corr(method='pearson')
        pearsoncorr
```

```
[129]:
```

	Sum of new_cases	Stock Price
Sum of new_cases	1.000000	-0.653411
Stock Price	-0.653411	1.000000

```
[130]: # as covid impact continues, there still is a egative relationship between
        ↳covid new cases vs stock price, however the relationship is not as strong as
        ↳the beginning of covid. The relationship is weaker in the US than Canada.
        pearsoncorr = test.corr(method='pearson')
        pearsoncorr
```

```
[130]:
```

	Sum of new_cases	Stock Price
Sum of new_cases	1.000000	-0.168529
Stock Price	-0.168529	1.000000

```
[ ]:
```

```
[ ]:
```

```
[ ]:
```