Individual Assignment

February 16, 2024

[ ]:
```
import pandas as pd
```

[ ]:
```
import tensorflow as tf

if tf.config.list_physical_devices('GPU'):
    print("TensorFlow can access the GPU.")
    print("Num GPUs Available: ", len(tf.config.list_physical_devices('GPU')))
    print("TensorFlow Devices: ", tf.config.list_physical_devices())
else:
    print("TensorFlow cannot access the GPU. Please check your system␣
 ↪configuration.")
```

```
TensorFlow can access the GPU.
Num GPUs Available:  1
TensorFlow Devices:  [PhysicalDevice(name='/physical_device:CPU:0',
device_type='CPU'), PhysicalDevice(name='/physical_device:GPU:0',
device_type='GPU')]
```

[ ]:
```
import tensorflow as tf
print(tf.__version__)
```

```
2.10.1
```

0.0.1 If you are using colab, you can import google drive to save model checkpoints in a folder

from google.colab import drive drive.mount('/content/drive')

[ ]:
```
df = pd.read_csv("GME.csv")
```

[ ]:
```
df.shape
```

[ ]:
```
(251, 7)
```

[ ]:
```
df.tail(10)
```

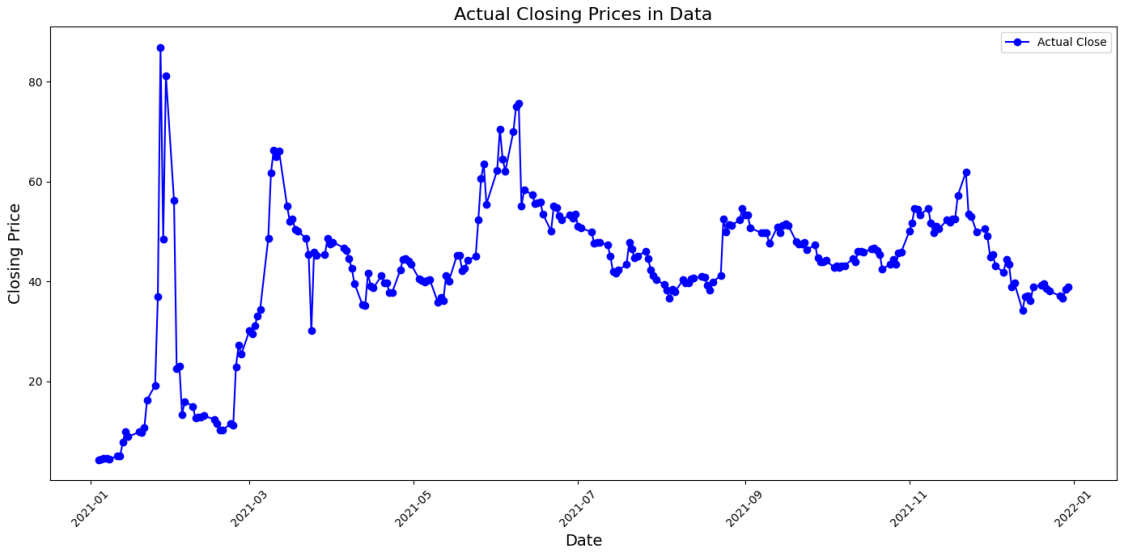
[ ]:

	Date	Open	High	Low	Close	Adj Close	\
241	2021-12-16	38.232498	38.610001	35.532501	36.147499	36.147499	
242	2021-12-17	35.937500	39.642502	34.832500	38.910000	38.910000	

```
243  2021-12-20  38.297501  39.919998  37.424999  39.285000  39.285000
244  2021-12-21  39.264999  40.062500  38.785000  39.529999  39.529999
245  2021-12-22  39.582500  39.787498  38.029999  38.500000  38.500000
246  2021-12-23  38.500000  38.750000  36.505001  38.035000  38.035000
247  2021-12-27  38.000000  38.154999  35.000000  37.077499  37.077499
248  2021-12-28  36.875000  39.352501  36.602501  36.615002  36.615002
249  2021-12-29  36.962502  38.872501  35.535000  38.482498  38.482498
250  2021-12-30  37.750000  40.000000  37.500000  38.832500  38.832500

       Volume
241   8659200
242  17226800
243   7314400
244   5720800
245   4188800
246   4222000
247   6454400
248   5324400
249   8149600
250   6247600
```

[ ]:
```python
import matplotlib.pyplot as plt


# Ensure the 'Date' column is in datetime format for proper plotting
df['Date'] = pd.to_datetime(df['Date'])

# Setting the plot size for better readability
plt.figure(figsize=(14, 7))

# Plotting the actual closing prices in the training period
plt.plot(df['Date'], df['Close'], label='Actual Close', color='blue',␣
 ↪marker='o')

# Adding title and labels with font size adjustments
plt.title('Actual Closing Prices in Data', fontsize=16)
plt.xlabel('Date', fontsize=14)
plt.ylabel('Closing Price', fontsize=14)

# Rotating date labels for better visibility
plt.xticks(rotation=45)

# Adding a legend to distinguish the actual values
plt.legend()

# Display the plot
plt.tight_layout()
```

```
plt.show()
```



[ ]:
```
import numpy as np
import missingno as msno
import seaborn as sns
from sklearn.preprocessing import MinMaxScaler
from sklearn.metrics import mean_squared_error, mean_absolute_error
from keras.models import Sequential
from keras.layers import LSTM, Dropout, Dense, BatchNormalization
from keras.regularizers import l2
from keras import backend as K
from pandas.tseries.holiday import USFederalHolidayCalendar
from pandas.tseries.offsets import CustomBusinessDay
from datetime import datetime, timedelta
```

[ ]:
```
# Convert 'Date' to datetime and sort the DataFrame just in case
df['Date'] = pd.to_datetime(df['Date']) # This line converts the 'Date' column␣
 ↪of the DataFrame df to datetime objects.
df.sort_values('Date', inplace=True)
#  The .values attribute returns the data as a NumPy array. The .reshape(-1, 1)␣
 ↪function changes
#  the shape of this array to ensure it has two dimensions, with one column and␣
 ↪as many rows as necessary.
close_prices = df['Close'].values.reshape(-1, 1)
# Scale the data -> you can use any appropriate scaling methodology
scaler = MinMaxScaler(feature_range=(0, 1))
scaled_close_prices = scaler.fit_transform(close_prices)
```

[ ]:
```
scaled_close_prices.shape
```

[ ]:
```
(251, 1)
```

[ ]:
```
# Function to create sequences
def create_sequences(data, sequence_length):
    xs, ys = [], []
    for i in range(len(data) - sequence_length):
        x = data[i:(i + sequence_length)]
        y = data[i + sequence_length]
        xs.append(x)
        ys.append(y)
    return np.array(xs), np.array(ys)
```

[ ]:
```
SEQUENCE_LENGTH = 10  # This can be adjusted
X, y = create_sequences(scaled_close_prices, SEQUENCE_LENGTH)
```

[ ]:
```
print(X)

print(y)
```

```
[[[0.00000000e+00]
  [3.63350079e-04]
  [3.36098823e-03]
  …
  [4.28450301e-02]
  [6.86126066e-02]
  [5.52594912e-02]]

 [[3.63350079e-04]
  [3.36098823e-03]
  [2.51317138e-03]
  …
  [6.86126066e-02]
  [5.52594912e-02]
  [6.69472521e-02]]

 [[3.36098823e-03]
  [2.51317138e-03]
  [1.33228362e-03]
  …
  [5.52594912e-02]
  [6.69472521e-02]
  [6.62205519e-02]]

 …

 [[3.62229762e-01]
```

```
   [3.94961548e-01]
   [3.97686649e-01]
   …
   [4.14067694e-01]
   [4.08435768e-01]
   [3.96838833e-01]]

  [[3.94961548e-01]
   [3.97686649e-01]
   [3.85574980e-01]
   …
   [4.08435768e-01]
   [3.96838833e-01]
   [3.91237222e-01]]

  [[3.97686649e-01]
   [3.85574980e-01]
   [4.19033479e-01]
   …
   [3.96838833e-01]
   [3.91237222e-01]
   [4.13855716e-01]]]
 [[0.06694725]
  [0.06622055]
  [0.07805971]
  [0.14461334]
  [0.1802822 ]
  [0.39583962]
  [1.        ]
  [0.53397324]
  [0.93184156]
  [0.62904982]
  [0.22028099]
  [0.22757828]
  [0.109762  ]
  [0.14085871]
  [0.12944347]
  [0.10010295]
  [0.10279779]
  [0.102495  ]
  [0.10643129]
  [0.09768061]
  [0.08687095]
  [0.07097438]
  [0.07067159]
  [0.08705262]
  [0.08393387]
  [0.22545872]
```

[0.27699389]
[0.25582872]
[0.31232967]
[0.3056077]
[0.3237752]
[0.34851331]
[0.36483377]
[0.53669835]
[0.69536119]
[0.75016652]
[0.73502693]
[0.74865256]
[0.61433415]
[0.57808998]
[0.58305575]
[0.55865075]
[0.55416944]
[0.53666808]
[0.4980924]
[0.31214798]
[0.50414823]
[0.49582146]
[0.49672985]
[0.53657725]
[0.52252772]
[0.52746319]
[0.51383756]
[0.50641917]
[0.48664687]
[0.46330162]
[0.42726941]
[0.37497727]
[0.3746745]
[0.4520075]
[0.42145582]
[0.41615697]
[0.44546718]
[0.42778416]
[0.42772359]
[0.40549869]
[0.40552894]
[0.45927448]
[0.4860413]
[0.4884939]
[0.48125719]
[0.47338458]
[0.4388966]
[0.43444557]

[0.43066067]
[0.43529338]
[0.43559619]
[0.38142675]
[0.39263004]
[0.38618055]
[0.44586083]
[0.43199296]
[0.49461032]
[0.49482225]
[0.45897171]
[0.46399806]
[0.48307391]
[0.49282381]
[0.58190513]
[0.68222004]
[0.71725307]
[0.61996607]
[0.70178041]
[0.80236779]
[0.7295161]
[0.69978197]
[0.79561558]
[0.85614362]
[0.86389508]
[0.61509113]
[0.65430264]
[0.64249379]
[0.62148003]
[0.62290315]
[0.62478045]
[0.59519773]
[0.55447221]
[0.61512138]
[0.6119118]
[0.59062554]
[0.58214737]
[0.5934718]
[0.58629564]
[0.59616664]
[0.56655361]
[0.5619209]
[0.5520196]
[0.52507116]
[0.52725126]
[0.52679704]
[0.52080178]
[0.49297521]

[0.45530792]
[0.45288562]
[0.45960755]
[0.47308181]
[0.52664564]
[0.51038573]
[0.48931146]
[0.49388359]
[0.50472355]
[0.48837276]
[0.45984979]
[0.44695088]
[0.43562645]
[0.42511957]
[0.4102828]
[0.3922667]
[0.41237207]
[0.40731545]
[0.43565676]
[0.42935869]
[0.42854114]
[0.43935083]
[0.43986556]
[0.44413489]
[0.44298432]
[0.42330285]
[0.41073696]
[0.43011567]
[0.44704171]
[0.58450914]
[0.5522921]
[0.56915762]
[0.56834007]
[0.58120872]
[0.60858112]
[0.59262398]
[0.59428935]
[0.56167866]
[0.55032397]
[0.5497184]
[0.55086897]
[0.52431418]
[0.56364679]
[0.55105069]
[0.56703809]
[0.57263971]
[0.56840064]
[0.52973412]

[0.52292131]
[0.52349663]
[0.52682735]
[0.50841761]
[0.52149819]
[0.48855448]
[0.48043964]
[0.47907708]
[0.48343729]
[0.46663234]
[0.46911521]
[0.46575427]
[0.46893354]
[0.47062917]
[0.48704053]
[0.48013687]
[0.50508688]
[0.50439047]
[0.50272511]
[0.51102162]
[0.51335308]
[0.50647974]
[0.49797131]
[0.4619088]
[0.4745352]
[0.48625323]
[0.47314235]
[0.50142313]
[0.50342152]
[0.55362439]
[0.57451705]
[0.60885362]
[0.60736992]
[0.5934718]
[0.60979227]
[0.57333617]
[0.55089929]
[0.56643252]
[0.55971054]
[0.58102706]
[0.57509231]
[0.58363106]
[0.5839944]
[0.64055592]
[0.69732937]
[0.59543992]
[0.58902076]
[0.55250407]

```
[0.55943799]
[0.54187611]
[0.49230907]
[0.49751708]
[0.46975109]
[0.45379396]
[0.48616239]
[0.47356625]
[0.41939682]
[0.42923755]
[0.36222976]
[0.39496155]
[0.39768665]
[0.38557498]
[0.41903348]
[0.42357535]
[0.4265427 ]
[0.41406769]
[0.40843577]
[0.39683883]
[0.39123722]
[0.41385572]
[0.41809482]]
```

[ ]:
```
print(X.shape)
print(y.shape)
```

```
(241, 10, 1)
(241, 1)
```

[ ]:
```
# Split the data into training and test sets (train on data until May 31st)
TRAIN_END_DATE = '2021-05-31'
TEST_END_DATE = '2021-08-31'

# Find the index corresponding to the end of May 2021
train_indices = df[df['Date'] <= TRAIN_END_DATE].index

# Find the index corresponding to the end of August 2021
test_indices = df[(df['Date'] > pd.to_datetime(TRAIN_END_DATE)) & (df['Date']␣
 ↪<= pd.to_datetime(TEST_END_DATE))].index

X_train, y_train = X[:train_indices[-1]-SEQUENCE_LENGTH], y[:
 ↪train_indices[-1]-SEQUENCE_LENGTH]
X_test, y_test = X[train_indices[-1]+1-SEQUENCE_LENGTH:
 ↪test_indices[-1]+1-SEQUENCE_LENGTH], y[train_indices[-1]+1-SEQUENCE_LENGTH:
 ↪test_indices[-1]+1-SEQUENCE_LENGTH]
```

[ ]:
```
print(X_train.shape, y_train.shape)
```

```
(91, 10, 1) (91, 1)
```

[ ]:
```
print(X_test.shape, y_test.shape)
```

```
(65, 10, 1) (65, 1)
```

[ ]:
```
print(y_test)
```

```
[[0.70178041]
 [0.80236779]
 [0.7295161 ]
 [0.69978197]
 [0.79561558]
 [0.85614362]
 [0.86389508]
 [0.61509113]
 [0.65430264]
 [0.64249379]
 [0.62148003]
 [0.62290315]
 [0.62478045]
 [0.59519773]
 [0.55447221]
 [0.61512138]
 [0.6119118 ]
 [0.59062554]
 [0.58214737]
 [0.5934718 ]
 [0.58629564]
 [0.59616664]
 [0.56655361]
 [0.5619209 ]
 [0.5520196 ]
 [0.52507116]
 [0.52725126]
 [0.52679704]
 [0.52080178]
 [0.49297521]
 [0.45530792]
 [0.45288562]
 [0.45960755]
 [0.47308181]
 [0.52664564]
 [0.51038573]
 [0.48931146]
 [0.49388359]
 [0.50472355]
 [0.48837276]
 [0.45984979]
```

```
[0.44695088]
[0.43562645]
[0.42511957]
[0.4102828 ]
[0.3922667 ]
[0.41237207]
[0.40731545]
[0.43565676]
[0.42935869]
[0.42854114]
[0.43935083]
[0.43986556]
[0.44413489]
[0.44298432]
[0.42330285]
[0.41073696]
[0.43011567]
[0.44704171]
[0.58450914]
[0.5522921 ]
[0.56915762]
[0.56834007]
[0.58120872]
[0.60858112]]
```

The model described is a neural network architecture using Long Short-Term Memory (LSTM) layers, commonly employed for sequence prediction problems such as time series forecasting. Here's a breakdown of each component of the model:

1. LSTM Layer with return_sequences=True LSTM(50, return_sequences=True, input_shape=(X_train.shape[1], 1)): This is the first layer in the model and an LSTM layer with 50 units. LSTM units are a type of recurrent neural network (RNN) cell that are effective in capturing long-term dependencies in sequence data. return_sequences=True indicates that this layer returns the full sequence of outputs for each sample. This is necessary when stacking LSTM layers so that the subsequent LSTM layer can receive sequences of data as input. input_shape=(X_train.shape[1], 1) specifies the shape of the input data. In this context, X_train.shape[1] refers to the sequence length (number of time steps), and 1 refers to the number of features per time step. This model is configured to work with a single feature per time step, typical for univariate time series forecasting (e.g., predicting a stock price based on past values of the stock price alone).

2. LSTM Layer with return_sequences=False LSTM(50, return_sequences=False): This is the second LSTM layer in the model, also with 50 units. return_sequences=False means this layer only returns the output for the last time step in the input sequence. This is used when the subsequent layer expects a single vector per sample rather than a sequence of vectors. Since the next layer is a dense layer (fully connected layer), only the final output of the LSTM is needed. This layer serves to further process the information extracted by the first LSTM layer, focusing on extracting features that will be useful for the final prediction.

3. Dense Layer Dense(1): This is a fully connected layer that follows the LSTM layers. It has

a single unit. The purpose of this layer is to output a single value, which is the predicted value for the next time step in the sequence. For example, in stock price prediction, this would be the predicted stock price for the next day. Since this model is likely intended for regression (predicting a continuous value), there's no activation function specified, implying a linear activation is used by default. This allows the model to output values in the range of the real numbers.

[ ]:
```
def rmse(y_true, y_pred):
    return K.sqrt(K.mean(K.square(y_pred - y_true)))
```

[ ]:
```
# Define the LSTM model
model = Sequential([
    LSTM(50, activation = 'relu', return_sequences=True, input_shape=(X_train.
 ↪shape[1], 1)),
    LSTM(50, activation = 'relu', return_sequences=True),
    LSTM(50, activation = 'relu', return_sequences=False),
    Dense(1)
])

# Optimizer
learning_rate = 0.001
optimizer = tf.keras.optimizers.Adam(learning_rate=learning_rate)

# Compile the model
model.compile(optimizer=optimizer, loss='mean_squared_error' ,␣
 ↪metrics=['mean_squared_error', rmse, 'mean_absolute_error',␣
 ↪'mean_absolute_percentage_error'])

# Train the model
model.fit(X_train, y_train, epochs=500, batch_size=128, verbose = 1)
```

```
WARNING:tensorflow:Layer lstm will not use cuDNN kernels since it doesn't meet
the criteria. It will use a generic GPU kernel as fallback when running on GPU.
WARNING:tensorflow:Layer lstm_1 will not use cuDNN kernels since it doesn't meet
the criteria. It will use a generic GPU kernel as fallback when running on GPU.
WARNING:tensorflow:Layer lstm_2 will not use cuDNN kernels since it doesn't meet
the criteria. It will use a generic GPU kernel as fallback when running on GPU.
Epoch 1/500
1/1 [==============================] - 6s 6s/step - loss: 0.2068 -
mean_squared_error: 0.2068 - rmse: 0.4547 - mean_absolute_error: 0.4092 -
mean_absolute_percentage_error: 100.8747
Epoch 2/500
1/1 [==============================] - 0s 124ms/step - loss: 0.1991 -
mean_squared_error: 0.1991 - rmse: 0.4462 - mean_absolute_error: 0.4001 -
mean_absolute_percentage_error: 97.6461
Epoch 3/500
1/1 [==============================] - 0s 115ms/step - loss: 0.1932 -
mean_squared_error: 0.1932 - rmse: 0.4395 - mean_absolute_error: 0.3928 -
```

```
mean_absolute_percentage_error: 94.9775
Epoch 4/500
1/1 [==============================] - 0s 107ms/step - loss: 0.1871 -
mean_squared_error: 0.1871 - rmse: 0.4326 - mean_absolute_error: 0.3852 -
mean_absolute_percentage_error: 92.1798
Epoch 5/500
1/1 [==============================] - 0s 112ms/step - loss: 0.1810 -
mean_squared_error: 0.1810 - rmse: 0.4255 - mean_absolute_error: 0.3773 -
mean_absolute_percentage_error: 89.2717
Epoch 6/500
1/1 [==============================] - 0s 107ms/step - loss: 0.1748 -
mean_squared_error: 0.1748 - rmse: 0.4181 - mean_absolute_error: 0.3691 -
mean_absolute_percentage_error: 86.1912
Epoch 7/500
1/1 [==============================] - 0s 124ms/step - loss: 0.1682 -
mean_squared_error: 0.1682 - rmse: 0.4102 - mean_absolute_error: 0.3603 -
mean_absolute_percentage_error: 82.8768
Epoch 8/500
1/1 [==============================] - 0s 101ms/step - loss: 0.1614 -
mean_squared_error: 0.1614 - rmse: 0.4017 - mean_absolute_error: 0.3508 -
mean_absolute_percentage_error: 79.2999
Epoch 9/500
1/1 [==============================] - 0s 111ms/step - loss: 0.1542 -
mean_squared_error: 0.1542 - rmse: 0.3926 - mean_absolute_error: 0.3405 -
mean_absolute_percentage_error: 75.4285
Epoch 10/500
1/1 [==============================] - 0s 103ms/step - loss: 0.1465 -
mean_squared_error: 0.1465 - rmse: 0.3828 - mean_absolute_error: 0.3293 -
mean_absolute_percentage_error: 71.2069
Epoch 11/500
1/1 [==============================] - 0s 99ms/step - loss: 0.1383 -
mean_squared_error: 0.1383 - rmse: 0.3719 - mean_absolute_error: 0.3173 -
mean_absolute_percentage_error: 67.2222
Epoch 12/500
1/1 [==============================] - 0s 103ms/step - loss: 0.1296 -
mean_squared_error: 0.1296 - rmse: 0.3600 - mean_absolute_error: 0.3052 -
mean_absolute_percentage_error: 64.2460
Epoch 13/500
1/1 [==============================] - 0s 100ms/step - loss: 0.1204 -
mean_squared_error: 0.1204 - rmse: 0.3470 - mean_absolute_error: 0.2939 -
mean_absolute_percentage_error: 63.1819
Epoch 14/500
1/1 [==============================] - 0s 99ms/step - loss: 0.1108 -
mean_squared_error: 0.1108 - rmse: 0.3329 - mean_absolute_error: 0.2822 -
mean_absolute_percentage_error: 62.6754
Epoch 15/500
1/1 [==============================] - 0s 101ms/step - loss: 0.1008 -
mean_squared_error: 0.1008 - rmse: 0.3174 - mean_absolute_error: 0.2695 -
```

```
mean_absolute_percentage_error: 62.3451
Epoch 16/500
1/1 [==============================] - 0s 99ms/step - loss: 0.0904 -
mean_squared_error: 0.0904 - rmse: 0.3007 - mean_absolute_error: 0.2554 -
mean_absolute_percentage_error: 61.9660
Epoch 17/500
1/1 [==============================] - 0s 95ms/step - loss: 0.0798 -
mean_squared_error: 0.0798 - rmse: 0.2825 - mean_absolute_error: 0.2397 -
mean_absolute_percentage_error: 61.7067
Epoch 18/500
1/1 [==============================] - 0s 102ms/step - loss: 0.0692 -
mean_squared_error: 0.0692 - rmse: 0.2631 - mean_absolute_error: 0.2221 -
mean_absolute_percentage_error: 61.5000
Epoch 19/500
1/1 [==============================] - 0s 101ms/step - loss: 0.0590 -
mean_squared_error: 0.0590 - rmse: 0.2428 - mean_absolute_error: 0.2037 -
mean_absolute_percentage_error: 61.9471
Epoch 20/500
1/1 [==============================] - 0s 103ms/step - loss: 0.0495 -
mean_squared_error: 0.0495 - rmse: 0.2226 - mean_absolute_error: 0.1840 -
mean_absolute_percentage_error: 62.9251
Epoch 21/500
1/1 [==============================] - 0s 107ms/step - loss: 0.0417 -
mean_squared_error: 0.0417 - rmse: 0.2043 - mean_absolute_error: 0.1623 -
mean_absolute_percentage_error: 64.3016
Epoch 22/500
1/1 [==============================] - 0s 120ms/step - loss: 0.0367 -
mean_squared_error: 0.0367 - rmse: 0.1915 - mean_absolute_error: 0.1410 -
mean_absolute_percentage_error: 66.7623
Epoch 23/500
1/1 [==============================] - 0s 111ms/step - loss: 0.0356 -
mean_squared_error: 0.0356 - rmse: 0.1888 - mean_absolute_error: 0.1298 -
mean_absolute_percentage_error: 72.4412
Epoch 24/500
1/1 [==============================] - 0s 105ms/step - loss: 0.0393 -
mean_squared_error: 0.0393 - rmse: 0.1983 - mean_absolute_error: 0.1425 -
mean_absolute_percentage_error: 83.3459
Epoch 25/500
1/1 [==============================] - 0s 103ms/step - loss: 0.0454 -
mean_squared_error: 0.0454 - rmse: 0.2131 - mean_absolute_error: 0.1666 -
mean_absolute_percentage_error: 94.5385
Epoch 26/500
1/1 [==============================] - 0s 98ms/step - loss: 0.0495 -
mean_squared_error: 0.0495 - rmse: 0.2224 - mean_absolute_error: 0.1792 -
mean_absolute_percentage_error: 100.2087
Epoch 27/500
1/1 [==============================] - 0s 108ms/step - loss: 0.0496 -
mean_squared_error: 0.0496 - rmse: 0.2226 - mean_absolute_error: 0.1797 -
```

```
mean_absolute_percentage_error: 100.3727
Epoch 28/500
1/1 [==============================] - 0s 121ms/step - loss: 0.0467 -
mean_squared_error: 0.0467 - rmse: 0.2161 - mean_absolute_error: 0.1711 -
mean_absolute_percentage_error: 96.5230
Epoch 29/500
1/1 [==============================] - 0s 115ms/step - loss: 0.0427 -
mean_squared_error: 0.0427 - rmse: 0.2066 - mean_absolute_error: 0.1575 -
mean_absolute_percentage_error: 90.3300
Epoch 30/500
1/1 [==============================] - 0s 113ms/step - loss: 0.0391 -
mean_squared_error: 0.0391 - rmse: 0.1976 - mean_absolute_error: 0.1423 -
mean_absolute_percentage_error: 83.1937
Epoch 31/500
1/1 [==============================] - 0s 153ms/step - loss: 0.0365 -
mean_squared_error: 0.0365 - rmse: 0.1912 - mean_absolute_error: 0.1335 -
mean_absolute_percentage_error: 77.2046
Epoch 32/500
1/1 [==============================] - 0s 124ms/step - loss: 0.0353 -
mean_squared_error: 0.0353 - rmse: 0.1878 - mean_absolute_error: 0.1292 -
mean_absolute_percentage_error: 72.3956
Epoch 33/500
1/1 [==============================] - 0s 110ms/step - loss: 0.0350 -
mean_squared_error: 0.0350 - rmse: 0.1872 - mean_absolute_error: 0.1305 -
mean_absolute_percentage_error: 69.2585
Epoch 34/500
1/1 [==============================] - 0s 107ms/step - loss: 0.0355 -
mean_squared_error: 0.0355 - rmse: 0.1883 - mean_absolute_error: 0.1351 -
mean_absolute_percentage_error: 67.4261
Epoch 35/500
1/1 [==============================] - 0s 94ms/step - loss: 0.0362 -
mean_squared_error: 0.0362 - rmse: 0.1903 - mean_absolute_error: 0.1404 -
mean_absolute_percentage_error: 66.3905
Epoch 36/500
1/1 [==============================] - 0s 99ms/step - loss: 0.0370 -
mean_squared_error: 0.0370 - rmse: 0.1923 - mean_absolute_error: 0.1446 -
mean_absolute_percentage_error: 65.7058
Epoch 37/500
1/1 [==============================] - 0s 97ms/step - loss: 0.0376 -
mean_squared_error: 0.0376 - rmse: 0.1939 - mean_absolute_error: 0.1475 -
mean_absolute_percentage_error: 65.2981
Epoch 38/500
1/1 [==============================] - 0s 103ms/step - loss: 0.0380 -
mean_squared_error: 0.0380 - rmse: 0.1948 - mean_absolute_error: 0.1491 -
mean_absolute_percentage_error: 65.0863
Epoch 39/500
1/1 [==============================] - 0s 94ms/step - loss: 0.0380 -
mean_squared_error: 0.0380 - rmse: 0.1950 - mean_absolute_error: 0.1495 -
```

```
mean_absolute_percentage_error: 65.0151
Epoch 40/500
1/1 [==============================] - 0s 106ms/step - loss: 0.0378 -
mean_squared_error: 0.0378 - rmse: 0.1945 - mean_absolute_error: 0.1488 -
mean_absolute_percentage_error: 65.0642
Epoch 41/500
1/1 [==============================] - 0s 98ms/step - loss: 0.0374 -
mean_squared_error: 0.0374 - rmse: 0.1935 - mean_absolute_error: 0.1471 -
mean_absolute_percentage_error: 65.2134
Epoch 42/500
1/1 [==============================] - 0s 103ms/step - loss: 0.0369 -
mean_squared_error: 0.0369 - rmse: 0.1922 - mean_absolute_error: 0.1448 -
mean_absolute_percentage_error: 65.4738
Epoch 43/500
1/1 [==============================] - 0s 107ms/step - loss: 0.0363 -
mean_squared_error: 0.0363 - rmse: 0.1906 - mean_absolute_error: 0.1419 -
mean_absolute_percentage_error: 65.8290
Epoch 44/500
1/1 [==============================] - 0s 124ms/step - loss: 0.0357 -
mean_squared_error: 0.0357 - rmse: 0.1891 - mean_absolute_error: 0.1387 -
mean_absolute_percentage_error: 66.3064
Epoch 45/500
1/1 [==============================] - 0s 130ms/step - loss: 0.0352 -
mean_squared_error: 0.0352 - rmse: 0.1877 - mean_absolute_error: 0.1354 -
mean_absolute_percentage_error: 66.8641
Epoch 46/500
1/1 [==============================] - 0s 112ms/step - loss: 0.0348 -
mean_squared_error: 0.0348 - rmse: 0.1866 - mean_absolute_error: 0.1323 -
mean_absolute_percentage_error: 67.5574
Epoch 47/500
1/1 [==============================] - 0s 119ms/step - loss: 0.0346 -
mean_squared_error: 0.0346 - rmse: 0.1860 - mean_absolute_error: 0.1300 -
mean_absolute_percentage_error: 68.4504
Epoch 48/500
1/1 [==============================] - 0s 116ms/step - loss: 0.0345 -
mean_squared_error: 0.0345 - rmse: 0.1857 - mean_absolute_error: 0.1282 -
mean_absolute_percentage_error: 69.3562
Epoch 49/500
1/1 [==============================] - 0s 123ms/step - loss: 0.0345 -
mean_squared_error: 0.0345 - rmse: 0.1857 - mean_absolute_error: 0.1277 -
mean_absolute_percentage_error: 70.4254
Epoch 50/500
1/1 [==============================] - 0s 124ms/step - loss: 0.0346 -
mean_squared_error: 0.0346 - rmse: 0.1860 - mean_absolute_error: 0.1278 -
mean_absolute_percentage_error: 71.3903
Epoch 51/500
1/1 [==============================] - 0s 125ms/step - loss: 0.0347 -
mean_squared_error: 0.0347 - rmse: 0.1863 - mean_absolute_error: 0.1282 -
```

```
mean_absolute_percentage_error: 72.1696
Epoch 52/500
1/1 [==============================] - 0s 135ms/step - loss: 0.0348 -
mean_squared_error: 0.0348 - rmse: 0.1865 - mean_absolute_error: 0.1285 -
mean_absolute_percentage_error: 72.5881
Epoch 53/500
1/1 [==============================] - 0s 115ms/step - loss: 0.0348 -
mean_squared_error: 0.0348 - rmse: 0.1865 - mean_absolute_error: 0.1285 -
mean_absolute_percentage_error: 72.6017
Epoch 54/500
1/1 [==============================] - 0s 119ms/step - loss: 0.0347 -
mean_squared_error: 0.0347 - rmse: 0.1862 - mean_absolute_error: 0.1281 -
mean_absolute_percentage_error: 72.2211
Epoch 55/500
1/1 [==============================] - 0s 96ms/step - loss: 0.0345 -
mean_squared_error: 0.0345 - rmse: 0.1858 - mean_absolute_error: 0.1275 -
mean_absolute_percentage_error: 71.4881
Epoch 56/500
1/1 [==============================] - 0s 103ms/step - loss: 0.0343 -
mean_squared_error: 0.0343 - rmse: 0.1853 - mean_absolute_error: 0.1268 -
mean_absolute_percentage_error: 70.4920
Epoch 57/500
1/1 [==============================] - 0s 101ms/step - loss: 0.0342 -
mean_squared_error: 0.0342 - rmse: 0.1848 - mean_absolute_error: 0.1264 -
mean_absolute_percentage_error: 69.4120
Epoch 58/500
1/1 [==============================] - 0s 94ms/step - loss: 0.0340 -
mean_squared_error: 0.0340 - rmse: 0.1845 - mean_absolute_error: 0.1263 -
mean_absolute_percentage_error: 68.3226
Epoch 59/500
1/1 [==============================] - 0s 104ms/step - loss: 0.0340 -
mean_squared_error: 0.0340 - rmse: 0.1843 - mean_absolute_error: 0.1265 -
mean_absolute_percentage_error: 67.3201
Epoch 60/500
1/1 [==============================] - 0s 101ms/step - loss: 0.0340 -
mean_squared_error: 0.0340 - rmse: 0.1843 - mean_absolute_error: 0.1272 -
mean_absolute_percentage_error: 66.5083
Epoch 61/500
1/1 [==============================] - 0s 99ms/step - loss: 0.0340 -
mean_squared_error: 0.0340 - rmse: 0.1844 - mean_absolute_error: 0.1281 -
mean_absolute_percentage_error: 65.9144
Epoch 62/500
1/1 [==============================] - 0s 100ms/step - loss: 0.0340 -
mean_squared_error: 0.0340 - rmse: 0.1844 - mean_absolute_error: 0.1286 -
mean_absolute_percentage_error: 65.4585
Epoch 63/500
1/1 [==============================] - 0s 103ms/step - loss: 0.0340 -
mean_squared_error: 0.0340 - rmse: 0.1843 - mean_absolute_error: 0.1286 -
```

```
mean_absolute_percentage_error: 65.1558
Epoch 64/500
1/1 [==============================] - 0s 107ms/step - loss: 0.0339 -
mean_squared_error: 0.0339 - rmse: 0.1841 - mean_absolute_error: 0.1282 -
mean_absolute_percentage_error: 65.0008
Epoch 65/500
1/1 [==============================] - 0s 112ms/step - loss: 0.0338 -
mean_squared_error: 0.0338 - rmse: 0.1838 - mean_absolute_error: 0.1275 -
mean_absolute_percentage_error: 64.9693
Epoch 66/500
1/1 [==============================] - 0s 112ms/step - loss: 0.0336 -
mean_squared_error: 0.0336 - rmse: 0.1834 - mean_absolute_error: 0.1264 -
mean_absolute_percentage_error: 65.0324
Epoch 67/500
1/1 [==============================] - 0s 98ms/step - loss: 0.0335 -
mean_squared_error: 0.0335 - rmse: 0.1831 - mean_absolute_error: 0.1253 -
mean_absolute_percentage_error: 65.1771
Epoch 68/500
1/1 [==============================] - 0s 101ms/step - loss: 0.0334 -
mean_squared_error: 0.0334 - rmse: 0.1828 - mean_absolute_error: 0.1244 -
mean_absolute_percentage_error: 65.4024
Epoch 69/500
1/1 [==============================] - 0s 95ms/step - loss: 0.0333 -
mean_squared_error: 0.0333 - rmse: 0.1825 - mean_absolute_error: 0.1238 -
mean_absolute_percentage_error: 65.6662
Epoch 70/500
1/1 [==============================] - 0s 107ms/step - loss: 0.0333 -
mean_squared_error: 0.0333 - rmse: 0.1824 - mean_absolute_error: 0.1234 -
mean_absolute_percentage_error: 65.8938
Epoch 71/500
1/1 [==============================] - 0s 100ms/step - loss: 0.0332 -
mean_squared_error: 0.0332 - rmse: 0.1822 - mean_absolute_error: 0.1231 -
mean_absolute_percentage_error: 65.9851
Epoch 72/500
1/1 [==============================] - 0s 106ms/step - loss: 0.0331 -
mean_squared_error: 0.0331 - rmse: 0.1820 - mean_absolute_error: 0.1228 -
mean_absolute_percentage_error: 65.9119
Epoch 73/500
1/1 [==============================] - 0s 114ms/step - loss: 0.0331 -
mean_squared_error: 0.0331 - rmse: 0.1818 - mean_absolute_error: 0.1225 -
mean_absolute_percentage_error: 65.6541
Epoch 74/500
1/1 [==============================] - 0s 135ms/step - loss: 0.0330 -
mean_squared_error: 0.0330 - rmse: 0.1815 - mean_absolute_error: 0.1221 -
mean_absolute_percentage_error: 65.1963
Epoch 75/500
1/1 [==============================] - 0s 141ms/step - loss: 0.0328 -
mean_squared_error: 0.0328 - rmse: 0.1812 - mean_absolute_error: 0.1218 -
```

```
mean_absolute_percentage_error: 64.5776
Epoch 76/500
1/1 [==============================] - 0s 120ms/step - loss: 0.0327 -
mean_squared_error: 0.0327 - rmse: 0.1808 - mean_absolute_error: 0.1215 -
mean_absolute_percentage_error: 63.8428
Epoch 77/500
1/1 [==============================] - 0s 109ms/step - loss: 0.0326 -
mean_squared_error: 0.0326 - rmse: 0.1805 - mean_absolute_error: 0.1212 -
mean_absolute_percentage_error: 63.0449
Epoch 78/500
1/1 [==============================] - 0s 102ms/step - loss: 0.0325 -
mean_squared_error: 0.0325 - rmse: 0.1803 - mean_absolute_error: 0.1209 -
mean_absolute_percentage_error: 62.2638
Epoch 79/500
1/1 [==============================] - 0s 104ms/step - loss: 0.0324 -
mean_squared_error: 0.0324 - rmse: 0.1800 - mean_absolute_error: 0.1207 -
mean_absolute_percentage_error: 61.5401
Epoch 80/500
1/1 [==============================] - 0s 98ms/step - loss: 0.0323 -
mean_squared_error: 0.0323 - rmse: 0.1797 - mean_absolute_error: 0.1204 -
mean_absolute_percentage_error: 60.9087
Epoch 81/500
1/1 [==============================] - 0s 103ms/step - loss: 0.0322 -
mean_squared_error: 0.0322 - rmse: 0.1793 - mean_absolute_error: 0.1200 -
mean_absolute_percentage_error: 60.3884
Epoch 82/500
1/1 [==============================] - 0s 95ms/step - loss: 0.0320 -
mean_squared_error: 0.0320 - rmse: 0.1789 - mean_absolute_error: 0.1194 -
mean_absolute_percentage_error: 59.9769
Epoch 83/500
1/1 [==============================] - 0s 107ms/step - loss: 0.0319 -
mean_squared_error: 0.0319 - rmse: 0.1785 - mean_absolute_error: 0.1188 -
mean_absolute_percentage_error: 59.6750
Epoch 84/500
1/1 [==============================] - 0s 113ms/step - loss: 0.0317 -
mean_squared_error: 0.0317 - rmse: 0.1780 - mean_absolute_error: 0.1183 -
mean_absolute_percentage_error: 59.4455
Epoch 85/500
1/1 [==============================] - 0s 127ms/step - loss: 0.0315 -
mean_squared_error: 0.0315 - rmse: 0.1776 - mean_absolute_error: 0.1178 -
mean_absolute_percentage_error: 59.2775
Epoch 86/500
1/1 [==============================] - 0s 112ms/step - loss: 0.0314 -
mean_squared_error: 0.0314 - rmse: 0.1772 - mean_absolute_error: 0.1173 -
mean_absolute_percentage_error: 59.1386
Epoch 87/500
1/1 [==============================] - 0s 121ms/step - loss: 0.0313 -
mean_squared_error: 0.0313 - rmse: 0.1768 - mean_absolute_error: 0.1169 -
```

```
mean_absolute_percentage_error: 59.0100
Epoch 88/500
1/1 [==============================] - 0s 109ms/step - loss: 0.0311 -
mean_squared_error: 0.0311 - rmse: 0.1764 - mean_absolute_error: 0.1164 -
mean_absolute_percentage_error: 58.8325
Epoch 89/500
1/1 [==============================] - 0s 112ms/step - loss: 0.0309 -
mean_squared_error: 0.0309 - rmse: 0.1759 - mean_absolute_error: 0.1160 -
mean_absolute_percentage_error: 58.5663
Epoch 90/500
1/1 [==============================] - 0s 113ms/step - loss: 0.0307 -
mean_squared_error: 0.0307 - rmse: 0.1753 - mean_absolute_error: 0.1155 -
mean_absolute_percentage_error: 58.1828
Epoch 91/500
1/1 [==============================] - 0s 128ms/step - loss: 0.0305 -
mean_squared_error: 0.0305 - rmse: 0.1747 - mean_absolute_error: 0.1150 -
mean_absolute_percentage_error: 57.6804
Epoch 92/500
1/1 [==============================] - 0s 108ms/step - loss: 0.0303 -
mean_squared_error: 0.0303 - rmse: 0.1741 - mean_absolute_error: 0.1144 -
mean_absolute_percentage_error: 57.0826
Epoch 93/500
1/1 [==============================] - 0s 124ms/step - loss: 0.0301 -
mean_squared_error: 0.0301 - rmse: 0.1734 - mean_absolute_error: 0.1139 -
mean_absolute_percentage_error: 56.4339
Epoch 94/500
1/1 [==============================] - 0s 129ms/step - loss: 0.0298 -
mean_squared_error: 0.0298 - rmse: 0.1727 - mean_absolute_error: 0.1134 -
mean_absolute_percentage_error: 55.7676
Epoch 95/500
1/1 [==============================] - 0s 142ms/step - loss: 0.0296 -
mean_squared_error: 0.0296 - rmse: 0.1721 - mean_absolute_error: 0.1128 -
mean_absolute_percentage_error: 55.1565
Epoch 96/500
1/1 [==============================] - 0s 135ms/step - loss: 0.0294 -
mean_squared_error: 0.0294 - rmse: 0.1714 - mean_absolute_error: 0.1123 -
mean_absolute_percentage_error: 54.6457
Epoch 97/500
1/1 [==============================] - 0s 147ms/step - loss: 0.0291 -
mean_squared_error: 0.0291 - rmse: 0.1706 - mean_absolute_error: 0.1117 -
mean_absolute_percentage_error: 54.3040
Epoch 98/500
1/1 [==============================] - 0s 136ms/step - loss: 0.0288 -
mean_squared_error: 0.0288 - rmse: 0.1698 - mean_absolute_error: 0.1110 -
mean_absolute_percentage_error: 54.1445
Epoch 99/500
1/1 [==============================] - 0s 124ms/step - loss: 0.0285 -
mean_squared_error: 0.0285 - rmse: 0.1689 - mean_absolute_error: 0.1103 -
```

```
mean_absolute_percentage_error: 54.0718
Epoch 100/500
1/1 [==============================] - 0s 152ms/step - loss: 0.0282 -
mean_squared_error: 0.0282 - rmse: 0.1680 - mean_absolute_error: 0.1095 -
mean_absolute_percentage_error: 53.9839
Epoch 101/500
1/1 [==============================] - 0s 127ms/step - loss: 0.0279 -
mean_squared_error: 0.0279 - rmse: 0.1671 - mean_absolute_error: 0.1087 -
mean_absolute_percentage_error: 53.7767
Epoch 102/500
1/1 [==============================] - 0s 116ms/step - loss: 0.0276 -
mean_squared_error: 0.0276 - rmse: 0.1661 - mean_absolute_error: 0.1080 -
mean_absolute_percentage_error: 53.4041
Epoch 103/500
1/1 [==============================] - 0s 121ms/step - loss: 0.0272 -
mean_squared_error: 0.0272 - rmse: 0.1650 - mean_absolute_error: 0.1073 -
mean_absolute_percentage_error: 52.8597
Epoch 104/500
1/1 [==============================] - 0s 121ms/step - loss: 0.0269 -
mean_squared_error: 0.0269 - rmse: 0.1639 - mean_absolute_error: 0.1066 -
mean_absolute_percentage_error: 52.1881
Epoch 105/500
1/1 [==============================] - 0s 122ms/step - loss: 0.0265 -
mean_squared_error: 0.0265 - rmse: 0.1628 - mean_absolute_error: 0.1060 -
mean_absolute_percentage_error: 51.5426
Epoch 106/500
1/1 [==============================] - 0s 123ms/step - loss: 0.0261 -
mean_squared_error: 0.0261 - rmse: 0.1617 - mean_absolute_error: 0.1055 -
mean_absolute_percentage_error: 51.0680
Epoch 107/500
1/1 [==============================] - 0s 100ms/step - loss: 0.0258 -
mean_squared_error: 0.0258 - rmse: 0.1605 - mean_absolute_error: 0.1048 -
mean_absolute_percentage_error: 50.8078
Epoch 108/500
1/1 [==============================] - 0s 107ms/step - loss: 0.0254 -
mean_squared_error: 0.0254 - rmse: 0.1593 - mean_absolute_error: 0.1042 -
mean_absolute_percentage_error: 50.6987
Epoch 109/500
1/1 [==============================] - 0s 103ms/step - loss: 0.0250 -
mean_squared_error: 0.0250 - rmse: 0.1581 - mean_absolute_error: 0.1036 -
mean_absolute_percentage_error: 50.5752
Epoch 110/500
1/1 [==============================] - 0s 101ms/step - loss: 0.0246 -
mean_squared_error: 0.0246 - rmse: 0.1569 - mean_absolute_error: 0.1030 -
mean_absolute_percentage_error: 50.1655
Epoch 111/500
1/1 [==============================] - 0s 101ms/step - loss: 0.0242 -
mean_squared_error: 0.0242 - rmse: 0.1557 - mean_absolute_error: 0.1022 -
```

```
mean_absolute_percentage_error: 49.4679
Epoch 112/500
1/1 [==============================] - 0s 98ms/step - loss: 0.0239 -
mean_squared_error: 0.0239 - rmse: 0.1545 - mean_absolute_error: 0.1013 -
mean_absolute_percentage_error: 48.6378
Epoch 113/500
1/1 [==============================] - 0s 120ms/step - loss: 0.0235 -
mean_squared_error: 0.0235 - rmse: 0.1534 - mean_absolute_error: 0.1004 -
mean_absolute_percentage_error: 47.8947
Epoch 114/500
1/1 [==============================] - 0s 103ms/step - loss: 0.0232 -
mean_squared_error: 0.0232 - rmse: 0.1522 - mean_absolute_error: 0.0995 -
mean_absolute_percentage_error: 47.2554
Epoch 115/500
1/1 [==============================] - 0s 128ms/step - loss: 0.0228 -
mean_squared_error: 0.0228 - rmse: 0.1509 - mean_absolute_error: 0.0984 -
mean_absolute_percentage_error: 46.4389
Epoch 116/500
1/1 [==============================] - 0s 145ms/step - loss: 0.0224 -
mean_squared_error: 0.0224 - rmse: 0.1497 - mean_absolute_error: 0.0971 -
mean_absolute_percentage_error: 45.3483
Epoch 117/500
1/1 [==============================] - 0s 145ms/step - loss: 0.0221 -
mean_squared_error: 0.0221 - rmse: 0.1486 - mean_absolute_error: 0.0961 -
mean_absolute_percentage_error: 44.2209
Epoch 118/500
1/1 [==============================] - 0s 133ms/step - loss: 0.0218 -
mean_squared_error: 0.0218 - rmse: 0.1475 - mean_absolute_error: 0.0956 -
mean_absolute_percentage_error: 43.4016
Epoch 119/500
1/1 [==============================] - 0s 114ms/step - loss: 0.0215 -
mean_squared_error: 0.0215 - rmse: 0.1466 - mean_absolute_error: 0.0956 -
mean_absolute_percentage_error: 43.1188
Epoch 120/500
1/1 [==============================] - 0s 117ms/step - loss: 0.0212 -
mean_squared_error: 0.0212 - rmse: 0.1457 - mean_absolute_error: 0.0959 -
mean_absolute_percentage_error: 43.1035
Epoch 121/500
1/1 [==============================] - 0s 99ms/step - loss: 0.0210 -
mean_squared_error: 0.0210 - rmse: 0.1450 - mean_absolute_error: 0.0961 -
mean_absolute_percentage_error: 42.8315
Epoch 122/500
1/1 [==============================] - 0s 108ms/step - loss: 0.0208 -
mean_squared_error: 0.0208 - rmse: 0.1444 - mean_absolute_error: 0.0961 -
mean_absolute_percentage_error: 42.5608
Epoch 123/500
1/1 [==============================] - 0s 105ms/step - loss: 0.0207 -
mean_squared_error: 0.0207 - rmse: 0.1438 - mean_absolute_error: 0.0963 -
```

```
mean_absolute_percentage_error: 42.7899
Epoch 124/500
1/1 [==============================] - 0s 115ms/step - loss: 0.0206 -
mean_squared_error: 0.0206 - rmse: 0.1434 - mean_absolute_error: 0.0964 -
mean_absolute_percentage_error: 42.7250
Epoch 125/500
1/1 [==============================] - 0s 113ms/step - loss: 0.0205 -
mean_squared_error: 0.0205 - rmse: 0.1431 - mean_absolute_error: 0.0963 -
mean_absolute_percentage_error: 42.4799
Epoch 126/500
1/1 [==============================] - 0s 111ms/step - loss: 0.0204 -
mean_squared_error: 0.0204 - rmse: 0.1428 - mean_absolute_error: 0.0966 -
mean_absolute_percentage_error: 42.6753
Epoch 127/500
1/1 [==============================] - 0s 97ms/step - loss: 0.0203 -
mean_squared_error: 0.0203 - rmse: 0.1426 - mean_absolute_error: 0.0968 -
mean_absolute_percentage_error: 42.8244
Epoch 128/500
1/1 [==============================] - 0s 104ms/step - loss: 0.0203 -
mean_squared_error: 0.0203 - rmse: 0.1423 - mean_absolute_error: 0.0962 -
mean_absolute_percentage_error: 42.1504
Epoch 129/500
1/1 [==============================] - 0s 105ms/step - loss: 0.0202 -
mean_squared_error: 0.0202 - rmse: 0.1421 - mean_absolute_error: 0.0958 -
mean_absolute_percentage_error: 41.7111
Epoch 130/500
1/1 [==============================] - 0s 97ms/step - loss: 0.0201 -
mean_squared_error: 0.0201 - rmse: 0.1418 - mean_absolute_error: 0.0960 -
mean_absolute_percentage_error: 41.9853
Epoch 131/500
1/1 [==============================] - 0s 103ms/step - loss: 0.0200 -
mean_squared_error: 0.0200 - rmse: 0.1415 - mean_absolute_error: 0.0955 -
mean_absolute_percentage_error: 41.5405
Epoch 132/500
1/1 [==============================] - 0s 102ms/step - loss: 0.0199 -
mean_squared_error: 0.0199 - rmse: 0.1412 - mean_absolute_error: 0.0949 -
mean_absolute_percentage_error: 40.8839
Epoch 133/500
1/1 [==============================] - 0s 99ms/step - loss: 0.0199 -
mean_squared_error: 0.0199 - rmse: 0.1409 - mean_absolute_error: 0.0949 -
mean_absolute_percentage_error: 41.0132
Epoch 134/500
1/1 [==============================] - 0s 97ms/step - loss: 0.0198 -
mean_squared_error: 0.0198 - rmse: 0.1406 - mean_absolute_error: 0.0945 -
mean_absolute_percentage_error: 40.7144
Epoch 135/500
1/1 [==============================] - 0s 100ms/step - loss: 0.0197 -
mean_squared_error: 0.0197 - rmse: 0.1402 - mean_absolute_error: 0.0940 -
```

```
mean_absolute_percentage_error: 40.2519
Epoch 136/500
1/1 [==============================] - 0s 111ms/step - loss: 0.0196 -
mean_squared_error: 0.0196 - rmse: 0.1399 - mean_absolute_error: 0.0938 -
mean_absolute_percentage_error: 40.0565
Epoch 137/500
1/1 [==============================] - 0s 128ms/step - loss: 0.0195 -
mean_squared_error: 0.0195 - rmse: 0.1396 - mean_absolute_error: 0.0935 -
mean_absolute_percentage_error: 39.7874
Epoch 138/500
1/1 [==============================] - 0s 150ms/step - loss: 0.0194 -
mean_squared_error: 0.0194 - rmse: 0.1393 - mean_absolute_error: 0.0932 -
mean_absolute_percentage_error: 39.4645
Epoch 139/500
1/1 [==============================] - 0s 156ms/step - loss: 0.0193 -
mean_squared_error: 0.0193 - rmse: 0.1390 - mean_absolute_error: 0.0928 -
mean_absolute_percentage_error: 39.0913
Epoch 140/500
1/1 [==============================] - 0s 152ms/step - loss: 0.0192 -
mean_squared_error: 0.0192 - rmse: 0.1386 - mean_absolute_error: 0.0924 -
mean_absolute_percentage_error: 38.6955
Epoch 141/500
1/1 [==============================] - 0s 122ms/step - loss: 0.0191 -
mean_squared_error: 0.0191 - rmse: 0.1383 - mean_absolute_error: 0.0925 -
mean_absolute_percentage_error: 38.8005
Epoch 142/500
1/1 [==============================] - 0s 120ms/step - loss: 0.0190 -
mean_squared_error: 0.0190 - rmse: 0.1380 - mean_absolute_error: 0.0921 -
mean_absolute_percentage_error: 38.4975
Epoch 143/500
1/1 [==============================] - 0s 113ms/step - loss: 0.0190 -
mean_squared_error: 0.0190 - rmse: 0.1377 - mean_absolute_error: 0.0918 -
mean_absolute_percentage_error: 38.2258
Epoch 144/500
1/1 [==============================] - 0s 96ms/step - loss: 0.0189 -
mean_squared_error: 0.0189 - rmse: 0.1374 - mean_absolute_error: 0.0920 -
mean_absolute_percentage_error: 38.5172
Epoch 145/500
1/1 [==============================] - 0s 112ms/step - loss: 0.0188 -
mean_squared_error: 0.0188 - rmse: 0.1372 - mean_absolute_error: 0.0919 -
mean_absolute_percentage_error: 38.3587
Epoch 146/500
1/1 [==============================] - 0s 102ms/step - loss: 0.0187 -
mean_squared_error: 0.0187 - rmse: 0.1369 - mean_absolute_error: 0.0914 -
mean_absolute_percentage_error: 37.8636
Epoch 147/500
1/1 [==============================] - 0s 103ms/step - loss: 0.0187 -
mean_squared_error: 0.0187 - rmse: 0.1366 - mean_absolute_error: 0.0914 -
```

```
mean_absolute_percentage_error: 37.9002
Epoch 148/500
1/1 [==============================] - 0s 102ms/step - loss: 0.0186 -
mean_squared_error: 0.0186 - rmse: 0.1364 - mean_absolute_error: 0.0908 -
mean_absolute_percentage_error: 37.2708
Epoch 149/500
1/1 [==============================] - 0s 103ms/step - loss: 0.0185 -
mean_squared_error: 0.0185 - rmse: 0.1361 - mean_absolute_error: 0.0903 -
mean_absolute_percentage_error: 36.7617
Epoch 150/500
1/1 [==============================] - 0s 107ms/step - loss: 0.0184 -
mean_squared_error: 0.0184 - rmse: 0.1358 - mean_absolute_error: 0.0905 -
mean_absolute_percentage_error: 37.0762
Epoch 151/500
1/1 [==============================] - 0s 137ms/step - loss: 0.0184 -
mean_squared_error: 0.0184 - rmse: 0.1355 - mean_absolute_error: 0.0902 -
mean_absolute_percentage_error: 36.7572
Epoch 152/500
1/1 [==============================] - 0s 100ms/step - loss: 0.0183 -
mean_squared_error: 0.0183 - rmse: 0.1353 - mean_absolute_error: 0.0897 -
mean_absolute_percentage_error: 36.1892
Epoch 153/500
1/1 [==============================] - 0s 104ms/step - loss: 0.0182 -
mean_squared_error: 0.0182 - rmse: 0.1350 - mean_absolute_error: 0.0900 -
mean_absolute_percentage_error: 36.5297
Epoch 154/500
1/1 [==============================] - 0s 107ms/step - loss: 0.0181 -
mean_squared_error: 0.0181 - rmse: 0.1347 - mean_absolute_error: 0.0896 -
mean_absolute_percentage_error: 36.1309
Epoch 155/500
1/1 [==============================] - 0s 97ms/step - loss: 0.0181 -
mean_squared_error: 0.0181 - rmse: 0.1344 - mean_absolute_error: 0.0890 -
mean_absolute_percentage_error: 35.3350
Epoch 156/500
1/1 [==============================] - 0s 99ms/step - loss: 0.0180 -
mean_squared_error: 0.0180 - rmse: 0.1340 - mean_absolute_error: 0.0890 -
mean_absolute_percentage_error: 35.3438
Epoch 157/500
1/1 [==============================] - 0s 104ms/step - loss: 0.0179 -
mean_squared_error: 0.0179 - rmse: 0.1337 - mean_absolute_error: 0.0889 -
mean_absolute_percentage_error: 35.2046
Epoch 158/500
1/1 [==============================] - 0s 105ms/step - loss: 0.0178 -
mean_squared_error: 0.0178 - rmse: 0.1334 - mean_absolute_error: 0.0886 -
mean_absolute_percentage_error: 34.8501
Epoch 159/500
1/1 [==============================] - 0s 123ms/step - loss: 0.0177 -
mean_squared_error: 0.0177 - rmse: 0.1331 - mean_absolute_error: 0.0884 -
```

```
mean_absolute_percentage_error: 34.5860
Epoch 160/500
1/1 [==============================] - 0s 131ms/step - loss: 0.0176 -
mean_squared_error: 0.0176 - rmse: 0.1328 - mean_absolute_error: 0.0883 -
mean_absolute_percentage_error: 34.4538
Epoch 161/500
1/1 [==============================] - 0s 127ms/step - loss: 0.0175 -
mean_squared_error: 0.0175 - rmse: 0.1324 - mean_absolute_error: 0.0880 -
mean_absolute_percentage_error: 34.1534
Epoch 162/500
1/1 [==============================] - 0s 155ms/step - loss: 0.0174 -
mean_squared_error: 0.0174 - rmse: 0.1321 - mean_absolute_error: 0.0877 -
mean_absolute_percentage_error: 33.8069
Epoch 163/500
1/1 [==============================] - 0s 151ms/step - loss: 0.0174 -
mean_squared_error: 0.0174 - rmse: 0.1317 - mean_absolute_error: 0.0872 -
mean_absolute_percentage_error: 33.2875
Epoch 164/500
1/1 [==============================] - 0s 143ms/step - loss: 0.0173 -
mean_squared_error: 0.0173 - rmse: 0.1314 - mean_absolute_error: 0.0869 -
mean_absolute_percentage_error: 32.9162
Epoch 165/500
1/1 [==============================] - 0s 119ms/step - loss: 0.0172 -
mean_squared_error: 0.0172 - rmse: 0.1310 - mean_absolute_error: 0.0867 -
mean_absolute_percentage_error: 32.7738
Epoch 166/500
1/1 [==============================] - 0s 122ms/step - loss: 0.0171 -
mean_squared_error: 0.0171 - rmse: 0.1307 - mean_absolute_error: 0.0863 -
mean_absolute_percentage_error: 32.3094
Epoch 167/500
1/1 [==============================] - 0s 124ms/step - loss: 0.0170 -
mean_squared_error: 0.0170 - rmse: 0.1304 - mean_absolute_error: 0.0859 -
mean_absolute_percentage_error: 31.8703
Epoch 168/500
1/1 [==============================] - 0s 122ms/step - loss: 0.0169 -
mean_squared_error: 0.0169 - rmse: 0.1300 - mean_absolute_error: 0.0857 -
mean_absolute_percentage_error: 31.7748
Epoch 169/500
1/1 [==============================] - 0s 111ms/step - loss: 0.0168 -
mean_squared_error: 0.0168 - rmse: 0.1297 - mean_absolute_error: 0.0851 -
mean_absolute_percentage_error: 31.0736
Epoch 170/500
1/1 [==============================] - 0s 105ms/step - loss: 0.0168 -
mean_squared_error: 0.0168 - rmse: 0.1294 - mean_absolute_error: 0.0847 -
mean_absolute_percentage_error: 30.5660
Epoch 171/500
1/1 [==============================] - 0s 103ms/step - loss: 0.0167 -
mean_squared_error: 0.0167 - rmse: 0.1291 - mean_absolute_error: 0.0847 -
```

```
mean_absolute_percentage_error: 30.5751
Epoch 172/500
1/1 [==============================] - 0s 113ms/step - loss: 0.0166 -
mean_squared_error: 0.0166 - rmse: 0.1288 - mean_absolute_error: 0.0845 -
mean_absolute_percentage_error: 30.3955
Epoch 173/500
1/1 [==============================] - 0s 114ms/step - loss: 0.0165 -
mean_squared_error: 0.0165 - rmse: 0.1285 - mean_absolute_error: 0.0843 -
mean_absolute_percentage_error: 30.1354
Epoch 174/500
1/1 [==============================] - 0s 114ms/step - loss: 0.0164 -
mean_squared_error: 0.0164 - rmse: 0.1282 - mean_absolute_error: 0.0844 -
mean_absolute_percentage_error: 30.2214
Epoch 175/500
1/1 [==============================] - 0s 107ms/step - loss: 0.0164 -
mean_squared_error: 0.0164 - rmse: 0.1280 - mean_absolute_error: 0.0840 -
mean_absolute_percentage_error: 29.7425
Epoch 176/500
1/1 [==============================] - 0s 104ms/step - loss: 0.0163 -
mean_squared_error: 0.0163 - rmse: 0.1277 - mean_absolute_error: 0.0839 -
mean_absolute_percentage_error: 29.7037
Epoch 177/500
1/1 [==============================] - 0s 113ms/step - loss: 0.0162 -
mean_squared_error: 0.0162 - rmse: 0.1274 - mean_absolute_error: 0.0840 -
mean_absolute_percentage_error: 29.9297
Epoch 178/500
1/1 [==============================] - 0s 118ms/step - loss: 0.0162 -
mean_squared_error: 0.0162 - rmse: 0.1271 - mean_absolute_error: 0.0834 -
mean_absolute_percentage_error: 29.2459
Epoch 179/500
1/1 [==============================] - 0s 123ms/step - loss: 0.0161 -
mean_squared_error: 0.0161 - rmse: 0.1268 - mean_absolute_error: 0.0837 -
mean_absolute_percentage_error: 29.7491
Epoch 180/500
1/1 [==============================] - 0s 133ms/step - loss: 0.0160 -
mean_squared_error: 0.0160 - rmse: 0.1265 - mean_absolute_error: 0.0829 -
mean_absolute_percentage_error: 28.6612
Epoch 181/500
1/1 [==============================] - 0s 131ms/step - loss: 0.0159 -
mean_squared_error: 0.0159 - rmse: 0.1262 - mean_absolute_error: 0.0830 -
mean_absolute_percentage_error: 29.0395
Epoch 182/500
1/1 [==============================] - 0s 123ms/step - loss: 0.0159 -
mean_squared_error: 0.0159 - rmse: 0.1260 - mean_absolute_error: 0.0826 -
mean_absolute_percentage_error: 28.6925
Epoch 183/500
1/1 [==============================] - 0s 131ms/step - loss: 0.0158 -
mean_squared_error: 0.0158 - rmse: 0.1257 - mean_absolute_error: 0.0828 -
```

```
mean_absolute_percentage_error: 29.0725
Epoch 184/500
1/1 [==============================] - 0s 142ms/step - loss: 0.0157 -
mean_squared_error: 0.0157 - rmse: 0.1255 - mean_absolute_error: 0.0825 -
mean_absolute_percentage_error: 28.8247
Epoch 185/500
1/1 [==============================] - 0s 132ms/step - loss: 0.0157 -
mean_squared_error: 0.0157 - rmse: 0.1253 - mean_absolute_error: 0.0832 -
mean_absolute_percentage_error: 29.6647
Epoch 186/500
1/1 [==============================] - 0s 116ms/step - loss: 0.0156 -
mean_squared_error: 0.0156 - rmse: 0.1250 - mean_absolute_error: 0.0823 -
mean_absolute_percentage_error: 28.4813
Epoch 187/500
1/1 [==============================] - 0s 97ms/step - loss: 0.0156 -
mean_squared_error: 0.0156 - rmse: 0.1247 - mean_absolute_error: 0.0827 -
mean_absolute_percentage_error: 29.1523
Epoch 188/500
1/1 [==============================] - 0s 124ms/step - loss: 0.0155 -
mean_squared_error: 0.0155 - rmse: 0.1244 - mean_absolute_error: 0.0822 -
mean_absolute_percentage_error: 28.7104
Epoch 189/500
1/1 [==============================] - 0s 123ms/step - loss: 0.0154 -
mean_squared_error: 0.0154 - rmse: 0.1243 - mean_absolute_error: 0.0817 -
mean_absolute_percentage_error: 28.0810
Epoch 190/500
1/1 [==============================] - 0s 107ms/step - loss: 0.0154 -
mean_squared_error: 0.0154 - rmse: 0.1241 - mean_absolute_error: 0.0824 -
mean_absolute_percentage_error: 29.1295
Epoch 191/500
1/1 [==============================] - 0s 125ms/step - loss: 0.0153 -
mean_squared_error: 0.0153 - rmse: 0.1238 - mean_absolute_error: 0.0815 -
mean_absolute_percentage_error: 27.8986
Epoch 192/500
1/1 [==============================] - 0s 128ms/step - loss: 0.0152 -
mean_squared_error: 0.0152 - rmse: 0.1234 - mean_absolute_error: 0.0817 -
mean_absolute_percentage_error: 28.4701
Epoch 193/500
1/1 [==============================] - 0s 104ms/step - loss: 0.0152 -
mean_squared_error: 0.0152 - rmse: 0.1232 - mean_absolute_error: 0.0816 -
mean_absolute_percentage_error: 28.3663
Epoch 194/500
1/1 [==============================] - 0s 105ms/step - loss: 0.0151 -
mean_squared_error: 0.0151 - rmse: 0.1230 - mean_absolute_error: 0.0813 -
mean_absolute_percentage_error: 27.8147
Epoch 195/500
1/1 [==============================] - 0s 120ms/step - loss: 0.0151 -
mean_squared_error: 0.0151 - rmse: 0.1228 - mean_absolute_error: 0.0818 -
```

```
mean_absolute_percentage_error: 28.7379
Epoch 196/500
1/1 [==============================] - 0s 112ms/step - loss: 0.0150 -
mean_squared_error: 0.0150 - rmse: 0.1224 - mean_absolute_error: 0.0808 -
mean_absolute_percentage_error: 27.4434
Epoch 197/500
1/1 [==============================] - 0s 117ms/step - loss: 0.0149 -
mean_squared_error: 0.0149 - rmse: 0.1221 - mean_absolute_error: 0.0808 -
mean_absolute_percentage_error: 27.8843
Epoch 198/500
1/1 [==============================] - 0s 117ms/step - loss: 0.0148 -
mean_squared_error: 0.0148 - rmse: 0.1218 - mean_absolute_error: 0.0804 -
mean_absolute_percentage_error: 27.4414
Epoch 199/500
1/1 [==============================] - 0s 128ms/step - loss: 0.0148 -
mean_squared_error: 0.0148 - rmse: 0.1216 - mean_absolute_error: 0.0802 -
mean_absolute_percentage_error: 27.3056
Epoch 200/500
1/1 [==============================] - 0s 116ms/step - loss: 0.0147 -
mean_squared_error: 0.0147 - rmse: 0.1214 - mean_absolute_error: 0.0803 -
mean_absolute_percentage_error: 27.5398
Epoch 201/500
1/1 [==============================] - 0s 137ms/step - loss: 0.0147 -
mean_squared_error: 0.0147 - rmse: 0.1211 - mean_absolute_error: 0.0800 -
mean_absolute_percentage_error: 27.0914
Epoch 202/500
1/1 [==============================] - 0s 140ms/step - loss: 0.0146 -
mean_squared_error: 0.0146 - rmse: 0.1208 - mean_absolute_error: 0.0800 -
mean_absolute_percentage_error: 27.2273
Epoch 203/500
1/1 [==============================] - 0s 140ms/step - loss: 0.0145 -
mean_squared_error: 0.0145 - rmse: 0.1205 - mean_absolute_error: 0.0797 -
mean_absolute_percentage_error: 27.0106
Epoch 204/500
1/1 [==============================] - 0s 137ms/step - loss: 0.0145 -
mean_squared_error: 0.0145 - rmse: 0.1202 - mean_absolute_error: 0.0794 -
mean_absolute_percentage_error: 26.6228
Epoch 205/500
1/1 [==============================] - 0s 129ms/step - loss: 0.0144 -
mean_squared_error: 0.0144 - rmse: 0.1199 - mean_absolute_error: 0.0790 -
mean_absolute_percentage_error: 26.5953
Epoch 206/500
1/1 [==============================] - 0s 112ms/step - loss: 0.0143 -
mean_squared_error: 0.0143 - rmse: 0.1196 - mean_absolute_error: 0.0787 -
mean_absolute_percentage_error: 26.3954
Epoch 207/500
1/1 [==============================] - 0s 95ms/step - loss: 0.0142 -
mean_squared_error: 0.0142 - rmse: 0.1194 - mean_absolute_error: 0.0785 -
```

```
mean_absolute_percentage_error: 26.1265
Epoch 208/500
1/1 [==============================] - 0s 105ms/step - loss: 0.0142 -
mean_squared_error: 0.0142 - rmse: 0.1191 - mean_absolute_error: 0.0784 -
mean_absolute_percentage_error: 26.3450
Epoch 209/500
1/1 [==============================] - 0s 102ms/step - loss: 0.0141 -
mean_squared_error: 0.0141 - rmse: 0.1188 - mean_absolute_error: 0.0782 -
mean_absolute_percentage_error: 26.0823
Epoch 210/500
1/1 [==============================] - 0s 127ms/step - loss: 0.0140 -
mean_squared_error: 0.0140 - rmse: 0.1185 - mean_absolute_error: 0.0779 -
mean_absolute_percentage_error: 26.0456
Epoch 211/500
1/1 [==============================] - 0s 146ms/step - loss: 0.0140 -
mean_squared_error: 0.0140 - rmse: 0.1182 - mean_absolute_error: 0.0777 -
mean_absolute_percentage_error: 25.8946
Epoch 212/500
1/1 [==============================] - 0s 122ms/step - loss: 0.0139 -
mean_squared_error: 0.0139 - rmse: 0.1180 - mean_absolute_error: 0.0774 -
mean_absolute_percentage_error: 25.5854
Epoch 213/500
1/1 [==============================] - 0s 109ms/step - loss: 0.0138 -
mean_squared_error: 0.0138 - rmse: 0.1177 - mean_absolute_error: 0.0773 -
mean_absolute_percentage_error: 25.5980
Epoch 214/500
1/1 [==============================] - 0s 109ms/step - loss: 0.0138 -
mean_squared_error: 0.0138 - rmse: 0.1174 - mean_absolute_error: 0.0771 -
mean_absolute_percentage_error: 25.2303
Epoch 215/500
1/1 [==============================] - 0s 104ms/step - loss: 0.0137 -
mean_squared_error: 0.0137 - rmse: 0.1172 - mean_absolute_error: 0.0770 -
mean_absolute_percentage_error: 25.5088
Epoch 216/500
1/1 [==============================] - 0s 113ms/step - loss: 0.0137 -
mean_squared_error: 0.0137 - rmse: 0.1169 - mean_absolute_error: 0.0768 -
mean_absolute_percentage_error: 25.0584
Epoch 217/500
1/1 [==============================] - 0s 118ms/step - loss: 0.0136 -
mean_squared_error: 0.0136 - rmse: 0.1166 - mean_absolute_error: 0.0767 -
mean_absolute_percentage_error: 25.2791
Epoch 218/500
1/1 [==============================] - 0s 111ms/step - loss: 0.0135 -
mean_squared_error: 0.0135 - rmse: 0.1163 - mean_absolute_error: 0.0764 -
mean_absolute_percentage_error: 24.8176
Epoch 219/500
1/1 [==============================] - 0s 111ms/step - loss: 0.0135 -
mean_squared_error: 0.0135 - rmse: 0.1161 - mean_absolute_error: 0.0762 -
```

```
mean_absolute_percentage_error: 24.8470
Epoch 220/500
1/1 [==============================] - 0s 134ms/step - loss: 0.0134 -
mean_squared_error: 0.0134 - rmse: 0.1158 - mean_absolute_error: 0.0760 -
mean_absolute_percentage_error: 24.4154
Epoch 221/500
1/1 [==============================] - 0s 100ms/step - loss: 0.0134 -
mean_squared_error: 0.0134 - rmse: 0.1156 - mean_absolute_error: 0.0758 -
mean_absolute_percentage_error: 24.7127
Epoch 222/500
1/1 [==============================] - 0s 116ms/step - loss: 0.0133 -
mean_squared_error: 0.0133 - rmse: 0.1153 - mean_absolute_error: 0.0755 -
mean_absolute_percentage_error: 24.0003
Epoch 223/500
1/1 [==============================] - 0s 146ms/step - loss: 0.0132 -
mean_squared_error: 0.0132 - rmse: 0.1151 - mean_absolute_error: 0.0754 -
mean_absolute_percentage_error: 24.4817
Epoch 224/500
1/1 [==============================] - 0s 182ms/step - loss: 0.0132 -
mean_squared_error: 0.0132 - rmse: 0.1147 - mean_absolute_error: 0.0750 -
mean_absolute_percentage_error: 23.8201
Epoch 225/500
1/1 [==============================] - 0s 160ms/step - loss: 0.0131 -
mean_squared_error: 0.0131 - rmse: 0.1145 - mean_absolute_error: 0.0748 -
mean_absolute_percentage_error: 24.0977
Epoch 226/500
1/1 [==============================] - 0s 131ms/step - loss: 0.0130 -
mean_squared_error: 0.0130 - rmse: 0.1142 - mean_absolute_error: 0.0744 -
mean_absolute_percentage_error: 23.4779
Epoch 227/500
1/1 [==============================] - 0s 116ms/step - loss: 0.0130 -
mean_squared_error: 0.0130 - rmse: 0.1140 - mean_absolute_error: 0.0743 -
mean_absolute_percentage_error: 23.9062
Epoch 228/500
1/1 [==============================] - 0s 105ms/step - loss: 0.0130 -
mean_squared_error: 0.0130 - rmse: 0.1139 - mean_absolute_error: 0.0739 -
mean_absolute_percentage_error: 22.8203
Epoch 229/500
1/1 [==============================] - 0s 104ms/step - loss: 0.0129 -
mean_squared_error: 0.0129 - rmse: 0.1137 - mean_absolute_error: 0.0742 -
mean_absolute_percentage_error: 23.8405
Epoch 230/500
1/1 [==============================] - 0s 108ms/step - loss: 0.0128 -
mean_squared_error: 0.0128 - rmse: 0.1133 - mean_absolute_error: 0.0734 -
mean_absolute_percentage_error: 22.5799
Epoch 231/500
1/1 [==============================] - 0s 119ms/step - loss: 0.0128 -
mean_squared_error: 0.0128 - rmse: 0.1130 - mean_absolute_error: 0.0733 -
```

```
mean_absolute_percentage_error: 22.9694
Epoch 232/500
1/1 [==============================] - 0s 106ms/step - loss: 0.0127 -
mean_squared_error: 0.0127 - rmse: 0.1128 - mean_absolute_error: 0.0730 -
mean_absolute_percentage_error: 22.8218
Epoch 233/500
1/1 [==============================] - 0s 90ms/step - loss: 0.0127 -
mean_squared_error: 0.0127 - rmse: 0.1126 - mean_absolute_error: 0.0727 -
mean_absolute_percentage_error: 22.3727
Epoch 234/500
1/1 [==============================] - 0s 125ms/step - loss: 0.0126 -
mean_squared_error: 0.0126 - rmse: 0.1125 - mean_absolute_error: 0.0729 -
mean_absolute_percentage_error: 22.8987
Epoch 235/500
1/1 [==============================] - 0s 119ms/step - loss: 0.0126 -
mean_squared_error: 0.0126 - rmse: 0.1123 - mean_absolute_error: 0.0722 -
mean_absolute_percentage_error: 21.8782
Epoch 236/500
1/1 [==============================] - 0s 98ms/step - loss: 0.0125 -
mean_squared_error: 0.0125 - rmse: 0.1120 - mean_absolute_error: 0.0724 -
mean_absolute_percentage_error: 22.4802
Epoch 237/500
1/1 [==============================] - 0s 134ms/step - loss: 0.0125 -
mean_squared_error: 0.0125 - rmse: 0.1118 - mean_absolute_error: 0.0720 -
mean_absolute_percentage_error: 22.1073
Epoch 238/500
1/1 [==============================] - 0s 169ms/step - loss: 0.0125 -
mean_squared_error: 0.0125 - rmse: 0.1116 - mean_absolute_error: 0.0716 -
mean_absolute_percentage_error: 21.6186
Epoch 239/500
1/1 [==============================] - 0s 125ms/step - loss: 0.0125 -
mean_squared_error: 0.0125 - rmse: 0.1116 - mean_absolute_error: 0.0723 -
mean_absolute_percentage_error: 22.3423
Epoch 240/500
1/1 [==============================] - 0s 106ms/step - loss: 0.0124 -
mean_squared_error: 0.0124 - rmse: 0.1114 - mean_absolute_error: 0.0711 -
mean_absolute_percentage_error: 21.1304
Epoch 241/500
1/1 [==============================] - 0s 109ms/step - loss: 0.0123 -
mean_squared_error: 0.0123 - rmse: 0.1111 - mean_absolute_error: 0.0716 -
mean_absolute_percentage_error: 21.7688
Epoch 242/500
1/1 [==============================] - 0s 101ms/step - loss: 0.0123 -
mean_squared_error: 0.0123 - rmse: 0.1109 - mean_absolute_error: 0.0714 -
mean_absolute_percentage_error: 21.6339
Epoch 243/500
1/1 [==============================] - 0s 101ms/step - loss: 0.0123 -
mean_squared_error: 0.0123 - rmse: 0.1108 - mean_absolute_error: 0.0707 -
```

```
mean_absolute_percentage_error: 20.9400
Epoch 244/500
1/1 [==============================] - 0s 124ms/step - loss: 0.0123 -
mean_squared_error: 0.0123 - rmse: 0.1108 - mean_absolute_error: 0.0718 -
mean_absolute_percentage_error: 22.0548
Epoch 245/500
1/1 [==============================] - 0s 128ms/step - loss: 0.0122 -
mean_squared_error: 0.0122 - rmse: 0.1105 - mean_absolute_error: 0.0707 -
mean_absolute_percentage_error: 21.0162
Epoch 246/500
1/1 [==============================] - 0s 139ms/step - loss: 0.0121 -
mean_squared_error: 0.0121 - rmse: 0.1102 - mean_absolute_error: 0.0708 -
mean_absolute_percentage_error: 21.2472
Epoch 247/500
1/1 [==============================] - 0s 146ms/step - loss: 0.0121 -
mean_squared_error: 0.0121 - rmse: 0.1102 - mean_absolute_error: 0.0712 -
mean_absolute_percentage_error: 21.6709
Epoch 248/500
1/1 [==============================] - 0s 125ms/step - loss: 0.0121 -
mean_squared_error: 0.0121 - rmse: 0.1101 - mean_absolute_error: 0.0701 -
mean_absolute_percentage_error: 20.6075
Epoch 249/500
1/1 [==============================] - 0s 131ms/step - loss: 0.0121 -
mean_squared_error: 0.0121 - rmse: 0.1099 - mean_absolute_error: 0.0709 -
mean_absolute_percentage_error: 21.5628
Epoch 250/500
1/1 [==============================] - 0s 138ms/step - loss: 0.0120 -
mean_squared_error: 0.0120 - rmse: 0.1096 - mean_absolute_error: 0.0703 -
mean_absolute_percentage_error: 20.9254
Epoch 251/500
1/1 [==============================] - 0s 121ms/step - loss: 0.0120 -
mean_squared_error: 0.0120 - rmse: 0.1095 - mean_absolute_error: 0.0698 -
mean_absolute_percentage_error: 20.6153
Epoch 252/500
1/1 [==============================] - 0s 117ms/step - loss: 0.0120 -
mean_squared_error: 0.0120 - rmse: 0.1094 - mean_absolute_error: 0.0707 -
mean_absolute_percentage_error: 21.4728
Epoch 253/500
1/1 [==============================] - 0s 121ms/step - loss: 0.0119 -
mean_squared_error: 0.0119 - rmse: 0.1092 - mean_absolute_error: 0.0693 -
mean_absolute_percentage_error: 20.2376
Epoch 254/500
1/1 [==============================] - 0s 164ms/step - loss: 0.0119 -
mean_squared_error: 0.0119 - rmse: 0.1090 - mean_absolute_error: 0.0700 -
mean_absolute_percentage_error: 20.9627
Epoch 255/500
1/1 [==============================] - 0s 154ms/step - loss: 0.0118 -
mean_squared_error: 0.0118 - rmse: 0.1088 - mean_absolute_error: 0.0697 -
```

```
mean_absolute_percentage_error: 20.7227
Epoch 256/500
1/1 [==============================] - 0s 139ms/step - loss: 0.0118 -
mean_squared_error: 0.0118 - rmse: 0.1087 - mean_absolute_error: 0.0690 -
mean_absolute_percentage_error: 20.1185
Epoch 257/500
1/1 [==============================] - 0s 121ms/step - loss: 0.0118 -
mean_squared_error: 0.0118 - rmse: 0.1085 - mean_absolute_error: 0.0698 -
mean_absolute_percentage_error: 21.0754
Epoch 258/500
1/1 [==============================] - 0s 123ms/step - loss: 0.0117 -
mean_squared_error: 0.0117 - rmse: 0.1083 - mean_absolute_error: 0.0690 -
mean_absolute_percentage_error: 20.3532
Epoch 259/500
1/1 [==============================] - 0s 118ms/step - loss: 0.0117 -
mean_squared_error: 0.0117 - rmse: 0.1081 - mean_absolute_error: 0.0688 -
mean_absolute_percentage_error: 20.2308
Epoch 260/500
1/1 [==============================] - 0s 110ms/step - loss: 0.0117 -
mean_squared_error: 0.0117 - rmse: 0.1080 - mean_absolute_error: 0.0690 -
mean_absolute_percentage_error: 20.5530
Epoch 261/500
1/1 [==============================] - 0s 123ms/step - loss: 0.0116 -
mean_squared_error: 0.0116 - rmse: 0.1078 - mean_absolute_error: 0.0683 -
mean_absolute_percentage_error: 19.9781
Epoch 262/500
1/1 [==============================] - 0s 126ms/step - loss: 0.0116 -
mean_squared_error: 0.0116 - rmse: 0.1076 - mean_absolute_error: 0.0686 -
mean_absolute_percentage_error: 20.4142
Epoch 263/500
1/1 [==============================] - 0s 144ms/step - loss: 0.0115 -
mean_squared_error: 0.0115 - rmse: 0.1074 - mean_absolute_error: 0.0686 -
mean_absolute_percentage_error: 20.4310
Epoch 264/500
1/1 [==============================] - 0s 154ms/step - loss: 0.0115 -
mean_squared_error: 0.0115 - rmse: 0.1073 - mean_absolute_error: 0.0681 -
mean_absolute_percentage_error: 19.8030
Epoch 265/500
1/1 [==============================] - 0s 159ms/step - loss: 0.0115 -
mean_squared_error: 0.0115 - rmse: 0.1071 - mean_absolute_error: 0.0682 -
mean_absolute_percentage_error: 20.0808
Epoch 266/500
1/1 [==============================] - 0s 135ms/step - loss: 0.0114 -
mean_squared_error: 0.0114 - rmse: 0.1069 - mean_absolute_error: 0.0680 -
mean_absolute_percentage_error: 20.0262
Epoch 267/500
1/1 [==============================] - 0s 129ms/step - loss: 0.0114 -
mean_squared_error: 0.0114 - rmse: 0.1067 - mean_absolute_error: 0.0678 -
```

```
mean_absolute_percentage_error: 19.9622
Epoch 268/500
1/1 [==============================] - 0s 108ms/step - loss: 0.0113 -
mean_squared_error: 0.0113 - rmse: 0.1065 - mean_absolute_error: 0.0678 -
mean_absolute_percentage_error: 20.0652
Epoch 269/500
1/1 [==============================] - 0s 105ms/step - loss: 0.0113 -
mean_squared_error: 0.0113 - rmse: 0.1063 - mean_absolute_error: 0.0675 -
mean_absolute_percentage_error: 19.7429
Epoch 270/500
1/1 [==============================] - 0s 114ms/step - loss: 0.0113 -
mean_squared_error: 0.0113 - rmse: 0.1061 - mean_absolute_error: 0.0674 -
mean_absolute_percentage_error: 19.8863
Epoch 271/500
1/1 [==============================] - 0s 109ms/step - loss: 0.0112 -
mean_squared_error: 0.0112 - rmse: 0.1059 - mean_absolute_error: 0.0671 -
mean_absolute_percentage_error: 19.6469
Epoch 272/500
1/1 [==============================] - 0s 127ms/step - loss: 0.0112 -
mean_squared_error: 0.0112 - rmse: 0.1057 - mean_absolute_error: 0.0671 -
mean_absolute_percentage_error: 19.7903
Epoch 273/500
1/1 [==============================] - 0s 116ms/step - loss: 0.0111 -
mean_squared_error: 0.0111 - rmse: 0.1055 - mean_absolute_error: 0.0668 -
mean_absolute_percentage_error: 19.6030
Epoch 274/500
1/1 [==============================] - 0s 117ms/step - loss: 0.0111 -
mean_squared_error: 0.0111 - rmse: 0.1053 - mean_absolute_error: 0.0663 -
mean_absolute_percentage_error: 19.1852
Epoch 275/500
1/1 [==============================] - 0s 121ms/step - loss: 0.0110 -
mean_squared_error: 0.0110 - rmse: 0.1051 - mean_absolute_error: 0.0665 -
mean_absolute_percentage_error: 19.6010
Epoch 276/500
1/1 [==============================] - 0s 114ms/step - loss: 0.0110 -
mean_squared_error: 0.0110 - rmse: 0.1049 - mean_absolute_error: 0.0662 -
mean_absolute_percentage_error: 19.3806
Epoch 277/500
1/1 [==============================] - 0s 118ms/step - loss: 0.0110 -
mean_squared_error: 0.0110 - rmse: 0.1047 - mean_absolute_error: 0.0663 -
mean_absolute_percentage_error: 19.6323
Epoch 278/500
1/1 [==============================] - 0s 143ms/step - loss: 0.0109 -
mean_squared_error: 0.0109 - rmse: 0.1044 - mean_absolute_error: 0.0657 -
mean_absolute_percentage_error: 19.0593
Epoch 279/500
1/1 [==============================] - 0s 136ms/step - loss: 0.0109 -
mean_squared_error: 0.0109 - rmse: 0.1043 - mean_absolute_error: 0.0660 -
```

```
mean_absolute_percentage_error: 19.6182
Epoch 280/500
1/1 [==============================] - 0s 123ms/step - loss: 0.0108 -
mean_squared_error: 0.0108 - rmse: 0.1041 - mean_absolute_error: 0.0652 -
mean_absolute_percentage_error: 18.9023
Epoch 281/500
1/1 [==============================] - 0s 131ms/step - loss: 0.0108 -
mean_squared_error: 0.0108 - rmse: 0.1039 - mean_absolute_error: 0.0660 -
mean_absolute_percentage_error: 19.9318
Epoch 282/500
1/1 [==============================] - 0s 124ms/step - loss: 0.0107 -
mean_squared_error: 0.0107 - rmse: 0.1036 - mean_absolute_error: 0.0648 -
mean_absolute_percentage_error: 18.6905
Epoch 283/500
1/1 [==============================] - 0s 144ms/step - loss: 0.0107 -
mean_squared_error: 0.0107 - rmse: 0.1033 - mean_absolute_error: 0.0651 -
mean_absolute_percentage_error: 19.2167
Epoch 284/500
1/1 [==============================] - 0s 169ms/step - loss: 0.0106 -
mean_squared_error: 0.0106 - rmse: 0.1030 - mean_absolute_error: 0.0645 -
mean_absolute_percentage_error: 18.6659
Epoch 285/500
1/1 [==============================] - 0s 156ms/step - loss: 0.0106 -
mean_squared_error: 0.0106 - rmse: 0.1028 - mean_absolute_error: 0.0644 -
mean_absolute_percentage_error: 18.7533
Epoch 286/500
1/1 [==============================] - 0s 159ms/step - loss: 0.0105 -
mean_squared_error: 0.0105 - rmse: 0.1025 - mean_absolute_error: 0.0644 -
mean_absolute_percentage_error: 18.9169
Epoch 287/500
1/1 [==============================] - 0s 147ms/step - loss: 0.0105 -
mean_squared_error: 0.0105 - rmse: 0.1023 - mean_absolute_error: 0.0637 -
mean_absolute_percentage_error: 18.2855
Epoch 288/500
1/1 [==============================] - 0s 124ms/step - loss: 0.0104 -
mean_squared_error: 0.0104 - rmse: 0.1020 - mean_absolute_error: 0.0640 -
mean_absolute_percentage_error: 18.8265
Epoch 289/500
1/1 [==============================] - 0s 101ms/step - loss: 0.0103 -
mean_squared_error: 0.0103 - rmse: 0.1017 - mean_absolute_error: 0.0632 -
mean_absolute_percentage_error: 18.3271
Epoch 290/500
1/1 [==============================] - 0s 127ms/step - loss: 0.0103 -
mean_squared_error: 0.0103 - rmse: 0.1013 - mean_absolute_error: 0.0638 -
mean_absolute_percentage_error: 19.2152
Epoch 291/500
1/1 [==============================] - 0s 105ms/step - loss: 0.0102 -
mean_squared_error: 0.0102 - rmse: 0.1009 - mean_absolute_error: 0.0627 -
```

```
mean_absolute_percentage_error: 18.3709
Epoch 292/500
1/1 [==============================] - 0s 100ms/step - loss: 0.0101 -
mean_squared_error: 0.0101 - rmse: 0.1006 - mean_absolute_error: 0.0633 -
mean_absolute_percentage_error: 19.0488
Epoch 293/500
1/1 [==============================] - 0s 114ms/step - loss: 0.0101 -
mean_squared_error: 0.0101 - rmse: 0.1003 - mean_absolute_error: 0.0619 -
mean_absolute_percentage_error: 17.7836
Epoch 294/500
1/1 [==============================] - 0s 106ms/step - loss: 0.0100 -
mean_squared_error: 0.0100 - rmse: 0.1001 - mean_absolute_error: 0.0636 -
mean_absolute_percentage_error: 19.4017
Epoch 295/500
1/1 [==============================] - 0s 91ms/step - loss: 0.0100 -
mean_squared_error: 0.0100 - rmse: 0.0998 - mean_absolute_error: 0.0611 -
mean_absolute_percentage_error: 17.1470
Epoch 296/500
1/1 [==============================] - 0s 115ms/step - loss: 0.0099 -
mean_squared_error: 0.0099 - rmse: 0.0993 - mean_absolute_error: 0.0629 -
mean_absolute_percentage_error: 18.9610
Epoch 297/500
1/1 [==============================] - 0s 95ms/step - loss: 0.0097 -
mean_squared_error: 0.0097 - rmse: 0.0987 - mean_absolute_error: 0.0602 -
mean_absolute_percentage_error: 17.0541
Epoch 298/500
1/1 [==============================] - 0s 98ms/step - loss: 0.0096 -
mean_squared_error: 0.0096 - rmse: 0.0981 - mean_absolute_error: 0.0608 -
mean_absolute_percentage_error: 17.9001
Epoch 299/500
1/1 [==============================] - 0s 112ms/step - loss: 0.0095 -
mean_squared_error: 0.0095 - rmse: 0.0977 - mean_absolute_error: 0.0602 -
mean_absolute_percentage_error: 17.5255
Epoch 300/500
1/1 [==============================] - 0s 103ms/step - loss: 0.0095 -
mean_squared_error: 0.0095 - rmse: 0.0974 - mean_absolute_error: 0.0592 -
mean_absolute_percentage_error: 16.8249
Epoch 301/500
1/1 [==============================] - 0s 91ms/step - loss: 0.0095 -
mean_squared_error: 0.0095 - rmse: 0.0973 - mean_absolute_error: 0.0609 -
mean_absolute_percentage_error: 18.1406
Epoch 302/500
1/1 [==============================] - 0s 104ms/step - loss: 0.0095 -
mean_squared_error: 0.0095 - rmse: 0.0974 - mean_absolute_error: 0.0590 -
mean_absolute_percentage_error: 16.4805
Epoch 303/500
1/1 [==============================] - 0s 113ms/step - loss: 0.0095 -
mean_squared_error: 0.0095 - rmse: 0.0972 - mean_absolute_error: 0.0621 -
```

```
mean_absolute_percentage_error: 19.0639
Epoch 304/500
1/1 [==============================] - 0s 114ms/step - loss: 0.0093 -
mean_squared_error: 0.0093 - rmse: 0.0965 - mean_absolute_error: 0.0585 -
mean_absolute_percentage_error: 16.2872
Epoch 305/500
1/1 [==============================] - 0s 134ms/step - loss: 0.0091 -
mean_squared_error: 0.0091 - rmse: 0.0953 - mean_absolute_error: 0.0594 -
mean_absolute_percentage_error: 17.7547
Epoch 306/500
1/1 [==============================] - 0s 139ms/step - loss: 0.0089 -
mean_squared_error: 0.0089 - rmse: 0.0944 - mean_absolute_error: 0.0579 -
mean_absolute_percentage_error: 16.8365
Epoch 307/500
1/1 [==============================] - 0s 122ms/step - loss: 0.0089 -
mean_squared_error: 0.0089 - rmse: 0.0943 - mean_absolute_error: 0.0567 -
mean_absolute_percentage_error: 15.9174
Epoch 308/500
1/1 [==============================] - 0s 117ms/step - loss: 0.0089 -
mean_squared_error: 0.0089 - rmse: 0.0942 - mean_absolute_error: 0.0598 -
mean_absolute_percentage_error: 18.5805
Epoch 309/500
1/1 [==============================] - 0s 119ms/step - loss: 0.0087 -
mean_squared_error: 0.0087 - rmse: 0.0934 - mean_absolute_error: 0.0560 -
mean_absolute_percentage_error: 15.7007
Epoch 310/500
1/1 [==============================] - 0s 115ms/step - loss: 0.0085 -
mean_squared_error: 0.0085 - rmse: 0.0923 - mean_absolute_error: 0.0573 -
mean_absolute_percentage_error: 17.1672
Epoch 311/500
1/1 [==============================] - 0s 113ms/step - loss: 0.0084 -
mean_squared_error: 0.0084 - rmse: 0.0916 - mean_absolute_error: 0.0560 -
mean_absolute_percentage_error: 16.2831
Epoch 312/500
1/1 [==============================] - 0s 104ms/step - loss: 0.0083 -
mean_squared_error: 0.0083 - rmse: 0.0912 - mean_absolute_error: 0.0547 -
mean_absolute_percentage_error: 15.5130
Epoch 313/500
1/1 [==============================] - 0s 105ms/step - loss: 0.0083 -
mean_squared_error: 0.0083 - rmse: 0.0910 - mean_absolute_error: 0.0572 -
mean_absolute_percentage_error: 17.4422
Epoch 314/500
1/1 [==============================] - 0s 109ms/step - loss: 0.0083 -
mean_squared_error: 0.0083 - rmse: 0.0910 - mean_absolute_error: 0.0541 -
mean_absolute_percentage_error: 14.8314
Epoch 315/500
1/1 [==============================] - 0s 99ms/step - loss: 0.0083 -
mean_squared_error: 0.0083 - rmse: 0.0911 - mean_absolute_error: 0.0590 -
```

```
mean_absolute_percentage_error: 18.6542
Epoch 316/500
1/1 [==============================] - 0s 99ms/step - loss: 0.0082 -
mean_squared_error: 0.0082 - rmse: 0.0908 - mean_absolute_error: 0.0544 -
mean_absolute_percentage_error: 15.0026
Epoch 317/500
1/1 [==============================] - 0s 98ms/step - loss: 0.0081 -
mean_squared_error: 0.0081 - rmse: 0.0899 - mean_absolute_error: 0.0579 -
mean_absolute_percentage_error: 18.2504
Epoch 318/500
1/1 [==============================] - 0s 106ms/step - loss: 0.0079 -
mean_squared_error: 0.0079 - rmse: 0.0886 - mean_absolute_error: 0.0528 -
mean_absolute_percentage_error: 14.8715
Epoch 319/500
1/1 [==============================] - 0s 141ms/step - loss: 0.0076 -
mean_squared_error: 0.0076 - rmse: 0.0874 - mean_absolute_error: 0.0535 -
mean_absolute_percentage_error: 16.0003
Epoch 320/500
1/1 [==============================] - 0s 106ms/step - loss: 0.0076 -
mean_squared_error: 0.0076 - rmse: 0.0869 - mean_absolute_error: 0.0534 -
mean_absolute_percentage_error: 15.8010
Epoch 321/500
1/1 [==============================] - 0s 102ms/step - loss: 0.0076 -
mean_squared_error: 0.0076 - rmse: 0.0873 - mean_absolute_error: 0.0527 -
mean_absolute_percentage_error: 15.1603
Epoch 322/500
1/1 [==============================] - 0s 102ms/step - loss: 0.0079 -
mean_squared_error: 0.0079 - rmse: 0.0890 - mean_absolute_error: 0.0580 -
mean_absolute_percentage_error: 17.5024
Epoch 323/500
1/1 [==============================] - 0s 128ms/step - loss: 0.0088 -
mean_squared_error: 0.0088 - rmse: 0.0938 - mean_absolute_error: 0.0615 -
mean_absolute_percentage_error: 17.0377
Epoch 324/500
1/1 [==============================] - 0s 131ms/step - loss: 0.0085 -
mean_squared_error: 0.0085 - rmse: 0.0921 - mean_absolute_error: 0.0649 -
mean_absolute_percentage_error: 21.9657
Epoch 325/500
1/1 [==============================] - 0s 131ms/step - loss: 0.0075 -
mean_squared_error: 0.0075 - rmse: 0.0865 - mean_absolute_error: 0.0525 -
mean_absolute_percentage_error: 14.8354
Epoch 326/500
1/1 [==============================] - 0s 111ms/step - loss: 0.0073 -
mean_squared_error: 0.0073 - rmse: 0.0855 - mean_absolute_error: 0.0519 -
mean_absolute_percentage_error: 14.8503
Epoch 327/500
1/1 [==============================] - 0s 118ms/step - loss: 0.0080 -
mean_squared_error: 0.0080 - rmse: 0.0896 - mean_absolute_error: 0.0614 -
```

```
mean_absolute_percentage_error: 19.6351
Epoch 328/500
1/1 [==============================] - 0s 137ms/step - loss: 0.0077 -
mean_squared_error: 0.0077 - rmse: 0.0879 - mean_absolute_error: 0.0553 -
mean_absolute_percentage_error: 16.4189
Epoch 329/500
1/1 [==============================] - 0s 129ms/step - loss: 0.0070 -
mean_squared_error: 0.0070 - rmse: 0.0835 - mean_absolute_error: 0.0513 -
mean_absolute_percentage_error: 15.0603
Epoch 330/500
1/1 [==============================] - 0s 131ms/step - loss: 0.0077 -
mean_squared_error: 0.0077 - rmse: 0.0876 - mean_absolute_error: 0.0596 -
mean_absolute_percentage_error: 19.5675
Epoch 331/500
1/1 [==============================] - 0s 148ms/step - loss: 0.0077 -
mean_squared_error: 0.0077 - rmse: 0.0877 - mean_absolute_error: 0.0548 -
mean_absolute_percentage_error: 15.1994
Epoch 332/500
1/1 [==============================] - 0s 126ms/step - loss: 0.0068 -
mean_squared_error: 0.0068 - rmse: 0.0824 - mean_absolute_error: 0.0504 -
mean_absolute_percentage_error: 14.8741
Epoch 333/500
1/1 [==============================] - 0s 120ms/step - loss: 0.0077 -
mean_squared_error: 0.0077 - rmse: 0.0877 - mean_absolute_error: 0.0603 -
mean_absolute_percentage_error: 19.2733
Epoch 334/500
1/1 [==============================] - 0s 109ms/step - loss: 0.0079 -
mean_squared_error: 0.0079 - rmse: 0.0886 - mean_absolute_error: 0.0575 -
mean_absolute_percentage_error: 15.8013
Epoch 335/500
1/1 [==============================] - 0s 121ms/step - loss: 0.0066 -
mean_squared_error: 0.0066 - rmse: 0.0814 - mean_absolute_error: 0.0500 -
mean_absolute_percentage_error: 14.6590
Epoch 336/500
1/1 [==============================] - 0s 118ms/step - loss: 0.0077 -
mean_squared_error: 0.0077 - rmse: 0.0878 - mean_absolute_error: 0.0612 -
mean_absolute_percentage_error: 20.0284
Epoch 337/500
1/1 [==============================] - 0s 119ms/step - loss: 0.0075 -
mean_squared_error: 0.0075 - rmse: 0.0867 - mean_absolute_error: 0.0552 -
mean_absolute_percentage_error: 15.3913
Epoch 338/500
1/1 [==============================] - 0s 118ms/step - loss: 0.0067 -
mean_squared_error: 0.0067 - rmse: 0.0816 - mean_absolute_error: 0.0503 -
mean_absolute_percentage_error: 14.7118
Epoch 339/500
1/1 [==============================] - 0s 134ms/step - loss: 0.0078 -
mean_squared_error: 0.0078 - rmse: 0.0882 - mean_absolute_error: 0.0632 -
```

```
mean_absolute_percentage_error: 21.5009
Epoch 340/500
1/1 [==============================] - 0s 122ms/step - loss: 0.0068 -
mean_squared_error: 0.0068 - rmse: 0.0825 - mean_absolute_error: 0.0509 -
mean_absolute_percentage_error: 14.5601
Epoch 341/500
1/1 [==============================] - 0s 117ms/step - loss: 0.0069 -
mean_squared_error: 0.0069 - rmse: 0.0829 - mean_absolute_error: 0.0512 -
mean_absolute_percentage_error: 14.6226
Epoch 342/500
1/1 [==============================] - 0s 119ms/step - loss: 0.0072 -
mean_squared_error: 0.0072 - rmse: 0.0849 - mean_absolute_error: 0.0589 -
mean_absolute_percentage_error: 19.0589
Epoch 343/500
1/1 [==============================] - 0s 142ms/step - loss: 0.0063 -
mean_squared_error: 0.0063 - rmse: 0.0795 - mean_absolute_error: 0.0490 -
mean_absolute_percentage_error: 14.4840
Epoch 344/500
1/1 [==============================] - 0s 130ms/step - loss: 0.0068 -
mean_squared_error: 0.0068 - rmse: 0.0825 - mean_absolute_error: 0.0514 -
mean_absolute_percentage_error: 14.5440
Epoch 345/500
1/1 [==============================] - 0s 120ms/step - loss: 0.0065 -
mean_squared_error: 0.0065 - rmse: 0.0807 - mean_absolute_error: 0.0529 -
mean_absolute_percentage_error: 16.6784
Epoch 346/500
1/1 [==============================] - 0s 132ms/step - loss: 0.0062 -
mean_squared_error: 0.0062 - rmse: 0.0790 - mean_absolute_error: 0.0504 -
mean_absolute_percentage_error: 15.5460
Epoch 347/500
1/1 [==============================] - 0s 133ms/step - loss: 0.0066 -
mean_squared_error: 0.0066 - rmse: 0.0812 - mean_absolute_error: 0.0506 -
mean_absolute_percentage_error: 14.2041
Epoch 348/500
1/1 [==============================] - 0s 146ms/step - loss: 0.0061 -
mean_squared_error: 0.0061 - rmse: 0.0783 - mean_absolute_error: 0.0499 -
mean_absolute_percentage_error: 15.3074
Epoch 349/500
1/1 [==============================] - 0s 147ms/step - loss: 0.0062 -
mean_squared_error: 0.0062 - rmse: 0.0790 - mean_absolute_error: 0.0514 -
mean_absolute_percentage_error: 16.0392
Epoch 350/500
1/1 [==============================] - 0s 165ms/step - loss: 0.0064 -
mean_squared_error: 0.0064 - rmse: 0.0802 - mean_absolute_error: 0.0500 -
mean_absolute_percentage_error: 14.1727
Epoch 351/500
1/1 [==============================] - 0s 144ms/step - loss: 0.0060 -
mean_squared_error: 0.0060 - rmse: 0.0772 - mean_absolute_error: 0.0488 -
```

```
mean_absolute_percentage_error: 14.6272
Epoch 352/500
1/1 [==============================] - 0s 132ms/step - loss: 0.0062 -
mean_squared_error: 0.0062 - rmse: 0.0785 - mean_absolute_error: 0.0520 -
mean_absolute_percentage_error: 16.3176
Epoch 353/500
1/1 [==============================] - 0s 134ms/step - loss: 0.0063 -
mean_squared_error: 0.0063 - rmse: 0.0794 - mean_absolute_error: 0.0492 -
mean_absolute_percentage_error: 13.9042
Epoch 354/500
1/1 [==============================] - 0s 150ms/step - loss: 0.0058 -
mean_squared_error: 0.0058 - rmse: 0.0763 - mean_absolute_error: 0.0481 -
mean_absolute_percentage_error: 14.4096
Epoch 355/500
1/1 [==============================] - 0s 190ms/step - loss: 0.0061 -
mean_squared_error: 0.0061 - rmse: 0.0778 - mean_absolute_error: 0.0518 -
mean_absolute_percentage_error: 16.3261
Epoch 356/500
1/1 [==============================] - 0s 180ms/step - loss: 0.0062 -
mean_squared_error: 0.0062 - rmse: 0.0790 - mean_absolute_error: 0.0491 -
mean_absolute_percentage_error: 13.7213
Epoch 357/500
1/1 [==============================] - 0s 168ms/step - loss: 0.0057 -
mean_squared_error: 0.0057 - rmse: 0.0757 - mean_absolute_error: 0.0484 -
mean_absolute_percentage_error: 14.7456
Epoch 358/500
1/1 [==============================] - 0s 210ms/step - loss: 0.0058 -
mean_squared_error: 0.0058 - rmse: 0.0762 - mean_absolute_error: 0.0499 -
mean_absolute_percentage_error: 15.4816
Epoch 359/500
1/1 [==============================] - 0s 181ms/step - loss: 0.0061 -
mean_squared_error: 0.0061 - rmse: 0.0783 - mean_absolute_error: 0.0488 -
mean_absolute_percentage_error: 13.7133
Epoch 360/500
1/1 [==============================] - 0s 299ms/step - loss: 0.0057 -
mean_squared_error: 0.0057 - rmse: 0.0756 - mean_absolute_error: 0.0497 -
mean_absolute_percentage_error: 15.5404
Epoch 361/500
1/1 [==============================] - 0s 205ms/step - loss: 0.0055 -
mean_squared_error: 0.0055 - rmse: 0.0744 - mean_absolute_error: 0.0472 -
mean_absolute_percentage_error: 14.3276
Epoch 362/500
1/1 [==============================] - 0s 164ms/step - loss: 0.0058 -
mean_squared_error: 0.0058 - rmse: 0.0759 - mean_absolute_error: 0.0464 -
mean_absolute_percentage_error: 13.0543
Epoch 363/500
1/1 [==============================] - 0s 224ms/step - loss: 0.0057 -
mean_squared_error: 0.0057 - rmse: 0.0757 - mean_absolute_error: 0.0508 -
```

```
mean_absolute_percentage_error: 16.0979
Epoch 364/500
1/1 [==============================] - 0s 151ms/step - loss: 0.0055 -
mean_squared_error: 0.0055 - rmse: 0.0744 - mean_absolute_error: 0.0453 -
mean_absolute_percentage_error: 12.9677
Epoch 365/500
1/1 [==============================] - 0s 192ms/step - loss: 0.0054 -
mean_squared_error: 0.0054 - rmse: 0.0732 - mean_absolute_error: 0.0459 -
mean_absolute_percentage_error: 13.6975
Epoch 366/500
1/1 [==============================] - 0s 211ms/step - loss: 0.0054 -
mean_squared_error: 0.0054 - rmse: 0.0736 - mean_absolute_error: 0.0478 -
mean_absolute_percentage_error: 14.8112
Epoch 367/500
1/1 [==============================] - 0s 285ms/step - loss: 0.0055 -
mean_squared_error: 0.0055 - rmse: 0.0744 - mean_absolute_error: 0.0456 -
mean_absolute_percentage_error: 13.0025
Epoch 368/500
1/1 [==============================] - 0s 278ms/step - loss: 0.0055 -
mean_squared_error: 0.0055 - rmse: 0.0740 - mean_absolute_error: 0.0494 -
mean_absolute_percentage_error: 15.5877
Epoch 369/500
1/1 [==============================] - 0s 378ms/step - loss: 0.0053 -
mean_squared_error: 0.0053 - rmse: 0.0730 - mean_absolute_error: 0.0447 -
mean_absolute_percentage_error: 12.8990
Epoch 370/500
1/1 [==============================] - 0s 317ms/step - loss: 0.0052 -
mean_squared_error: 0.0052 - rmse: 0.0721 - mean_absolute_error: 0.0460 -
mean_absolute_percentage_error: 14.1610
Epoch 371/500
1/1 [==============================] - 0s 256ms/step - loss: 0.0051 -
mean_squared_error: 0.0051 - rmse: 0.0717 - mean_absolute_error: 0.0456 -
mean_absolute_percentage_error: 13.9056
Epoch 372/500
1/1 [==============================] - 0s 201ms/step - loss: 0.0052 -
mean_squared_error: 0.0052 - rmse: 0.0720 - mean_absolute_error: 0.0442 -
mean_absolute_percentage_error: 12.8771
Epoch 373/500
1/1 [==============================] - 0s 164ms/step - loss: 0.0052 -
mean_squared_error: 0.0052 - rmse: 0.0724 - mean_absolute_error: 0.0480 -
mean_absolute_percentage_error: 15.0093
Epoch 374/500
1/1 [==============================] - 0s 160ms/step - loss: 0.0053 -
mean_squared_error: 0.0053 - rmse: 0.0729 - mean_absolute_error: 0.0452 -
mean_absolute_percentage_error: 12.8053
Epoch 375/500
1/1 [==============================] - 0s 200ms/step - loss: 0.0054 -
mean_squared_error: 0.0054 - rmse: 0.0733 - mean_absolute_error: 0.0504 -
```

```
mean_absolute_percentage_error: 16.3388
Epoch 376/500
1/1 [==============================] - 0s 170ms/step - loss: 0.0056 -
mean_squared_error: 0.0056 - rmse: 0.0745 - mean_absolute_error: 0.0469 -
mean_absolute_percentage_error: 13.1085
Epoch 377/500
1/1 [==============================] - 0s 178ms/step - loss: 0.0055 -
mean_squared_error: 0.0055 - rmse: 0.0742 - mean_absolute_error: 0.0524 -
mean_absolute_percentage_error: 17.3411
Epoch 378/500
1/1 [==============================] - 0s 164ms/step - loss: 0.0055 -
mean_squared_error: 0.0055 - rmse: 0.0742 - mean_absolute_error: 0.0465 -
mean_absolute_percentage_error: 13.0633
Epoch 379/500
1/1 [==============================] - 0s 206ms/step - loss: 0.0051 -
mean_squared_error: 0.0051 - rmse: 0.0716 - mean_absolute_error: 0.0487 -
mean_absolute_percentage_error: 15.8561
Epoch 380/500
1/1 [==============================] - 0s 178ms/step - loss: 0.0049 -
mean_squared_error: 0.0049 - rmse: 0.0699 - mean_absolute_error: 0.0441 -
mean_absolute_percentage_error: 13.3645
Epoch 381/500
1/1 [==============================] - 0s 178ms/step - loss: 0.0049 -
mean_squared_error: 0.0049 - rmse: 0.0702 - mean_absolute_error: 0.0435 -
mean_absolute_percentage_error: 12.7026
Epoch 382/500
1/1 [==============================] - 0s 187ms/step - loss: 0.0051 -
mean_squared_error: 0.0051 - rmse: 0.0716 - mean_absolute_error: 0.0485 -
mean_absolute_percentage_error: 15.5205
Epoch 383/500
1/1 [==============================] - 0s 131ms/step - loss: 0.0053 -
mean_squared_error: 0.0053 - rmse: 0.0730 - mean_absolute_error: 0.0460 -
mean_absolute_percentage_error: 13.0998
Epoch 384/500
1/1 [==============================] - 0s 126ms/step - loss: 0.0051 -
mean_squared_error: 0.0051 - rmse: 0.0716 - mean_absolute_error: 0.0491 -
mean_absolute_percentage_error: 15.6975
Epoch 385/500
1/1 [==============================] - 0s 129ms/step - loss: 0.0049 -
mean_squared_error: 0.0049 - rmse: 0.0697 - mean_absolute_error: 0.0431 -
mean_absolute_percentage_error: 12.5912
Epoch 386/500
1/1 [==============================] - 0s 111ms/step - loss: 0.0047 -
mean_squared_error: 0.0047 - rmse: 0.0688 - mean_absolute_error: 0.0442 -
mean_absolute_percentage_error: 13.7340
Epoch 387/500
1/1 [==============================] - 0s 123ms/step - loss: 0.0048 -
mean_squared_error: 0.0048 - rmse: 0.0694 - mean_absolute_error: 0.0463 -
```

```
mean_absolute_percentage_error: 14.9727
Epoch 388/500
1/1 [==============================] - 0s 120ms/step - loss: 0.0050 -
mean_squared_error: 0.0050 - rmse: 0.0704 - mean_absolute_error: 0.0434 -
mean_absolute_percentage_error: 12.1903
Epoch 389/500
1/1 [==============================] - 0s 114ms/step - loss: 0.0050 -
mean_squared_error: 0.0050 - rmse: 0.0708 - mean_absolute_error: 0.0480 -
mean_absolute_percentage_error: 15.1097
Epoch 390/500
1/1 [==============================] - 0s 112ms/step - loss: 0.0051 -
mean_squared_error: 0.0051 - rmse: 0.0712 - mean_absolute_error: 0.0443 -
mean_absolute_percentage_error: 12.4323
Epoch 391/500
1/1 [==============================] - 0s 141ms/step - loss: 0.0049 -
mean_squared_error: 0.0049 - rmse: 0.0700 - mean_absolute_error: 0.0476 -
mean_absolute_percentage_error: 15.4605
Epoch 392/500
1/1 [==============================] - 0s 111ms/step - loss: 0.0047 -
mean_squared_error: 0.0047 - rmse: 0.0689 - mean_absolute_error: 0.0423 -
mean_absolute_percentage_error: 12.2020
Epoch 393/500
1/1 [==============================] - 0s 107ms/step - loss: 0.0046 -
mean_squared_error: 0.0046 - rmse: 0.0678 - mean_absolute_error: 0.0440 -
mean_absolute_percentage_error: 13.8398
Epoch 394/500
1/1 [==============================] - 0s 119ms/step - loss: 0.0046 -
mean_squared_error: 0.0046 - rmse: 0.0676 - mean_absolute_error: 0.0435 -
mean_absolute_percentage_error: 13.5667
Epoch 395/500
1/1 [==============================] - 0s 123ms/step - loss: 0.0046 -
mean_squared_error: 0.0046 - rmse: 0.0680 - mean_absolute_error: 0.0418 -
mean_absolute_percentage_error: 12.0871
Epoch 396/500
1/1 [==============================] - 0s 139ms/step - loss: 0.0047 -
mean_squared_error: 0.0047 - rmse: 0.0688 - mean_absolute_error: 0.0460 -
mean_absolute_percentage_error: 14.7412
Epoch 397/500
1/1 [==============================] - 0s 144ms/step - loss: 0.0048 -
mean_squared_error: 0.0048 - rmse: 0.0695 - mean_absolute_error: 0.0434 -
mean_absolute_percentage_error: 12.3123
Epoch 398/500
1/1 [==============================] - 0s 130ms/step - loss: 0.0048 -
mean_squared_error: 0.0048 - rmse: 0.0695 - mean_absolute_error: 0.0475 -
mean_absolute_percentage_error: 15.2400
Epoch 399/500
1/1 [==============================] - 0s 122ms/step - loss: 0.0049 -
mean_squared_error: 0.0049 - rmse: 0.0697 - mean_absolute_error: 0.0434 -
```

```
mean_absolute_percentage_error: 12.0237
Epoch 400/500
1/1 [==============================] - 0s 122ms/step - loss: 0.0047 -
mean_squared_error: 0.0047 - rmse: 0.0688 - mean_absolute_error: 0.0472 -
mean_absolute_percentage_error: 15.8148
Epoch 401/500
1/1 [==============================] - 0s 127ms/step - loss: 0.0046 -
mean_squared_error: 0.0046 - rmse: 0.0675 - mean_absolute_error: 0.0419 -
mean_absolute_percentage_error: 12.0809
Epoch 402/500
1/1 [==============================] - 0s 119ms/step - loss: 0.0044 -
mean_squared_error: 0.0044 - rmse: 0.0664 - mean_absolute_error: 0.0426 -
mean_absolute_percentage_error: 13.0926
Epoch 403/500
1/1 [==============================] - 0s 138ms/step - loss: 0.0044 -
mean_squared_error: 0.0044 - rmse: 0.0664 - mean_absolute_error: 0.0425 -
mean_absolute_percentage_error: 12.8227
Epoch 404/500
1/1 [==============================] - 0s 115ms/step - loss: 0.0045 -
mean_squared_error: 0.0045 - rmse: 0.0671 - mean_absolute_error: 0.0414 -
mean_absolute_percentage_error: 11.7367
Epoch 405/500
1/1 [==============================] - 0s 117ms/step - loss: 0.0046 -
mean_squared_error: 0.0046 - rmse: 0.0679 - mean_absolute_error: 0.0454 -
mean_absolute_percentage_error: 14.3838
Epoch 406/500
1/1 [==============================] - 0s 120ms/step - loss: 0.0047 -
mean_squared_error: 0.0047 - rmse: 0.0689 - mean_absolute_error: 0.0428 -
mean_absolute_percentage_error: 11.6710
Epoch 407/500
1/1 [==============================] - 0s 114ms/step - loss: 0.0047 -
mean_squared_error: 0.0047 - rmse: 0.0686 - mean_absolute_error: 0.0475 -
mean_absolute_percentage_error: 15.6451
Epoch 408/500
1/1 [==============================] - 0s 112ms/step - loss: 0.0046 -
mean_squared_error: 0.0046 - rmse: 0.0681 - mean_absolute_error: 0.0422 -
mean_absolute_percentage_error: 11.7554
Epoch 409/500
1/1 [==============================] - 0s 124ms/step - loss: 0.0044 -
mean_squared_error: 0.0044 - rmse: 0.0665 - mean_absolute_error: 0.0443 -
mean_absolute_percentage_error: 14.4119
Epoch 410/500
1/1 [==============================] - 0s 144ms/step - loss: 0.0043 -
mean_squared_error: 0.0043 - rmse: 0.0655 - mean_absolute_error: 0.0411 -
mean_absolute_percentage_error: 12.3560
Epoch 411/500
1/1 [==============================] - 0s 129ms/step - loss: 0.0043 -
mean_squared_error: 0.0043 - rmse: 0.0656 - mean_absolute_error: 0.0406 -
```

```
mean_absolute_percentage_error: 11.8145
Epoch 412/500
1/1 [==============================] - 0s 125ms/step - loss: 0.0044 -
mean_squared_error: 0.0044 - rmse: 0.0666 - mean_absolute_error: 0.0444 -
mean_absolute_percentage_error: 14.0134
Epoch 413/500
1/1 [==============================] - 0s 122ms/step - loss: 0.0046 -
mean_squared_error: 0.0046 - rmse: 0.0677 - mean_absolute_error: 0.0421 -
mean_absolute_percentage_error: 11.7897
Epoch 414/500
1/1 [==============================] - 0s 136ms/step - loss: 0.0046 -
mean_squared_error: 0.0046 - rmse: 0.0675 - mean_absolute_error: 0.0461 -
mean_absolute_percentage_error: 14.9640
Epoch 415/500
1/1 [==============================] - 0s 123ms/step - loss: 0.0045 -
mean_squared_error: 0.0045 - rmse: 0.0672 - mean_absolute_error: 0.0414 -
mean_absolute_percentage_error: 11.4276
Epoch 416/500
1/1 [==============================] - 0s 145ms/step - loss: 0.0043 -
mean_squared_error: 0.0043 - rmse: 0.0658 - mean_absolute_error: 0.0438 -
mean_absolute_percentage_error: 14.3895
Epoch 417/500
1/1 [==============================] - 0s 137ms/step - loss: 0.0042 -
mean_squared_error: 0.0042 - rmse: 0.0648 - mean_absolute_error: 0.0407 -
mean_absolute_percentage_error: 12.2256
Epoch 418/500
1/1 [==============================] - 0s 137ms/step - loss: 0.0042 -
mean_squared_error: 0.0042 - rmse: 0.0647 - mean_absolute_error: 0.0404 -
mean_absolute_percentage_error: 11.8528
Epoch 419/500
1/1 [==============================] - 0s 139ms/step - loss: 0.0043 -
mean_squared_error: 0.0043 - rmse: 0.0654 - mean_absolute_error: 0.0426 -
mean_absolute_percentage_error: 13.2861
Epoch 420/500
1/1 [==============================] - 0s 129ms/step - loss: 0.0044 -
mean_squared_error: 0.0044 - rmse: 0.0663 - mean_absolute_error: 0.0411 -
mean_absolute_percentage_error: 11.4366
Epoch 421/500
1/1 [==============================] - 0s 116ms/step - loss: 0.0044 -
mean_squared_error: 0.0044 - rmse: 0.0664 - mean_absolute_error: 0.0447 -
mean_absolute_percentage_error: 14.4655
Epoch 422/500
1/1 [==============================] - 0s 108ms/step - loss: 0.0044 -
mean_squared_error: 0.0044 - rmse: 0.0664 - mean_absolute_error: 0.0410 -
mean_absolute_percentage_error: 11.3581
Epoch 423/500
1/1 [==============================] - 0s 111ms/step - loss: 0.0043 -
mean_squared_error: 0.0043 - rmse: 0.0655 - mean_absolute_error: 0.0439 -
```

```
mean_absolute_percentage_error: 14.4688
Epoch 424/500
1/1 [==============================] - 0s 123ms/step - loss: 0.0042 -
mean_squared_error: 0.0042 - rmse: 0.0645 - mean_absolute_error: 0.0402 -
mean_absolute_percentage_error: 11.8062
Epoch 425/500
1/1 [==============================] - 0s 119ms/step - loss: 0.0041 -
mean_squared_error: 0.0041 - rmse: 0.0640 - mean_absolute_error: 0.0405 -
mean_absolute_percentage_error: 12.3409
Epoch 426/500
1/1 [==============================] - 0s 126ms/step - loss: 0.0041 -
mean_squared_error: 0.0041 - rmse: 0.0642 - mean_absolute_error: 0.0413 -
mean_absolute_percentage_error: 12.8325
Epoch 427/500
1/1 [==============================] - 0s 130ms/step - loss: 0.0042 -
mean_squared_error: 0.0042 - rmse: 0.0648 - mean_absolute_error: 0.0401 -
mean_absolute_percentage_error: 11.4803
Epoch 428/500
1/1 [==============================] - 0s 123ms/step - loss: 0.0043 -
mean_squared_error: 0.0043 - rmse: 0.0654 - mean_absolute_error: 0.0436 -
mean_absolute_percentage_error: 13.9693
Epoch 429/500
1/1 [==============================] - 0s 118ms/step - loss: 0.0043 -
mean_squared_error: 0.0043 - rmse: 0.0658 - mean_absolute_error: 0.0407 -
mean_absolute_percentage_error: 11.2571
Epoch 430/500
1/1 [==============================] - 0s 113ms/step - loss: 0.0043 -
mean_squared_error: 0.0043 - rmse: 0.0656 - mean_absolute_error: 0.0445 -
mean_absolute_percentage_error: 14.6307
Epoch 431/500
1/1 [==============================] - 0s 107ms/step - loss: 0.0043 -
mean_squared_error: 0.0043 - rmse: 0.0655 - mean_absolute_error: 0.0405 -
mean_absolute_percentage_error: 11.3365
Epoch 432/500
1/1 [==============================] - 0s 107ms/step - loss: 0.0042 -
mean_squared_error: 0.0042 - rmse: 0.0649 - mean_absolute_error: 0.0436 -
mean_absolute_percentage_error: 14.3614
Epoch 433/500
1/1 [==============================] - 0s 116ms/step - loss: 0.0041 -
mean_squared_error: 0.0041 - rmse: 0.0642 - mean_absolute_error: 0.0396 -
mean_absolute_percentage_error: 11.3433
Epoch 434/500
1/1 [==============================] - 0s 123ms/step - loss: 0.0040 -
mean_squared_error: 0.0040 - rmse: 0.0634 - mean_absolute_error: 0.0405 -
mean_absolute_percentage_error: 12.4480
Epoch 435/500
1/1 [==============================] - 0s 139ms/step - loss: 0.0040 -
mean_squared_error: 0.0040 - rmse: 0.0632 - mean_absolute_error: 0.0399 -
```

```
mean_absolute_percentage_error: 12.0462
Epoch 436/500
1/1 [==============================] - 0s 128ms/step - loss: 0.0040 -
mean_squared_error: 0.0040 - rmse: 0.0634 - mean_absolute_error: 0.0395 -
mean_absolute_percentage_error: 11.5398
Epoch 437/500
1/1 [==============================] - 0s 142ms/step - loss: 0.0041 -
mean_squared_error: 0.0041 - rmse: 0.0637 - mean_absolute_error: 0.0415 -
mean_absolute_percentage_error: 13.2424
Epoch 438/500
1/1 [==============================] - 0s 144ms/step - loss: 0.0041 -
mean_squared_error: 0.0041 - rmse: 0.0639 - mean_absolute_error: 0.0393 -
mean_absolute_percentage_error: 11.1921
Epoch 439/500
1/1 [==============================] - 0s 135ms/step - loss: 0.0041 -
mean_squared_error: 0.0041 - rmse: 0.0637 - mean_absolute_error: 0.0421 -
mean_absolute_percentage_error: 13.5590
Epoch 440/500
1/1 [==============================] - 0s 139ms/step - loss: 0.0041 -
mean_squared_error: 0.0041 - rmse: 0.0637 - mean_absolute_error: 0.0393 -
mean_absolute_percentage_error: 11.2052
Epoch 441/500
1/1 [==============================] - 0s 171ms/step - loss: 0.0041 -
mean_squared_error: 0.0041 - rmse: 0.0637 - mean_absolute_error: 0.0421 -
mean_absolute_percentage_error: 13.6094
Epoch 442/500
1/1 [==============================] - 0s 140ms/step - loss: 0.0041 -
mean_squared_error: 0.0041 - rmse: 0.0637 - mean_absolute_error: 0.0393 -
mean_absolute_percentage_error: 11.1561
Epoch 443/500
1/1 [==============================] - 0s 146ms/step - loss: 0.0040 -
mean_squared_error: 0.0040 - rmse: 0.0635 - mean_absolute_error: 0.0417 -
mean_absolute_percentage_error: 13.2125
Epoch 444/500
1/1 [==============================] - 0s 129ms/step - loss: 0.0040 -
mean_squared_error: 0.0040 - rmse: 0.0633 - mean_absolute_error: 0.0392 -
mean_absolute_percentage_error: 11.2336
Epoch 445/500
1/1 [==============================] - 0s 135ms/step - loss: 0.0040 -
mean_squared_error: 0.0040 - rmse: 0.0630 - mean_absolute_error: 0.0413 -
mean_absolute_percentage_error: 13.2173
Epoch 446/500
1/1 [==============================] - 0s 129ms/step - loss: 0.0039 -
mean_squared_error: 0.0039 - rmse: 0.0628 - mean_absolute_error: 0.0390 -
mean_absolute_percentage_error: 11.4315
Epoch 447/500
1/1 [==============================] - 0s 126ms/step - loss: 0.0039 -
mean_squared_error: 0.0039 - rmse: 0.0625 - mean_absolute_error: 0.0403 -
```

```
mean_absolute_percentage_error: 12.6662
Epoch 448/500
1/1 [==============================] - 0s 125ms/step - loss: 0.0039 -
mean_squared_error: 0.0039 - rmse: 0.0623 - mean_absolute_error: 0.0389 -
mean_absolute_percentage_error: 11.4971
Epoch 449/500
1/1 [==============================] - 0s 126ms/step - loss: 0.0039 -
mean_squared_error: 0.0039 - rmse: 0.0622 - mean_absolute_error: 0.0395 -
mean_absolute_percentage_error: 12.0156
Epoch 450/500
1/1 [==============================] - 0s 142ms/step - loss: 0.0039 -
mean_squared_error: 0.0039 - rmse: 0.0621 - mean_absolute_error: 0.0389 -
mean_absolute_percentage_error: 11.5329
Epoch 451/500
1/1 [==============================] - 0s 124ms/step - loss: 0.0038 -
mean_squared_error: 0.0038 - rmse: 0.0620 - mean_absolute_error: 0.0394 -
mean_absolute_percentage_error: 12.1435
Epoch 452/500
1/1 [==============================] - 0s 131ms/step - loss: 0.0038 -
mean_squared_error: 0.0038 - rmse: 0.0619 - mean_absolute_error: 0.0388 -
mean_absolute_percentage_error: 11.6397
Epoch 453/500
1/1 [==============================] - 0s 121ms/step - loss: 0.0038 -
mean_squared_error: 0.0038 - rmse: 0.0618 - mean_absolute_error: 0.0395 -
mean_absolute_percentage_error: 12.2222
Epoch 454/500
1/1 [==============================] - 0s 126ms/step - loss: 0.0038 -
mean_squared_error: 0.0038 - rmse: 0.0618 - mean_absolute_error: 0.0386 -
mean_absolute_percentage_error: 11.5288
Epoch 455/500
1/1 [==============================] - 0s 166ms/step - loss: 0.0039 -
mean_squared_error: 0.0039 - rmse: 0.0621 - mean_absolute_error: 0.0404 -
mean_absolute_percentage_error: 12.8416
Epoch 456/500
1/1 [==============================] - 0s 142ms/step - loss: 0.0040 -
mean_squared_error: 0.0040 - rmse: 0.0633 - mean_absolute_error: 0.0393 -
mean_absolute_percentage_error: 11.1706
Epoch 457/500
1/1 [==============================] - 0s 128ms/step - loss: 0.0044 -
mean_squared_error: 0.0044 - rmse: 0.0665 - mean_absolute_error: 0.0465 -
mean_absolute_percentage_error: 15.4317
Epoch 458/500
1/1 [==============================] - 0s 146ms/step - loss: 0.0056 -
mean_squared_error: 0.0056 - rmse: 0.0750 - mean_absolute_error: 0.0520 -
mean_absolute_percentage_error: 13.7507
Epoch 459/500
1/1 [==============================] - 0s 126ms/step - loss: 0.0064 -
mean_squared_error: 0.0064 - rmse: 0.0799 - mean_absolute_error: 0.0623 -
```

```
mean_absolute_percentage_error: 22.4259
Epoch 460/500
1/1 [==============================] - 0s 131ms/step - loss: 0.0071 -
mean_squared_error: 0.0071 - rmse: 0.0843 - mean_absolute_error: 0.0626 -
mean_absolute_percentage_error: 15.5500
Epoch 461/500
1/1 [==============================] - 0s 127ms/step - loss: 0.0041 -
mean_squared_error: 0.0041 - rmse: 0.0643 - mean_absolute_error: 0.0447 -
mean_absolute_percentage_error: 15.9012
Epoch 462/500
1/1 [==============================] - 0s 124ms/step - loss: 0.0053 -
mean_squared_error: 0.0053 - rmse: 0.0725 - mean_absolute_error: 0.0545 -
mean_absolute_percentage_error: 19.1377
Epoch 463/500
1/1 [==============================] - 0s 120ms/step - loss: 0.0066 -
mean_squared_error: 0.0066 - rmse: 0.0812 - mean_absolute_error: 0.0592 -
mean_absolute_percentage_error: 15.8497
Epoch 464/500
1/1 [==============================] - 0s 120ms/step - loss: 0.0040 -
mean_squared_error: 0.0040 - rmse: 0.0632 - mean_absolute_error: 0.0403 -
mean_absolute_percentage_error: 12.4288
Epoch 465/500
1/1 [==============================] - 0s 111ms/step - loss: 0.0066 -
mean_squared_error: 0.0066 - rmse: 0.0810 - mean_absolute_error: 0.0626 -
mean_absolute_percentage_error: 21.4211
Epoch 466/500
1/1 [==============================] - 0s 116ms/step - loss: 0.0058 -
mean_squared_error: 0.0058 - rmse: 0.0761 - mean_absolute_error: 0.0531 -
mean_absolute_percentage_error: 13.6615
Epoch 467/500
1/1 [==============================] - 0s 118ms/step - loss: 0.0048 -
mean_squared_error: 0.0048 - rmse: 0.0695 - mean_absolute_error: 0.0451 -
mean_absolute_percentage_error: 12.3303
Epoch 468/500
1/1 [==============================] - 0s 118ms/step - loss: 0.0064 -
mean_squared_error: 0.0064 - rmse: 0.0797 - mean_absolute_error: 0.0622 -
mean_absolute_percentage_error: 22.1711
Epoch 469/500
1/1 [==============================] - 0s 113ms/step - loss: 0.0040 -
mean_squared_error: 0.0040 - rmse: 0.0632 - mean_absolute_error: 0.0415 -
mean_absolute_percentage_error: 13.2598
Epoch 470/500
1/1 [==============================] - 0s 121ms/step - loss: 0.0055 -
mean_squared_error: 0.0055 - rmse: 0.0742 - mean_absolute_error: 0.0506 -
mean_absolute_percentage_error: 13.2745
Epoch 471/500
1/1 [==============================] - 0s 126ms/step - loss: 0.0040 -
mean_squared_error: 0.0040 - rmse: 0.0633 - mean_absolute_error: 0.0418 -
```

```
mean_absolute_percentage_error: 13.5907
Epoch 472/500
1/1 [==============================] - 0s 121ms/step - loss: 0.0051 -
mean_squared_error: 0.0051 - rmse: 0.0717 - mean_absolute_error: 0.0518 -
mean_absolute_percentage_error: 17.7340
Epoch 473/500
1/1 [==============================] - 0s 109ms/step - loss: 0.0046 -
mean_squared_error: 0.0046 - rmse: 0.0676 - mean_absolute_error: 0.0437 -
mean_absolute_percentage_error: 12.2779
Epoch 474/500
1/1 [==============================] - 0s 112ms/step - loss: 0.0045 -
mean_squared_error: 0.0045 - rmse: 0.0673 - mean_absolute_error: 0.0434 -
mean_absolute_percentage_error: 12.2112
Epoch 475/500
1/1 [==============================] - 0s 127ms/step - loss: 0.0047 -
mean_squared_error: 0.0047 - rmse: 0.0682 - mean_absolute_error: 0.0491 -
mean_absolute_percentage_error: 16.6827
Epoch 476/500
1/1 [==============================] - 0s 130ms/step - loss: 0.0040 -
mean_squared_error: 0.0040 - rmse: 0.0631 - mean_absolute_error: 0.0431 -
mean_absolute_percentage_error: 14.6404
Epoch 477/500
1/1 [==============================] - 0s 136ms/step - loss: 0.0046 -
mean_squared_error: 0.0046 - rmse: 0.0678 - mean_absolute_error: 0.0441 -
mean_absolute_percentage_error: 12.5068
Epoch 478/500
1/1 [==============================] - 0s 145ms/step - loss: 0.0039 -
mean_squared_error: 0.0039 - rmse: 0.0624 - mean_absolute_error: 0.0402 -
mean_absolute_percentage_error: 12.5583
Epoch 479/500
1/1 [==============================] - 0s 143ms/step - loss: 0.0046 -
mean_squared_error: 0.0046 - rmse: 0.0677 - mean_absolute_error: 0.0485 -
mean_absolute_percentage_error: 16.5355
Epoch 480/500
1/1 [==============================] - 0s 117ms/step - loss: 0.0039 -
mean_squared_error: 0.0039 - rmse: 0.0621 - mean_absolute_error: 0.0399 -
mean_absolute_percentage_error: 11.9822
Epoch 481/500
1/1 [==============================] - 0s 127ms/step - loss: 0.0043 -
mean_squared_error: 0.0043 - rmse: 0.0656 - mean_absolute_error: 0.0426 -
mean_absolute_percentage_error: 12.3790
Epoch 482/500
1/1 [==============================] - 0s 119ms/step - loss: 0.0039 -
mean_squared_error: 0.0039 - rmse: 0.0623 - mean_absolute_error: 0.0414 -
mean_absolute_percentage_error: 13.2085
Epoch 483/500
1/1 [==============================] - 0s 119ms/step - loss: 0.0040 -
mean_squared_error: 0.0040 - rmse: 0.0636 - mean_absolute_error: 0.0438 -
```

```
mean_absolute_percentage_error: 14.6355
Epoch 484/500
1/1 [==============================] - 0s 115ms/step - loss: 0.0040 -
mean_squared_error: 0.0040 - rmse: 0.0634 - mean_absolute_error: 0.0398 -
mean_absolute_percentage_error: 11.5466
Epoch 485/500
1/1 [==============================] - 0s 106ms/step - loss: 0.0038 -
mean_squared_error: 0.0038 - rmse: 0.0619 - mean_absolute_error: 0.0390 -
mean_absolute_percentage_error: 11.7481
Epoch 486/500
1/1 [==============================] - 0s 108ms/step - loss: 0.0041 -
mean_squared_error: 0.0041 - rmse: 0.0639 - mean_absolute_error: 0.0446 -
mean_absolute_percentage_error: 14.9803
Epoch 487/500
1/1 [==============================] - 0s 152ms/step - loss: 0.0037 -
mean_squared_error: 0.0037 - rmse: 0.0609 - mean_absolute_error: 0.0386 -
mean_absolute_percentage_error: 11.6902
Epoch 488/500
1/1 [==============================] - 0s 129ms/step - loss: 0.0040 -
mean_squared_error: 0.0040 - rmse: 0.0631 - mean_absolute_error: 0.0398 -
mean_absolute_percentage_error: 11.5307
Epoch 489/500
1/1 [==============================] - 0s 123ms/step - loss: 0.0037 -
mean_squared_error: 0.0037 - rmse: 0.0612 - mean_absolute_error: 0.0400 -
mean_absolute_percentage_error: 12.6327
Epoch 490/500
1/1 [==============================] - 0s 125ms/step - loss: 0.0038 -
mean_squared_error: 0.0038 - rmse: 0.0616 - mean_absolute_error: 0.0407 -
mean_absolute_percentage_error: 13.1010
Epoch 491/500
1/1 [==============================] - 0s 121ms/step - loss: 0.0039 -
mean_squared_error: 0.0039 - rmse: 0.0621 - mean_absolute_error: 0.0388 -
mean_absolute_percentage_error: 11.2211
Epoch 492/500
1/1 [==============================] - 0s 102ms/step - loss: 0.0036 -
mean_squared_error: 0.0036 - rmse: 0.0604 - mean_absolute_error: 0.0383 -
mean_absolute_percentage_error: 11.5746
Epoch 493/500
1/1 [==============================] - 0s 110ms/step - loss: 0.0039 -
mean_squared_error: 0.0039 - rmse: 0.0621 - mean_absolute_error: 0.0421 -
mean_absolute_percentage_error: 13.5309
Epoch 494/500
1/1 [==============================] - 0s 114ms/step - loss: 0.0037 -
mean_squared_error: 0.0037 - rmse: 0.0607 - mean_absolute_error: 0.0383 -
mean_absolute_percentage_error: 11.3045
Epoch 495/500
1/1 [==============================] - 0s 124ms/step - loss: 0.0037 -
mean_squared_error: 0.0037 - rmse: 0.0607 - mean_absolute_error: 0.0383 -
```

```
mean_absolute_percentage_error: 11.2965
Epoch 496/500
1/1 [==============================] - 0s 157ms/step - loss: 0.0038 -
mean_squared_error: 0.0038 - rmse: 0.0613 - mean_absolute_error: 0.0411 -
mean_absolute_percentage_error: 13.3662
Epoch 497/500
1/1 [==============================] - 0s 152ms/step - loss: 0.0036 -
mean_squared_error: 0.0036 - rmse: 0.0599 - mean_absolute_error: 0.0384 -
mean_absolute_percentage_error: 11.8188
Epoch 498/500
1/1 [==============================] - 0s 156ms/step - loss: 0.0037 -
mean_squared_error: 0.0037 - rmse: 0.0608 - mean_absolute_error: 0.0385 -
mean_absolute_percentage_error: 11.4106
Epoch 499/500
1/1 [==============================] - 0s 153ms/step - loss: 0.0036 -
mean_squared_error: 0.0036 - rmse: 0.0603 - mean_absolute_error: 0.0397 -
mean_absolute_percentage_error: 12.5660
Epoch 500/500
1/1 [==============================] - 0s 144ms/step - loss: 0.0036 -
mean_squared_error: 0.0036 - rmse: 0.0597 - mean_absolute_error: 0.0384 -
mean_absolute_percentage_error: 12.0028
```

[ ]:
```
<keras.callbacks.History at 0x2048bacd8c8>
```

[ ]:
```
business_days = pd.date_range(start=pd.to_datetime(TRAIN_END_DATE) +␣
↪timedelta(days=1),
                              periods=66, freq='B')
```

[ ]:
```
business_days
```

[ ]:
```
DatetimeIndex(['2021-06-01', '2021-06-02', '2021-06-03', '2021-06-04',
               '2021-06-07', '2021-06-08', '2021-06-09', '2021-06-10',
               '2021-06-11', '2021-06-14', '2021-06-15', '2021-06-16',
               '2021-06-17', '2021-06-18', '2021-06-21', '2021-06-22',
               '2021-06-23', '2021-06-24', '2021-06-25', '2021-06-28',
               '2021-06-29', '2021-06-30', '2021-07-01', '2021-07-02',
               '2021-07-05', '2021-07-06', '2021-07-07', '2021-07-08',
               '2021-07-09', '2021-07-12', '2021-07-13', '2021-07-14',
               '2021-07-15', '2021-07-16', '2021-07-19', '2021-07-20',
               '2021-07-21', '2021-07-22', '2021-07-23', '2021-07-26',
               '2021-07-27', '2021-07-28', '2021-07-29', '2021-07-30',
               '2021-08-02', '2021-08-03', '2021-08-04', '2021-08-05',
               '2021-08-06', '2021-08-09', '2021-08-10', '2021-08-11',
               '2021-08-12', '2021-08-13', '2021-08-16', '2021-08-17',
               '2021-08-18', '2021-08-19', '2021-08-20', '2021-08-23',
               '2021-08-24', '2021-08-25', '2021-08-26', '2021-08-27',
               '2021-08-30', '2021-08-31'],
              dtype='datetime64[ns]', freq='B')
```

[ ]:
```
# Get the last sequence from the training data
last_sequence = X_train[-1].reshape((1, SEQUENCE_LENGTH, 1))
```

[ ]:
```
# Create a list to hold predictions
predictions = []

# Predict future prices
for i in range(len(business_days)):
    # Get the prediction (scaled value)
    current_prediction = model.predict(last_sequence)[0]

    # Append the prediction
    predictions.append(current_prediction)

    # Check if there's an actual next value available in y_test
    if i < len(y_test):
        # Update 'last_sequence' with the actual next value from y_test
        actual_next_value = y_test[i]
        last_sequence = np.roll(last_sequence, -1, axis=1)
        last_sequence[0, -1, 0] = actual_next_value
    else:
        # If no actual next value is available, use the predicted value (for␣
 ↪predictions beyond y_test)
        last_sequence = np.roll(last_sequence, -1, axis=1)
        last_sequence[0, -1, 0] = current_prediction

# Inverse transform the predictions to get actual values
predicted_prices = scaler.inverse_transform(np.array(predictions).reshape(-1,␣
 ↪1))

# Create a DataFrame with the predicted stock prices and dates
predictions_df = pd.DataFrame({
    'Date': business_days,
    'Predicted_Close': predicted_prices.flatten()
})

# Show the prediction results
print(predictions_df)
```

```
1/1 [==============================] - 1s 629ms/step
1/1 [==============================] - 0s 50ms/step
1/1 [==============================] - 0s 42ms/step
1/1 [==============================] - 0s 35ms/step
1/1 [==============================] - 0s 42ms/step
1/1 [==============================] - 0s 47ms/step
1/1 [==============================] - 0s 36ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 43ms/step
```

```
1/1 [==============================] - 0s 37ms/step
1/1 [==============================] - 0s 71ms/step
1/1 [==============================] - 0s 71ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 44ms/step
1/1 [==============================] - 0s 42ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 55ms/step
1/1 [==============================] - 0s 51ms/step
1/1 [==============================] - 0s 71ms/step
1/1 [==============================] - 0s 46ms/step
1/1 [==============================] - 0s 43ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 42ms/step
1/1 [==============================] - 0s 45ms/step
1/1 [==============================] - 0s 38ms/step
1/1 [==============================] - 0s 45ms/step
1/1 [==============================] - 0s 38ms/step
1/1 [==============================] - 0s 41ms/step
1/1 [==============================] - 0s 41ms/step
1/1 [==============================] - 0s 38ms/step
1/1 [==============================] - 0s 45ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 38ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 36ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 50ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 44ms/step
1/1 [==============================] - 0s 62ms/step
1/1 [==============================] - 0s 51ms/step
1/1 [==============================] - 0s 58ms/step
1/1 [==============================] - 0s 63ms/step
1/1 [==============================] - 0s 52ms/step
1/1 [==============================] - 0s 47ms/step
1/1 [==============================] - 0s 38ms/step
1/1 [==============================] - 0s 46ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 45ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 45ms/step
1/1 [==============================] - 0s 37ms/step
1/1 [==============================] - 0s 37ms/step
1/1 [==============================] - 0s 42ms/step
1/1 [==============================] - 0s 40ms/step
```

```
1/1 [==============================] - 0s 47ms/step
1/1 [==============================] - 0s 35ms/step
1/1 [==============================] - 0s 41ms/step
1/1 [==============================] - 0s 38ms/step
1/1 [==============================] - 0s 34ms/step
1/1 [==============================] - 0s 34ms/step
1/1 [==============================] - 0s 42ms/step
1/1 [==============================] - 0s 47ms/step
1/1 [==============================] - 0s 44ms/step
1/1 [==============================] - 0s 47ms/step
         Date  Predicted_Close
0  2021-06-01        59.010445
1  2021-06-02        59.543983
2  2021-06-03        61.573044
3  2021-06-04        58.990559
4  2021-06-07        57.066444
..        …              …
61 2021-08-25        53.516556
62 2021-08-26        51.871582
63 2021-08-27        49.200794
64 2021-08-30        51.207821
65 2021-08-31        54.112732

[66 rows x 2 columns]
```

[ ]:
```
# Continue from the previous predictions_df creation code

# Ensure the 'Date' columns in both DataFrames are in the same format
df['Date'] = pd.to_datetime(df['Date'])
predictions_df['Date'] = pd.to_datetime(predictions_df['Date'])

# Merge the predictions with the actual closing prices from 'df'
predictions_with_actuals_df = predictions_df.merge(df[['Date', 'Close']],␣
 ↪on='Date', how='left')

# Rename columns for clarity
predictions_with_actuals_df.rename(columns={'Close': 'Actual_Close'},␣
 ↪inplace=True)

# Show the DataFrame with predictions and actual closing prices
print(predictions_with_actuals_df)
```

```
         Date  Predicted_Close  Actual_Close
0  2021-06-01        59.010445     62.255001
1  2021-06-02        59.543983     70.559998
2  2021-06-03        61.573044     64.544998
3  2021-06-04        58.990559     62.090000
4  2021-06-07        57.066444     70.002502
```

```
..        …              …            …
61 2021-08-25        53.516556    49.912498
62 2021-08-26        51.871582    51.305000
63 2021-08-27        49.200794    51.237499
64 2021-08-30        51.207821    52.299999
65 2021-08-31        54.112732    54.560001

[66 rows x 3 columns]
```

[ ]:
```
print(predictions_with_actuals_df["Actual_Close"].isnull().sum())
print(predictions_with_actuals_df["Predicted_Close"].isnull().sum())

predictions_with_actuals_df.dropna(subset=["Actual_Close", "Predicted_Close"],␣
 ↪inplace=True)
```

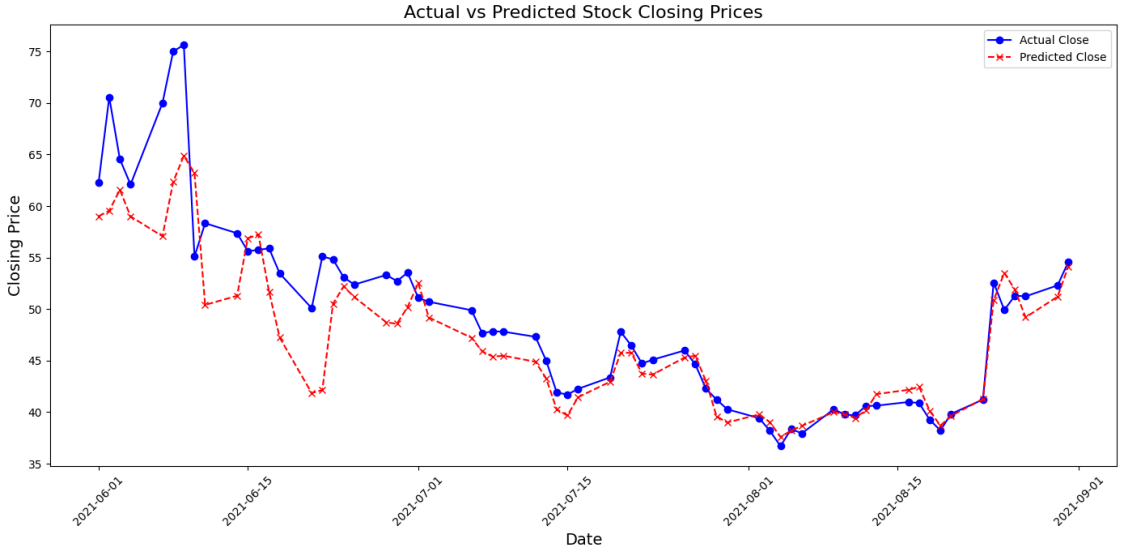
```
1
0
```

[ ]:
```
mse = mean_squared_error(predictions_with_actuals_df["Actual_Close"],␣
 ↪predictions_with_actuals_df["Predicted_Close"])
rmse = np.sqrt(mse)
mae = mean_absolute_error(predictions_with_actuals_df["Actual_Close"],␣
 ↪predictions_with_actuals_df["Predicted_Close"])

print("Mean Squared Error: ", mse)
print("Root Mean Squared Error: ", rmse)
print("Mean Absolute Error: ", mae)
```

```
Mean Squared Error:  18.646688259132834
Root Mean Squared Error:  4.3181811285693925
Mean Absolute Error:  2.800768384367488
```

[ ]:
```
# Ensure the 'Date' column is in datetime format for proper plotting
predictions_with_actuals_df['Date'] = pd.
 ↪to_datetime(predictions_with_actuals_df['Date'])

# Setting the plot size for better readability
plt.figure(figsize=(14, 7))

# Plotting the actual closing prices
plt.plot(predictions_with_actuals_df['Date'],␣
 ↪predictions_with_actuals_df['Actual_Close'], label='Actual Close',␣
 ↪color='blue', marker='o')

# Plotting the predicted closing prices
plt.plot(predictions_with_actuals_df['Date'],␣
 ↪predictions_with_actuals_df['Predicted_Close'], label='Predicted Close',␣
 ↪color='red', linestyle='--', marker='x')
```

```
# Adding title and labels with font size adjustments
plt.title('Actual vs Predicted Stock Closing Prices', fontsize=16)
plt.xlabel('Date', fontsize=14)
plt.ylabel('Closing Price', fontsize=14)

# Rotating date labels for better visibility
plt.xticks(rotation=45)

# Adding a legend to distinguish between actual and predicted values
plt.legend()

# Display the plot
plt.tight_layout()
plt.show()
```



Incorporating the sentiment data to train LSTM.

[ ]:
```
sentiment_df = pd.read_csv('rGME_dataset_features.csv')
```

```
c:\Users\ac253\anaconda3\envs\NLXIndAssign\lib\site-
packages\IPython\core\interactiveshell.py:3552: DtypeWarning: Columns (8) have
mixed types.Specify dtype option on import or set low_memory=False.
  exec(code_obj, self.user_global_ns, self.user_ns)
```

[ ]:
```
sentiment_df.head(20)
```

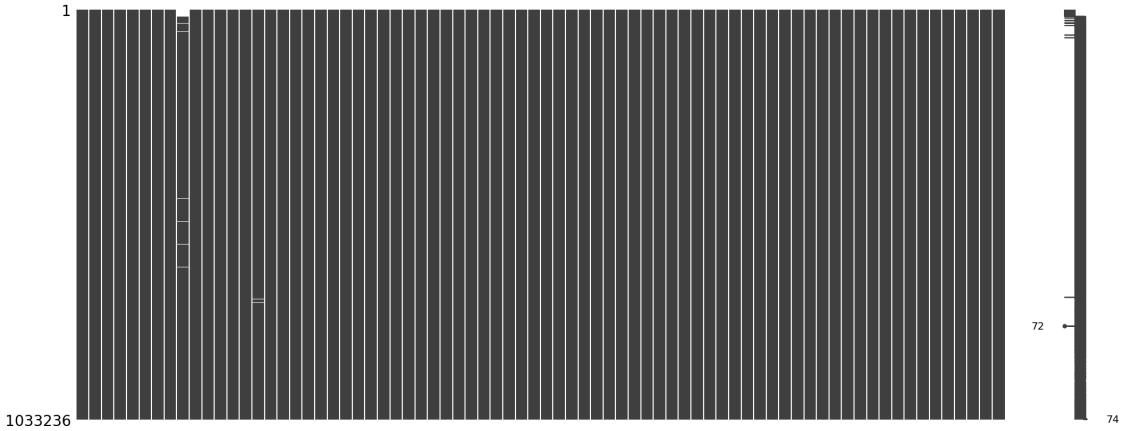
[ ]:
```
    Unnamed: 0      id                                              title  \
0            0  kqfajb              You NEED to see this about GME
```

```
1            1  kqjh2t                      Short Squeeze Incoming
2            2  kqvp7l  THIS CONVINCED ME TO ALL IN  GME (EXTREME PUMP…
3            3  krcwch  You already know what we must do brothers and …
4            4  krnthg                           ICR conference (11th Jan)
5            5  kryizd  Hey guys! We have a free discord channel that'…
6            6  kuo3w1  GME is FINALLY going to the moon, this technic…
7            7  kv1t51                 Ryan Cohen appointed to board!!!!?
8            8  kv1w9e  Holly f*ck, our GME rollercoaster will break o…
9            9  kv3vrm  BUCKLE YOUR SEATBELTS OR YOURE GONNA FALL OFF …
10          10  kv671o                       Ryan Cohen not being paid???
11          11  kvvchb  Low Volume the day after Cohen essentially tak…
12          12  kvw83z  questions from a potential investor about game…
13          13  kwespl         The reason why GME isn't exploding upwards
14          14  kwevqp                   Cramer showing interest in GME
15          15  kwiuqj                               Hold the line! 420.69
16          16  kwj6sc                  new investor here, advice welcome
17          17  kwjdpe                         You retards know what's up
18          18  kwk6hs          You guys were right, retarded, but right.
19          19  kwkpzp             Anyone hear that Point72 is short GME?

                                                  url  score  \
0   https://www.reddit.com/r/GME/comments/kqfajb/y…    1.0
1   /r/wallstreetbets/comments/kqcwdo/gamestops_gr…    1.0
2   https://www.reddit.com/r/GME/comments/kqvp7l/t…    1.0
3   /r/wallstreetbets/comments/kr98ym/gme_gang_we_…    1.0
4   https://www.reddit.com/r/GME/comments/krnthg/i…    1.0
5   https://www.reddit.com/r/GME/comments/kryizd/h…    1.0
6   https://www.reddit.com/r/GME/comments/kuo3w1/g…    1.0
7   https://news.gamestop.com/news-releases/news-r…    1.0
8   https://www.reddit.com/r/GME/comments/kv1w9e/h…    1.0
9                https://i.redd.it/t8e6nqnxspa61.png    1.0
10  https://www.reddit.com/r/GME/comments/kv671o/r…    2.0
11  https://www.reddit.com/r/GME/comments/kvvchb/l…    1.0
12  https://www.reddit.com/r/GME/comments/kvw83z/q…    2.0
13  https://www.reddit.com/r/GME/comments/kwespl/t…    1.0
14  https://twitter.com/jimcramer/status/134931064…    1.0
15  https://www.reddit.com/r/GME/comments/kwiuqj/h…    1.0
16  https://www.reddit.com/r/GME/comments/kwj6sc/n…    2.0
17  https://www.reddit.com/r/GME/comments/kwjdpe/y…    3.0
18               https://i.redd.it/bi4amc3co4b61.jpg    1.0
19  https://www.reddit.com/r/GME/comments/kwkpzp/a…    1.0

               author  num_comments        date flair  compound  …  _poss  \
0         TitsDownOnly           9.0  2021-01-04   NaN    0.9872  …      0
1          zoomermoney           1.0  2021-01-04   NaN    0.9906  …      0
2         TitsDownOnly           6.0  2021-01-05   NaN    0.5319  …      0
3     dontforgettolive           4.0  2021-01-05   NaN   -0.2960  …      1
```

```
4              nicky94          10.0  2021-01-06   NaN    0.0000  …       0
5          thehelper900          15.0  2021-01-06   NaN    0.7777  …       0
6          TitsDownOnly          16.0  2021-01-10   NaN    0.9667  …       0
7              nicky94           6.0  2021-01-11   NaN    0.0000  …       0
8    username-__-taken          20.0  2021-01-11   NaN    0.0000  …       1
9           jonastirona           1.0  2021-01-11   NaN    0.9517  …       1
10              IsaacPG          11.0  2021-01-11   NaN    0.0000  …       0
11             nicky94          16.0  2021-01-12   NaN   -0.2732  …       0
12           johnestar           8.0  2021-01-12   NaN    0.0000  …       1
13    pinkguyfriedrice           3.0  2021-01-13   NaN    0.0000  …       0
14             nicky94           0.0  2021-01-13   NaN    0.4588  …       0
15     WeedRockCryptos          11.0  2021-01-13   NaN    0.0000  …       0
16        robertino129          11.0  2021-01-13   NaN    0.4588  …       0
17                NG350          21.0  2021-01-13   NaN    0.0000  …       0
18  haventredditeither           2.0  2021-01-13   NaN   -0.3291  …       0
19        Moneymger007          18.0  2021-01-13   NaN    0.0000  …       0

    _intj  _appos _npadvmod _predet  _case  _expl  _oprd  _dative _nmod
0       0       6         0       0      0      0      0        0     0
1       0       3         0       0      0      0      0        0     0
2       0       0         0       0      0      0      0        0     0
3       0       0         0       0      0      0      0        0     0
4       0       0         1       0      0      0      0        0     0
5       1       0         0       0      0      0      0        0     0
6       0       2         0       0      0      0      0        0     0
7       0       0         0       0      0      0      0        0     0
8       0       0         0       0      0      0      0        0     0
9       0       1         0       0      0      0      0        0     0
10      0       0         0       0      0      0      0        0     0
11      0       0         1       0      0      0      0        0     0
12      0       0         0       0      1      0      0        0     0
13      0       0         0       0      0      0      0        0     0
14      0       0         0       0      0      0      0        0     0
15      0       0         0       0      0      0      0        0     0
16      0       1         0       0      0      0      0        0     0
17      0       0         0       0      0      0      0        0     0
18      0       0         0       0      0      0      0        0     1
19      0       0         0       0      0      0      0        0     0

[20 rows x 74 columns]
```

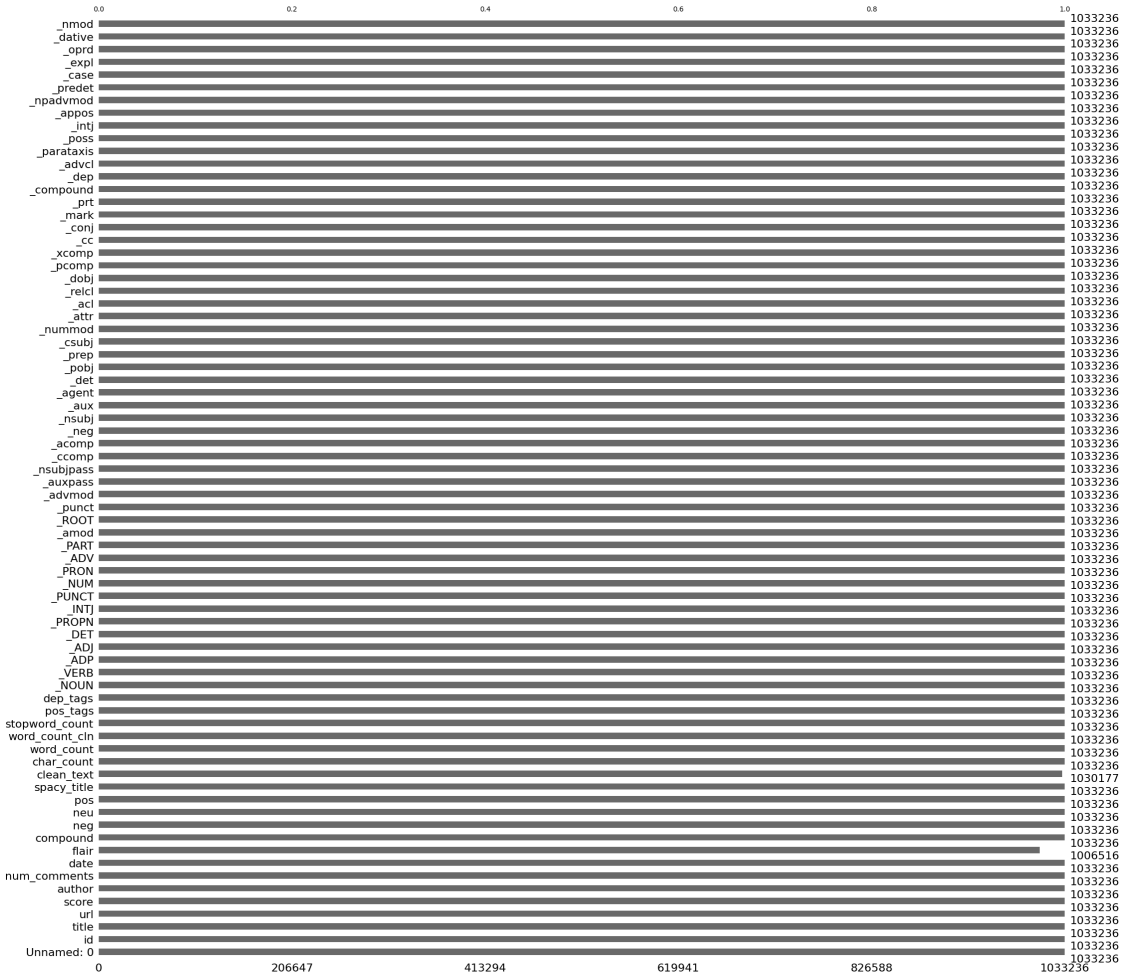
[ ]:
```
msno.matrix(sentiment_df)
```

[ ]:
```
<AxesSubplot:>
```



[ ]:
```
msno.bar(sentiment_df)
```

[ ]: <AxesSubplot:>



[ ]:
```
sentiment_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1033236 entries, 0 to 1033235
Data columns (total 74 columns):
 #   Column          Non-Null Count    Dtype
---  ------          --------------    -----
 0   Unnamed: 0      1033236 non-null  int64
 1   id              1033236 non-null  object
 2   title           1033236 non-null  object
 3   url             1033236 non-null  object
 4   score           1033236 non-null  float64
 5   author          1033236 non-null  object
 6   num_comments    1033236 non-null  float64
 7   date            1033236 non-null  object
 8   flair           1006516 non-null  object
 9   compound        1033236 non-null  float64
 10  neg             1033236 non-null  float64
 11  neu             1033236 non-null  float64
 12  pos             1033236 non-null  float64
 13  spacy_title     1033236 non-null  object
 14  clean_text      1030177 non-null  object
 15  char_count      1033236 non-null  int64
 16  word_count      1033236 non-null  int64
 17  word_count_cln  1033236 non-null  int64
 18  stopword_count  1033236 non-null  int64
 19  pos_tags        1033236 non-null  object
 20  dep_tags        1033236 non-null  object
 21  _NOUN           1033236 non-null  int64
 22  _VERB           1033236 non-null  int64
 23  _ADP            1033236 non-null  int64
 24  _ADJ            1033236 non-null  int64
 25  _DET            1033236 non-null  int64
 26  _PROPN          1033236 non-null  int64
 27  _INTJ           1033236 non-null  int64
 28  _PUNCT          1033236 non-null  int64
 29  _NUM            1033236 non-null  int64
 30  _PRON           1033236 non-null  int64
 31  _ADV            1033236 non-null  int64
 32  _PART           1033236 non-null  int64
 33  _amod           1033236 non-null  int64
 34  _ROOT           1033236 non-null  int64
 35  _punct          1033236 non-null  int64
 36  _advmod         1033236 non-null  int64
 37  _auxpass        1033236 non-null  int64
 38  _nsubjpass      1033236 non-null  int64
```

```
 39  _ccomp          1033236 non-null  int64
 40  _acomp          1033236 non-null  int64
 41  _neg            1033236 non-null  int64
 42  _nsubj          1033236 non-null  int64
 43  _aux            1033236 non-null  int64
 44  _agent          1033236 non-null  int64
 45  _det            1033236 non-null  int64
 46  _pobj           1033236 non-null  int64
 47  _prep           1033236 non-null  int64
 48  _csubj          1033236 non-null  int64
 49  _nummod         1033236 non-null  int64
 50  _attr           1033236 non-null  int64
 51  _acl            1033236 non-null  int64
 52  _relcl          1033236 non-null  int64
 53  _dobj           1033236 non-null  int64
 54  _pcomp          1033236 non-null  int64
 55  _xcomp          1033236 non-null  int64
 56  _cc             1033236 non-null  int64
 57  _conj           1033236 non-null  int64
 58  _mark           1033236 non-null  int64
 59  _prt            1033236 non-null  int64
 60  _compound       1033236 non-null  int64
 61  _dep            1033236 non-null  int64
 62  _advcl          1033236 non-null  int64
 63  _parataxis      1033236 non-null  int64
 64  _poss           1033236 non-null  int64
 65  _intj           1033236 non-null  int64
 66  _appos          1033236 non-null  int64
 67  _npadvmod       1033236 non-null  int64
 68  _predet         1033236 non-null  int64
 69  _case           1033236 non-null  int64
 70  _expl           1033236 non-null  int64
 71  _oprd           1033236 non-null  int64
 72  _dative         1033236 non-null  int64
 73  _nmod           1033236 non-null  int64
dtypes: float64(6), int64(58), object(10)
memory usage: 583.3+ MB
```

[ ]:
```
sentiment_df.describe().T
```

[ ]:
```
                 count           mean             std     min        25%  \
Unnamed: 0    1033236.0  516617.500000  298269.685706  0.0000  258308.75
score         1033236.0       3.486193      93.732797  0.0000       1.00
num_comments  1033236.0      12.269418     107.590595  0.0000       1.00
compound      1033236.0       0.152268       0.419748 -0.9963       0.00
neg           1033236.0       0.067381       0.147753  0.0000       0.00
…                   …              …              …       …          …
```

```
_case          1033236.0       0.039243       0.200817  0.0000       0.00
_expl          1033236.0       0.006203       0.081620  0.0000       0.00
_oprd          1033236.0       0.004941       0.081326  0.0000       0.00
_dative        1033236.0       0.014138       0.121439  0.0000       0.00
_nmod          1033236.0       0.145191       0.925120  0.0000       0.00

                    50%           75%        max
Unnamed: 0     516617.5  774926.2500  1033235.0
score               1.0       1.0000    59578.0
num_comments        5.0      10.0000    36189.0
compound            0.0       0.4574        1.0
neg                 0.0       0.0590        1.0
…                   …            …          …
_case                0.0       0.0000       20.0
_expl                0.0       0.0000        3.0
_oprd                0.0       0.0000       11.0
_dative              0.0       0.0000        4.0
_nmod                0.0       0.0000      148.0

[64 rows x 8 columns]
```

[ ]:
```
sentiment_df.shape
```

[ ]:
```
(1033236, 74)
```

[ ]:
```
sentiment_df['date'] = pd.to_datetime(sentiment_df['date'])
```

[ ]:
```
sentiment_df_small = sentiment_df[["id", "date", "score", "num_comments",␣
 ↪"compound", "neg", "neu", "pos", "word_count_cln"]]
sentiment_df_small.head(20)
```

[ ]:
```
        id       date  score  num_comments  compound    neg    neu    pos  \
0   kqfajb 2021-01-04    1.0           9.0    0.9872  0.000  0.189  0.811
1   kqjh2t 2021-01-04    1.0           1.0    0.9906  0.000  0.079  0.921
2   kqvp7l 2021-01-05    1.0           6.0    0.5319  0.000  0.744  0.256
3   krcwch 2021-01-05    1.0           4.0   -0.2960  0.115  0.885  0.000
4   krnthg 2021-01-06    1.0          10.0    0.0000  0.000  1.000  0.000
5   kryizd 2021-01-06    1.0          15.0    0.7777  0.107  0.516  0.377
6   kuo3w1 2021-01-10    1.0          16.0    0.9667  0.000  0.392  0.608
7   kv1t51 2021-01-11    1.0           6.0    0.0000  0.000  1.000  0.000
8   kv1w9e 2021-01-11    1.0          20.0    0.0000  0.000  1.000  0.000
9   kv3vrm 2021-01-11    1.0           1.0    0.9517  0.000  0.423  0.577
10  kv671o 2021-01-11    2.0          11.0    0.0000  0.000  1.000  0.000
11  kvvchb 2021-01-12    1.0          16.0   -0.2732  0.160  0.840  0.000
12  kvw83z 2021-01-12    2.0           8.0    0.0000  0.000  1.000  0.000
13  kwespl 2021-01-13    1.0           3.0    0.0000  0.000  1.000  0.000
14  kwevqp 2021-01-13    1.0           0.0    0.4588  0.000  0.625  0.375
```

```
15  kwiuqj 2021-01-13    1.0          11.0    0.0000  0.000  1.000  0.000
16  kwj6sc 2021-01-13    2.0          11.0    0.4588  0.000  0.571  0.429
17  kwjdpe 2021-01-13    3.0          21.0    0.0000  0.000  1.000  0.000
18  kwk6hs 2021-01-13    1.0           2.0   -0.3291  0.281  0.719  0.000
19  kwkpzp 2021-01-13    1.0          18.0    0.0000  0.000  1.000  0.000

    word_count_cln
0                8
1               10
2                6
3                5
4                4
5                9
6               11
7                4
8                6
9               10
10               3
11               8
12               7
13               4
14               5
15               3
16               4
17               2
18               4
19               4
```

[ ]:
```
sentiment_df_small.drop_duplicates(keep='first', inplace=True)
```

```
c:\Users\ac253\anaconda3\envs\NLXIndAssign\lib\site-
packages\pandas\util\_decorators.py:311: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  return func(*args, **kwargs)
```

[ ]:
```
COMMENT_THRESHOLD = 20
SCORE_THRESHOLD = 10



sentiment_df_small_filtered =␣
 ↪sentiment_df_small[~((sentiment_df_small['num_comments'] <␣
 ↪COMMENT_THRESHOLD) & (sentiment_df_small['score'] < SCORE_THRESHOLD))]
```

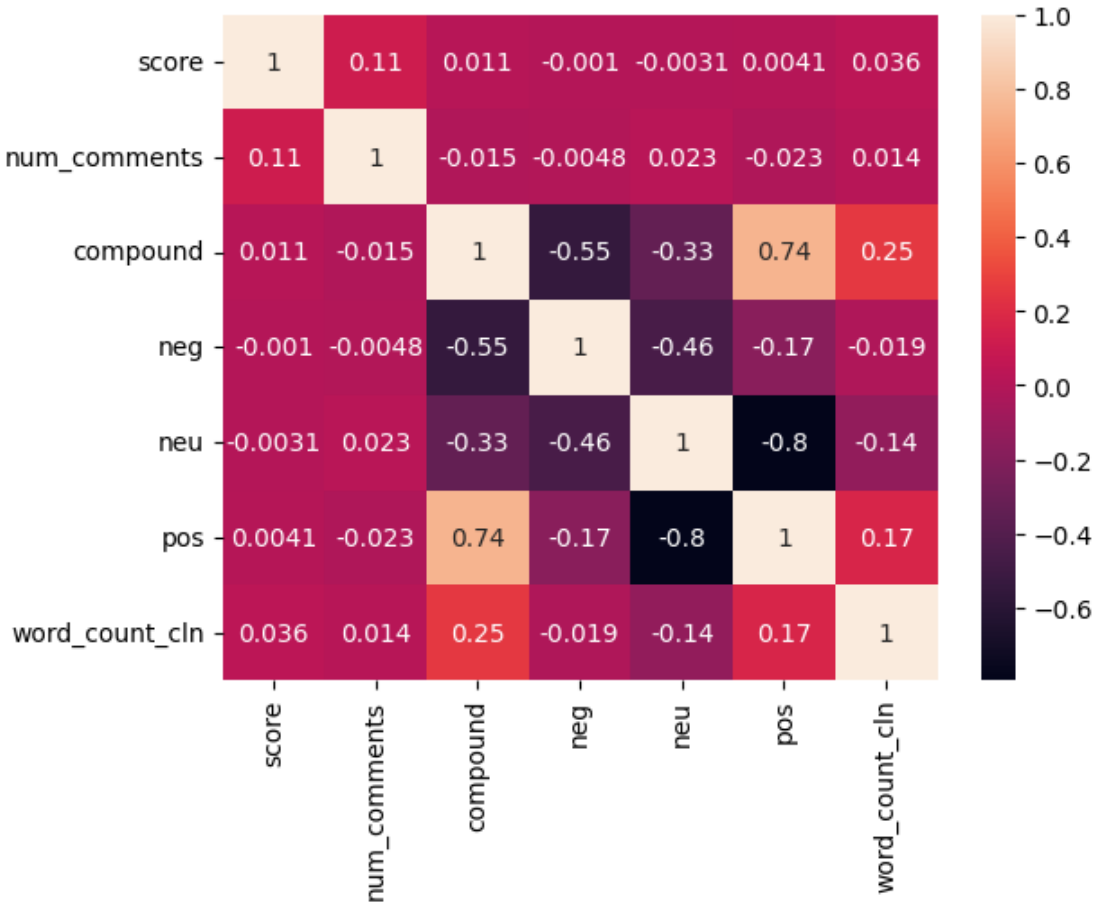
[ ]:
```
sentiment_df_small_filtered.corr()
```

[ ]:

	score	num_comments	compound	neg	neu	pos	word_count_cln
score	1.000000	0.111392	0.011317	-0.001022	-0.003050	0.004087	0.036296
num_comments	0.111392	1.000000	-0.015103	-0.004770	0.023305	-0.022605	0.013539
compound	0.011317	-0.015103	1.000000	-0.545647	-0.334265	0.742323	0.249631
neg	-0.001022	-0.004770	-0.545647	1.000000	-0.459173	-0.171917	-0.018922
neu	-0.003050	0.023305	-0.334265	-0.459173	1.000000	-0.796181	-0.137241
pos	0.004087	-0.022605	0.742323	-0.171917	-0.796181	1.000000	0.165082
word_count_cln	0.036296	0.013539	0.249631	-0.018922	-0.137241	0.165082	1.000000

[ ]:
```
sns.heatmap(sentiment_df_small_filtered.corr(), annot=True)
```

[ ]: <AxesSubplot:>



[ ]:
```
sentiment_df_small_filtered.sort_values(by='date', ascending=True, inplace=True)

sentiment_df_small_filtered.head(20)
```

```
c:\Users\ac253\anaconda3\envs\NLXIndAssign\lib\site-
packages\pandas\util\_decorators.py:311: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  return func(*args, **kwargs)
```

[ ]:

	id	date	score	num_comments	compound	neg	neu	pos	\
8	kv1w9e	2021-01-11	1.0	20.0	0.0000	0.000	1.000	0.000	
17	kwjdpe	2021-01-13	3.0	21.0	0.0000	0.000	1.000	0.000	
35	kxkkt4	2021-01-14	1.0	29.0	0.0000	0.000	1.000	0.000	
50	kym7ae	2021-01-16	1.0	21.0	0.0000	0.000	1.000	0.000	
51	kyodi5	2021-01-16	2.0	34.0	0.0000	0.000	1.000	0.000	
54	kzf5mz	2021-01-17	1.0	27.0	0.2263	0.000	0.513	0.487	
57	kzl3ne	2021-01-17	1.0	93.0	0.7698	0.082	0.617	0.301	
75	l0lcji	2021-01-19	1.0	21.0	-0.2235	0.239	0.761	0.000	
77	l0lnju	2021-01-19	2.0	20.0	0.3736	0.000	0.661	0.339	
82	l17ic7	2021-01-20	1.0	99.0	0.3595	0.000	0.707	0.293	
88	l1n3vd	2021-01-20	1.0	55.0	0.4215	0.000	0.417	0.583	
111	l2ghnr	2021-01-21	1.0	34.0	0.0000	0.000	1.000	0.000	
101	l279ha	2021-01-21	1.0	41.0	0.2263	0.130	0.683	0.186	
113	l2gidg	2021-01-21	1.0	151.0	-0.0191	0.118	0.882	0.000	
97	l22r5n	2021-01-21	1.0	20.0	0.0000	0.000	1.000	0.000	
99	l23tfb	2021-01-21	1.0	74.0	0.0000	0.000	1.000	0.000	
209	l32wjw	2021-01-22	1.0	29.0	0.1027	0.000	0.851	0.149	
201	l2yya7	2021-01-22	1.0	25.0	0.0000	0.000	1.000	0.000	
197	l2y0ax	2021-01-22	1.0	37.0	0.0000	0.000	1.000	0.000	
184	l2uiiq	2021-01-22	1.0	22.0	0.0000	0.000	1.000	0.000	

	word_count_cln
8	6
17	2
35	2
50	3
51	6
54	1
57	11
75	3
77	4
82	7

```
88                3
111               1
101               9
113               5
97                2
99                4
209               3
201               2
197               2
184               4
```

[ ]:
```
sentiment_df_small_filtered.describe().T
```

[ ]:
```
                 count       mean         std     min     25%     50%  \
score          42293.0  57.638333  459.860480  0.0000   1.000   2.000
num_comments   42293.0  71.889698  483.535857  0.0000  15.000  27.000
compound       42293.0   0.143395    0.433773 -0.9873   0.000   0.000
neg            42293.0   0.067591    0.135754  0.0000   0.000   0.000
neu            42293.0   0.791068    0.221022  0.0000   0.653   0.827
pos            42293.0   0.141341    0.199313  0.0000   0.000   0.000
word_count_cln 42293.0   7.262951    6.070378  0.0000   3.000   6.000

                   75%      max
score          20.0000  59578.0
num_comments   50.0000  36189.0
compound        0.4574      1.0
neg             0.0860      1.0
neu             1.0000      1.0
pos             0.2390      1.0
word_count_cln  9.0000    141.0
```

[ ]:
```
#Calculate weighted sentiment scores using 'num_comments' as the weight
sentiment_df_small_filtered['weighted_compound'] =␣
 ↪sentiment_df_small_filtered['compound'] *␣
 ↪sentiment_df_small_filtered['num_comments']
sentiment_df_small_filtered['weighted_neg'] =␣
 ↪sentiment_df_small_filtered['neg'] *␣
 ↪sentiment_df_small_filtered['num_comments']
sentiment_df_small_filtered['weighted_neu'] =␣
 ↪sentiment_df_small_filtered['neu'] *␣
 ↪sentiment_df_small_filtered['num_comments']
sentiment_df_small_filtered['weighted_pos'] =␣
 ↪sentiment_df_small_filtered['pos'] *␣
 ↪sentiment_df_small_filtered['num_comments']

# Calculate weighted sentiment scores using 'score' as the weight
```

```
#filtered_df['weighted_compound_score'] = filtered_df['compound'] *␣
 ↪filtered_df['score']
#filtered_df['weighted_neg_score'] = filtered_df['neg'] * filtered_df['score']
#filtered_df['weighted_neu_score'] = filtered_df['neu'] * filtered_df['score']
#filtered_df['weighted_pos_score'] = filtered_df['pos'] * filtered_df['score']
```

```
c:\Users\ac253\anaconda3\envs\NLXIndAssign\lib\site-
packages\ipykernel_launcher.py:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy

c:\Users\ac253\anaconda3\envs\NLXIndAssign\lib\site-
packages\ipykernel_launcher.py:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  This is separate from the ipykernel package so we can avoid doing imports
until
c:\Users\ac253\anaconda3\envs\NLXIndAssign\lib\site-
packages\ipykernel_launcher.py:4: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  after removing the cwd from sys.path.
c:\Users\ac253\anaconda3\envs\NLXIndAssign\lib\site-
packages\ipykernel_launcher.py:5: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  """
```

[ ]:
```
sentiment_df_sorted_grouped = sentiment_df_small_filtered.groupby('date').agg({
    'weighted_compound': 'sum',
    'weighted_neg': 'sum',
    'weighted_neu': 'sum',
    'weighted_pos': 'sum',
    'num_comments': 'sum',
    'score': 'sum'
```

```
}).reset_index()

# Calculate the weighted average sentiment for each day
sentiment_df_sorted_grouped['avg_weighted_compound'] =␣
 ↪sentiment_df_sorted_grouped['weighted_compound'] /␣
 ↪sentiment_df_sorted_grouped['num_comments']
sentiment_df_sorted_grouped['avg_weighted_neg'] =␣
 ↪sentiment_df_sorted_grouped['weighted_neg'] /␣
 ↪sentiment_df_sorted_grouped['num_comments']
sentiment_df_sorted_grouped['avg_weighted_neu'] =␣
 ↪sentiment_df_sorted_grouped['weighted_neu'] /␣
 ↪sentiment_df_sorted_grouped['num_comments']
sentiment_df_sorted_grouped['avg_weighted_pos'] =␣
 ↪sentiment_df_sorted_grouped['weighted_pos'] /␣
 ↪sentiment_df_sorted_grouped['num_comments']

sentiment_df_sorted_grouped.replace([np.inf, -np.inf], np.nan, inplace=True)
sentiment_df_sorted_grouped.fillna(0, inplace=True)
```

[ ]:
```
sentiment_df_sorted_grouped.drop(['weighted_compound', 'weighted_neg',␣
 ↪'weighted_neu', 'weighted_pos'], axis=1, inplace=True)
```

[ ]:
```
sentiment_df_sorted_grouped.head(321)
```

[ ]:

	date	num_comments	score	avg_weighted_compound	\
0	2021-01-11	20.0	1.0	0.000000	
1	2021-01-13	21.0	3.0	0.000000	
2	2021-01-14	29.0	1.0	0.000000	
3	2021-01-16	55.0	3.0	0.000000	
4	2021-01-17	120.0	2.0	0.647513	
..	…	…	…	…	
310	2021-12-07	6525.0	94232.0	0.273822	
311	2021-12-08	8014.0	61115.0	0.151607	
312	2021-12-09	3079.0	223.0	0.055083	
313	2021-12-10	4042.0	38.0	0.036775	
314	2021-12-11	1089.0	21.0	0.162347	

	avg_weighted_neg	avg_weighted_neu	avg_weighted_pos
0	0.000000	1.000000	0.000000
1	0.000000	1.000000	0.000000
2	0.000000	1.000000	0.000000
3	0.000000	1.000000	0.000000
4	0.063550	0.593600	0.342850
..	…	…	…
310	0.032083	0.820205	0.147717
311	0.064720	0.796248	0.139005
312	0.077695	0.823520	0.098805

```
313          0.062924          0.828005          0.109101
314          0.095837          0.727529          0.176634

[315 rows x 7 columns]
```

[ ]:
```
df_sentiment = sentiment_df_sorted_grouped.copy()
```

[ ]:
```
print(df_sentiment.describe().T)

print(df_sentiment.info())
```

```
                        count         mean           std       min  \
num_comments            315.0  9652.161905  18148.196675  20.00000
score                   315.0  7738.723810  39802.678301   1.00000
avg_weighted_compound   315.0     0.116886      0.111505  -0.30384
avg_weighted_neg        315.0     0.057419      0.030174   0.00000
avg_weighted_neu        315.0     0.825728      0.056186   0.59360
avg_weighted_pos        315.0     0.116855      0.050353   0.00000

                                25%          50%          75%            max
num_comments            2930.500000  4139.000000  7258.500000  126073.000000
score                     38.000000    48.000000   118.000000  326417.000000
avg_weighted_compound      0.044810     0.107659     0.176825       0.647513
avg_weighted_neg           0.036539     0.053241     0.074756       0.172550
avg_weighted_neu           0.793531     0.831066     0.857269       1.000000
avg_weighted_pos           0.088418     0.109541     0.141377       0.396571
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 315 entries, 0 to 314
Data columns (total 7 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   date                   315 non-null    datetime64[ns]
 1   num_comments           315 non-null    float64
 2   score                  315 non-null    float64
 3   avg_weighted_compound  315 non-null    float64
 4   avg_weighted_neg       315 non-null    float64
 5   avg_weighted_neu       315 non-null    float64
 6   avg_weighted_pos       315 non-null    float64
dtypes: datetime64[ns](1), float64(6)
memory usage: 17.4 KB
None
```

[ ]:
```
combined_df = pd.merge(df, df_sentiment, left_on='Date', right_on='date',␣
↪how='left')
combined_df.drop(columns=['date'], inplace=True) # Drop the duplicate 'date'␣
↪column
```

```
combined_df.fillna(method='ffill', inplace=True) # Forward fill any missing values
```

[ ]:
```
combined_df.dropna(inplace=True)
combined_df.reset_index(drop=True, inplace=True)
combined_df.drop(columns=['Open', 'High', 'Low', 'Adj Close', 'Volume'], inplace=True)

combined_df['Closing Price'] = combined_df['Close']
combined_df.drop(columns=['Close'], inplace=True)
```

[ ]:
```
combined_df.head(20)
```

[ ]:

	Date	num_comments	score	avg_weighted_compound	avg_weighted_neg	avg_weighted_neu	avg_weighted_pos	Closing Price
0	2021-01-11	20.0	1.0	0.000000	0.000000	1.000000	0.000000	4.985000
1	2021-01-12	20.0	1.0	0.000000	0.000000	1.000000	0.000000	4.987500
2	2021-01-13	21.0	3.0	0.000000	0.000000	1.000000	0.000000	7.850000
3	2021-01-14	29.0	1.0	0.000000	0.000000	1.000000	0.000000	9.977500
4	2021-01-15	29.0	1.0	0.000000	0.000000	1.000000	0.000000	8.875000
5	2021-01-19	41.0	3.0	0.067768	0.122415	0.712220	0.165366	9.840000
6	2021-01-20	154.0	2.0	0.381643	0.000000	0.603429	0.396571	9.780000
7	2021-01-21	320.0	5.0	0.019982	0.072337	0.903703	0.023831	10.757500
8	2021-01-22	1002.0	11.0	0.046663	0.000000	0.957446	0.042554	16.252501
9	2021-01-25	23.0	1.0	0.000000	0.000000	1.000000	0.000000	19.197500
10	2021-01-26	49.0	2.0	0.495867	0.000000	0.607653	0.392347	36.994999
11	2021-01-27	6909.0	7226.0	-0.019640	0.172550			
12	2021-01-28	3600.0	698.0	0.173934	0.091738			
13	2021-01-29	2562.0	34.0	0.299951	0.023989			
14	2021-02-01	7656.0	18318.0	0.301093	0.064267			
15	2021-02-02	10298.0	16992.0	0.018219	0.114838			
16	2021-02-03	7277.0	25883.0	0.171981	0.072968			
17	2021-02-04	4848.0	19107.0	0.190835	0.087177			
18	2021-02-05	4848.0	19107.0	0.190835	0.087177			
19	2021-02-08	5404.0	96.0	0.088856	0.070751			

```
11          0.690390          0.137093      86.877502
12          0.760290          0.147961      48.400002
13          0.743922          0.232089      81.250000
14          0.695509          0.240199      56.250000
15          0.755255          0.130032      22.500000
16          0.796117          0.130924      23.102501
17          0.718488          0.194314      13.375000
18          0.718488          0.194314      15.942500
19          0.828765          0.100487      15.000000
```

[ ]:
```
print(combined_df.shape)

print(combined_df.info())
```

```
(246, 8)
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 246 entries, 0 to 245
Data columns (total 8 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   Date                   246 non-null    datetime64[ns]
 1   num_comments           246 non-null    float64
 2   score                  246 non-null    float64
 3   avg_weighted_compound  246 non-null    float64
 4   avg_weighted_neg       246 non-null    float64
 5   avg_weighted_neu       246 non-null    float64
 6   avg_weighted_pos       246 non-null    float64
 7   Closing Price          246 non-null    float64
dtypes: datetime64[ns](1), float64(7)
memory usage: 15.5 KB
None
```

[ ]:
```
combined_df['Date'] = pd.to_datetime(combined_df['Date'])
```

[ ]:
```
train_indices = combined_df[combined_df["Date"] <= TRAIN_END_DATE].index
test_indices = combined_df[(combined_df["Date"] > TRAIN_END_DATE) &␣
 ↪(combined_df["Date"] <= TEST_END_DATE)].index
```

combined_train_df = combined_df[combined_df.index <= pd.to_datetime(TRAIN_END_DATE)]
combined_test_df = combined_df[(combined_df.index > pd.to_datetime(TRAIN_END_DATE))
& (combined_df.index <= pd.to_datetime(TEST_END_DATE))]

[ ]:
```
features = combined_df.drop(columns=['Date']) # Drop the 'Date' column
target = combined_df['Closing Price'] # Set the 'Closing Price' as the target␣
 ↪variable
```

[ ]:
```
scaler_new = MinMaxScaler(feature_range=(0, 1))
scaled_features = scaler_new.fit_transform(features)
```

```
scaled_target = scaler_new.fit_transform(target.values.reshape(-1, 1)).
 ↪flatten()  # Flatten to make it a 1D array
```

[ ]:
```
def create_train_sequences(features, target, sequence_length):
    X, y = [], []
    for i in range(len(features) - sequence_length):
        seq = features[i:i+sequence_length]  # Include closing price in features
        X.append(seq)
        y.append(target[i + sequence_length])  # Target is the closing price at␣
 ↪sequence_length ahead
    return np.array(X), np.array(y)
```

[ ]:
```
# Splitting the data
train_end = train_indices[-1] + 1
test_end = test_indices[-1] + 1

# Creating training sequences
X_train, y_train = create_train_sequences(scaled_features[:train_end],␣
 ↪scaled_target[:train_end], SEQUENCE_LENGTH)

# Creating testing sequences
# For X_test, we want to exclude the closing price
X_test, y_test = create_train_sequences(scaled_features[train_end:test_end],␣
 ↪scaled_target[train_end:test_end], SEQUENCE_LENGTH)

y_train = y_train.reshape(-1, 1)
y_test = y_test.reshape(-1, 1)
```

[ ]:
```
X_train.shape, y_train.shape
```

[ ]:
```
((87, 10, 7), (87, 1))
```

[ ]:
```
X_test.shape, y_test.shape
```

[ ]:
```
((55, 10, 7), (55, 1))
```

[ ]:
```
def rmse(y_true, y_pred):
    return K.sqrt(K.mean(K.square(y_pred - y_true)))
```

lstm_model = Sequential([LSTM(units=64, activation="relu", return_sequences=True, input_shape=(X_train.shape[1], X_train.shape[2]), kernel_regularizer=l2(0.001)), Dropout(0.3), BatchNormalization(),

```
LSTM(units=32, activation="relu", kernel_regularizer=l2(0.001)),
Dropout(0.3),
BatchNormalization(),
```

```
Dense(units=64, activation="relu", kernel_regularizer=l2(0.001)),
Dropout(0.3),
BatchNormalization(),


Dense(units=1)

])
```

lstm_model = Sequential([LSTM(units=50, activation="relu", return_sequences=True, input_shape=(X_train.shape[1], X_train.shape[2])), Dropout(0.2), LSTM(units=50, activation="relu"), # Note: return_sequences is False by default Dropout(0.2), Dense(units=100, activation="relu"), # Additional Dense layer with 100 units Dropout(0.2), Dense(units=50, activation="relu"), # Additional Dense layer with 50 units Dropout(0.2), Dense(units=1) # Output layer predicting a single value])

lstm_model_simplified = Sequential([LSTM(units=32, activation="relu", input_shape=(X_train.shape[1], X_train.shape[2])), Dropout(0.2), Dense(units=1)])

[ ]:
```
lstm_model = Sequential([
    LSTM(units=50, activation="relu", return_sequences=True,␣
 ↪input_shape=(X_train.shape[1], X_train.shape[2])),
    Dropout(0.2),
    LSTM(units=50, activation="relu", return_sequences=True),
    Dropout(0.2),
    Dense(units=100, activation="relu"),
    Dropout(0.2),
    Dense(units=50, activation="sigmoid"),
    Dropout(0.2),
    Dense(units=1)
])

# Optimizer
learning_rate = 0.001
optimizer = tf.keras.optimizers.Adam(learning_rate=learning_rate)


lstm_model.compile(optimizer=optimizer, loss='mean_squared_error' ,␣
 ↪metrics=['mean_squared_error', rmse, 'mean_absolute_error',␣
 ↪'mean_absolute_percentage_error'])
```

```
WARNING:tensorflow:Layer lstm_3 will not use cuDNN kernels since it doesn't meet
the criteria. It will use a generic GPU kernel as fallback when running on GPU.
WARNING:tensorflow:Layer lstm_4 will not use cuDNN kernels since it doesn't meet
the criteria. It will use a generic GPU kernel as fallback when running on GPU.
```

[ ]:
```
history = lstm_model.fit(
    X_train, y_train,
    epochs=500,
```

```
    batch_size=32,
    verbose=1
)
```

```
Epoch 1/500
3/3 [==============================] - 4s 95ms/step - loss: 1.2496 -
mean_squared_error: 1.2496 - rmse: 1.1149 - mean_absolute_error: 1.0447 -
mean_absolute_percentage_error: 330.1769
Epoch 2/500
3/3 [==============================] - 0s 92ms/step - loss: 1.1227 -
mean_squared_error: 1.1227 - rmse: 1.0543 - mean_absolute_error: 0.9876 -
mean_absolute_percentage_error: 303.3459
Epoch 3/500
3/3 [==============================] - 0s 107ms/step - loss: 0.9167 -
mean_squared_error: 0.9167 - rmse: 0.9399 - mean_absolute_error: 0.8763 -
mean_absolute_percentage_error: 261.5468
Epoch 4/500
3/3 [==============================] - 0s 117ms/step - loss: 0.6905 -
mean_squared_error: 0.6905 - rmse: 0.8259 - mean_absolute_error: 0.7430 -
mean_absolute_percentage_error: 223.8874
Epoch 5/500
3/3 [==============================] - 0s 93ms/step - loss: 0.4926 -
mean_squared_error: 0.4926 - rmse: 0.6866 - mean_absolute_error: 0.6031 -
mean_absolute_percentage_error: 177.9195
Epoch 6/500
3/3 [==============================] - 0s 91ms/step - loss: 0.3269 -
mean_squared_error: 0.3269 - rmse: 0.5655 - mean_absolute_error: 0.4667 -
mean_absolute_percentage_error: 143.6940
Epoch 7/500
3/3 [==============================] - 0s 89ms/step - loss: 0.2413 -
mean_squared_error: 0.2413 - rmse: 0.4896 - mean_absolute_error: 0.3962 -
mean_absolute_percentage_error: 138.9284
Epoch 8/500
3/3 [==============================] - 0s 102ms/step - loss: 0.2862 -
mean_squared_error: 0.2862 - rmse: 0.5350 - mean_absolute_error: 0.4383 -
mean_absolute_percentage_error: 162.2817
Epoch 9/500
3/3 [==============================] - 0s 98ms/step - loss: 0.2285 -
mean_squared_error: 0.2285 - rmse: 0.4736 - mean_absolute_error: 0.3855 -
mean_absolute_percentage_error: 145.5161
Epoch 10/500
3/3 [==============================] - 0s 97ms/step - loss: 0.1947 -
mean_squared_error: 0.1947 - rmse: 0.4372 - mean_absolute_error: 0.3506 -
mean_absolute_percentage_error: 131.8620
Epoch 11/500
3/3 [==============================] - 0s 114ms/step - loss: 0.1966 -
mean_squared_error: 0.1966 - rmse: 0.4439 - mean_absolute_error: 0.3540 -
mean_absolute_percentage_error: 129.2665
```

```
Epoch 12/500
3/3 [==============================] - 0s 112ms/step - loss: 0.1958 -
mean_squared_error: 0.1958 - rmse: 0.4411 - mean_absolute_error: 0.3454 -
mean_absolute_percentage_error: 121.0130
Epoch 13/500
3/3 [==============================] - 0s 108ms/step - loss: 0.1645 -
mean_squared_error: 0.1645 - rmse: 0.4048 - mean_absolute_error: 0.3259 -
mean_absolute_percentage_error: 118.4090
Epoch 14/500
3/3 [==============================] - 0s 111ms/step - loss: 0.1677 -
mean_squared_error: 0.1677 - rmse: 0.4094 - mean_absolute_error: 0.3250 -
mean_absolute_percentage_error: 127.5552
Epoch 15/500
3/3 [==============================] - 0s 121ms/step - loss: 0.1526 -
mean_squared_error: 0.1526 - rmse: 0.3901 - mean_absolute_error: 0.3125 -
mean_absolute_percentage_error: 114.7493
Epoch 16/500
3/3 [==============================] - 0s 93ms/step - loss: 0.1616 -
mean_squared_error: 0.1616 - rmse: 0.4018 - mean_absolute_error: 0.3192 -
mean_absolute_percentage_error: 123.0332
Epoch 17/500
3/3 [==============================] - 0s 93ms/step - loss: 0.1481 -
mean_squared_error: 0.1481 - rmse: 0.3830 - mean_absolute_error: 0.3040 -
mean_absolute_percentage_error: 123.7100
Epoch 18/500
3/3 [==============================] - 0s 96ms/step - loss: 0.1586 -
mean_squared_error: 0.1586 - rmse: 0.3988 - mean_absolute_error: 0.3145 -
mean_absolute_percentage_error: 127.5922
Epoch 19/500
3/3 [==============================] - 0s 90ms/step - loss: 0.1450 -
mean_squared_error: 0.1450 - rmse: 0.3801 - mean_absolute_error: 0.3046 -
mean_absolute_percentage_error: 117.8810
Epoch 20/500
3/3 [==============================] - 0s 116ms/step - loss: 0.1493 -
mean_squared_error: 0.1493 - rmse: 0.3841 - mean_absolute_error: 0.3107 -
mean_absolute_percentage_error: 126.9016
Epoch 21/500
3/3 [==============================] - 0s 114ms/step - loss: 0.1428 -
mean_squared_error: 0.1428 - rmse: 0.3745 - mean_absolute_error: 0.3053 -
mean_absolute_percentage_error: 118.5398
Epoch 22/500
3/3 [==============================] - 0s 100ms/step - loss: 0.1465 -
mean_squared_error: 0.1465 - rmse: 0.3814 - mean_absolute_error: 0.3083 -
mean_absolute_percentage_error: 119.9030
Epoch 23/500
3/3 [==============================] - 0s 92ms/step - loss: 0.1478 -
mean_squared_error: 0.1478 - rmse: 0.3830 - mean_absolute_error: 0.3078 -
mean_absolute_percentage_error: 120.7937
```

```
Epoch 24/500
3/3 [==============================] - 0s 86ms/step - loss: 0.1341 -
mean_squared_error: 0.1341 - rmse: 0.3660 - mean_absolute_error: 0.2901 -
mean_absolute_percentage_error: 113.6869
Epoch 25/500
3/3 [==============================] - 0s 80ms/step - loss: 0.1399 -
mean_squared_error: 0.1399 - rmse: 0.3733 - mean_absolute_error: 0.2987 -
mean_absolute_percentage_error: 112.7078
Epoch 26/500
3/3 [==============================] - 0s 84ms/step - loss: 0.1379 -
mean_squared_error: 0.1379 - rmse: 0.3719 - mean_absolute_error: 0.3021 -
mean_absolute_percentage_error: 120.6363
Epoch 27/500
3/3 [==============================] - 0s 89ms/step - loss: 0.1419 -
mean_squared_error: 0.1419 - rmse: 0.3761 - mean_absolute_error: 0.2998 -
mean_absolute_percentage_error: 120.7590
Epoch 28/500
3/3 [==============================] - 0s 94ms/step - loss: 0.1376 -
mean_squared_error: 0.1376 - rmse: 0.3705 - mean_absolute_error: 0.2933 -
mean_absolute_percentage_error: 117.3815
Epoch 29/500
3/3 [==============================] - 0s 80ms/step - loss: 0.1342 -
mean_squared_error: 0.1342 - rmse: 0.3668 - mean_absolute_error: 0.2892 -
mean_absolute_percentage_error: 114.1928
Epoch 30/500
3/3 [==============================] - 0s 96ms/step - loss: 0.1263 -
mean_squared_error: 0.1263 - rmse: 0.3545 - mean_absolute_error: 0.2807 -
mean_absolute_percentage_error: 107.7676
Epoch 31/500
3/3 [==============================] - 0s 102ms/step - loss: 0.1400 -
mean_squared_error: 0.1400 - rmse: 0.3754 - mean_absolute_error: 0.2957 -
mean_absolute_percentage_error: 114.3720
Epoch 32/500
3/3 [==============================] - 0s 87ms/step - loss: 0.1385 -
mean_squared_error: 0.1385 - rmse: 0.3735 - mean_absolute_error: 0.2977 -
mean_absolute_percentage_error: 121.1976
Epoch 33/500
3/3 [==============================] - 0s 74ms/step - loss: 0.1265 -
mean_squared_error: 0.1265 - rmse: 0.3537 - mean_absolute_error: 0.2836 -
mean_absolute_percentage_error: 111.7707
Epoch 34/500
3/3 [==============================] - 0s 79ms/step - loss: 0.1309 -
mean_squared_error: 0.1309 - rmse: 0.3619 - mean_absolute_error: 0.2871 -
mean_absolute_percentage_error: 113.9850
Epoch 35/500
3/3 [==============================] - 0s 93ms/step - loss: 0.1218 -
mean_squared_error: 0.1218 - rmse: 0.3443 - mean_absolute_error: 0.2756 -
mean_absolute_percentage_error: 104.4658
```

```
Epoch 36/500
3/3 [==============================] - 0s 108ms/step - loss: 0.1183 -
mean_squared_error: 0.1183 - rmse: 0.3440 - mean_absolute_error: 0.2727 -
mean_absolute_percentage_error: 101.8086
Epoch 37/500
3/3 [==============================] - 0s 83ms/step - loss: 0.1228 -
mean_squared_error: 0.1228 - rmse: 0.3497 - mean_absolute_error: 0.2736 -
mean_absolute_percentage_error: 103.3232
Epoch 38/500
3/3 [==============================] - 0s 87ms/step - loss: 0.1165 -
mean_squared_error: 0.1165 - rmse: 0.3405 - mean_absolute_error: 0.2770 -
mean_absolute_percentage_error: 108.2551
Epoch 39/500
3/3 [==============================] - 0s 78ms/step - loss: 0.1023 -
mean_squared_error: 0.1023 - rmse: 0.3193 - mean_absolute_error: 0.2524 -
mean_absolute_percentage_error: 96.5963
Epoch 40/500
3/3 [==============================] - 0s 91ms/step - loss: 0.1113 -
mean_squared_error: 0.1113 - rmse: 0.3337 - mean_absolute_error: 0.2622 -
mean_absolute_percentage_error: 99.5141
Epoch 41/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0996 -
mean_squared_error: 0.0996 - rmse: 0.3166 - mean_absolute_error: 0.2510 -
mean_absolute_percentage_error: 95.5688
Epoch 42/500
3/3 [==============================] - 0s 131ms/step - loss: 0.1031 -
mean_squared_error: 0.1031 - rmse: 0.3185 - mean_absolute_error: 0.2516 -
mean_absolute_percentage_error: 96.5194
Epoch 43/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0891 -
mean_squared_error: 0.0891 - rmse: 0.2944 - mean_absolute_error: 0.2342 -
mean_absolute_percentage_error: 96.1224
Epoch 44/500
3/3 [==============================] - 0s 87ms/step - loss: 0.0869 -
mean_squared_error: 0.0869 - rmse: 0.2949 - mean_absolute_error: 0.2340 -
mean_absolute_percentage_error: 91.2906
Epoch 45/500
3/3 [==============================] - 0s 93ms/step - loss: 0.0768 -
mean_squared_error: 0.0768 - rmse: 0.2791 - mean_absolute_error: 0.2190 -
mean_absolute_percentage_error: 86.0026
Epoch 46/500
3/3 [==============================] - 0s 90ms/step - loss: 0.0740 -
mean_squared_error: 0.0740 - rmse: 0.2730 - mean_absolute_error: 0.2149 -
mean_absolute_percentage_error: 82.7703
Epoch 47/500
3/3 [==============================] - 0s 88ms/step - loss: 0.0759 -
mean_squared_error: 0.0759 - rmse: 0.2754 - mean_absolute_error: 0.2135 -
mean_absolute_percentage_error: 90.0336
```

```
Epoch 48/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0699 -
mean_squared_error: 0.0699 - rmse: 0.2624 - mean_absolute_error: 0.2069 -
mean_absolute_percentage_error: 86.7425
Epoch 49/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0690 -
mean_squared_error: 0.0690 - rmse: 0.2638 - mean_absolute_error: 0.2015 -
mean_absolute_percentage_error: 83.7131
Epoch 50/500
3/3 [==============================] - 0s 95ms/step - loss: 0.0653 -
mean_squared_error: 0.0653 - rmse: 0.2542 - mean_absolute_error: 0.1989 -
mean_absolute_percentage_error: 81.4404
Epoch 51/500
3/3 [==============================] - 0s 100ms/step - loss: 0.0633 -
mean_squared_error: 0.0633 - rmse: 0.2502 - mean_absolute_error: 0.1946 -
mean_absolute_percentage_error: 81.5826
Epoch 52/500
3/3 [==============================] - 0s 99ms/step - loss: 0.0611 -
mean_squared_error: 0.0611 - rmse: 0.2487 - mean_absolute_error: 0.1913 -
mean_absolute_percentage_error: 81.4371
Epoch 53/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0592 -
mean_squared_error: 0.0592 - rmse: 0.2448 - mean_absolute_error: 0.1888 -
mean_absolute_percentage_error: 74.6161
Epoch 54/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0568 -
mean_squared_error: 0.0568 - rmse: 0.2377 - mean_absolute_error: 0.1827 -
mean_absolute_percentage_error: 76.1303
Epoch 55/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0571 -
mean_squared_error: 0.0571 - rmse: 0.2391 - mean_absolute_error: 0.1833 -
mean_absolute_percentage_error: 77.9247
Epoch 56/500
3/3 [==============================] - 0s 98ms/step - loss: 0.0493 -
mean_squared_error: 0.0493 - rmse: 0.2195 - mean_absolute_error: 0.1701 -
mean_absolute_percentage_error: 71.5931
Epoch 57/500
3/3 [==============================] - 0s 103ms/step - loss: 0.0477 -
mean_squared_error: 0.0477 - rmse: 0.2200 - mean_absolute_error: 0.1675 -
mean_absolute_percentage_error: 67.2519
Epoch 58/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0475 -
mean_squared_error: 0.0475 - rmse: 0.2172 - mean_absolute_error: 0.1705 -
mean_absolute_percentage_error: 66.2485
Epoch 59/500
3/3 [==============================] - 0s 86ms/step - loss: 0.0477 -
mean_squared_error: 0.0477 - rmse: 0.2167 - mean_absolute_error: 0.1645 -
mean_absolute_percentage_error: 66.5066
```

```
Epoch 60/500
3/3 [==============================] - 0s 101ms/step - loss: 0.0457 -
mean_squared_error: 0.0457 - rmse: 0.2122 - mean_absolute_error: 0.1632 -
mean_absolute_percentage_error: 68.5484
Epoch 61/500
3/3 [==============================] - 0s 85ms/step - loss: 0.0449 -
mean_squared_error: 0.0449 - rmse: 0.2137 - mean_absolute_error: 0.1628 -
mean_absolute_percentage_error: 67.0642
Epoch 62/500
3/3 [==============================] - 0s 82ms/step - loss: 0.0487 -
mean_squared_error: 0.0487 - rmse: 0.2218 - mean_absolute_error: 0.1676 -
mean_absolute_percentage_error: 65.7210
Epoch 63/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0417 -
mean_squared_error: 0.0417 - rmse: 0.2005 - mean_absolute_error: 0.1553 -
mean_absolute_percentage_error: 62.1864
Epoch 64/500
3/3 [==============================] - 0s 90ms/step - loss: 0.0438 -
mean_squared_error: 0.0438 - rmse: 0.2083 - mean_absolute_error: 0.1617 -
mean_absolute_percentage_error: 63.6750
Epoch 65/500
3/3 [==============================] - 0s 89ms/step - loss: 0.0445 -
mean_squared_error: 0.0445 - rmse: 0.2094 - mean_absolute_error: 0.1574 -
mean_absolute_percentage_error: 60.6272
Epoch 66/500
3/3 [==============================] - 0s 92ms/step - loss: 0.0421 -
mean_squared_error: 0.0421 - rmse: 0.2074 - mean_absolute_error: 0.1576 -
mean_absolute_percentage_error: 61.7876
Epoch 67/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0391 -
mean_squared_error: 0.0391 - rmse: 0.1953 - mean_absolute_error: 0.1529 -
mean_absolute_percentage_error: 59.7419
Epoch 68/500
3/3 [==============================] - 0s 105ms/step - loss: 0.0374 -
mean_squared_error: 0.0374 - rmse: 0.1944 - mean_absolute_error: 0.1450 -
mean_absolute_percentage_error: 58.2265
Epoch 69/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0378 -
mean_squared_error: 0.0378 - rmse: 0.1960 - mean_absolute_error: 0.1469 -
mean_absolute_percentage_error: 56.8469
Epoch 70/500
3/3 [==============================] - 0s 94ms/step - loss: 0.0381 -
mean_squared_error: 0.0381 - rmse: 0.1892 - mean_absolute_error: 0.1481 -
mean_absolute_percentage_error: 57.4829
Epoch 71/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0378 -
mean_squared_error: 0.0378 - rmse: 0.1912 - mean_absolute_error: 0.1485 -
mean_absolute_percentage_error: 57.8733
```

```
Epoch 72/500
3/3 [==============================] - 0s 75ms/step - loss: 0.0390 -
mean_squared_error: 0.0390 - rmse: 0.1958 - mean_absolute_error: 0.1511 -
mean_absolute_percentage_error: 57.6544
Epoch 73/500
3/3 [==============================] - 0s 80ms/step - loss: 0.0402 -
mean_squared_error: 0.0402 - rmse: 0.2016 - mean_absolute_error: 0.1506 -
mean_absolute_percentage_error: 58.0797
Epoch 74/500
3/3 [==============================] - 0s 86ms/step - loss: 0.0407 -
mean_squared_error: 0.0407 - rmse: 0.1990 - mean_absolute_error: 0.1485 -
mean_absolute_percentage_error: 59.0345
Epoch 75/500
3/3 [==============================] - 0s 87ms/step - loss: 0.0368 -
mean_squared_error: 0.0368 - rmse: 0.1892 - mean_absolute_error: 0.1457 -
mean_absolute_percentage_error: 56.8538
Epoch 76/500
3/3 [==============================] - 0s 68ms/step - loss: 0.0342 -
mean_squared_error: 0.0342 - rmse: 0.1820 - mean_absolute_error: 0.1411 -
mean_absolute_percentage_error: 53.9310
Epoch 77/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0360 -
mean_squared_error: 0.0360 - rmse: 0.1921 - mean_absolute_error: 0.1435 -
mean_absolute_percentage_error: 56.0643
Epoch 78/500
3/3 [==============================] - 0s 104ms/step - loss: 0.0343 -
mean_squared_error: 0.0343 - rmse: 0.1874 - mean_absolute_error: 0.1398 -
mean_absolute_percentage_error: 54.6849
Epoch 79/500
3/3 [==============================] - 0s 107ms/step - loss: 0.0367 -
mean_squared_error: 0.0367 - rmse: 0.1866 - mean_absolute_error: 0.1453 -
mean_absolute_percentage_error: 55.4207
Epoch 80/500
3/3 [==============================] - 0s 112ms/step - loss: 0.0358 -
mean_squared_error: 0.0358 - rmse: 0.1866 - mean_absolute_error: 0.1438 -
mean_absolute_percentage_error: 53.4199
Epoch 81/500
3/3 [==============================] - 0s 91ms/step - loss: 0.0359 -
mean_squared_error: 0.0359 - rmse: 0.1891 - mean_absolute_error: 0.1418 -
mean_absolute_percentage_error: 54.9449
Epoch 82/500
3/3 [==============================] - 0s 95ms/step - loss: 0.0333 -
mean_squared_error: 0.0333 - rmse: 0.1820 - mean_absolute_error: 0.1380 -
mean_absolute_percentage_error: 53.6972
Epoch 83/500
3/3 [==============================] - 0s 87ms/step - loss: 0.0334 -
mean_squared_error: 0.0334 - rmse: 0.1831 - mean_absolute_error: 0.1387 -
mean_absolute_percentage_error: 56.3561
```

```
Epoch 84/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0325 -
mean_squared_error: 0.0325 - rmse: 0.1788 - mean_absolute_error: 0.1344 -
mean_absolute_percentage_error: 51.4377
Epoch 85/500
3/3 [==============================] - 0s 74ms/step - loss: 0.0324 -
mean_squared_error: 0.0324 - rmse: 0.1761 - mean_absolute_error: 0.1352 -
mean_absolute_percentage_error: 53.3515
Epoch 86/500
3/3 [==============================] - 0s 95ms/step - loss: 0.0296 -
mean_squared_error: 0.0296 - rmse: 0.1724 - mean_absolute_error: 0.1291 -
mean_absolute_percentage_error: 50.6911
Epoch 87/500
3/3 [==============================] - 0s 114ms/step - loss: 0.0340 -
mean_squared_error: 0.0340 - rmse: 0.1820 - mean_absolute_error: 0.1368 -
mean_absolute_percentage_error: 56.3948
Epoch 88/500
3/3 [==============================] - 0s 113ms/step - loss: 0.0296 -
mean_squared_error: 0.0296 - rmse: 0.1713 - mean_absolute_error: 0.1265 -
mean_absolute_percentage_error: 51.2727
Epoch 89/500
3/3 [==============================] - 0s 125ms/step - loss: 0.0306 -
mean_squared_error: 0.0306 - rmse: 0.1753 - mean_absolute_error: 0.1295 -
mean_absolute_percentage_error: 51.3388
Epoch 90/500
3/3 [==============================] - 0s 125ms/step - loss: 0.0305 -
mean_squared_error: 0.0305 - rmse: 0.1733 - mean_absolute_error: 0.1299 -
mean_absolute_percentage_error: 53.2501
Epoch 91/500
3/3 [==============================] - 0s 129ms/step - loss: 0.0295 -
mean_squared_error: 0.0295 - rmse: 0.1722 - mean_absolute_error: 0.1282 -
mean_absolute_percentage_error: 50.2122
Epoch 92/500
3/3 [==============================] - 0s 143ms/step - loss: 0.0303 -
mean_squared_error: 0.0303 - rmse: 0.1720 - mean_absolute_error: 0.1316 -
mean_absolute_percentage_error: 52.9186
Epoch 93/500
3/3 [==============================] - 0s 148ms/step - loss: 0.0304 -
mean_squared_error: 0.0304 - rmse: 0.1765 - mean_absolute_error: 0.1277 -
mean_absolute_percentage_error: 49.3351
Epoch 94/500
3/3 [==============================] - 0s 121ms/step - loss: 0.0296 -
mean_squared_error: 0.0296 - rmse: 0.1732 - mean_absolute_error: 0.1273 -
mean_absolute_percentage_error: 47.6838
Epoch 95/500
3/3 [==============================] - 0s 122ms/step - loss: 0.0300 -
mean_squared_error: 0.0300 - rmse: 0.1749 - mean_absolute_error: 0.1331 -
mean_absolute_percentage_error: 51.7062
```

```
Epoch 96/500
3/3 [==============================] - 0s 123ms/step - loss: 0.0278 -
mean_squared_error: 0.0278 - rmse: 0.1673 - mean_absolute_error: 0.1223 -
mean_absolute_percentage_error: 48.1533
Epoch 97/500
3/3 [==============================] - 0s 99ms/step - loss: 0.0255 -
mean_squared_error: 0.0255 - rmse: 0.1607 - mean_absolute_error: 0.1160 -
mean_absolute_percentage_error: 43.2768
Epoch 98/500
3/3 [==============================] - 0s 112ms/step - loss: 0.0239 -
mean_squared_error: 0.0239 - rmse: 0.1534 - mean_absolute_error: 0.1149 -
mean_absolute_percentage_error: 45.7699
Epoch 99/500
3/3 [==============================] - 0s 98ms/step - loss: 0.0294 -
mean_squared_error: 0.0294 - rmse: 0.1734 - mean_absolute_error: 0.1258 -
mean_absolute_percentage_error: 49.0019
Epoch 100/500
3/3 [==============================] - 0s 85ms/step - loss: 0.0273 -
mean_squared_error: 0.0273 - rmse: 0.1659 - mean_absolute_error: 0.1217 -
mean_absolute_percentage_error: 47.7036
Epoch 101/500
3/3 [==============================] - 0s 76ms/step - loss: 0.0268 -
mean_squared_error: 0.0268 - rmse: 0.1635 - mean_absolute_error: 0.1229 -
mean_absolute_percentage_error: 44.9706
Epoch 102/500
3/3 [==============================] - 0s 93ms/step - loss: 0.0258 -
mean_squared_error: 0.0258 - rmse: 0.1621 - mean_absolute_error: 0.1182 -
mean_absolute_percentage_error: 46.1519
Epoch 103/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0244 -
mean_squared_error: 0.0244 - rmse: 0.1554 - mean_absolute_error: 0.1170 -
mean_absolute_percentage_error: 43.2113
Epoch 104/500
3/3 [==============================] - 0s 87ms/step - loss: 0.0274 -
mean_squared_error: 0.0274 - rmse: 0.1675 - mean_absolute_error: 0.1228 -
mean_absolute_percentage_error: 48.8416
Epoch 105/500
3/3 [==============================] - 0s 85ms/step - loss: 0.0266 -
mean_squared_error: 0.0266 - rmse: 0.1634 - mean_absolute_error: 0.1203 -
mean_absolute_percentage_error: 45.7465
Epoch 106/500
3/3 [==============================] - 0s 95ms/step - loss: 0.0279 -
mean_squared_error: 0.0279 - rmse: 0.1638 - mean_absolute_error: 0.1226 -
mean_absolute_percentage_error: 47.8615
Epoch 107/500
3/3 [==============================] - 0s 101ms/step - loss: 0.0249 -
mean_squared_error: 0.0249 - rmse: 0.1593 - mean_absolute_error: 0.1144 -
mean_absolute_percentage_error: 44.4256
```

```
Epoch 108/500
3/3 [==============================] - 0s 79ms/step - loss: 0.0266 -
mean_squared_error: 0.0266 - rmse: 0.1609 - mean_absolute_error: 0.1216 -
mean_absolute_percentage_error: 48.3641
Epoch 109/500
3/3 [==============================] - 0s 89ms/step - loss: 0.0259 -
mean_squared_error: 0.0259 - rmse: 0.1593 - mean_absolute_error: 0.1179 -
mean_absolute_percentage_error: 44.7961
Epoch 110/500
3/3 [==============================] - 0s 82ms/step - loss: 0.0246 -
mean_squared_error: 0.0246 - rmse: 0.1535 - mean_absolute_error: 0.1160 -
mean_absolute_percentage_error: 44.7645
Epoch 111/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0236 -
mean_squared_error: 0.0236 - rmse: 0.1510 - mean_absolute_error: 0.1133 -
mean_absolute_percentage_error: 41.7209
Epoch 112/500
3/3 [==============================] - 0s 82ms/step - loss: 0.0235 -
mean_squared_error: 0.0235 - rmse: 0.1528 - mean_absolute_error: 0.1139 -
mean_absolute_percentage_error: 42.9494
Epoch 113/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0246 -
mean_squared_error: 0.0246 - rmse: 0.1568 - mean_absolute_error: 0.1166 -
mean_absolute_percentage_error: 45.2837
Epoch 114/500
3/3 [==============================] - 0s 81ms/step - loss: 0.0226 -
mean_squared_error: 0.0226 - rmse: 0.1515 - mean_absolute_error: 0.1108 -
mean_absolute_percentage_error: 41.4948
Epoch 115/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0242 -
mean_squared_error: 0.0242 - rmse: 0.1549 - mean_absolute_error: 0.1120 -
mean_absolute_percentage_error: 42.5136
Epoch 116/500
3/3 [==============================] - 0s 94ms/step - loss: 0.0233 -
mean_squared_error: 0.0233 - rmse: 0.1532 - mean_absolute_error: 0.1134 -
mean_absolute_percentage_error: 43.0818
Epoch 117/500
3/3 [==============================] - 0s 104ms/step - loss: 0.0215 -
mean_squared_error: 0.0215 - rmse: 0.1481 - mean_absolute_error: 0.1085 -
mean_absolute_percentage_error: 40.4590
Epoch 118/500
3/3 [==============================] - 0s 96ms/step - loss: 0.0221 -
mean_squared_error: 0.0221 - rmse: 0.1450 - mean_absolute_error: 0.1119 -
mean_absolute_percentage_error: 42.6313
Epoch 119/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0245 -
mean_squared_error: 0.0245 - rmse: 0.1570 - mean_absolute_error: 0.1170 -
mean_absolute_percentage_error: 47.9874
```

```
Epoch 120/500
3/3 [==============================] - 0s 86ms/step - loss: 0.0251 -
mean_squared_error: 0.0251 - rmse: 0.1570 - mean_absolute_error: 0.1174 -
mean_absolute_percentage_error: 44.1620
Epoch 121/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0237 -
mean_squared_error: 0.0237 - rmse: 0.1526 - mean_absolute_error: 0.1119 -
mean_absolute_percentage_error: 41.8887
Epoch 122/500
3/3 [==============================] - 0s 82ms/step - loss: 0.0232 -
mean_squared_error: 0.0232 - rmse: 0.1515 - mean_absolute_error: 0.1112 -
mean_absolute_percentage_error: 41.2793
Epoch 123/500
3/3 [==============================] - 0s 88ms/step - loss: 0.0244 -
mean_squared_error: 0.0244 - rmse: 0.1534 - mean_absolute_error: 0.1139 -
mean_absolute_percentage_error: 43.7119
Epoch 124/500
3/3 [==============================] - 0s 89ms/step - loss: 0.0210 -
mean_squared_error: 0.0210 - rmse: 0.1429 - mean_absolute_error: 0.1067 -
mean_absolute_percentage_error: 38.1969
Epoch 125/500
3/3 [==============================] - 0s 87ms/step - loss: 0.0225 -
mean_squared_error: 0.0225 - rmse: 0.1514 - mean_absolute_error: 0.1091 -
mean_absolute_percentage_error: 41.0268
Epoch 126/500
3/3 [==============================] - 0s 81ms/step - loss: 0.0225 -
mean_squared_error: 0.0225 - rmse: 0.1502 - mean_absolute_error: 0.1099 -
mean_absolute_percentage_error: 42.5824
Epoch 127/500
3/3 [==============================] - 0s 93ms/step - loss: 0.0225 -
mean_squared_error: 0.0225 - rmse: 0.1482 - mean_absolute_error: 0.1089 -
mean_absolute_percentage_error: 39.0227
Epoch 128/500
3/3 [==============================] - 0s 94ms/step - loss: 0.0209 -
mean_squared_error: 0.0209 - rmse: 0.1453 - mean_absolute_error: 0.1054 -
mean_absolute_percentage_error: 38.3106
Epoch 129/500
3/3 [==============================] - 0s 92ms/step - loss: 0.0216 -
mean_squared_error: 0.0216 - rmse: 0.1485 - mean_absolute_error: 0.1062 -
mean_absolute_percentage_error: 40.0913
Epoch 130/500
3/3 [==============================] - 0s 91ms/step - loss: 0.0215 -
mean_squared_error: 0.0215 - rmse: 0.1475 - mean_absolute_error: 0.1069 -
mean_absolute_percentage_error: 41.7550
Epoch 131/500
3/3 [==============================] - 0s 71ms/step - loss: 0.0198 -
mean_squared_error: 0.0198 - rmse: 0.1423 - mean_absolute_error: 0.1055 -
mean_absolute_percentage_error: 38.3011
```

```
Epoch 132/500
3/3 [==============================] - 0s 75ms/step - loss: 0.0213 -
mean_squared_error: 0.0213 - rmse: 0.1464 - mean_absolute_error: 0.1065 -
mean_absolute_percentage_error: 35.4043
Epoch 133/500
3/3 [==============================] - 0s 72ms/step - loss: 0.0221 -
mean_squared_error: 0.0221 - rmse: 0.1473 - mean_absolute_error: 0.1053 -
mean_absolute_percentage_error: 37.9461
Epoch 134/500
3/3 [==============================] - 0s 69ms/step - loss: 0.0214 -
mean_squared_error: 0.0214 - rmse: 0.1473 - mean_absolute_error: 0.1059 -
mean_absolute_percentage_error: 40.9625
Epoch 135/500
3/3 [==============================] - 0s 76ms/step - loss: 0.0211 -
mean_squared_error: 0.0211 - rmse: 0.1442 - mean_absolute_error: 0.1049 -
mean_absolute_percentage_error: 39.6680
Epoch 136/500
3/3 [==============================] - 0s 76ms/step - loss: 0.0192 -
mean_squared_error: 0.0192 - rmse: 0.1391 - mean_absolute_error: 0.1014 -
mean_absolute_percentage_error: 35.7366
Epoch 137/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0205 -
mean_squared_error: 0.0205 - rmse: 0.1438 - mean_absolute_error: 0.1033 -
mean_absolute_percentage_error: 36.3173
Epoch 138/500
3/3 [==============================] - 0s 118ms/step - loss: 0.0198 -
mean_squared_error: 0.0198 - rmse: 0.1404 - mean_absolute_error: 0.1018 -
mean_absolute_percentage_error: 38.6769
Epoch 139/500
3/3 [==============================] - 0s 95ms/step - loss: 0.0205 -
mean_squared_error: 0.0205 - rmse: 0.1441 - mean_absolute_error: 0.1052 -
mean_absolute_percentage_error: 41.1735
Epoch 140/500
3/3 [==============================] - 0s 88ms/step - loss: 0.0208 -
mean_squared_error: 0.0208 - rmse: 0.1421 - mean_absolute_error: 0.1030 -
mean_absolute_percentage_error: 38.8985
Epoch 141/500
3/3 [==============================] - 0s 92ms/step - loss: 0.0191 -
mean_squared_error: 0.0191 - rmse: 0.1365 - mean_absolute_error: 0.1011 -
mean_absolute_percentage_error: 36.2063
Epoch 142/500
3/3 [==============================] - 0s 74ms/step - loss: 0.0208 -
mean_squared_error: 0.0208 - rmse: 0.1411 - mean_absolute_error: 0.1046 -
mean_absolute_percentage_error: 37.8460
Epoch 143/500
3/3 [==============================] - 0s 74ms/step - loss: 0.0198 -
mean_squared_error: 0.0198 - rmse: 0.1414 - mean_absolute_error: 0.1031 -
mean_absolute_percentage_error: 36.4573
```

```
Epoch 144/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0186 -
mean_squared_error: 0.0186 - rmse: 0.1362 - mean_absolute_error: 0.0997 -
mean_absolute_percentage_error: 35.9993
Epoch 145/500
3/3 [==============================] - 0s 72ms/step - loss: 0.0182 -
mean_squared_error: 0.0182 - rmse: 0.1360 - mean_absolute_error: 0.0970 -
mean_absolute_percentage_error: 34.9011
Epoch 146/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0190 -
mean_squared_error: 0.0190 - rmse: 0.1392 - mean_absolute_error: 0.1010 -
mean_absolute_percentage_error: 35.5802
Epoch 147/500
3/3 [==============================] - 0s 108ms/step - loss: 0.0186 -
mean_squared_error: 0.0186 - rmse: 0.1345 - mean_absolute_error: 0.1007 -
mean_absolute_percentage_error: 36.4967
Epoch 148/500
3/3 [==============================] - 0s 98ms/step - loss: 0.0195 -
mean_squared_error: 0.0195 - rmse: 0.1368 - mean_absolute_error: 0.0991 -
mean_absolute_percentage_error: 34.4536
Epoch 149/500
3/3 [==============================] - 0s 107ms/step - loss: 0.0187 -
mean_squared_error: 0.0187 - rmse: 0.1338 - mean_absolute_error: 0.0984 -
mean_absolute_percentage_error: 35.0291
Epoch 150/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0184 -
mean_squared_error: 0.0184 - rmse: 0.1366 - mean_absolute_error: 0.0951 -
mean_absolute_percentage_error: 34.8415
Epoch 151/500
3/3 [==============================] - 0s 73ms/step - loss: 0.0171 -
mean_squared_error: 0.0171 - rmse: 0.1279 - mean_absolute_error: 0.0948 -
mean_absolute_percentage_error: 34.0390
Epoch 152/500
3/3 [==============================] - 0s 76ms/step - loss: 0.0186 -
mean_squared_error: 0.0186 - rmse: 0.1376 - mean_absolute_error: 0.0990 -
mean_absolute_percentage_error: 37.6234
Epoch 153/500
3/3 [==============================] - 0s 66ms/step - loss: 0.0181 -
mean_squared_error: 0.0181 - rmse: 0.1352 - mean_absolute_error: 0.0981 -
mean_absolute_percentage_error: 34.9548
Epoch 154/500
3/3 [==============================] - 0s 74ms/step - loss: 0.0167 -
mean_squared_error: 0.0167 - rmse: 0.1298 - mean_absolute_error: 0.0944 -
mean_absolute_percentage_error: 32.2396
Epoch 155/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0192 -
mean_squared_error: 0.0192 - rmse: 0.1396 - mean_absolute_error: 0.0973 -
mean_absolute_percentage_error: 35.2212
```

```
Epoch 156/500
3/3 [==============================] - 0s 80ms/step - loss: 0.0192 -
mean_squared_error: 0.0192 - rmse: 0.1395 - mean_absolute_error: 0.0978 -
mean_absolute_percentage_error: 33.6015
Epoch 157/500
3/3 [==============================] - 0s 100ms/step - loss: 0.0192 -
mean_squared_error: 0.0192 - rmse: 0.1346 - mean_absolute_error: 0.0976 -
mean_absolute_percentage_error: 34.1888
Epoch 158/500
3/3 [==============================] - 0s 106ms/step - loss: 0.0183 -
mean_squared_error: 0.0183 - rmse: 0.1363 - mean_absolute_error: 0.0968 -
mean_absolute_percentage_error: 33.8066
Epoch 159/500
3/3 [==============================] - 0s 100ms/step - loss: 0.0172 -
mean_squared_error: 0.0172 - rmse: 0.1320 - mean_absolute_error: 0.0937 -
mean_absolute_percentage_error: 33.7855
Epoch 160/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0163 -
mean_squared_error: 0.0163 - rmse: 0.1231 - mean_absolute_error: 0.0944 -
mean_absolute_percentage_error: 30.8557
Epoch 161/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0190 -
mean_squared_error: 0.0190 - rmse: 0.1328 - mean_absolute_error: 0.0984 -
mean_absolute_percentage_error: 34.4001
Epoch 162/500
3/3 [==============================] - 0s 80ms/step - loss: 0.0173 -
mean_squared_error: 0.0173 - rmse: 0.1292 - mean_absolute_error: 0.0938 -
mean_absolute_percentage_error: 33.0711
Epoch 163/500
3/3 [==============================] - 0s 73ms/step - loss: 0.0169 -
mean_squared_error: 0.0169 - rmse: 0.1261 - mean_absolute_error: 0.0927 -
mean_absolute_percentage_error: 32.8942
Epoch 164/500
3/3 [==============================] - 0s 76ms/step - loss: 0.0152 -
mean_squared_error: 0.0152 - rmse: 0.1232 - mean_absolute_error: 0.0907 -
mean_absolute_percentage_error: 32.6707
Epoch 165/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0182 -
mean_squared_error: 0.0182 - rmse: 0.1356 - mean_absolute_error: 0.0946 -
mean_absolute_percentage_error: 33.6545
Epoch 166/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0165 -
mean_squared_error: 0.0165 - rmse: 0.1280 - mean_absolute_error: 0.0926 -
mean_absolute_percentage_error: 33.1064
Epoch 167/500
3/3 [==============================] - 0s 87ms/step - loss: 0.0177 -
mean_squared_error: 0.0177 - rmse: 0.1334 - mean_absolute_error: 0.0951 -
mean_absolute_percentage_error: 34.6507
```

```
Epoch 168/500
3/3 [==============================] - 0s 111ms/step - loss: 0.0176 -
mean_squared_error: 0.0176 - rmse: 0.1311 - mean_absolute_error: 0.0946 -
mean_absolute_percentage_error: 33.4980
Epoch 169/500
3/3 [==============================] - 0s 98ms/step - loss: 0.0168 -
mean_squared_error: 0.0168 - rmse: 0.1286 - mean_absolute_error: 0.0927 -
mean_absolute_percentage_error: 32.8702
Epoch 170/500
3/3 [==============================] - 0s 103ms/step - loss: 0.0169 -
mean_squared_error: 0.0169 - rmse: 0.1282 - mean_absolute_error: 0.0942 -
mean_absolute_percentage_error: 32.6221
Epoch 171/500
3/3 [==============================] - 0s 81ms/step - loss: 0.0174 -
mean_squared_error: 0.0174 - rmse: 0.1298 - mean_absolute_error: 0.0950 -
mean_absolute_percentage_error: 34.1091
Epoch 172/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0181 -
mean_squared_error: 0.0181 - rmse: 0.1347 - mean_absolute_error: 0.0982 -
mean_absolute_percentage_error: 33.1213
Epoch 173/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0153 -
mean_squared_error: 0.0153 - rmse: 0.1233 - mean_absolute_error: 0.0896 -
mean_absolute_percentage_error: 30.9772
Epoch 174/500
3/3 [==============================] - 0s 99ms/step - loss: 0.0163 -
mean_squared_error: 0.0163 - rmse: 0.1254 - mean_absolute_error: 0.0934 -
mean_absolute_percentage_error: 32.7641
Epoch 175/500
3/3 [==============================] - 0s 91ms/step - loss: 0.0168 -
mean_squared_error: 0.0168 - rmse: 0.1233 - mean_absolute_error: 0.0912 -
mean_absolute_percentage_error: 32.4298
Epoch 176/500
3/3 [==============================] - 0s 126ms/step - loss: 0.0175 -
mean_squared_error: 0.0175 - rmse: 0.1295 - mean_absolute_error: 0.0951 -
mean_absolute_percentage_error: 32.7083
Epoch 177/500
3/3 [==============================] - 0s 127ms/step - loss: 0.0157 -
mean_squared_error: 0.0157 - rmse: 0.1224 - mean_absolute_error: 0.0878 -
mean_absolute_percentage_error: 32.3876
Epoch 178/500
3/3 [==============================] - 0s 98ms/step - loss: 0.0159 -
mean_squared_error: 0.0159 - rmse: 0.1242 - mean_absolute_error: 0.0887 -
mean_absolute_percentage_error: 31.9828
Epoch 179/500
3/3 [==============================] - 0s 113ms/step - loss: 0.0164 -
mean_squared_error: 0.0164 - rmse: 0.1294 - mean_absolute_error: 0.0904 -
mean_absolute_percentage_error: 32.0397
```

```
Epoch 180/500
3/3 [==============================] - 0s 89ms/step - loss: 0.0153 -
mean_squared_error: 0.0153 - rmse: 0.1232 - mean_absolute_error: 0.0884 -
mean_absolute_percentage_error: 30.0710
Epoch 181/500
3/3 [==============================] - 0s 85ms/step - loss: 0.0152 -
mean_squared_error: 0.0152 - rmse: 0.1244 - mean_absolute_error: 0.0867 -
mean_absolute_percentage_error: 30.4511
Epoch 182/500
3/3 [==============================] - 0s 80ms/step - loss: 0.0165 -
mean_squared_error: 0.0165 - rmse: 0.1267 - mean_absolute_error: 0.0926 -
mean_absolute_percentage_error: 33.4860
Epoch 183/500
3/3 [==============================] - 0s 88ms/step - loss: 0.0162 -
mean_squared_error: 0.0162 - rmse: 0.1273 - mean_absolute_error: 0.0906 -
mean_absolute_percentage_error: 32.4682
Epoch 184/500
3/3 [==============================] - 0s 75ms/step - loss: 0.0149 -
mean_squared_error: 0.0149 - rmse: 0.1204 - mean_absolute_error: 0.0875 -
mean_absolute_percentage_error: 31.7522
Epoch 185/500
3/3 [==============================] - 0s 76ms/step - loss: 0.0170 -
mean_squared_error: 0.0170 - rmse: 0.1302 - mean_absolute_error: 0.0937 -
mean_absolute_percentage_error: 32.9228
Epoch 186/500
3/3 [==============================] - 0s 85ms/step - loss: 0.0158 -
mean_squared_error: 0.0158 - rmse: 0.1264 - mean_absolute_error: 0.0916 -
mean_absolute_percentage_error: 31.8188
Epoch 187/500
3/3 [==============================] - 0s 91ms/step - loss: 0.0166 -
mean_squared_error: 0.0166 - rmse: 0.1240 - mean_absolute_error: 0.0900 -
mean_absolute_percentage_error: 33.1517
Epoch 188/500
3/3 [==============================] - 0s 100ms/step - loss: 0.0166 -
mean_squared_error: 0.0166 - rmse: 0.1297 - mean_absolute_error: 0.0926 -
mean_absolute_percentage_error: 32.8628
Epoch 189/500
3/3 [==============================] - 0s 82ms/step - loss: 0.0149 -
mean_squared_error: 0.0149 - rmse: 0.1219 - mean_absolute_error: 0.0879 -
mean_absolute_percentage_error: 30.8179
Epoch 190/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0157 -
mean_squared_error: 0.0157 - rmse: 0.1247 - mean_absolute_error: 0.0892 -
mean_absolute_percentage_error: 31.2506
Epoch 191/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0167 -
mean_squared_error: 0.0167 - rmse: 0.1303 - mean_absolute_error: 0.0917 -
mean_absolute_percentage_error: 31.5245
```

```
Epoch 192/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0152 -
mean_squared_error: 0.0152 - rmse: 0.1228 - mean_absolute_error: 0.0875 -
mean_absolute_percentage_error: 31.1234
Epoch 193/500
3/3 [==============================] - 0s 81ms/step - loss: 0.0160 -
mean_squared_error: 0.0160 - rmse: 0.1266 - mean_absolute_error: 0.0890 -
mean_absolute_percentage_error: 30.5720
Epoch 194/500
3/3 [==============================] - 0s 75ms/step - loss: 0.0150 -
mean_squared_error: 0.0150 - rmse: 0.1237 - mean_absolute_error: 0.0883 -
mean_absolute_percentage_error: 30.1180
Epoch 195/500
3/3 [==============================] - 0s 81ms/step - loss: 0.0148 -
mean_squared_error: 0.0148 - rmse: 0.1185 - mean_absolute_error: 0.0888 -
mean_absolute_percentage_error: 29.3139
Epoch 196/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0161 -
mean_squared_error: 0.0161 - rmse: 0.1274 - mean_absolute_error: 0.0892 -
mean_absolute_percentage_error: 31.2139
Epoch 197/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0152 -
mean_squared_error: 0.0152 - rmse: 0.1230 - mean_absolute_error: 0.0886 -
mean_absolute_percentage_error: 31.2320
Epoch 198/500
3/3 [==============================] - 0s 99ms/step - loss: 0.0156 -
mean_squared_error: 0.0156 - rmse: 0.1251 - mean_absolute_error: 0.0887 -
mean_absolute_percentage_error: 30.0103
Epoch 199/500
3/3 [==============================] - 0s 89ms/step - loss: 0.0139 -
mean_squared_error: 0.0139 - rmse: 0.1151 - mean_absolute_error: 0.0826 -
mean_absolute_percentage_error: 29.1899
Epoch 200/500
3/3 [==============================] - 0s 71ms/step - loss: 0.0154 -
mean_squared_error: 0.0154 - rmse: 0.1234 - mean_absolute_error: 0.0893 -
mean_absolute_percentage_error: 30.5182
Epoch 201/500
3/3 [==============================] - 0s 71ms/step - loss: 0.0165 -
mean_squared_error: 0.0165 - rmse: 0.1270 - mean_absolute_error: 0.0908 -
mean_absolute_percentage_error: 33.1680
Epoch 202/500
3/3 [==============================] - 0s 71ms/step - loss: 0.0141 -
mean_squared_error: 0.0141 - rmse: 0.1198 - mean_absolute_error: 0.0826 -
mean_absolute_percentage_error: 29.8582
Epoch 203/500
3/3 [==============================] - 0s 76ms/step - loss: 0.0146 -
mean_squared_error: 0.0146 - rmse: 0.1222 - mean_absolute_error: 0.0844 -
mean_absolute_percentage_error: 27.5052
```

```
Epoch 204/500
3/3 [==============================] - 0s 93ms/step - loss: 0.0168 -
mean_squared_error: 0.0168 - rmse: 0.1252 - mean_absolute_error: 0.0889 -
mean_absolute_percentage_error: 29.9199
Epoch 205/500
3/3 [==============================] - 0s 87ms/step - loss: 0.0151 -
mean_squared_error: 0.0151 - rmse: 0.1235 - mean_absolute_error: 0.0867 -
mean_absolute_percentage_error: 31.5563
Epoch 206/500
3/3 [==============================] - 0s 94ms/step - loss: 0.0147 -
mean_squared_error: 0.0147 - rmse: 0.1210 - mean_absolute_error: 0.0849 -
mean_absolute_percentage_error: 27.5566
Epoch 207/500
3/3 [==============================] - 0s 106ms/step - loss: 0.0157 -
mean_squared_error: 0.0157 - rmse: 0.1253 - mean_absolute_error: 0.0897 -
mean_absolute_percentage_error: 30.8735
Epoch 208/500
3/3 [==============================] - 0s 96ms/step - loss: 0.0142 -
mean_squared_error: 0.0142 - rmse: 0.1161 - mean_absolute_error: 0.0864 -
mean_absolute_percentage_error: 29.1323
Epoch 209/500
3/3 [==============================] - 0s 111ms/step - loss: 0.0144 -
mean_squared_error: 0.0144 - rmse: 0.1211 - mean_absolute_error: 0.0858 -
mean_absolute_percentage_error: 28.7104
Epoch 210/500
3/3 [==============================] - 0s 81ms/step - loss: 0.0147 -
mean_squared_error: 0.0147 - rmse: 0.1197 - mean_absolute_error: 0.0862 -
mean_absolute_percentage_error: 29.6896
Epoch 211/500
3/3 [==============================] - 0s 88ms/step - loss: 0.0160 -
mean_squared_error: 0.0160 - rmse: 0.1259 - mean_absolute_error: 0.0891 -
mean_absolute_percentage_error: 30.8614
Epoch 212/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0137 -
mean_squared_error: 0.0137 - rmse: 0.1184 - mean_absolute_error: 0.0836 -
mean_absolute_percentage_error: 28.1290
Epoch 213/500
3/3 [==============================] - 0s 82ms/step - loss: 0.0143 -
mean_squared_error: 0.0143 - rmse: 0.1192 - mean_absolute_error: 0.0857 -
mean_absolute_percentage_error: 28.9043
Epoch 214/500
3/3 [==============================] - 0s 95ms/step - loss: 0.0156 -
mean_squared_error: 0.0156 - rmse: 0.1250 - mean_absolute_error: 0.0883 -
mean_absolute_percentage_error: 28.6365
Epoch 215/500
3/3 [==============================] - 0s 100ms/step - loss: 0.0147 -
mean_squared_error: 0.0147 - rmse: 0.1224 - mean_absolute_error: 0.0863 -
mean_absolute_percentage_error: 30.2071
```

```
Epoch 216/500
3/3 [==============================] - 0s 90ms/step - loss: 0.0150 -
mean_squared_error: 0.0150 - rmse: 0.1237 - mean_absolute_error: 0.0873 -
mean_absolute_percentage_error: 30.2315
Epoch 217/500
3/3 [==============================] - 0s 93ms/step - loss: 0.0135 -
mean_squared_error: 0.0135 - rmse: 0.1155 - mean_absolute_error: 0.0810 -
mean_absolute_percentage_error: 28.0744
Epoch 218/500
3/3 [==============================] - 0s 103ms/step - loss: 0.0129 -
mean_squared_error: 0.0129 - rmse: 0.1135 - mean_absolute_error: 0.0812 -
mean_absolute_percentage_error: 30.1564
Epoch 219/500
3/3 [==============================] - 0s 95ms/step - loss: 0.0155 -
mean_squared_error: 0.0155 - rmse: 0.1256 - mean_absolute_error: 0.0881 -
mean_absolute_percentage_error: 30.1387
Epoch 220/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0138 -
mean_squared_error: 0.0138 - rmse: 0.1171 - mean_absolute_error: 0.0843 -
mean_absolute_percentage_error: 29.1325
Epoch 221/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0142 -
mean_squared_error: 0.0142 - rmse: 0.1182 - mean_absolute_error: 0.0859 -
mean_absolute_percentage_error: 29.2348
Epoch 222/500
3/3 [==============================] - 0s 81ms/step - loss: 0.0143 -
mean_squared_error: 0.0143 - rmse: 0.1178 - mean_absolute_error: 0.0844 -
mean_absolute_percentage_error: 28.2943
Epoch 223/500
3/3 [==============================] - 0s 95ms/step - loss: 0.0139 -
mean_squared_error: 0.0139 - rmse: 0.1159 - mean_absolute_error: 0.0834 -
mean_absolute_percentage_error: 29.2863
Epoch 224/500
3/3 [==============================] - 0s 87ms/step - loss: 0.0135 -
mean_squared_error: 0.0135 - rmse: 0.1163 - mean_absolute_error: 0.0807 -
mean_absolute_percentage_error: 29.2848
Epoch 225/500
3/3 [==============================] - 0s 93ms/step - loss: 0.0144 -
mean_squared_error: 0.0144 - rmse: 0.1185 - mean_absolute_error: 0.0853 -
mean_absolute_percentage_error: 29.5812
Epoch 226/500
3/3 [==============================] - 0s 89ms/step - loss: 0.0134 -
mean_squared_error: 0.0134 - rmse: 0.1132 - mean_absolute_error: 0.0827 -
mean_absolute_percentage_error: 27.9414
Epoch 227/500
3/3 [==============================] - 0s 90ms/step - loss: 0.0137 -
mean_squared_error: 0.0137 - rmse: 0.1175 - mean_absolute_error: 0.0835 -
mean_absolute_percentage_error: 29.5168
```

```
Epoch 228/500
3/3 [==============================] - 0s 94ms/step - loss: 0.0141 -
mean_squared_error: 0.0141 - rmse: 0.1195 - mean_absolute_error: 0.0851 -
mean_absolute_percentage_error: 29.5708
Epoch 229/500
3/3 [==============================] - 0s 93ms/step - loss: 0.0147 -
mean_squared_error: 0.0147 - rmse: 0.1223 - mean_absolute_error: 0.0857 -
mean_absolute_percentage_error: 30.4292
Epoch 230/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0130 -
mean_squared_error: 0.0130 - rmse: 0.1132 - mean_absolute_error: 0.0821 -
mean_absolute_percentage_error: 29.0595
Epoch 231/500
3/3 [==============================] - 0s 91ms/step - loss: 0.0141 -
mean_squared_error: 0.0141 - rmse: 0.1148 - mean_absolute_error: 0.0852 -
mean_absolute_percentage_error: 28.8731
Epoch 232/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0138 -
mean_squared_error: 0.0138 - rmse: 0.1154 - mean_absolute_error: 0.0824 -
mean_absolute_percentage_error: 28.6648
Epoch 233/500
3/3 [==============================] - 0s 91ms/step - loss: 0.0143 -
mean_squared_error: 0.0143 - rmse: 0.1185 - mean_absolute_error: 0.0843 -
mean_absolute_percentage_error: 27.8418
Epoch 234/500
3/3 [==============================] - 0s 98ms/step - loss: 0.0137 -
mean_squared_error: 0.0137 - rmse: 0.1174 - mean_absolute_error: 0.0827 -
mean_absolute_percentage_error: 27.7331
Epoch 235/500
3/3 [==============================] - 0s 96ms/step - loss: 0.0142 -
mean_squared_error: 0.0142 - rmse: 0.1205 - mean_absolute_error: 0.0841 -
mean_absolute_percentage_error: 28.6135
Epoch 236/500
3/3 [==============================] - 0s 110ms/step - loss: 0.0139 -
mean_squared_error: 0.0139 - rmse: 0.1178 - mean_absolute_error: 0.0822 -
mean_absolute_percentage_error: 29.2045
Epoch 237/500
3/3 [==============================] - 0s 95ms/step - loss: 0.0137 -
mean_squared_error: 0.0137 - rmse: 0.1159 - mean_absolute_error: 0.0844 -
mean_absolute_percentage_error: 30.0576
Epoch 238/500
3/3 [==============================] - 0s 98ms/step - loss: 0.0135 -
mean_squared_error: 0.0135 - rmse: 0.1138 - mean_absolute_error: 0.0834 -
mean_absolute_percentage_error: 28.5836
Epoch 239/500
3/3 [==============================] - 0s 98ms/step - loss: 0.0126 -
mean_squared_error: 0.0126 - rmse: 0.1108 - mean_absolute_error: 0.0803 -
mean_absolute_percentage_error: 27.8251
```

```
Epoch 240/500
3/3 [==============================] - 0s 99ms/step - loss: 0.0130 -
mean_squared_error: 0.0130 - rmse: 0.1143 - mean_absolute_error: 0.0823 -
mean_absolute_percentage_error: 28.3827
Epoch 241/500
3/3 [==============================] - 0s 93ms/step - loss: 0.0133 -
mean_squared_error: 0.0133 - rmse: 0.1127 - mean_absolute_error: 0.0835 -
mean_absolute_percentage_error: 28.9227
Epoch 242/500
3/3 [==============================] - 0s 96ms/step - loss: 0.0126 -
mean_squared_error: 0.0126 - rmse: 0.1110 - mean_absolute_error: 0.0781 -
mean_absolute_percentage_error: 26.6424
Epoch 243/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0137 -
mean_squared_error: 0.0137 - rmse: 0.1167 - mean_absolute_error: 0.0849 -
mean_absolute_percentage_error: 28.4026
Epoch 244/500
3/3 [==============================] - 0s 81ms/step - loss: 0.0143 -
mean_squared_error: 0.0143 - rmse: 0.1191 - mean_absolute_error: 0.0846 -
mean_absolute_percentage_error: 28.1978
Epoch 245/500
3/3 [==============================] - 0s 81ms/step - loss: 0.0132 -
mean_squared_error: 0.0132 - rmse: 0.1160 - mean_absolute_error: 0.0812 -
mean_absolute_percentage_error: 26.9343
Epoch 246/500
3/3 [==============================] - 0s 85ms/step - loss: 0.0140 -
mean_squared_error: 0.0140 - rmse: 0.1185 - mean_absolute_error: 0.0844 -
mean_absolute_percentage_error: 28.7373
Epoch 247/500
3/3 [==============================] - 0s 95ms/step - loss: 0.0144 -
mean_squared_error: 0.0144 - rmse: 0.1190 - mean_absolute_error: 0.0834 -
mean_absolute_percentage_error: 28.7707
Epoch 248/500
3/3 [==============================] - 0s 95ms/step - loss: 0.0134 -
mean_squared_error: 0.0134 - rmse: 0.1123 - mean_absolute_error: 0.0814 -
mean_absolute_percentage_error: 27.1606
Epoch 249/500
3/3 [==============================] - 0s 91ms/step - loss: 0.0131 -
mean_squared_error: 0.0131 - rmse: 0.1117 - mean_absolute_error: 0.0803 -
mean_absolute_percentage_error: 27.6447
Epoch 250/500
3/3 [==============================] - 0s 99ms/step - loss: 0.0133 -
mean_squared_error: 0.0133 - rmse: 0.1134 - mean_absolute_error: 0.0806 -
mean_absolute_percentage_error: 27.4231
Epoch 251/500
3/3 [==============================] - 0s 88ms/step - loss: 0.0129 -
mean_squared_error: 0.0129 - rmse: 0.1148 - mean_absolute_error: 0.0811 -
mean_absolute_percentage_error: 28.4066
```

```
Epoch 252/500
3/3 [==============================] - 0s 85ms/step - loss: 0.0136 -
mean_squared_error: 0.0136 - rmse: 0.1177 - mean_absolute_error: 0.0836 -
mean_absolute_percentage_error: 27.4244
Epoch 253/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0129 -
mean_squared_error: 0.0129 - rmse: 0.1136 - mean_absolute_error: 0.0805 -
mean_absolute_percentage_error: 28.0941
Epoch 254/500
3/3 [==============================] - 0s 85ms/step - loss: 0.0138 -
mean_squared_error: 0.0138 - rmse: 0.1186 - mean_absolute_error: 0.0838 -
mean_absolute_percentage_error: 27.8071
Epoch 255/500
3/3 [==============================] - 0s 81ms/step - loss: 0.0128 -
mean_squared_error: 0.0128 - rmse: 0.1140 - mean_absolute_error: 0.0816 -
mean_absolute_percentage_error: 27.5259
Epoch 256/500
3/3 [==============================] - 0s 95ms/step - loss: 0.0136 -
mean_squared_error: 0.0136 - rmse: 0.1157 - mean_absolute_error: 0.0832 -
mean_absolute_percentage_error: 27.6896
Epoch 257/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0125 -
mean_squared_error: 0.0125 - rmse: 0.1110 - mean_absolute_error: 0.0813 -
mean_absolute_percentage_error: 26.5458
Epoch 258/500
3/3 [==============================] - 0s 88ms/step - loss: 0.0140 -
mean_squared_error: 0.0140 - rmse: 0.1199 - mean_absolute_error: 0.0839 -
mean_absolute_percentage_error: 28.7665
Epoch 259/500
3/3 [==============================] - 0s 89ms/step - loss: 0.0126 -
mean_squared_error: 0.0126 - rmse: 0.1089 - mean_absolute_error: 0.0794 -
mean_absolute_percentage_error: 26.8755
Epoch 260/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0137 -
mean_squared_error: 0.0137 - rmse: 0.1183 - mean_absolute_error: 0.0821 -
mean_absolute_percentage_error: 26.7680
Epoch 261/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0118 -
mean_squared_error: 0.0118 - rmse: 0.1092 - mean_absolute_error: 0.0773 -
mean_absolute_percentage_error: 25.8595
Epoch 262/500
3/3 [==============================] - 0s 90ms/step - loss: 0.0130 -
mean_squared_error: 0.0130 - rmse: 0.1130 - mean_absolute_error: 0.0814 -
mean_absolute_percentage_error: 27.5695
Epoch 263/500
3/3 [==============================] - 0s 82ms/step - loss: 0.0124 -
mean_squared_error: 0.0124 - rmse: 0.1104 - mean_absolute_error: 0.0793 -
mean_absolute_percentage_error: 27.0008
```

```
Epoch 264/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0133 -
mean_squared_error: 0.0133 - rmse: 0.1155 - mean_absolute_error: 0.0807 -
mean_absolute_percentage_error: 28.1662
Epoch 265/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0139 -
mean_squared_error: 0.0139 - rmse: 0.1193 - mean_absolute_error: 0.0834 -
mean_absolute_percentage_error: 27.5825
Epoch 266/500
3/3 [==============================] - 0s 102ms/step - loss: 0.0132 -
mean_squared_error: 0.0132 - rmse: 0.1134 - mean_absolute_error: 0.0811 -
mean_absolute_percentage_error: 28.0970
Epoch 267/500
3/3 [==============================] - 0s 107ms/step - loss: 0.0132 -
mean_squared_error: 0.0132 - rmse: 0.1103 - mean_absolute_error: 0.0812 -
mean_absolute_percentage_error: 26.4724
Epoch 268/500
3/3 [==============================] - 0s 92ms/step - loss: 0.0128 -
mean_squared_error: 0.0128 - rmse: 0.1130 - mean_absolute_error: 0.0795 -
mean_absolute_percentage_error: 26.9190
Epoch 269/500
3/3 [==============================] - 0s 86ms/step - loss: 0.0131 -
mean_squared_error: 0.0131 - rmse: 0.1136 - mean_absolute_error: 0.0796 -
mean_absolute_percentage_error: 26.8365
Epoch 270/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0125 -
mean_squared_error: 0.0125 - rmse: 0.1130 - mean_absolute_error: 0.0780 -
mean_absolute_percentage_error: 25.9242
Epoch 271/500
3/3 [==============================] - 0s 82ms/step - loss: 0.0127 -
mean_squared_error: 0.0127 - rmse: 0.1092 - mean_absolute_error: 0.0795 -
mean_absolute_percentage_error: 25.3689
Epoch 272/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0130 -
mean_squared_error: 0.0130 - rmse: 0.1149 - mean_absolute_error: 0.0790 -
mean_absolute_percentage_error: 26.1944
Epoch 273/500
3/3 [==============================] - 0s 79ms/step - loss: 0.0134 -
mean_squared_error: 0.0134 - rmse: 0.1170 - mean_absolute_error: 0.0825 -
mean_absolute_percentage_error: 28.0076
Epoch 274/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0134 -
mean_squared_error: 0.0134 - rmse: 0.1154 - mean_absolute_error: 0.0824 -
mean_absolute_percentage_error: 27.6051
Epoch 275/500
3/3 [==============================] - 0s 74ms/step - loss: 0.0142 -
mean_squared_error: 0.0142 - rmse: 0.1150 - mean_absolute_error: 0.0814 -
mean_absolute_percentage_error: 28.4429
```

```
Epoch 276/500
3/3 [==============================] - 0s 98ms/step - loss: 0.0120 -
mean_squared_error: 0.0120 - rmse: 0.1093 - mean_absolute_error: 0.0775 -
mean_absolute_percentage_error: 25.1828
Epoch 277/500
3/3 [==============================] - 0s 107ms/step - loss: 0.0137 -
mean_squared_error: 0.0137 - rmse: 0.1180 - mean_absolute_error: 0.0821 -
mean_absolute_percentage_error: 25.9360
Epoch 278/500
3/3 [==============================] - 0s 100ms/step - loss: 0.0127 -
mean_squared_error: 0.0127 - rmse: 0.1106 - mean_absolute_error: 0.0800 -
mean_absolute_percentage_error: 25.8149
Epoch 279/500
3/3 [==============================] - 0s 81ms/step - loss: 0.0121 -
mean_squared_error: 0.0121 - rmse: 0.1104 - mean_absolute_error: 0.0780 -
mean_absolute_percentage_error: 25.8213
Epoch 280/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0135 -
mean_squared_error: 0.0135 - rmse: 0.1126 - mean_absolute_error: 0.0816 -
mean_absolute_percentage_error: 26.4532
Epoch 281/500
3/3 [==============================] - 0s 86ms/step - loss: 0.0120 -
mean_squared_error: 0.0120 - rmse: 0.1055 - mean_absolute_error: 0.0780 -
mean_absolute_percentage_error: 25.4521
Epoch 282/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0126 -
mean_squared_error: 0.0126 - rmse: 0.1102 - mean_absolute_error: 0.0777 -
mean_absolute_percentage_error: 26.1720
Epoch 283/500
3/3 [==============================] - 0s 101ms/step - loss: 0.0119 -
mean_squared_error: 0.0119 - rmse: 0.1101 - mean_absolute_error: 0.0771 -
mean_absolute_percentage_error: 26.1828
Epoch 284/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0130 -
mean_squared_error: 0.0130 - rmse: 0.1148 - mean_absolute_error: 0.0814 -
mean_absolute_percentage_error: 26.6268
Epoch 285/500
3/3 [==============================] - 0s 94ms/step - loss: 0.0121 -
mean_squared_error: 0.0121 - rmse: 0.1084 - mean_absolute_error: 0.0767 -
mean_absolute_percentage_error: 25.0270
Epoch 286/500
3/3 [==============================] - 0s 89ms/step - loss: 0.0122 -
mean_squared_error: 0.0122 - rmse: 0.1118 - mean_absolute_error: 0.0781 -
mean_absolute_percentage_error: 26.4182
Epoch 287/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0112 -
mean_squared_error: 0.0112 - rmse: 0.1070 - mean_absolute_error: 0.0762 -
mean_absolute_percentage_error: 26.3706
```

```
Epoch 288/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0127 -
mean_squared_error: 0.0127 - rmse: 0.1110 - mean_absolute_error: 0.0809 -
mean_absolute_percentage_error: 27.2324
Epoch 289/500
3/3 [==============================] - 0s 76ms/step - loss: 0.0122 -
mean_squared_error: 0.0122 - rmse: 0.1082 - mean_absolute_error: 0.0790 -
mean_absolute_percentage_error: 26.8263
Epoch 290/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0119 -
mean_squared_error: 0.0119 - rmse: 0.1087 - mean_absolute_error: 0.0759 -
mean_absolute_percentage_error: 24.7935
Epoch 291/500
3/3 [==============================] - 0s 87ms/step - loss: 0.0126 -
mean_squared_error: 0.0126 - rmse: 0.1134 - mean_absolute_error: 0.0770 -
mean_absolute_percentage_error: 25.9795
Epoch 292/500
3/3 [==============================] - 0s 89ms/step - loss: 0.0134 -
mean_squared_error: 0.0134 - rmse: 0.1152 - mean_absolute_error: 0.0810 -
mean_absolute_percentage_error: 25.9045
Epoch 293/500
3/3 [==============================] - 0s 89ms/step - loss: 0.0118 -
mean_squared_error: 0.0118 - rmse: 0.1060 - mean_absolute_error: 0.0753 -
mean_absolute_percentage_error: 24.7493
Epoch 294/500
3/3 [==============================] - 0s 96ms/step - loss: 0.0132 -
mean_squared_error: 0.0132 - rmse: 0.1161 - mean_absolute_error: 0.0814 -
mean_absolute_percentage_error: 26.3742
Epoch 295/500
3/3 [==============================] - 0s 131ms/step - loss: 0.0119 -
mean_squared_error: 0.0119 - rmse: 0.1088 - mean_absolute_error: 0.0775 -
mean_absolute_percentage_error: 25.7300
Epoch 296/500
3/3 [==============================] - 0s 132ms/step - loss: 0.0124 -
mean_squared_error: 0.0124 - rmse: 0.1071 - mean_absolute_error: 0.0779 -
mean_absolute_percentage_error: 26.6667
Epoch 297/500
3/3 [==============================] - 0s 105ms/step - loss: 0.0130 -
mean_squared_error: 0.0130 - rmse: 0.1125 - mean_absolute_error: 0.0778 -
mean_absolute_percentage_error: 26.2974
Epoch 298/500
3/3 [==============================] - 0s 90ms/step - loss: 0.0119 -
mean_squared_error: 0.0119 - rmse: 0.1073 - mean_absolute_error: 0.0768 -
mean_absolute_percentage_error: 26.4555
Epoch 299/500
3/3 [==============================] - 0s 80ms/step - loss: 0.0129 -
mean_squared_error: 0.0129 - rmse: 0.1145 - mean_absolute_error: 0.0816 -
mean_absolute_percentage_error: 27.3165
```

```
Epoch 300/500
3/3 [==============================] - 0s 76ms/step - loss: 0.0113 -
mean_squared_error: 0.0113 - rmse: 0.1051 - mean_absolute_error: 0.0748 -
mean_absolute_percentage_error: 25.0177
Epoch 301/500
3/3 [==============================] - 0s 85ms/step - loss: 0.0125 -
mean_squared_error: 0.0125 - rmse: 0.1074 - mean_absolute_error: 0.0797 -
mean_absolute_percentage_error: 25.8193
Epoch 302/500
3/3 [==============================] - 0s 94ms/step - loss: 0.0118 -
mean_squared_error: 0.0118 - rmse: 0.1064 - mean_absolute_error: 0.0754 -
mean_absolute_percentage_error: 25.5159
Epoch 303/500
3/3 [==============================] - 0s 82ms/step - loss: 0.0121 -
mean_squared_error: 0.0121 - rmse: 0.1086 - mean_absolute_error: 0.0760 -
mean_absolute_percentage_error: 24.2010
Epoch 304/500
3/3 [==============================] - 0s 80ms/step - loss: 0.0115 -
mean_squared_error: 0.0115 - rmse: 0.1056 - mean_absolute_error: 0.0762 -
mean_absolute_percentage_error: 25.1805
Epoch 305/500
3/3 [==============================] - 0s 111ms/step - loss: 0.0122 -
mean_squared_error: 0.0122 - rmse: 0.1084 - mean_absolute_error: 0.0776 -
mean_absolute_percentage_error: 25.5892
Epoch 306/500
3/3 [==============================] - 0s 107ms/step - loss: 0.0125 -
mean_squared_error: 0.0125 - rmse: 0.1086 - mean_absolute_error: 0.0765 -
mean_absolute_percentage_error: 25.9691
Epoch 307/500
3/3 [==============================] - 0s 103ms/step - loss: 0.0117 -
mean_squared_error: 0.0117 - rmse: 0.1052 - mean_absolute_error: 0.0750 -
mean_absolute_percentage_error: 24.2371
Epoch 308/500
3/3 [==============================] - 0s 93ms/step - loss: 0.0124 -
mean_squared_error: 0.0124 - rmse: 0.1095 - mean_absolute_error: 0.0788 -
mean_absolute_percentage_error: 25.2026
Epoch 309/500
3/3 [==============================] - 0s 85ms/step - loss: 0.0121 -
mean_squared_error: 0.0121 - rmse: 0.1112 - mean_absolute_error: 0.0760 -
mean_absolute_percentage_error: 25.3194
Epoch 310/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0127 -
mean_squared_error: 0.0127 - rmse: 0.1095 - mean_absolute_error: 0.0787 -
mean_absolute_percentage_error: 25.4929
Epoch 311/500
3/3 [==============================] - 0s 80ms/step - loss: 0.0108 -
mean_squared_error: 0.0108 - rmse: 0.1026 - mean_absolute_error: 0.0769 -
mean_absolute_percentage_error: 24.9372
```

```
Epoch 312/500
3/3 [==============================] - 0s 76ms/step - loss: 0.0110 -
mean_squared_error: 0.0110 - rmse: 0.1017 - mean_absolute_error: 0.0738 -
mean_absolute_percentage_error: 25.0130
Epoch 313/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0124 -
mean_squared_error: 0.0124 - rmse: 0.1086 - mean_absolute_error: 0.0767 -
mean_absolute_percentage_error: 25.3276
Epoch 314/500
3/3 [==============================] - 0s 91ms/step - loss: 0.0125 -
mean_squared_error: 0.0125 - rmse: 0.1102 - mean_absolute_error: 0.0772 -
mean_absolute_percentage_error: 25.2822
Epoch 315/500
3/3 [==============================] - 0s 135ms/step - loss: 0.0118 -
mean_squared_error: 0.0118 - rmse: 0.1068 - mean_absolute_error: 0.0790 -
mean_absolute_percentage_error: 25.6962
Epoch 316/500
3/3 [==============================] - 0s 104ms/step - loss: 0.0129 -
mean_squared_error: 0.0129 - rmse: 0.1133 - mean_absolute_error: 0.0779 -
mean_absolute_percentage_error: 27.3642
Epoch 317/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0121 -
mean_squared_error: 0.0121 - rmse: 0.1102 - mean_absolute_error: 0.0760 -
mean_absolute_percentage_error: 24.7379
Epoch 318/500
3/3 [==============================] - 0s 82ms/step - loss: 0.0116 -
mean_squared_error: 0.0116 - rmse: 0.1082 - mean_absolute_error: 0.0762 -
mean_absolute_percentage_error: 25.4901
Epoch 319/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0117 -
mean_squared_error: 0.0117 - rmse: 0.1088 - mean_absolute_error: 0.0775 -
mean_absolute_percentage_error: 26.3340
Epoch 320/500
3/3 [==============================] - 0s 80ms/step - loss: 0.0115 -
mean_squared_error: 0.0115 - rmse: 0.1061 - mean_absolute_error: 0.0769 -
mean_absolute_percentage_error: 25.3399
Epoch 321/500
3/3 [==============================] - 0s 80ms/step - loss: 0.0119 -
mean_squared_error: 0.0119 - rmse: 0.1060 - mean_absolute_error: 0.0760 -
mean_absolute_percentage_error: 25.0493
Epoch 322/500
3/3 [==============================] - 0s 91ms/step - loss: 0.0108 -
mean_squared_error: 0.0108 - rmse: 0.1044 - mean_absolute_error: 0.0733 -
mean_absolute_percentage_error: 24.5030
Epoch 323/500
3/3 [==============================] - 0s 86ms/step - loss: 0.0108 -
mean_squared_error: 0.0108 - rmse: 0.1051 - mean_absolute_error: 0.0736 -
mean_absolute_percentage_error: 24.6667
```

```
Epoch 324/500
3/3 [==============================] - 0s 91ms/step - loss: 0.0125 -
mean_squared_error: 0.0125 - rmse: 0.1102 - mean_absolute_error: 0.0776 -
mean_absolute_percentage_error: 27.0725
Epoch 325/500
3/3 [==============================] - 0s 112ms/step - loss: 0.0118 -
mean_squared_error: 0.0118 - rmse: 0.1031 - mean_absolute_error: 0.0780 -
mean_absolute_percentage_error: 25.6224
Epoch 326/500
3/3 [==============================] - 0s 98ms/step - loss: 0.0122 -
mean_squared_error: 0.0122 - rmse: 0.1091 - mean_absolute_error: 0.0777 -
mean_absolute_percentage_error: 25.0339
Epoch 327/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0110 -
mean_squared_error: 0.0110 - rmse: 0.1060 - mean_absolute_error: 0.0752 -
mean_absolute_percentage_error: 24.9920
Epoch 328/500
3/3 [==============================] - 0s 75ms/step - loss: 0.0116 -
mean_squared_error: 0.0116 - rmse: 0.1061 - mean_absolute_error: 0.0743 -
mean_absolute_percentage_error: 24.5086
Epoch 329/500
3/3 [==============================] - 0s 75ms/step - loss: 0.0119 -
mean_squared_error: 0.0119 - rmse: 0.1052 - mean_absolute_error: 0.0755 -
mean_absolute_percentage_error: 25.7068
Epoch 330/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0118 -
mean_squared_error: 0.0118 - rmse: 0.1071 - mean_absolute_error: 0.0775 -
mean_absolute_percentage_error: 25.4557
Epoch 331/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0119 -
mean_squared_error: 0.0119 - rmse: 0.1060 - mean_absolute_error: 0.0757 -
mean_absolute_percentage_error: 25.5689
Epoch 332/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0119 -
mean_squared_error: 0.0119 - rmse: 0.1066 - mean_absolute_error: 0.0749 -
mean_absolute_percentage_error: 24.5567
Epoch 333/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0116 -
mean_squared_error: 0.0116 - rmse: 0.1069 - mean_absolute_error: 0.0753 -
mean_absolute_percentage_error: 24.6655
Epoch 334/500
3/3 [==============================] - 0s 107ms/step - loss: 0.0112 -
mean_squared_error: 0.0112 - rmse: 0.1053 - mean_absolute_error: 0.0749 -
mean_absolute_percentage_error: 25.0878
Epoch 335/500
3/3 [==============================] - 0s 113ms/step - loss: 0.0108 -
mean_squared_error: 0.0108 - rmse: 0.1016 - mean_absolute_error: 0.0727 -
mean_absolute_percentage_error: 23.7151
```

```
Epoch 336/500
3/3 [==============================] - 0s 87ms/step - loss: 0.0113 -
mean_squared_error: 0.0113 - rmse: 0.1067 - mean_absolute_error: 0.0735 -
mean_absolute_percentage_error: 24.8008
Epoch 337/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0126 -
mean_squared_error: 0.0126 - rmse: 0.1113 - mean_absolute_error: 0.0782 -
mean_absolute_percentage_error: 26.3372
Epoch 338/500
3/3 [==============================] - 0s 73ms/step - loss: 0.0112 -
mean_squared_error: 0.0112 - rmse: 0.1070 - mean_absolute_error: 0.0751 -
mean_absolute_percentage_error: 24.2632
Epoch 339/500
3/3 [==============================] - 0s 76ms/step - loss: 0.0120 -
mean_squared_error: 0.0120 - rmse: 0.1085 - mean_absolute_error: 0.0756 -
mean_absolute_percentage_error: 23.6753
Epoch 340/500
3/3 [==============================] - 0s 89ms/step - loss: 0.0100 -
mean_squared_error: 0.0100 - rmse: 0.0988 - mean_absolute_error: 0.0704 -
mean_absolute_percentage_error: 23.4737
Epoch 341/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0118 -
mean_squared_error: 0.0118 - rmse: 0.1086 - mean_absolute_error: 0.0755 -
mean_absolute_percentage_error: 24.7590
Epoch 342/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0109 -
mean_squared_error: 0.0109 - rmse: 0.1056 - mean_absolute_error: 0.0730 -
mean_absolute_percentage_error: 25.8012
Epoch 343/500
3/3 [==============================] - 0s 86ms/step - loss: 0.0114 -
mean_squared_error: 0.0114 - rmse: 0.1067 - mean_absolute_error: 0.0738 -
mean_absolute_percentage_error: 25.9279
Epoch 344/500
3/3 [==============================] - 0s 112ms/step - loss: 0.0107 -
mean_squared_error: 0.0107 - rmse: 0.1044 - mean_absolute_error: 0.0721 -
mean_absolute_percentage_error: 23.4851
Epoch 345/500
3/3 [==============================] - 0s 105ms/step - loss: 0.0111 -
mean_squared_error: 0.0111 - rmse: 0.1042 - mean_absolute_error: 0.0751 -
mean_absolute_percentage_error: 24.7646
Epoch 346/500
3/3 [==============================] - 0s 98ms/step - loss: 0.0119 -
mean_squared_error: 0.0119 - rmse: 0.1067 - mean_absolute_error: 0.0738 -
mean_absolute_percentage_error: 24.5383
Epoch 347/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0110 -
mean_squared_error: 0.0110 - rmse: 0.1036 - mean_absolute_error: 0.0737 -
mean_absolute_percentage_error: 24.2350
```

```
Epoch 348/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0112 -
mean_squared_error: 0.0112 - rmse: 0.1062 - mean_absolute_error: 0.0748 -
mean_absolute_percentage_error: 24.4041
Epoch 349/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0113 -
mean_squared_error: 0.0113 - rmse: 0.1040 - mean_absolute_error: 0.0754 -
mean_absolute_percentage_error: 24.7932
Epoch 350/500
3/3 [==============================] - 0s 79ms/step - loss: 0.0096 -
mean_squared_error: 0.0096 - rmse: 0.0953 - mean_absolute_error: 0.0696 -
mean_absolute_percentage_error: 22.9461
Epoch 351/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0117 -
mean_squared_error: 0.0117 - rmse: 0.1061 - mean_absolute_error: 0.0761 -
mean_absolute_percentage_error: 24.9010
Epoch 352/500
3/3 [==============================] - 0s 82ms/step - loss: 0.0110 -
mean_squared_error: 0.0110 - rmse: 0.1062 - mean_absolute_error: 0.0744 -
mean_absolute_percentage_error: 23.6273
Epoch 353/500
3/3 [==============================] - 0s 94ms/step - loss: 0.0113 -
mean_squared_error: 0.0113 - rmse: 0.1049 - mean_absolute_error: 0.0735 -
mean_absolute_percentage_error: 24.7676
Epoch 354/500
3/3 [==============================] - 0s 107ms/step - loss: 0.0109 -
mean_squared_error: 0.0109 - rmse: 0.1013 - mean_absolute_error: 0.0736 -
mean_absolute_percentage_error: 24.7319
Epoch 355/500
3/3 [==============================] - 0s 108ms/step - loss: 0.0116 -
mean_squared_error: 0.0116 - rmse: 0.1060 - mean_absolute_error: 0.0742 -
mean_absolute_percentage_error: 24.8060
Epoch 356/500
3/3 [==============================] - 0s 118ms/step - loss: 0.0107 -
mean_squared_error: 0.0107 - rmse: 0.0999 - mean_absolute_error: 0.0718 -
mean_absolute_percentage_error: 24.0681
Epoch 357/500
3/3 [==============================] - 0s 89ms/step - loss: 0.0098 -
mean_squared_error: 0.0098 - rmse: 0.0966 - mean_absolute_error: 0.0705 -
mean_absolute_percentage_error: 23.2764
Epoch 358/500
3/3 [==============================] - 0s 75ms/step - loss: 0.0108 -
mean_squared_error: 0.0108 - rmse: 0.1033 - mean_absolute_error: 0.0723 -
mean_absolute_percentage_error: 23.5129
Epoch 359/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0121 -
mean_squared_error: 0.0121 - rmse: 0.1078 - mean_absolute_error: 0.0748 -
mean_absolute_percentage_error: 25.8241
```

```
Epoch 360/500
3/3 [==============================] - 0s 85ms/step - loss: 0.0114 -
mean_squared_error: 0.0114 - rmse: 0.1068 - mean_absolute_error: 0.0737 -
mean_absolute_percentage_error: 23.3849
Epoch 361/500
3/3 [==============================] - 0s 75ms/step - loss: 0.0109 -
mean_squared_error: 0.0109 - rmse: 0.1055 - mean_absolute_error: 0.0726 -
mean_absolute_percentage_error: 23.2104
Epoch 362/500
3/3 [==============================] - 0s 82ms/step - loss: 0.0113 -
mean_squared_error: 0.0113 - rmse: 0.1062 - mean_absolute_error: 0.0739 -
mean_absolute_percentage_error: 24.3299
Epoch 363/500
3/3 [==============================] - 0s 104ms/step - loss: 0.0102 -
mean_squared_error: 0.0102 - rmse: 0.1011 - mean_absolute_error: 0.0711 -
mean_absolute_percentage_error: 23.0935
Epoch 364/500
3/3 [==============================] - 0s 90ms/step - loss: 0.0111 -
mean_squared_error: 0.0111 - rmse: 0.1021 - mean_absolute_error: 0.0734 -
mean_absolute_percentage_error: 24.2329
Epoch 365/500
3/3 [==============================] - 0s 114ms/step - loss: 0.0098 -
mean_squared_error: 0.0098 - rmse: 0.0942 - mean_absolute_error: 0.0688 -
mean_absolute_percentage_error: 21.7455
Epoch 366/500
3/3 [==============================] - 0s 95ms/step - loss: 0.0107 -
mean_squared_error: 0.0107 - rmse: 0.1004 - mean_absolute_error: 0.0704 -
mean_absolute_percentage_error: 22.6234
Epoch 367/500
3/3 [==============================] - 0s 81ms/step - loss: 0.0113 -
mean_squared_error: 0.0113 - rmse: 0.1035 - mean_absolute_error: 0.0723 -
mean_absolute_percentage_error: 23.6299
Epoch 368/500
3/3 [==============================] - 0s 101ms/step - loss: 0.0104 -
mean_squared_error: 0.0104 - rmse: 0.0991 - mean_absolute_error: 0.0705 -
mean_absolute_percentage_error: 22.9859
Epoch 369/500
3/3 [==============================] - 0s 86ms/step - loss: 0.0108 -
mean_squared_error: 0.0108 - rmse: 0.1039 - mean_absolute_error: 0.0708 -
mean_absolute_percentage_error: 22.7418
Epoch 370/500
3/3 [==============================] - 0s 79ms/step - loss: 0.0105 -
mean_squared_error: 0.0105 - rmse: 0.1000 - mean_absolute_error: 0.0704 -
mean_absolute_percentage_error: 22.2353
Epoch 371/500
3/3 [==============================] - 0s 90ms/step - loss: 0.0105 -
mean_squared_error: 0.0105 - rmse: 0.1002 - mean_absolute_error: 0.0710 -
mean_absolute_percentage_error: 21.1894
```

```
Epoch 372/500
3/3 [==============================] - 0s 98ms/step - loss: 0.0099 -
mean_squared_error: 0.0099 - rmse: 0.0995 - mean_absolute_error: 0.0699 -
mean_absolute_percentage_error: 22.5833
Epoch 373/500
3/3 [==============================] - 0s 92ms/step - loss: 0.0109 -
mean_squared_error: 0.0109 - rmse: 0.1017 - mean_absolute_error: 0.0710 -
mean_absolute_percentage_error: 22.8590
Epoch 374/500
3/3 [==============================] - 0s 88ms/step - loss: 0.0106 -
mean_squared_error: 0.0106 - rmse: 0.1040 - mean_absolute_error: 0.0726 -
mean_absolute_percentage_error: 23.5522
Epoch 375/500
3/3 [==============================] - 0s 89ms/step - loss: 0.0106 -
mean_squared_error: 0.0106 - rmse: 0.1020 - mean_absolute_error: 0.0702 -
mean_absolute_percentage_error: 22.6255
Epoch 376/500
3/3 [==============================] - 0s 104ms/step - loss: 0.0103 -
mean_squared_error: 0.0103 - rmse: 0.0983 - mean_absolute_error: 0.0681 -
mean_absolute_percentage_error: 21.7902
Epoch 377/500
3/3 [==============================] - 0s 102ms/step - loss: 0.0106 -
mean_squared_error: 0.0106 - rmse: 0.1025 - mean_absolute_error: 0.0721 -
mean_absolute_percentage_error: 22.9467
Epoch 378/500
3/3 [==============================] - 0s 90ms/step - loss: 0.0112 -
mean_squared_error: 0.0112 - rmse: 0.1067 - mean_absolute_error: 0.0710 -
mean_absolute_percentage_error: 21.9288
Epoch 379/500
3/3 [==============================] - 0s 100ms/step - loss: 0.0100 -
mean_squared_error: 0.0100 - rmse: 0.0984 - mean_absolute_error: 0.0673 -
mean_absolute_percentage_error: 22.2081
Epoch 380/500
3/3 [==============================] - 0s 107ms/step - loss: 0.0110 -
mean_squared_error: 0.0110 - rmse: 0.1025 - mean_absolute_error: 0.0728 -
mean_absolute_percentage_error: 23.2675
Epoch 381/500
3/3 [==============================] - 0s 94ms/step - loss: 0.0112 -
mean_squared_error: 0.0112 - rmse: 0.1039 - mean_absolute_error: 0.0733 -
mean_absolute_percentage_error: 22.6009
Epoch 382/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0102 -
mean_squared_error: 0.0102 - rmse: 0.0962 - mean_absolute_error: 0.0698 -
mean_absolute_percentage_error: 21.7582
Epoch 383/500
3/3 [==============================] - 0s 105ms/step - loss: 0.0099 -
mean_squared_error: 0.0099 - rmse: 0.0977 - mean_absolute_error: 0.0701 -
mean_absolute_percentage_error: 21.5878
```

```
Epoch 384/500
3/3 [==============================] - 0s 103ms/step - loss: 0.0107 -
mean_squared_error: 0.0107 - rmse: 0.1005 - mean_absolute_error: 0.0709 -
mean_absolute_percentage_error: 22.4904
Epoch 385/500
3/3 [==============================] - 0s 96ms/step - loss: 0.0100 -
mean_squared_error: 0.0100 - rmse: 0.0990 - mean_absolute_error: 0.0706 -
mean_absolute_percentage_error: 22.8502
Epoch 386/500
3/3 [==============================] - 0s 82ms/step - loss: 0.0101 -
mean_squared_error: 0.0101 - rmse: 0.1003 - mean_absolute_error: 0.0709 -
mean_absolute_percentage_error: 22.9471
Epoch 387/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0098 -
mean_squared_error: 0.0098 - rmse: 0.1000 - mean_absolute_error: 0.0667 -
mean_absolute_percentage_error: 21.5775
Epoch 388/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0115 -
mean_squared_error: 0.0115 - rmse: 0.1087 - mean_absolute_error: 0.0717 -
mean_absolute_percentage_error: 22.6946
Epoch 389/500
3/3 [==============================] - 0s 79ms/step - loss: 0.0099 -
mean_squared_error: 0.0099 - rmse: 0.0971 - mean_absolute_error: 0.0694 -
mean_absolute_percentage_error: 21.7590
Epoch 390/500
3/3 [==============================] - 0s 80ms/step - loss: 0.0097 -
mean_squared_error: 0.0097 - rmse: 0.0967 - mean_absolute_error: 0.0688 -
mean_absolute_percentage_error: 22.5613
Epoch 391/500
3/3 [==============================] - 0s 73ms/step - loss: 0.0115 -
mean_squared_error: 0.0115 - rmse: 0.1074 - mean_absolute_error: 0.0735 -
mean_absolute_percentage_error: 23.3654
Epoch 392/500
3/3 [==============================] - 0s 69ms/step - loss: 0.0102 -
mean_squared_error: 0.0102 - rmse: 0.1012 - mean_absolute_error: 0.0676 -
mean_absolute_percentage_error: 22.0700
Epoch 393/500
3/3 [==============================] - 0s 65ms/step - loss: 0.0095 -
mean_squared_error: 0.0095 - rmse: 0.0983 - mean_absolute_error: 0.0691 -
mean_absolute_percentage_error: 22.5340
Epoch 394/500
3/3 [==============================] - 0s 70ms/step - loss: 0.0099 -
mean_squared_error: 0.0099 - rmse: 0.1004 - mean_absolute_error: 0.0690 -
mean_absolute_percentage_error: 22.8252
Epoch 395/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0116 -
mean_squared_error: 0.0116 - rmse: 0.1038 - mean_absolute_error: 0.0736 -
mean_absolute_percentage_error: 23.4164
```

```
Epoch 396/500
3/3 [==============================] - 0s 107ms/step - loss: 0.0117 -
mean_squared_error: 0.0117 - rmse: 0.1069 - mean_absolute_error: 0.0725 -
mean_absolute_percentage_error: 23.6272
Epoch 397/500
3/3 [==============================] - 0s 86ms/step - loss: 0.0105 -
mean_squared_error: 0.0105 - rmse: 0.1018 - mean_absolute_error: 0.0698 -
mean_absolute_percentage_error: 22.9631
Epoch 398/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0108 -
mean_squared_error: 0.0108 - rmse: 0.1020 - mean_absolute_error: 0.0729 -
mean_absolute_percentage_error: 23.1266
Epoch 399/500
3/3 [==============================] - 0s 86ms/step - loss: 0.0111 -
mean_squared_error: 0.0111 - rmse: 0.1038 - mean_absolute_error: 0.0731 -
mean_absolute_percentage_error: 23.2818
Epoch 400/500
3/3 [==============================] - 0s 96ms/step - loss: 0.0107 -
mean_squared_error: 0.0107 - rmse: 0.1026 - mean_absolute_error: 0.0698 -
mean_absolute_percentage_error: 21.2616
Epoch 401/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0104 -
mean_squared_error: 0.0104 - rmse: 0.1001 - mean_absolute_error: 0.0679 -
mean_absolute_percentage_error: 20.9061
Epoch 402/500
3/3 [==============================] - 0s 87ms/step - loss: 0.0098 -
mean_squared_error: 0.0098 - rmse: 0.0992 - mean_absolute_error: 0.0699 -
mean_absolute_percentage_error: 21.4809
Epoch 403/500
3/3 [==============================] - 0s 103ms/step - loss: 0.0108 -
mean_squared_error: 0.0108 - rmse: 0.1034 - mean_absolute_error: 0.0712 -
mean_absolute_percentage_error: 22.1238
Epoch 404/500
3/3 [==============================] - 0s 104ms/step - loss: 0.0099 -
mean_squared_error: 0.0099 - rmse: 0.1003 - mean_absolute_error: 0.0680 -
mean_absolute_percentage_error: 21.8044
Epoch 405/500
3/3 [==============================] - 0s 107ms/step - loss: 0.0112 -
mean_squared_error: 0.0112 - rmse: 0.1056 - mean_absolute_error: 0.0735 -
mean_absolute_percentage_error: 22.7988
Epoch 406/500
3/3 [==============================] - 0s 85ms/step - loss: 0.0096 -
mean_squared_error: 0.0096 - rmse: 0.0983 - mean_absolute_error: 0.0685 -
mean_absolute_percentage_error: 21.6788
Epoch 407/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0096 -
mean_squared_error: 0.0096 - rmse: 0.0988 - mean_absolute_error: 0.0669 -
mean_absolute_percentage_error: 21.7860
```

```
Epoch 408/500
3/3 [==============================] - 0s 90ms/step - loss: 0.0093 -
mean_squared_error: 0.0093 - rmse: 0.0975 - mean_absolute_error: 0.0663 -
mean_absolute_percentage_error: 20.6769
Epoch 409/500
3/3 [==============================] - 0s 104ms/step - loss: 0.0095 -
mean_squared_error: 0.0095 - rmse: 0.0973 - mean_absolute_error: 0.0675 -
mean_absolute_percentage_error: 21.8078
Epoch 410/500
3/3 [==============================] - 0s 90ms/step - loss: 0.0101 -
mean_squared_error: 0.0101 - rmse: 0.1017 - mean_absolute_error: 0.0697 -
mean_absolute_percentage_error: 23.1624
Epoch 411/500
3/3 [==============================] - 0s 106ms/step - loss: 0.0099 -
mean_squared_error: 0.0099 - rmse: 0.0989 - mean_absolute_error: 0.0690 -
mean_absolute_percentage_error: 22.9745
Epoch 412/500
3/3 [==============================] - 0s 119ms/step - loss: 0.0112 -
mean_squared_error: 0.0112 - rmse: 0.1045 - mean_absolute_error: 0.0732 -
mean_absolute_percentage_error: 23.1497
Epoch 413/500
3/3 [==============================] - 0s 105ms/step - loss: 0.0093 -
mean_squared_error: 0.0093 - rmse: 0.0962 - mean_absolute_error: 0.0671 -
mean_absolute_percentage_error: 21.1431
Epoch 414/500
3/3 [==============================] - 0s 103ms/step - loss: 0.0090 -
mean_squared_error: 0.0090 - rmse: 0.0936 - mean_absolute_error: 0.0665 -
mean_absolute_percentage_error: 21.5454
Epoch 415/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0099 -
mean_squared_error: 0.0099 - rmse: 0.1003 - mean_absolute_error: 0.0685 -
mean_absolute_percentage_error: 22.3666
Epoch 416/500
3/3 [==============================] - 0s 80ms/step - loss: 0.0096 -
mean_squared_error: 0.0096 - rmse: 0.0983 - mean_absolute_error: 0.0681 -
mean_absolute_percentage_error: 22.2588
Epoch 417/500
3/3 [==============================] - 0s 106ms/step - loss: 0.0104 -
mean_squared_error: 0.0104 - rmse: 0.1018 - mean_absolute_error: 0.0705 -
mean_absolute_percentage_error: 23.1496
Epoch 418/500
3/3 [==============================] - 0s 101ms/step - loss: 0.0113 -
mean_squared_error: 0.0113 - rmse: 0.1047 - mean_absolute_error: 0.0743 -
mean_absolute_percentage_error: 23.4941
Epoch 419/500
3/3 [==============================] - 0s 99ms/step - loss: 0.0097 -
mean_squared_error: 0.0097 - rmse: 0.0974 - mean_absolute_error: 0.0678 -
mean_absolute_percentage_error: 21.4761
```

```
Epoch 420/500
3/3 [==============================] - 0s 110ms/step - loss: 0.0101 -
mean_squared_error: 0.0101 - rmse: 0.0977 - mean_absolute_error: 0.0687 -
mean_absolute_percentage_error: 22.2159
Epoch 421/500
3/3 [==============================] - 0s 88ms/step - loss: 0.0104 -
mean_squared_error: 0.0104 - rmse: 0.1022 - mean_absolute_error: 0.0697 -
mean_absolute_percentage_error: 22.0354
Epoch 422/500
3/3 [==============================] - 0s 94ms/step - loss: 0.0099 -
mean_squared_error: 0.0099 - rmse: 0.0990 - mean_absolute_error: 0.0697 -
mean_absolute_percentage_error: 22.2191
Epoch 423/500
3/3 [==============================] - 0s 102ms/step - loss: 0.0102 -
mean_squared_error: 0.0102 - rmse: 0.1000 - mean_absolute_error: 0.0695 -
mean_absolute_percentage_error: 21.6724
Epoch 424/500
3/3 [==============================] - 0s 101ms/step - loss: 0.0098 -
mean_squared_error: 0.0098 - rmse: 0.0986 - mean_absolute_error: 0.0694 -
mean_absolute_percentage_error: 21.3250
Epoch 425/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0099 -
mean_squared_error: 0.0099 - rmse: 0.0999 - mean_absolute_error: 0.0687 -
mean_absolute_percentage_error: 21.8759
Epoch 426/500
3/3 [==============================] - 0s 130ms/step - loss: 0.0099 -
mean_squared_error: 0.0099 - rmse: 0.0987 - mean_absolute_error: 0.0665 -
mean_absolute_percentage_error: 22.0946
Epoch 427/500
3/3 [==============================] - 0s 92ms/step - loss: 0.0097 -
mean_squared_error: 0.0097 - rmse: 0.0992 - mean_absolute_error: 0.0671 -
mean_absolute_percentage_error: 20.9019
Epoch 428/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0106 -
mean_squared_error: 0.0106 - rmse: 0.1018 - mean_absolute_error: 0.0705 -
mean_absolute_percentage_error: 23.0753
Epoch 429/500
3/3 [==============================] - 0s 88ms/step - loss: 0.0100 -
mean_squared_error: 0.0100 - rmse: 0.1003 - mean_absolute_error: 0.0688 -
mean_absolute_percentage_error: 23.6314
Epoch 430/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0111 -
mean_squared_error: 0.0111 - rmse: 0.1063 - mean_absolute_error: 0.0698 -
mean_absolute_percentage_error: 22.2963
Epoch 431/500
3/3 [==============================] - 0s 82ms/step - loss: 0.0097 -
mean_squared_error: 0.0097 - rmse: 0.0989 - mean_absolute_error: 0.0703 -
mean_absolute_percentage_error: 22.1726
```

```
Epoch 432/500
3/3 [==============================] - 0s 103ms/step - loss: 0.0097 -
mean_squared_error: 0.0097 - rmse: 0.0963 - mean_absolute_error: 0.0678 -
mean_absolute_percentage_error: 22.2820
Epoch 433/500
3/3 [==============================] - 0s 120ms/step - loss: 0.0098 -
mean_squared_error: 0.0098 - rmse: 0.0975 - mean_absolute_error: 0.0683 -
mean_absolute_percentage_error: 21.8334
Epoch 434/500
3/3 [==============================] - 0s 89ms/step - loss: 0.0097 -
mean_squared_error: 0.0097 - rmse: 0.0994 - mean_absolute_error: 0.0680 -
mean_absolute_percentage_error: 22.2866
Epoch 435/500
3/3 [==============================] - 0s 95ms/step - loss: 0.0093 -
mean_squared_error: 0.0093 - rmse: 0.0971 - mean_absolute_error: 0.0683 -
mean_absolute_percentage_error: 21.5003
Epoch 436/500
3/3 [==============================] - 0s 97ms/step - loss: 0.0109 -
mean_squared_error: 0.0109 - rmse: 0.1008 - mean_absolute_error: 0.0720 -
mean_absolute_percentage_error: 22.4684
Epoch 437/500
3/3 [==============================] - 0s 81ms/step - loss: 0.0101 -
mean_squared_error: 0.0101 - rmse: 0.0961 - mean_absolute_error: 0.0675 -
mean_absolute_percentage_error: 21.0020
Epoch 438/500
3/3 [==============================] - 0s 84ms/step - loss: 0.0098 -
mean_squared_error: 0.0098 - rmse: 0.0975 - mean_absolute_error: 0.0695 -
mean_absolute_percentage_error: 20.9088
Epoch 439/500
3/3 [==============================] - 0s 82ms/step - loss: 0.0102 -
mean_squared_error: 0.0102 - rmse: 0.0997 - mean_absolute_error: 0.0699 -
mean_absolute_percentage_error: 21.9096
Epoch 440/500
3/3 [==============================] - 0s 113ms/step - loss: 0.0096 -
mean_squared_error: 0.0096 - rmse: 0.0991 - mean_absolute_error: 0.0689 -
mean_absolute_percentage_error: 22.7562
Epoch 441/500
3/3 [==============================] - 0s 102ms/step - loss: 0.0094 -
mean_squared_error: 0.0094 - rmse: 0.0944 - mean_absolute_error: 0.0659 -
mean_absolute_percentage_error: 22.2095
Epoch 442/500
3/3 [==============================] - 0s 104ms/step - loss: 0.0105 -
mean_squared_error: 0.0105 - rmse: 0.0993 - mean_absolute_error: 0.0699 -
mean_absolute_percentage_error: 22.5951
Epoch 443/500
3/3 [==============================] - 0s 102ms/step - loss: 0.0101 -
mean_squared_error: 0.0101 - rmse: 0.0989 - mean_absolute_error: 0.0690 -
mean_absolute_percentage_error: 22.4392
```

```
Epoch 444/500
3/3 [==============================] - 0s 95ms/step - loss: 0.0095 -
mean_squared_error: 0.0095 - rmse: 0.0946 - mean_absolute_error: 0.0670 -
mean_absolute_percentage_error: 22.4011
Epoch 445/500
3/3 [==============================] - 0s 74ms/step - loss: 0.0097 -
mean_squared_error: 0.0097 - rmse: 0.0989 - mean_absolute_error: 0.0679 -
mean_absolute_percentage_error: 21.3021
Epoch 446/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0106 -
mean_squared_error: 0.0106 - rmse: 0.1039 - mean_absolute_error: 0.0710 -
mean_absolute_percentage_error: 22.8390
Epoch 447/500
3/3 [==============================] - 0s 71ms/step - loss: 0.0108 -
mean_squared_error: 0.0108 - rmse: 0.1034 - mean_absolute_error: 0.0708 -
mean_absolute_percentage_error: 23.0973
Epoch 448/500
3/3 [==============================] - 0s 75ms/step - loss: 0.0107 -
mean_squared_error: 0.0107 - rmse: 0.1024 - mean_absolute_error: 0.0709 -
mean_absolute_percentage_error: 23.5550
Epoch 449/500
3/3 [==============================] - 0s 79ms/step - loss: 0.0111 -
mean_squared_error: 0.0111 - rmse: 0.1038 - mean_absolute_error: 0.0696 -
mean_absolute_percentage_error: 22.4342
Epoch 450/500
3/3 [==============================] - 0s 81ms/step - loss: 0.0095 -
mean_squared_error: 0.0095 - rmse: 0.0972 - mean_absolute_error: 0.0681 -
mean_absolute_percentage_error: 21.8965
Epoch 451/500
3/3 [==============================] - 0s 91ms/step - loss: 0.0099 -
mean_squared_error: 0.0099 - rmse: 0.1002 - mean_absolute_error: 0.0691 -
mean_absolute_percentage_error: 23.0540
Epoch 452/500
3/3 [==============================] - 0s 108ms/step - loss: 0.0092 -
mean_squared_error: 0.0092 - rmse: 0.0970 - mean_absolute_error: 0.0674 -
mean_absolute_percentage_error: 21.7950
Epoch 453/500
3/3 [==============================] - 0s 109ms/step - loss: 0.0101 -
mean_squared_error: 0.0101 - rmse: 0.0985 - mean_absolute_error: 0.0687 -
mean_absolute_percentage_error: 22.1150
Epoch 454/500
3/3 [==============================] - 0s 89ms/step - loss: 0.0093 -
mean_squared_error: 0.0093 - rmse: 0.0977 - mean_absolute_error: 0.0673 -
mean_absolute_percentage_error: 22.5290
Epoch 455/500
3/3 [==============================] - 0s 73ms/step - loss: 0.0106 -
mean_squared_error: 0.0106 - rmse: 0.1019 - mean_absolute_error: 0.0683 -
mean_absolute_percentage_error: 22.8707
```

```
Epoch 456/500
3/3 [==============================] - 0s 100ms/step - loss: 0.0093 -
mean_squared_error: 0.0093 - rmse: 0.0970 - mean_absolute_error: 0.0673 -
mean_absolute_percentage_error: 21.5677
Epoch 457/500
3/3 [==============================] - 0s 80ms/step - loss: 0.0103 -
mean_squared_error: 0.0103 - rmse: 0.1019 - mean_absolute_error: 0.0692 -
mean_absolute_percentage_error: 21.9417
Epoch 458/500
3/3 [==============================] - 0s 75ms/step - loss: 0.0101 -
mean_squared_error: 0.0101 - rmse: 0.0987 - mean_absolute_error: 0.0683 -
mean_absolute_percentage_error: 21.7895
Epoch 459/500
3/3 [==============================] - 0s 73ms/step - loss: 0.0093 -
mean_squared_error: 0.0093 - rmse: 0.0977 - mean_absolute_error: 0.0666 -
mean_absolute_percentage_error: 21.6504
Epoch 460/500
3/3 [==============================] - 0s 93ms/step - loss: 0.0107 -
mean_squared_error: 0.0107 - rmse: 0.1014 - mean_absolute_error: 0.0708 -
mean_absolute_percentage_error: 24.2941
Epoch 461/500
3/3 [==============================] - 0s 87ms/step - loss: 0.0098 -
mean_squared_error: 0.0098 - rmse: 0.0958 - mean_absolute_error: 0.0677 -
mean_absolute_percentage_error: 21.3728
Epoch 462/500
3/3 [==============================] - 0s 102ms/step - loss: 0.0093 -
mean_squared_error: 0.0093 - rmse: 0.0947 - mean_absolute_error: 0.0675 -
mean_absolute_percentage_error: 22.0513
Epoch 463/500
3/3 [==============================] - 0s 124ms/step - loss: 0.0097 -
mean_squared_error: 0.0097 - rmse: 0.0955 - mean_absolute_error: 0.0675 -
mean_absolute_percentage_error: 21.3785
Epoch 464/500
3/3 [==============================] - 0s 115ms/step - loss: 0.0103 -
mean_squared_error: 0.0103 - rmse: 0.0984 - mean_absolute_error: 0.0690 -
mean_absolute_percentage_error: 21.9119
Epoch 465/500
3/3 [==============================] - 0s 90ms/step - loss: 0.0094 -
mean_squared_error: 0.0094 - rmse: 0.0974 - mean_absolute_error: 0.0663 -
mean_absolute_percentage_error: 22.0088
Epoch 466/500
3/3 [==============================] - 0s 88ms/step - loss: 0.0098 -
mean_squared_error: 0.0098 - rmse: 0.0962 - mean_absolute_error: 0.0691 -
mean_absolute_percentage_error: 22.9906
Epoch 467/500
3/3 [==============================] - 0s 85ms/step - loss: 0.0111 -
mean_squared_error: 0.0111 - rmse: 0.1061 - mean_absolute_error: 0.0712 -
mean_absolute_percentage_error: 22.9867
```

```
Epoch 468/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0097 -
mean_squared_error: 0.0097 - rmse: 0.0968 - mean_absolute_error: 0.0666 -
mean_absolute_percentage_error: 21.8286
Epoch 469/500
3/3 [==============================] - 0s 103ms/step - loss: 0.0091 -
mean_squared_error: 0.0091 - rmse: 0.0938 - mean_absolute_error: 0.0674 -
mean_absolute_percentage_error: 22.0001
Epoch 470/500
3/3 [==============================] - 0s 93ms/step - loss: 0.0094 -
mean_squared_error: 0.0094 - rmse: 0.0981 - mean_absolute_error: 0.0658 -
mean_absolute_percentage_error: 20.7561
Epoch 471/500
3/3 [==============================] - 0s 123ms/step - loss: 0.0095 -
mean_squared_error: 0.0095 - rmse: 0.0971 - mean_absolute_error: 0.0661 -
mean_absolute_percentage_error: 22.1511
Epoch 472/500
3/3 [==============================] - 0s 102ms/step - loss: 0.0085 -
mean_squared_error: 0.0085 - rmse: 0.0924 - mean_absolute_error: 0.0631 -
mean_absolute_percentage_error: 21.1037
Epoch 473/500
3/3 [==============================] - 0s 93ms/step - loss: 0.0089 -
mean_squared_error: 0.0089 - rmse: 0.0938 - mean_absolute_error: 0.0664 -
mean_absolute_percentage_error: 22.3736
Epoch 474/500
3/3 [==============================] - 0s 89ms/step - loss: 0.0098 -
mean_squared_error: 0.0098 - rmse: 0.0972 - mean_absolute_error: 0.0680 -
mean_absolute_percentage_error: 22.1760
Epoch 475/500
3/3 [==============================] - 0s 77ms/step - loss: 0.0096 -
mean_squared_error: 0.0096 - rmse: 0.0986 - mean_absolute_error: 0.0693 -
mean_absolute_percentage_error: 22.3902
Epoch 476/500
3/3 [==============================] - 0s 91ms/step - loss: 0.0094 -
mean_squared_error: 0.0094 - rmse: 0.0980 - mean_absolute_error: 0.0684 -
mean_absolute_percentage_error: 22.0965
Epoch 477/500
3/3 [==============================] - 0s 92ms/step - loss: 0.0096 -
mean_squared_error: 0.0096 - rmse: 0.0968 - mean_absolute_error: 0.0676 -
mean_absolute_percentage_error: 22.4265
Epoch 478/500
3/3 [==============================] - 0s 86ms/step - loss: 0.0093 -
mean_squared_error: 0.0093 - rmse: 0.0956 - mean_absolute_error: 0.0642 -
mean_absolute_percentage_error: 20.6889
Epoch 479/500
3/3 [==============================] - 0s 102ms/step - loss: 0.0093 -
mean_squared_error: 0.0093 - rmse: 0.0950 - mean_absolute_error: 0.0663 -
mean_absolute_percentage_error: 21.2904
```

```
Epoch 480/500
3/3 [==============================] - 0s 79ms/step - loss: 0.0098 -
mean_squared_error: 0.0098 - rmse: 0.0974 - mean_absolute_error: 0.0672 -
mean_absolute_percentage_error: 22.6549
Epoch 481/500
3/3 [==============================] - 0s 110ms/step - loss: 0.0090 -
mean_squared_error: 0.0090 - rmse: 0.0952 - mean_absolute_error: 0.0642 -
mean_absolute_percentage_error: 21.2151
Epoch 482/500
3/3 [==============================] - 0s 112ms/step - loss: 0.0098 -
mean_squared_error: 0.0098 - rmse: 0.0973 - mean_absolute_error: 0.0678 -
mean_absolute_percentage_error: 21.8427
Epoch 483/500
3/3 [==============================] - 0s 92ms/step - loss: 0.0100 -
mean_squared_error: 0.0100 - rmse: 0.0964 - mean_absolute_error: 0.0675 -
mean_absolute_percentage_error: 21.3265
Epoch 484/500
3/3 [==============================] - 0s 85ms/step - loss: 0.0087 -
mean_squared_error: 0.0087 - rmse: 0.0911 - mean_absolute_error: 0.0653 -
mean_absolute_percentage_error: 22.1312
Epoch 485/500
3/3 [==============================] - 0s 92ms/step - loss: 0.0097 -
mean_squared_error: 0.0097 - rmse: 0.0966 - mean_absolute_error: 0.0683 -
mean_absolute_percentage_error: 23.2409
Epoch 486/500
3/3 [==============================] - 0s 83ms/step - loss: 0.0085 -
mean_squared_error: 0.0085 - rmse: 0.0896 - mean_absolute_error: 0.0636 -
mean_absolute_percentage_error: 21.4429
Epoch 487/500
3/3 [==============================] - 0s 79ms/step - loss: 0.0103 -
mean_squared_error: 0.0103 - rmse: 0.1012 - mean_absolute_error: 0.0702 -
mean_absolute_percentage_error: 22.2518
Epoch 488/500
3/3 [==============================] - 0s 100ms/step - loss: 0.0092 -
mean_squared_error: 0.0092 - rmse: 0.0927 - mean_absolute_error: 0.0656 -
mean_absolute_percentage_error: 21.1304
Epoch 489/500
3/3 [==============================] - 0s 81ms/step - loss: 0.0103 -
mean_squared_error: 0.0103 - rmse: 0.0990 - mean_absolute_error: 0.0690 -
mean_absolute_percentage_error: 23.1318
Epoch 490/500
3/3 [==============================] - 0s 87ms/step - loss: 0.0098 -
mean_squared_error: 0.0098 - rmse: 0.0999 - mean_absolute_error: 0.0692 -
mean_absolute_percentage_error: 22.6630
Epoch 491/500
3/3 [==============================] - 0s 101ms/step - loss: 0.0086 -
mean_squared_error: 0.0086 - rmse: 0.0927 - mean_absolute_error: 0.0647 -
mean_absolute_percentage_error: 21.5266
```

```
Epoch 492/500
3/3 [==============================] - 0s 78ms/step - loss: 0.0095 -
mean_squared_error: 0.0095 - rmse: 0.0966 - mean_absolute_error: 0.0665 -
mean_absolute_percentage_error: 21.1473
Epoch 493/500
3/3 [==============================] - 0s 71ms/step - loss: 0.0102 -
mean_squared_error: 0.0102 - rmse: 0.1019 - mean_absolute_error: 0.0668 -
mean_absolute_percentage_error: 22.2349
Epoch 494/500
3/3 [==============================] - 0s 72ms/step - loss: 0.0095 -
mean_squared_error: 0.0095 - rmse: 0.0948 - mean_absolute_error: 0.0664 -
mean_absolute_percentage_error: 22.2633
Epoch 495/500
3/3 [==============================] - 0s 65ms/step - loss: 0.0102 -
mean_squared_error: 0.0102 - rmse: 0.1012 - mean_absolute_error: 0.0686 -
mean_absolute_percentage_error: 22.3569
Epoch 496/500
3/3 [==============================] - 0s 62ms/step - loss: 0.0094 -
mean_squared_error: 0.0094 - rmse: 0.0979 - mean_absolute_error: 0.0675 -
mean_absolute_percentage_error: 22.0134
Epoch 497/500
3/3 [==============================] - 0s 70ms/step - loss: 0.0085 -
mean_squared_error: 0.0085 - rmse: 0.0911 - mean_absolute_error: 0.0630 -
mean_absolute_percentage_error: 21.6863
Epoch 498/500
3/3 [==============================] - 0s 76ms/step - loss: 0.0094 -
mean_squared_error: 0.0094 - rmse: 0.0958 - mean_absolute_error: 0.0674 -
mean_absolute_percentage_error: 22.5538
Epoch 499/500
3/3 [==============================] - 0s 75ms/step - loss: 0.0092 -
mean_squared_error: 0.0092 - rmse: 0.0946 - mean_absolute_error: 0.0652 -
mean_absolute_percentage_error: 22.2966
Epoch 500/500
3/3 [==============================] - 0s 70ms/step - loss: 0.0093 -
mean_squared_error: 0.0093 - rmse: 0.0971 - mean_absolute_error: 0.0659 -
mean_absolute_percentage_error: 20.7164
```

[ ]:
```
business_days = pd.date_range(start=pd.to_datetime(TRAIN_END_DATE) +␣
↪timedelta(days=1),
                              periods=66, freq='B')
business_days
```

[ ]:
```
DatetimeIndex(['2021-06-01', '2021-06-02', '2021-06-03', '2021-06-04',
               '2021-06-07', '2021-06-08', '2021-06-09', '2021-06-10',
               '2021-06-11', '2021-06-14', '2021-06-15', '2021-06-16',
               '2021-06-17', '2021-06-18', '2021-06-21', '2021-06-22',
               '2021-06-23', '2021-06-24', '2021-06-25', '2021-06-28',
```

```
               '2021-06-29', '2021-06-30', '2021-07-01', '2021-07-02',
               '2021-07-05', '2021-07-06', '2021-07-07', '2021-07-08',
               '2021-07-09', '2021-07-12', '2021-07-13', '2021-07-14',
               '2021-07-15', '2021-07-16', '2021-07-19', '2021-07-20',
               '2021-07-21', '2021-07-22', '2021-07-23', '2021-07-26',
               '2021-07-27', '2021-07-28', '2021-07-29', '2021-07-30',
               '2021-08-02', '2021-08-03', '2021-08-04', '2021-08-05',
               '2021-08-06', '2021-08-09', '2021-08-10', '2021-08-11',
               '2021-08-12', '2021-08-13', '2021-08-16', '2021-08-17',
               '2021-08-18', '2021-08-19', '2021-08-20', '2021-08-23',
               '2021-08-24', '2021-08-25', '2021-08-26', '2021-08-27',
               '2021-08-30', '2021-08-31'],
              dtype='datetime64[ns]', freq='B')
```

[ ]:
```
# Initialize the starting sequence for prediction
current_sequence = X_train[-1]

# Initialize an empty list to store predicted prices
predicted_prices = []

# Predict future prices
for i in range(len(business_days)):

    if i < len(X_test):
        current_sequence = X_test[i]
    else:
        # Once beyond the range of X_test, you need to start using the last␣
 ↪predicted values
        # since actual values are no longer available
        # Prepare the next sequence based on the last prediction
        next_sequence = np.roll(current_sequence, -1, axis=0)
        next_sequence[-1, -1] = predicted_close_scaled.flatten()[0]  # Update␣
 ↪with last predicted close
        current_sequence = next_sequence

    # Reshape the current sequence to match the model's expected input shape␣
 ↪and predict the next closing price
    predicted_close_scaled = lstm_model.predict(current_sequence.reshape(1,␣
 ↪SEQUENCE_LENGTH, current_sequence.shape[1]))

    # Store the scaled prediction
    predicted_prices.append(predicted_close_scaled.flatten()[0])

# Inverse transform the scaled predicted prices to their original scale
predicted_prices = scaler_new.inverse_transform(np.array(predicted_prices).
 ↪reshape(-1, 1)).flatten()
```

```python
# Create a DataFrame with the predicted stock prices and corresponding dates
predictions_df = pd.DataFrame({
    'Date': business_days,
    'Predicted_Close': predicted_prices
})

# Display the prediction results
print(predictions_df)
```

```
1/1 [==============================] - 1s 827ms/step
1/1 [==============================] - 0s 41ms/step
1/1 [==============================] - 0s 41ms/step
1/1 [==============================] - 0s 52ms/step
1/1 [==============================] - 0s 52ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 35ms/step
1/1 [==============================] - 0s 43ms/step
1/1 [==============================] - 0s 36ms/step
1/1 [==============================] - 0s 44ms/step
1/1 [==============================] - 0s 37ms/step
1/1 [==============================] - 0s 56ms/step
1/1 [==============================] - 0s 42ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 36ms/step
1/1 [==============================] - 0s 38ms/step
1/1 [==============================] - 0s 36ms/step
1/1 [==============================] - 0s 43ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 33ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 49ms/step
1/1 [==============================] - 0s 52ms/step
1/1 [==============================] - 0s 61ms/step
1/1 [==============================] - 0s 61ms/step
1/1 [==============================] - 0s 57ms/step
1/1 [==============================] - 0s 53ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 50ms/step
1/1 [==============================] - 0s 36ms/step
1/1 [==============================] - 0s 50ms/step
1/1 [==============================] - 0s 37ms/step
1/1 [==============================] - 0s 38ms/step
1/1 [==============================] - 0s 43ms/step
1/1 [==============================] - 0s 35ms/step
1/1 [==============================] - 0s 33ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 32ms/step
```

```
1/1 [==============================] - 0s 31ms/step
1/1 [==============================] - 0s 32ms/step
1/1 [==============================] - 0s 34ms/step
1/1 [==============================] - 0s 30ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 36ms/step
1/1 [==============================] - 0s 35ms/step
1/1 [==============================] - 0s 37ms/step
1/1 [==============================] - 0s 45ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 45ms/step
1/1 [==============================] - 0s 49ms/step
1/1 [==============================] - 0s 61ms/step
1/1 [==============================] - 0s 52ms/step
1/1 [==============================] - 0s 61ms/step
1/1 [==============================] - 0s 56ms/step
1/1 [==============================] - 0s 54ms/step
1/1 [==============================] - 0s 54ms/step
1/1 [==============================] - 0s 64ms/step
1/1 [==============================] - 0s 50ms/step
1/1 [==============================] - 0s 43ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 51ms/step
1/1 [==============================] - 0s 58ms/step
1/1 [==============================] - 0s 71ms/step
1/1 [==============================] - 0s 56ms/step
1/1 [==============================] - 0s 51ms/step
1/1 [==============================] - 0s 47ms/step
         Date  Predicted_Close
0  2021-06-01        42.011532
1  2021-06-02        40.142887
2  2021-06-03        37.963966
3  2021-06-04        37.740295
4  2021-06-07        41.644104
..        …              …
61 2021-08-25        42.780300
62 2021-08-26        41.121155
63 2021-08-27        42.786839
64 2021-08-30        40.755310
65 2021-08-31        42.391933

[66 rows x 2 columns]
```

[ ]:
```
# Continue from the previous predictions_df creation code

# Ensure the 'Date' columns in both DataFrames are in the same format
df['Date'] = pd.to_datetime(combined_df['Date'])
```

```
predictions_df['Date'] = pd.to_datetime(predictions_df['Date'])

# Merge the predictions with the actual closing prices from 'df'
predictions_with_actuals_df = predictions_df.merge(df[['Date', 'Close']],␣
 ↪on='Date', how='left')

# Rename columns for clarity
predictions_with_actuals_df.rename(columns={'Close': 'Actual_Close'},␣
 ↪inplace=True)

# Show the DataFrame with predictions and actual closing prices
print(predictions_with_actuals_df)
```

```
         Date  Predicted_Close  Actual_Close
0  2021-06-01        42.011532     45.002499
1  2021-06-02        40.142887     52.357498
2  2021-06-03        37.963966     60.639999
3  2021-06-04        37.740295     63.532501
4  2021-06-07        41.644104     55.500000
..        …              …             …
61 2021-08-25        42.780300     39.262501
62 2021-08-26        41.121155     38.224998
63 2021-08-27        42.786839     39.825001
64 2021-08-30        40.755310     41.222500
65 2021-08-31        42.391933     52.572498

[66 rows x 3 columns]
```

[ ]:
```
print(predictions_with_actuals_df["Actual_Close"].isnull().sum())
print(predictions_with_actuals_df["Predicted_Close"].isnull().sum())

predictions_with_actuals_df.dropna(subset=["Actual_Close", "Predicted_Close"],␣
 ↪inplace=True)
```

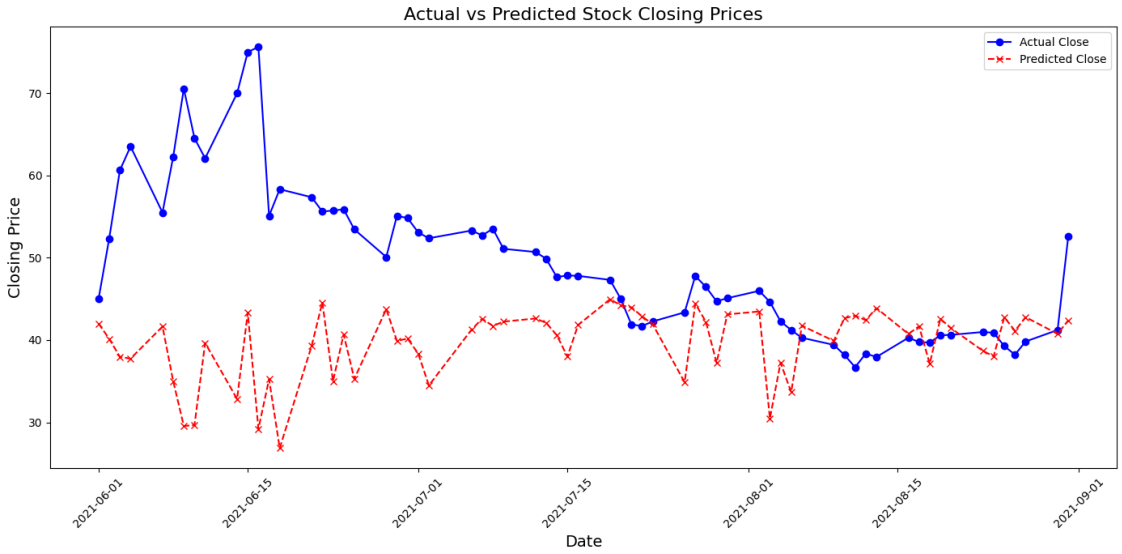
```
1
0
```

[ ]:
```
mse = mean_squared_error(predictions_with_actuals_df["Actual_Close"],␣
 ↪predictions_with_actuals_df["Predicted_Close"])
rmse = np.sqrt(mse)
mae = mean_absolute_error(predictions_with_actuals_df["Actual_Close"],␣
 ↪predictions_with_actuals_df["Predicted_Close"])

print("Mean Squared Error: ", mse)
print("Root Mean Squared Error: ", rmse)
print("Mean Absolute Error: ", mae)
```

```
Mean Squared Error:  239.58752455025103
```

```
Root Mean Squared Error:  15.478615072100315
Mean Absolute Error:  11.084920255848107
```

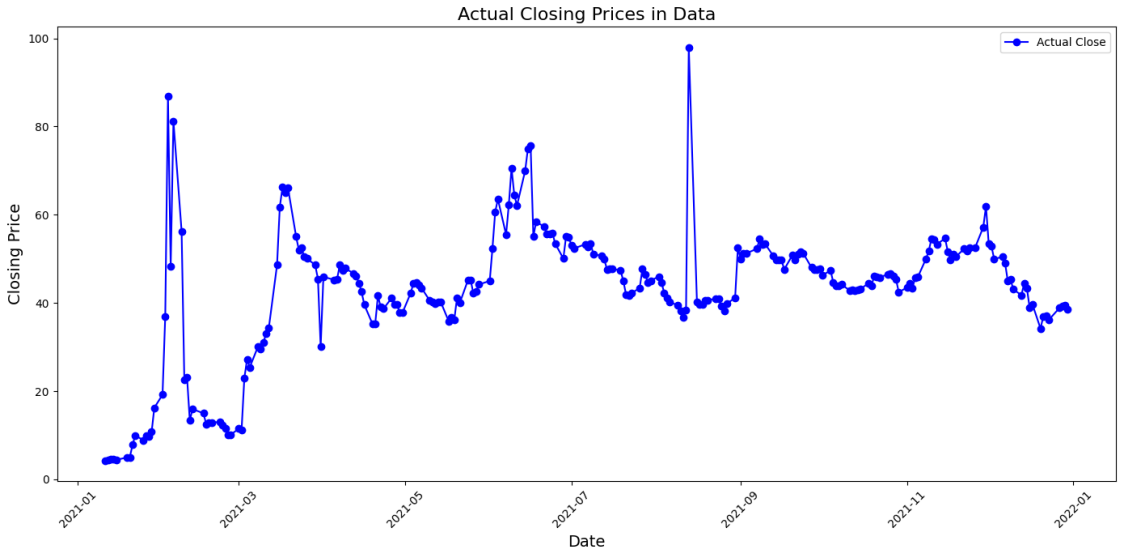
[ ]:
```python
import matplotlib.pyplot as plt

# Ensure the 'Date' column is in datetime format for proper plotting
predictions_with_actuals_df['Date'] = pd.
 ↪to_datetime(predictions_with_actuals_df['Date'])

# Setting the plot size for better readability
plt.figure(figsize=(14, 7))

# Plotting the actual closing prices
plt.plot(predictions_with_actuals_df['Date'],␣
 ↪predictions_with_actuals_df['Actual_Close'], label='Actual Close',␣
 ↪color='blue', marker='o')

# Plotting the predicted closing prices
plt.plot(predictions_with_actuals_df['Date'],␣
 ↪predictions_with_actuals_df['Predicted_Close'], label='Predicted Close',␣
 ↪color='red', linestyle='--', marker='x')

# Adding title and labels with font size adjustments
plt.title('Actual vs Predicted Stock Closing Prices', fontsize=16)
plt.xlabel('Date', fontsize=14)
plt.ylabel('Closing Price', fontsize=14)

# Rotating date labels for better visibility
plt.xticks(rotation=45)

# Adding a legend to distinguish between actual and predicted values
plt.legend()

# Display the plot
plt.tight_layout()
plt.show()
```



0.1 After introducing a spike in the data

[ ]:
```
df_spiked = pd.read_csv("GME_spiked.csv")
```

[ ]:
```
# Ensure the 'Date' column is in datetime format for proper plotting
df_spiked['Date'] = pd.to_datetime(df['Date'])

# Setting the plot size for better readability
plt.figure(figsize=(14, 7))

# Plotting the actual closing prices in the training period
plt.plot(df_spiked['Date'], df_spiked['Close'], label='Actual Close',␣
 ↪color='blue', marker='o')

# Adding title and labels with font size adjustments
plt.title('Actual Closing Prices in Data', fontsize=16)
plt.xlabel('Date', fontsize=14)
plt.ylabel('Closing Price', fontsize=14)

# Rotating date labels for better visibility
plt.xticks(rotation=45)

# Adding a legend to distinguish the actual values
plt.legend()

# Display the plot
plt.tight_layout()
plt.show()
```



[ ]:
```
# Convert 'Date' to datetime and sort the DataFrame just in case
df_spiked['Date'] = pd.to_datetime(df_spiked['Date']) # This line converts the␣
 ↪'Date' column of the DataFrame df to datetime objects.
df_spiked.sort_values('Date', inplace=True)
#  The .values attribute returns the data as a NumPy array. The .reshape(-1, 1)␣
 ↪function changes
#  the shape of this array to ensure it has two dimensions, with one column and␣
 ↪as many rows as necessary.
close_prices = df_spiked['Close'].values.reshape(-1, 1)
# Scale the data -> you can use any appropriate scaling methodology
scaler = MinMaxScaler(feature_range=(0, 1))
scaled_close_prices = scaler.fit_transform(close_prices)
```

[ ]:
```
combined_df = pd.merge(df_spiked, df_sentiment, left_on='Date',␣
 ↪right_on='date', how='left')
combined_df.drop(columns=['date'], inplace=True) # Drop the duplicate 'date'␣
 ↪column
combined_df.fillna(method='ffill', inplace=True) # Forward fill any missing␣
 ↪values
```

[ ]:
```
combined_df.dropna(inplace=True)
combined_df.reset_index(drop=True, inplace=True)
combined_df.drop(columns=['Open', 'High', 'Low', 'Adj Close', 'Volume'],␣
 ↪inplace=True)

combined_df['Closing Price'] = combined_df['Close']
combined_df.drop(columns=['Close'], inplace=True)
```

```
[ ]: combined_df.head(20)
```

```
[ ]:          Date  num_comments    score  avg_weighted_compound  avg_weighted_neg  \
    0  2021-01-11          20.0      1.0               0.000000          0.000000
    1  2021-01-12          20.0      1.0               0.000000          0.000000
    2  2021-01-13          21.0      3.0               0.000000          0.000000
    3  2021-01-14          29.0      1.0               0.000000          0.000000
    4  2021-01-15          29.0      1.0               0.000000          0.000000
    5  2021-01-19          41.0      3.0               0.067768          0.122415
    6  2021-01-20         154.0      2.0               0.381643          0.000000
    7  2021-01-21         320.0      5.0               0.019982          0.072337
    8  2021-01-22        1002.0     11.0               0.046663          0.000000
    9  2021-01-25          23.0      1.0               0.000000          0.000000
    10 2021-01-26          49.0      2.0               0.495867          0.000000
    11 2021-01-27        6909.0   7226.0              -0.019640          0.172550
    12 2021-01-28        3600.0    698.0               0.173934          0.091738
    13 2021-01-29        2562.0     34.0               0.299951          0.023989
    14 2021-02-01        7656.0  18318.0               0.301093          0.064267
    15 2021-02-02       10298.0  16992.0               0.018219          0.114838
    16 2021-02-03        7277.0  25883.0               0.171981          0.072968
    17 2021-02-04        4848.0  19107.0               0.190835          0.087177
    18 2021-02-05        4848.0  19107.0               0.190835          0.087177
    19 2021-02-08        5404.0     96.0               0.088856          0.070751

        avg_weighted_neu  avg_weighted_pos  Closing Price
    0           1.000000          0.000000       4.312500
    1           1.000000          0.000000       4.342500
    2           1.000000          0.000000       4.590000
    3           1.000000          0.000000       4.520000
    4           1.000000          0.000000       4.422500
    5           0.712220          0.165366       4.985000
    6           0.603429          0.396571       4.987500
    7           0.903703          0.023831       7.850000
    8           0.957446          0.042554       9.977500
    9           1.000000          0.000000       8.875000
    10          0.607653          0.392347       9.840000
    11          0.690390          0.137093       9.780000
    12          0.760290          0.147961      10.757500
    13          0.743922          0.232089      16.252501
    14          0.695509          0.240199      19.197500
    15          0.755255          0.130032      36.994999
    16          0.796117          0.130924      86.877502
    17          0.718488          0.194314      48.400002
    18          0.718488          0.194314      81.250000
    19          0.828765          0.100487      56.250000
```

[ ]:
```
print(combined_df.shape)

print(combined_df.info())
```

```
(251, 8)
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 251 entries, 0 to 250
Data columns (total 8 columns):
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----
 0   Date                    251 non-null    datetime64[ns]
 1   num_comments            251 non-null    float64
 2   score                   251 non-null    float64
 3   avg_weighted_compound   251 non-null    float64
 4   avg_weighted_neg        251 non-null    float64
 5   avg_weighted_neu        251 non-null    float64
 6   avg_weighted_pos        251 non-null    float64
 7   Closing Price           251 non-null    float64
dtypes: datetime64[ns](1), float64(7)
memory usage: 15.8 KB
None
```

[ ]:
```
combined_df['Date'] = pd.to_datetime(combined_df['Date'])
```

[ ]:
```
train_indices = combined_df[combined_df["Date"] <= TRAIN_END_DATE].index
test_indices = combined_df[(combined_df["Date"] > TRAIN_END_DATE) &␣
 ↪(combined_df["Date"] <= TEST_END_DATE)].index
```

combined_train_df = combined_df[combined_df.index <= pd.to_datetime(TRAIN_END_DATE)]
combined_test_df = combined_df[(combined_df.index > pd.to_datetime(TRAIN_END_DATE))
& (combined_df.index <= pd.to_datetime(TEST_END_DATE))]

[ ]:
```
features = combined_df.drop(columns=['Date']) # Drop the 'Date' column
target = combined_df['Closing Price'] # Set the 'Closing Price' as the target␣
 ↪variable
```

[ ]:
```
scaler_new = MinMaxScaler(feature_range=(0, 1))
scaled_features = scaler_new.fit_transform(features)
scaled_target = scaler_new.fit_transform(target.values.reshape(-1, 1)).
 ↪flatten()  # Flatten to make it a 1D array
```

[ ]:
```
def create_train_sequences(features, target, sequence_length):
    X, y = [], []
    for i in range(len(features) - sequence_length):
        seq = features[i:i+sequence_length]  # Include closing price in features
        X.append(seq)
        y.append(target[i + sequence_length])  # Target is the closing price at␣
 ↪sequence_length ahead
```

```
    return np.array(X), np.array(y)
```

[ ]:
```
def create_test_sequences(features, target, sequence_length):
    X, y = [], []
    for i in range(len(features) - sequence_length):
        seq = features[i:i+sequence_length, :-1]  # Exclude closing price from␣
 ↪features
        X.append(seq)
        y.append(target[i + sequence_length])  # Target is still the closing␣
 ↪price
    return np.array(X), np.array(y)
```

[ ]:
```
# Splitting the data
train_end = train_indices[-1] + 1
test_end = test_indices[-1] + 1

# Creating training sequences
X_train, y_train = create_train_sequences(scaled_features[:train_end],␣
 ↪scaled_target[:train_end], SEQUENCE_LENGTH)

# Creating testing sequences
# For X_test, we want to exclude the closing price
X_test, y_test = create_train_sequences(scaled_features[train_end:test_end],␣
 ↪scaled_target[train_end:test_end], SEQUENCE_LENGTH)

y_train = y_train.reshape(-1, 1)
y_test = y_test.reshape(-1, 1)
```

[ ]:
```
X_train.shape, y_train.shape
```

[ ]:
```
((87, 10, 7), (87, 1))
```

[ ]:
```
X_test.shape, y_test.shape
```

[ ]:
```
((55, 10, 7), (55, 1))
```

[ ]:
```
# Initialize the starting sequence for prediction
current_sequence = X_train[-1]

# Initialize an empty list to store predicted prices
predicted_prices = []

# Predict future prices
for i in range(len(business_days)):

    if i < len(X_test):
        current_sequence = X_test[i]
```

```
    else:
        # Prepare the next sequence based on the last prediction
        next_sequence = np.roll(current_sequence, -1, axis=0)
        next_sequence[-1, -1] = predicted_close_scaled.flatten()[0]
        current_sequence = next_sequence

    # Reshape the current sequence to match the model's expected input shape␣
 ↪and predict the next closing price
    predicted_close_scaled = lstm_model.predict(current_sequence.reshape(1,␣
 ↪SEQUENCE_LENGTH, current_sequence.shape[1]))

    # Store the scaled prediction
    predicted_prices.append(predicted_close_scaled.flatten()[0])

# Inverse transform the scaled predicted prices to their original scale
predicted_prices = scaler_new.inverse_transform(np.array(predicted_prices).
 ↪reshape(-1, 1)).flatten()

# Create a DataFrame with the predicted stock prices and corresponding dates
predictions_df = pd.DataFrame({
    'Date': business_days,
    'Predicted_Close': predicted_prices
})

# Display the prediction results
print(predictions_df)
```

```
1/1 [==============================] - 0s 47ms/step
1/1 [==============================] - 0s 47ms/step
1/1 [==============================] - 0s 49ms/step
1/1 [==============================] - 0s 44ms/step
1/1 [==============================] - 0s 46ms/step
1/1 [==============================] - 0s 54ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 37ms/step
1/1 [==============================] - 0s 35ms/step
1/1 [==============================] - 0s 37ms/step
1/1 [==============================] - 0s 38ms/step
1/1 [==============================] - 0s 41ms/step
1/1 [==============================] - 0s 37ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 45ms/step
1/1 [==============================] - 0s 50ms/step
1/1 [==============================] - 0s 56ms/step
1/1 [==============================] - 0s 47ms/step
1/1 [==============================] - 0s 51ms/step
1/1 [==============================] - 0s 41ms/step
```

```
1/1 [==============================] - 0s 44ms/step
1/1 [==============================] - 0s 64ms/step
1/1 [==============================] - 0s 60ms/step
1/1 [==============================] - 0s 48ms/step
1/1 [==============================] - 0s 45ms/step
1/1 [==============================] - 0s 37ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 41ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 35ms/step
1/1 [==============================] - 0s 45ms/step
1/1 [==============================] - 0s 47ms/step
1/1 [==============================] - 0s 42ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 84ms/step
1/1 [==============================] - 0s 66ms/step
1/1 [==============================] - 0s 57ms/step
1/1 [==============================] - 0s 50ms/step
1/1 [==============================] - 0s 44ms/step
1/1 [==============================] - 0s 50ms/step
1/1 [==============================] - 0s 50ms/step
1/1 [==============================] - 0s 51ms/step
1/1 [==============================] - 0s 46ms/step
1/1 [==============================] - 0s 36ms/step
1/1 [==============================] - 0s 51ms/step
1/1 [==============================] - 0s 66ms/step
1/1 [==============================] - 0s 50ms/step
1/1 [==============================] - 0s 50ms/step
1/1 [==============================] - 0s 49ms/step
1/1 [==============================] - 0s 53ms/step
1/1 [==============================] - 0s 38ms/step
1/1 [==============================] - 0s 35ms/step
1/1 [==============================] - 0s 41ms/step
1/1 [==============================] - 0s 37ms/step
1/1 [==============================] - 0s 53ms/step
1/1 [==============================] - 0s 43ms/step
1/1 [==============================] - 0s 50ms/step
1/1 [==============================] - 0s 42ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 51ms/step
1/1 [==============================] - 0s 35ms/step
1/1 [==============================] - 0s 65ms/step
1/1 [==============================] - 0s 46ms/step
1/1 [==============================] - 0s 44ms/step
1/1 [==============================] - 0s 62ms/step
         Date  Predicted_Close
```

```
0  2021-06-01        47.354233
1  2021-06-02        47.763813
2  2021-06-03        46.136074
3  2021-06-04        44.962330
4  2021-06-07        48.447960
..        …              …
61 2021-08-25        47.174320
62 2021-08-26        42.558910
63 2021-08-27        47.503368
64 2021-08-30        45.167538
65 2021-08-31        46.504169

[66 rows x 2 columns]
```

[ ]:
```
# Continue from the previous predictions_df creation code

# Ensure the 'Date' columns in both DataFrames are in the same format
df_spiked['Date'] = pd.to_datetime(combined_df['Date'])
predictions_df['Date'] = pd.to_datetime(predictions_df['Date'])

# Merge the predictions with the actual closing prices from 'df'
predictions_with_actuals_df = predictions_df.merge(df_spiked[['Date',␣
 ↪'Close']], on='Date', how='left')

# Rename columns for clarity
predictions_with_actuals_df.rename(columns={'Close': 'Actual_Close'},␣
 ↪inplace=True)

# Show the DataFrame with predictions and actual closing prices
print(predictions_with_actuals_df)
```

```
         Date  Predicted_Close  Actual_Close
0  2021-06-01        47.354233     45.002499
1  2021-06-02        47.763813     52.357498
2  2021-06-03        46.136074     60.639999
3  2021-06-04        44.962330     63.532501
4  2021-06-07        48.447960     55.500000
..        …              …            …
61 2021-08-25        47.174320     39.262501
62 2021-08-26        42.558910     38.224998
63 2021-08-27        47.503368     39.825001
64 2021-08-30        45.167538     41.222500
65 2021-08-31        46.504169     52.572498

[66 rows x 3 columns]
```

[ ]:
```
print(predictions_with_actuals_df["Actual_Close"].isnull().sum())
print(predictions_with_actuals_df["Predicted_Close"].isnull().sum())
```

```
predictions_with_actuals_df.dropna(subset=["Actual_Close", "Predicted_Close"],␣
 ↪inplace=True)
```

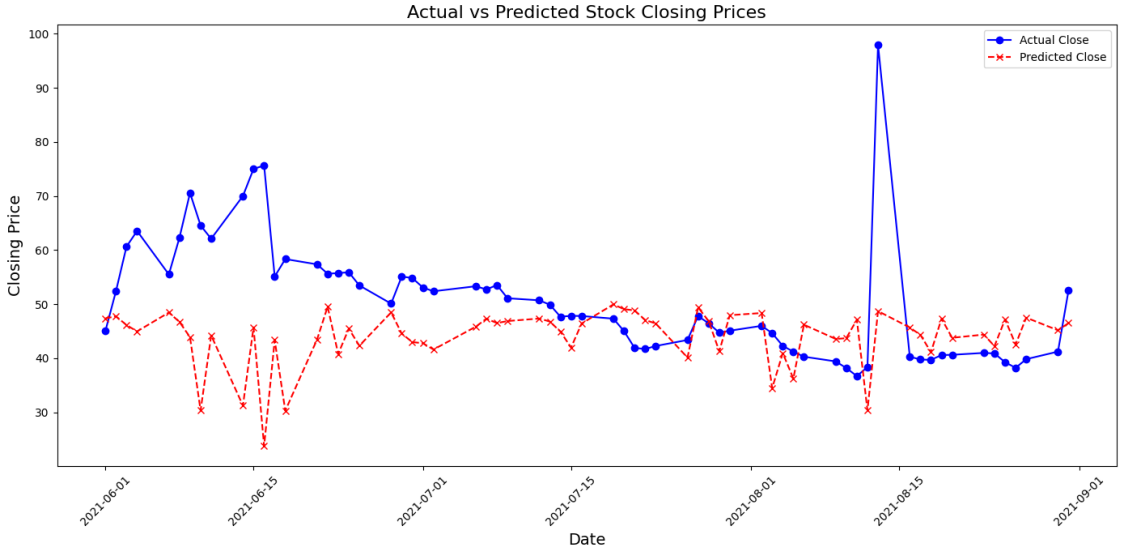
```
1
0
```

[ ]:
```
mse = mean_squared_error(predictions_with_actuals_df["Actual_Close"],␣
 ↪predictions_with_actuals_df["Predicted_Close"])
rmse = np.sqrt(mse)
mae = mean_absolute_error(predictions_with_actuals_df["Actual_Close"],␣
 ↪predictions_with_actuals_df["Predicted_Close"])

print("Mean Squared Error: ", mse)
print("Root Mean Squared Error: ", rmse)
print("Mean Absolute Error: ", mae)
```

```
Mean Squared Error:  210.95748559607551
Root Mean Squared Error:  14.52437556647705
Mean Absolute Error:  9.785541507972132
```

[ ]:
```
# Ensure the 'Date' column is in datetime format for proper plotting
predictions_with_actuals_df['Date'] = pd.
 ↪to_datetime(predictions_with_actuals_df['Date'])

# Setting the plot size for better readability
plt.figure(figsize=(14, 7))

# Plotting the actual closing prices
plt.plot(predictions_with_actuals_df['Date'],␣
 ↪predictions_with_actuals_df['Actual_Close'], label='Actual Close',␣
 ↪color='blue', marker='o')

# Plotting the predicted closing prices
plt.plot(predictions_with_actuals_df['Date'],␣
 ↪predictions_with_actuals_df['Predicted_Close'], label='Predicted Close',␣
 ↪color='red', linestyle='--', marker='x')

# Adding title and labels with font size adjustments
plt.title('Actual vs Predicted Stock Closing Prices', fontsize=16)
plt.xlabel('Date', fontsize=14)
plt.ylabel('Closing Price', fontsize=14)

# Rotating date labels for better visibility
plt.xticks(rotation=45)

# Adding a legend to distinguish between actual and predicted values
plt.legend()
```

```
# Display the plot
plt.tight_layout()
plt.show()
```



[ ]: