ler5yoxse

May 6, 2025

[ ]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
import datetime
import seaborn as sns
from sklearn.preprocessing import MinMaxScaler
from sklearn.decomposition import PCA
from sklearn.model_selection import train_test_split
from tensorflow.keras import Sequential
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import LSTM
from sklearn.metrics import r2_score
```

[6]:
```
data = pd.read_csv('Google_Stock_Price_Train.csv',thousands=',')
data
```

[6]:

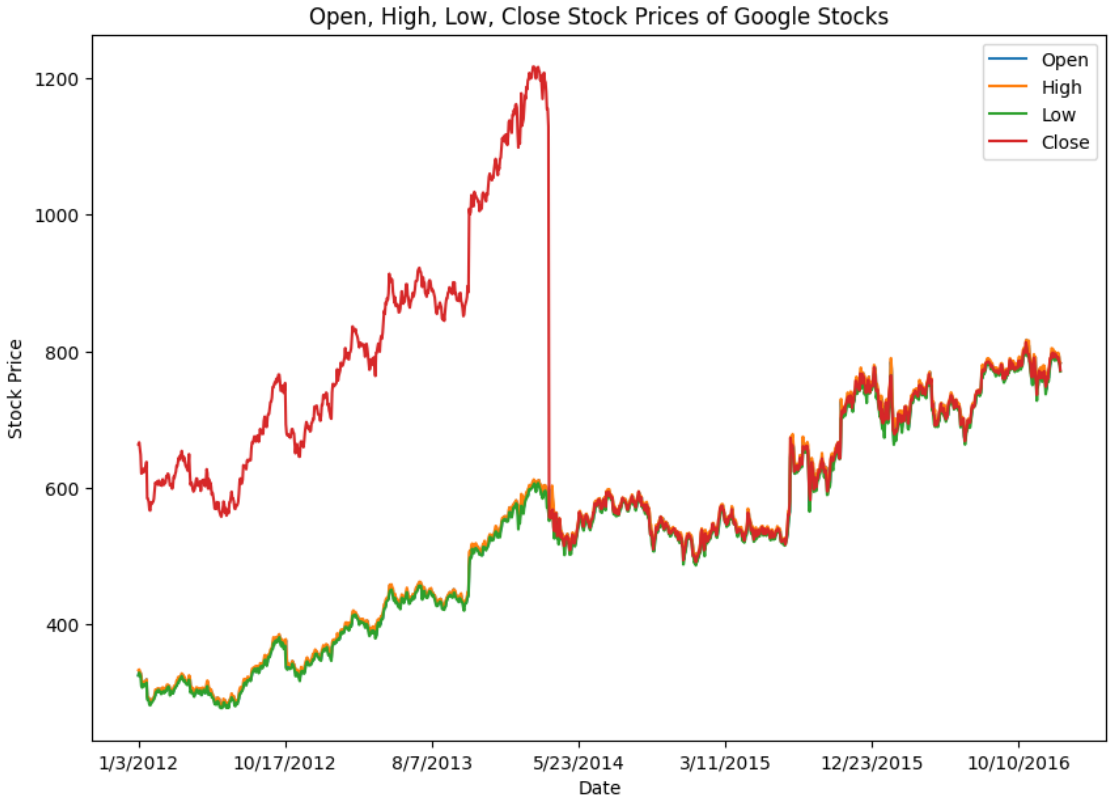
	Date	Open	High	Low	Close	Volume
0	1/3/2012	325.25	332.83	324.97	663.59	7380500
1	1/4/2012	331.27	333.87	329.08	666.45	5749400
2	1/5/2012	329.83	330.75	326.89	657.21	6590300
3	1/6/2012	328.34	328.77	323.68	648.24	5405900
4	1/9/2012	322.04	322.29	309.46	620.76	11688800
…	…	…	…	…	…	…
1253	12/23/2016	790.90	792.74	787.28	789.91	623400
1254	12/27/2016	790.68	797.86	787.66	791.55	789100
1255	12/28/2016	793.70	794.23	783.20	785.05	1153800
1256	12/29/2016	783.33	785.93	778.92	782.79	744300
1257	12/30/2016	782.75	782.78	770.41	771.82	1770000

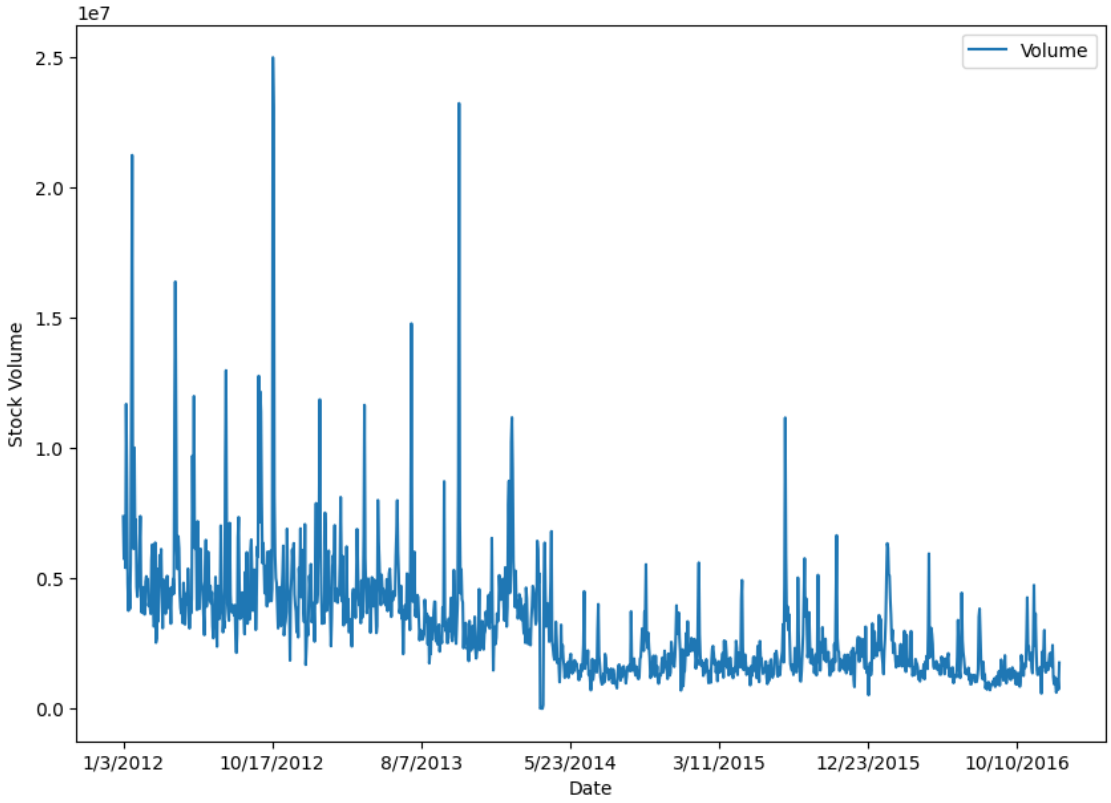
[1258 rows x 6 columns]

[10]:
```
ax1 = data.plot(x="Date", y=["Open", "High", "Low", "Close"],␣
↪figsize=(10,7),title='Open, High, Low, Close Stock Prices of Google Stocks')
ax1.set_ylabel("Stock Price")
```

```
ax2 = data.plot(x="Date", y=["Volume"],  figsize=(10,7))
ax2.set_ylabel("Stock Volume")
```

[10]: Text(0, 0.5, 'Stock Volume')

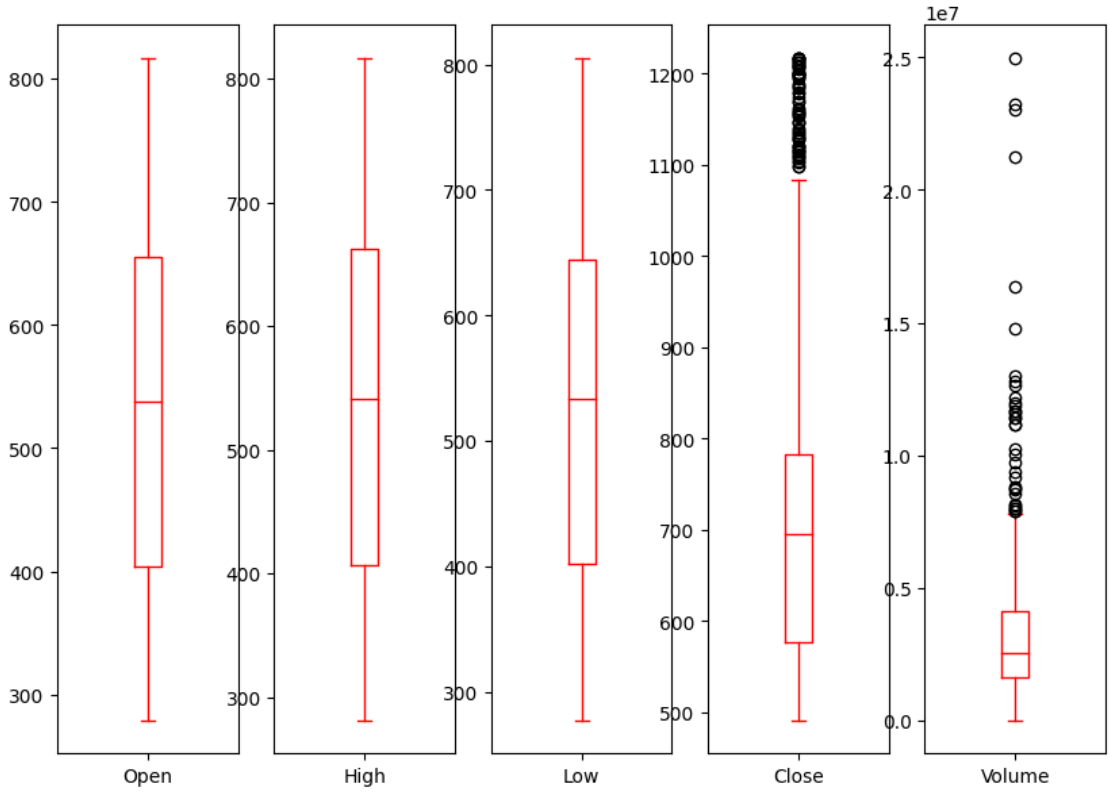




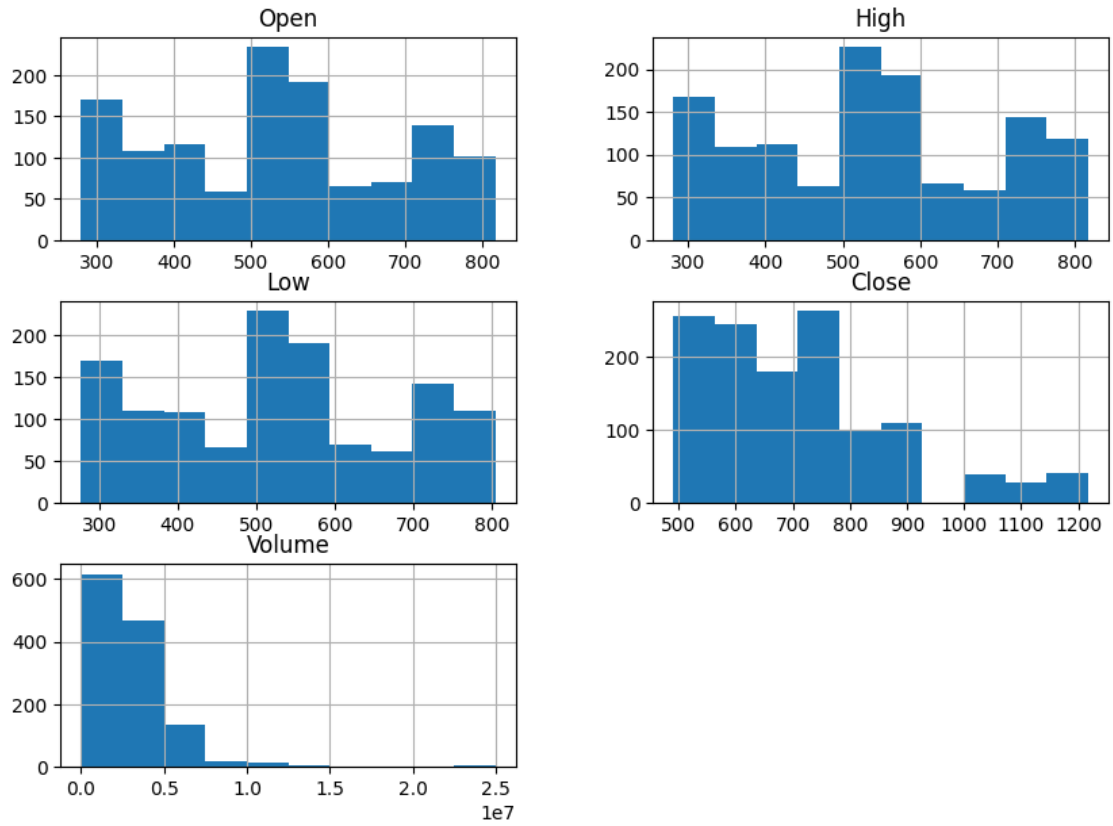
[11]:
```
data.isna().sum()
```

[11]:
```
Date      0
Open      0
High      0
Low       0
Close     0
Volume    0
dtype: int64
```

[12]:
```
data[['Open','High','Low','Close','Volume']].plot(kind='box', layout=(1,5),␣
↪subplots=True, sharex=False, sharey=False, figsize=(10,7),color='red')
plt.show()
```

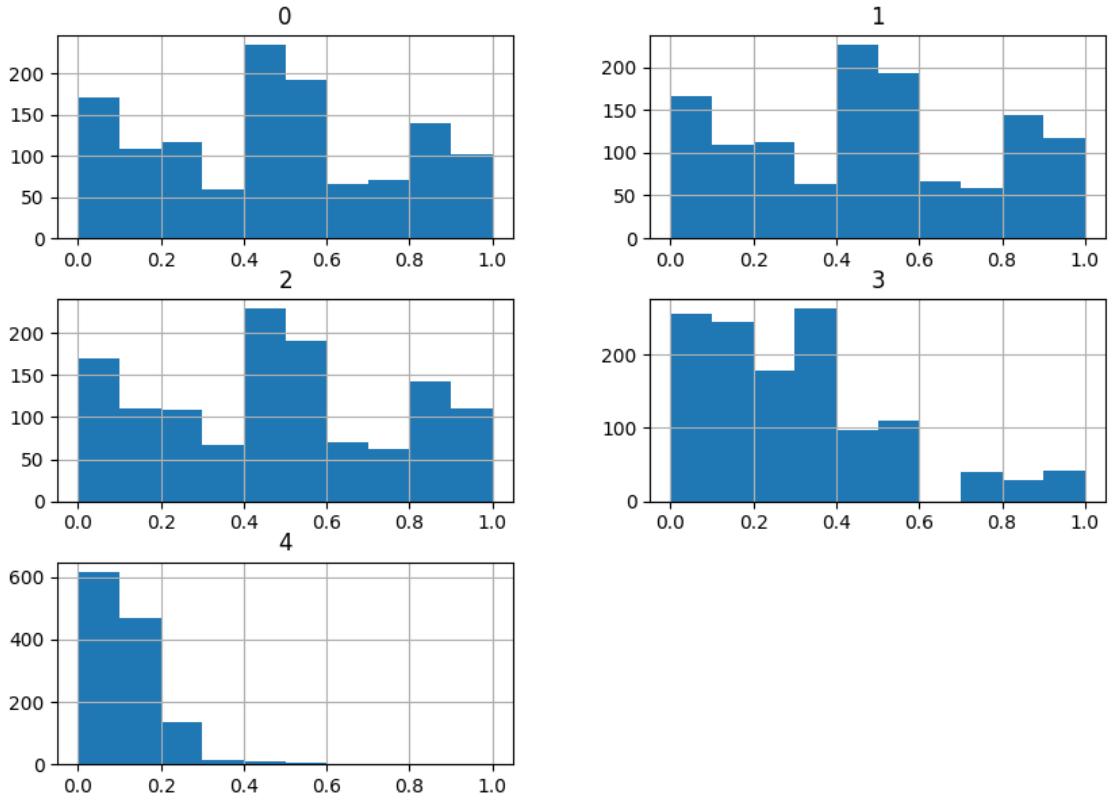


[14]:
```
data.hist(figsize=(10,7))
plt.show()
```

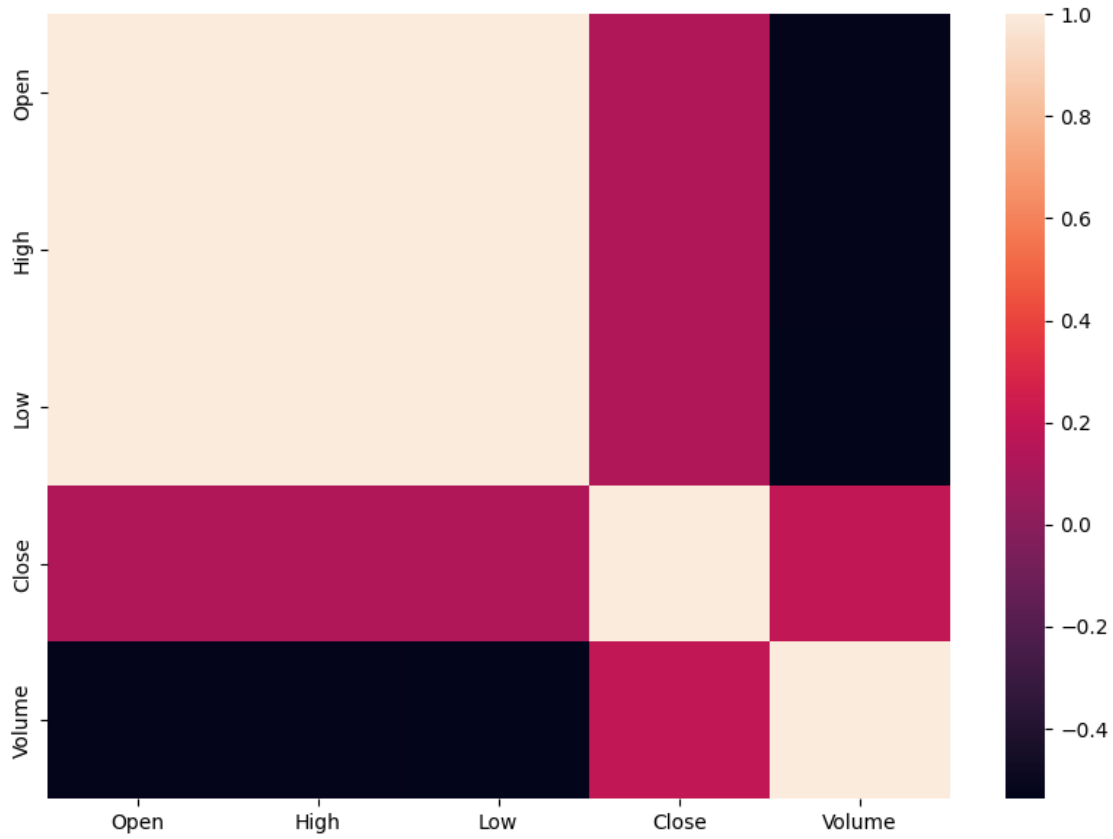


[34]:
```
scaler = MinMaxScaler()
data_without_date = data.drop("Date", axis=1)
scaled_data = pd.DataFrame(scaler.fit_transform(data_without_date))
```

[35]:
```
scaled_data.hist(figsize=(10,7))
plt.show()
```



[36]:
```
plt.figure(figsize=(10,7))
sns.heatmap(data.drop("Date", axis=1).corr())
plt.show()
```



[37]:
```
scaled_data = scaled_data.drop([0, 2, 3], axis=1)
scaled_data
```

[37]:

	1	4
0	0.096401	0.295258
1	0.098344	0.229936
2	0.092517	0.263612
3	0.088819	0.216179
4	0.076718	0.467797
…	…	…
1253	0.955292	0.024650
1254	0.964853	0.031286
1255	0.958074	0.045891
1256	0.942574	0.029491
1257	0.936691	0.070569

[1258 rows x 2 columns]

[38]:
```
def split_seq_multivariate(sequence, n_past, n_future):
```

```
    '''
    n_past ==> no of past observations
    n_future ==> no of future observations
    '''
    x = []
    y = []
    for window_start in range(len(sequence)):
        past_end = window_start + n_past
        future_end = past_end + n_future
        if future_end > len(sequence):
            break
        # slicing the past and future parts of the window (this indexing is for␣
↪2 features vala data only)
        past = sequence[window_start:past_end, :]
        future = sequence[past_end:future_end, -1]
        x.append(past)
        y.append(future)

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

[39]:
```
n_steps = 60

scaled_data = scaled_data.to_numpy()
scaled_data.shape
```

[39]: (1258, 2)

[40]:
```
x, y = split_seq_multivariate(scaled_data, n_steps, 1)
```

[41]:
```
x.shape, y.shape
```

[41]: ((1198, 60, 2), (1198, 1))

[42]:
```
y = y[:, 0]
y.shape
```

[42]: (1198,)

[44]:
```
x_train, x_test, y_train, y_test = train_test_split(x, y,test_size=0.2,␣
 ↪random_state=42)

x_train.shape, x_test.shape, y_train.shape, y_test.shape
```

[44]: ((958, 60, 2), (240, 60, 2), (958,), (240,))

[45]:
```
model = Sequential()
model.add(LSTM(612, input_shape=(n_steps, 2)))
```

```
model.add(Dense(50, activation='relu'))
model.add(Dense(50, activation='relu'))
model.add(Dense(30, activation='relu'))
model.add(Dense(1))
```

[46]:
```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 lstm (LSTM)                 (None, 612)               1505520

 dense (Dense)               (None, 50)                30650

 dense_1 (Dense)             (None, 50)                2550

 dense_2 (Dense)             (None, 30)                1530

 dense_3 (Dense)             (None, 1)                 31

=================================================================
Total params: 1540281 (5.88 MB)
Trainable params: 1540281 (5.88 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

[47]:
```
model.compile(optimizer='adam', loss='mse', metrics=['mae'])
```

[50]:
```
history = model.fit(x_train, y_train, epochs=250, batch_size=32, verbose=2,␣
↪validation_data=(x_test, y_test))
```

```
Epoch 1/250
30/30 - 1s - loss: 0.0011 - mae: 0.0230 - val_loss: 0.0046 - val_mae: 0.0410 -
1s/epoch - 45ms/step
Epoch 2/250
30/30 - 1s - loss: 9.8473e-04 - mae: 0.0221 - val_loss: 0.0052 - val_mae: 0.0411
- 529ms/epoch - 18ms/step
Epoch 3/250
30/30 - 1s - loss: 8.4283e-04 - mae: 0.0207 - val_loss: 0.0050 - val_mae: 0.0413
- 545ms/epoch - 18ms/step
Epoch 4/250
30/30 - 0s - loss: 7.7966e-04 - mae: 0.0202 - val_loss: 0.0050 - val_mae: 0.0417
- 455ms/epoch - 15ms/step
Epoch 5/250
30/30 - 0s - loss: 7.6793e-04 - mae: 0.0196 - val_loss: 0.0050 - val_mae: 0.0421
- 461ms/epoch - 15ms/step
```

```
Epoch 6/250
30/30 - 0s - loss: 7.0780e-04 - mae: 0.0190 - val_loss: 0.0050 - val_mae: 0.0402
- 456ms/epoch - 15ms/step
Epoch 7/250
30/30 - 0s - loss: 7.1152e-04 - mae: 0.0187 - val_loss: 0.0054 - val_mae: 0.0423
- 476ms/epoch - 16ms/step
Epoch 8/250
30/30 - 0s - loss: 6.7412e-04 - mae: 0.0181 - val_loss: 0.0047 - val_mae: 0.0420
- 469ms/epoch - 16ms/step
Epoch 9/250
30/30 - 0s - loss: 6.8164e-04 - mae: 0.0184 - val_loss: 0.0052 - val_mae: 0.0431
- 459ms/epoch - 15ms/step
Epoch 10/250
30/30 - 0s - loss: 6.5459e-04 - mae: 0.0181 - val_loss: 0.0048 - val_mae: 0.0410
- 472ms/epoch - 16ms/step
Epoch 11/250
30/30 - 0s - loss: 6.1229e-04 - mae: 0.0173 - val_loss: 0.0051 - val_mae: 0.0419
- 477ms/epoch - 16ms/step
Epoch 12/250
30/30 - 0s - loss: 6.2908e-04 - mae: 0.0175 - val_loss: 0.0055 - val_mae: 0.0427
- 454ms/epoch - 15ms/step
Epoch 13/250
30/30 - 0s - loss: 5.9914e-04 - mae: 0.0172 - val_loss: 0.0048 - val_mae: 0.0408
- 475ms/epoch - 16ms/step
Epoch 14/250
30/30 - 0s - loss: 5.8877e-04 - mae: 0.0172 - val_loss: 0.0056 - val_mae: 0.0435
- 467ms/epoch - 16ms/step
Epoch 15/250
30/30 - 0s - loss: 6.1806e-04 - mae: 0.0177 - val_loss: 0.0053 - val_mae: 0.0419
- 472ms/epoch - 16ms/step
Epoch 16/250
30/30 - 0s - loss: 6.3176e-04 - mae: 0.0177 - val_loss: 0.0053 - val_mae: 0.0422
- 475ms/epoch - 16ms/step
Epoch 17/250
30/30 - 0s - loss: 5.6503e-04 - mae: 0.0168 - val_loss: 0.0054 - val_mae: 0.0419
- 470ms/epoch - 16ms/step
Epoch 18/250
30/30 - 0s - loss: 5.6771e-04 - mae: 0.0166 - val_loss: 0.0050 - val_mae: 0.0414
- 461ms/epoch - 15ms/step
Epoch 19/250
30/30 - 0s - loss: 5.9781e-04 - mae: 0.0171 - val_loss: 0.0054 - val_mae: 0.0423
- 463ms/epoch - 15ms/step
Epoch 20/250
30/30 - 0s - loss: 5.4743e-04 - mae: 0.0167 - val_loss: 0.0050 - val_mae: 0.0422
- 477ms/epoch - 16ms/step
Epoch 21/250
30/30 - 0s - loss: 6.0998e-04 - mae: 0.0177 - val_loss: 0.0056 - val_mae: 0.0429
- 453ms/epoch - 15ms/step
```

```
Epoch 22/250
30/30 - 0s - loss: 5.8755e-04 - mae: 0.0172 - val_loss: 0.0051 - val_mae: 0.0419
- 458ms/epoch - 15ms/step
Epoch 23/250
30/30 - 0s - loss: 6.3688e-04 - mae: 0.0177 - val_loss: 0.0053 - val_mae: 0.0418
- 463ms/epoch - 15ms/step
Epoch 24/250
30/30 - 0s - loss: 6.6053e-04 - mae: 0.0187 - val_loss: 0.0058 - val_mae: 0.0434
- 488ms/epoch - 16ms/step
Epoch 25/250
30/30 - 1s - loss: 6.5145e-04 - mae: 0.0186 - val_loss: 0.0049 - val_mae: 0.0417
- 515ms/epoch - 17ms/step
Epoch 26/250
30/30 - 1s - loss: 6.1843e-04 - mae: 0.0179 - val_loss: 0.0054 - val_mae: 0.0423
- 528ms/epoch - 18ms/step
Epoch 27/250
30/30 - 1s - loss: 5.8185e-04 - mae: 0.0171 - val_loss: 0.0056 - val_mae: 0.0435
- 526ms/epoch - 18ms/step
Epoch 28/250
30/30 - 1s - loss: 5.5624e-04 - mae: 0.0168 - val_loss: 0.0053 - val_mae: 0.0420
- 547ms/epoch - 18ms/step
Epoch 29/250
30/30 - 0s - loss: 5.9381e-04 - mae: 0.0174 - val_loss: 0.0051 - val_mae: 0.0416
- 474ms/epoch - 16ms/step
Epoch 30/250
30/30 - 0s - loss: 6.8935e-04 - mae: 0.0191 - val_loss: 0.0054 - val_mae: 0.0421
- 474ms/epoch - 16ms/step
Epoch 31/250
30/30 - 0s - loss: 7.5995e-04 - mae: 0.0193 - val_loss: 0.0057 - val_mae: 0.0450
- 467ms/epoch - 16ms/step
Epoch 32/250
30/30 - 0s - loss: 7.4281e-04 - mae: 0.0194 - val_loss: 0.0056 - val_mae: 0.0419
- 469ms/epoch - 16ms/step
Epoch 33/250
30/30 - 0s - loss: 7.0208e-04 - mae: 0.0188 - val_loss: 0.0058 - val_mae: 0.0441
- 462ms/epoch - 15ms/step
Epoch 34/250
30/30 - 0s - loss: 6.6163e-04 - mae: 0.0187 - val_loss: 0.0055 - val_mae: 0.0425
- 462ms/epoch - 15ms/step
Epoch 35/250
30/30 - 0s - loss: 7.4854e-04 - mae: 0.0196 - val_loss: 0.0058 - val_mae: 0.0431
- 474ms/epoch - 16ms/step
Epoch 36/250
30/30 - 0s - loss: 7.4260e-04 - mae: 0.0190 - val_loss: 0.0053 - val_mae: 0.0410
- 462ms/epoch - 15ms/step
Epoch 37/250
30/30 - 0s - loss: 7.9546e-04 - mae: 0.0192 - val_loss: 0.0047 - val_mae: 0.0409
- 476ms/epoch - 16ms/step
```

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Epoch 38/250
30/30 - 0s - loss: 7.1461e-04 - mae: 0.0191 - val_loss: 0.0051 - val_mae: 0.0408
- 479ms/epoch - 16ms/step
Epoch 39/250
30/30 - 0s - loss: 6.9380e-04 - mae: 0.0189 - val_loss: 0.0052 - val_mae: 0.0407
- 463ms/epoch - 15ms/step
Epoch 40/250
30/30 - 0s - loss: 6.1563e-04 - mae: 0.0179 - val_loss: 0.0048 - val_mae: 0.0399
- 463ms/epoch - 15ms/step
Epoch 41/250
30/30 - 0s - loss: 5.5730e-04 - mae: 0.0169 - val_loss: 0.0048 - val_mae: 0.0401
- 465ms/epoch - 15ms/step
Epoch 42/250
30/30 - 0s - loss: 4.9529e-04 - mae: 0.0158 - val_loss: 0.0048 - val_mae: 0.0402
- 459ms/epoch - 15ms/step
Epoch 43/250
30/30 - 0s - loss: 4.8374e-04 - mae: 0.0156 - val_loss: 0.0054 - val_mae: 0.0420
- 470ms/epoch - 16ms/step
Epoch 44/250
30/30 - 0s - loss: 4.6603e-04 - mae: 0.0150 - val_loss: 0.0049 - val_mae: 0.0400
- 468ms/epoch - 16ms/step
Epoch 45/250
30/30 - 0s - loss: 4.5848e-04 - mae: 0.0150 - val_loss: 0.0052 - val_mae: 0.0410
- 466ms/epoch - 16ms/step
Epoch 46/250
30/30 - 0s - loss: 4.3539e-04 - mae: 0.0147 - val_loss: 0.0051 - val_mae: 0.0407
- 474ms/epoch - 16ms/step
Epoch 47/250
30/30 - 0s - loss: 4.6797e-04 - mae: 0.0155 - val_loss: 0.0051 - val_mae: 0.0407
- 464ms/epoch - 15ms/step
Epoch 48/250
30/30 - 0s - loss: 4.4922e-04 - mae: 0.0146 - val_loss: 0.0053 - val_mae: 0.0425
- 468ms/epoch - 16ms/step
Epoch 49/250
30/30 - 0s - loss: 5.5922e-04 - mae: 0.0164 - val_loss: 0.0054 - val_mae: 0.0430
- 474ms/epoch - 16ms/step
Epoch 50/250
30/30 - 1s - loss: 5.2215e-04 - mae: 0.0163 - val_loss: 0.0052 - val_mae: 0.0406
- 515ms/epoch - 17ms/step
Epoch 51/250
30/30 - 1s - loss: 5.1483e-04 - mae: 0.0162 - val_loss: 0.0050 - val_mae: 0.0413
- 517ms/epoch - 17ms/step
Epoch 52/250
30/30 - 1s - loss: 4.7363e-04 - mae: 0.0153 - val_loss: 0.0052 - val_mae: 0.0421
- 542ms/epoch - 18ms/step
Epoch 53/250
30/30 - 1s - loss: 4.6355e-04 - mae: 0.0154 - val_loss: 0.0052 - val_mae: 0.0412
- 543ms/epoch - 18ms/step
```

```
Epoch 54/250
30/30 - 0s - loss: 4.8226e-04 - mae: 0.0153 - val_loss: 0.0053 - val_mae: 0.0422
- 470ms/epoch - 16ms/step
Epoch 55/250
30/30 - 0s - loss: 5.6003e-04 - mae: 0.0172 - val_loss: 0.0054 - val_mae: 0.0420
- 469ms/epoch - 16ms/step
Epoch 56/250
30/30 - 0s - loss: 4.8221e-04 - mae: 0.0157 - val_loss: 0.0056 - val_mae: 0.0426
- 487ms/epoch - 16ms/step
Epoch 57/250
30/30 - 0s - loss: 4.7913e-04 - mae: 0.0160 - val_loss: 0.0053 - val_mae: 0.0422
- 482ms/epoch - 16ms/step
Epoch 58/250
30/30 - 0s - loss: 5.3047e-04 - mae: 0.0165 - val_loss: 0.0053 - val_mae: 0.0425
- 485ms/epoch - 16ms/step
Epoch 59/250
30/30 - 0s - loss: 5.0244e-04 - mae: 0.0162 - val_loss: 0.0050 - val_mae: 0.0412
- 469ms/epoch - 16ms/step
Epoch 60/250
30/30 - 0s - loss: 5.0296e-04 - mae: 0.0160 - val_loss: 0.0050 - val_mae: 0.0421
- 479ms/epoch - 16ms/step
Epoch 61/250
30/30 - 0s - loss: 4.8956e-04 - mae: 0.0159 - val_loss: 0.0051 - val_mae: 0.0414
- 472ms/epoch - 16ms/step
Epoch 62/250
30/30 - 0s - loss: 4.8085e-04 - mae: 0.0158 - val_loss: 0.0051 - val_mae: 0.0421
- 485ms/epoch - 16ms/step
Epoch 63/250
30/30 - 0s - loss: 4.6537e-04 - mae: 0.0156 - val_loss: 0.0053 - val_mae: 0.0415
- 472ms/epoch - 16ms/step
Epoch 64/250
30/30 - 0s - loss: 4.8694e-04 - mae: 0.0158 - val_loss: 0.0052 - val_mae: 0.0426
- 476ms/epoch - 16ms/step
Epoch 65/250
30/30 - 0s - loss: 4.5909e-04 - mae: 0.0149 - val_loss: 0.0052 - val_mae: 0.0425
- 491ms/epoch - 16ms/step
Epoch 66/250
30/30 - 0s - loss: 6.0255e-04 - mae: 0.0178 - val_loss: 0.0065 - val_mae: 0.0445
- 483ms/epoch - 16ms/step
Epoch 67/250
30/30 - 0s - loss: 0.0011 - mae: 0.0226 - val_loss: 0.0059 - val_mae: 0.0442 -
469ms/epoch - 16ms/step
Epoch 68/250
30/30 - 0s - loss: 0.0028 - mae: 0.0335 - val_loss: 0.0057 - val_mae: 0.0438 -
493ms/epoch - 16ms/step
Epoch 69/250
30/30 - 0s - loss: 0.0053 - mae: 0.0463 - val_loss: 0.0055 - val_mae: 0.0586 -
468ms/epoch - 16ms/step
```

```
Epoch 70/250
30/30 - 0s - loss: 0.0046 - mae: 0.0395 - val_loss: 0.0045 - val_mae: 0.0427 -
478ms/epoch - 16ms/step
Epoch 71/250
30/30 - 0s - loss: 0.0039 - mae: 0.0348 - val_loss: 0.0039 - val_mae: 0.0350 -
474ms/epoch - 16ms/step
Epoch 72/250
30/30 - 0s - loss: 0.0037 - mae: 0.0346 - val_loss: 0.0037 - val_mae: 0.0356 -
482ms/epoch - 16ms/step
Epoch 73/250
30/30 - 0s - loss: 0.0034 - mae: 0.0325 - val_loss: 0.0040 - val_mae: 0.0352 -
482ms/epoch - 16ms/step
Epoch 74/250
30/30 - 1s - loss: 0.0034 - mae: 0.0316 - val_loss: 0.0038 - val_mae: 0.0353 -
590ms/epoch - 20ms/step
Epoch 75/250
30/30 - 1s - loss: 0.0034 - mae: 0.0321 - val_loss: 0.0035 - val_mae: 0.0359 -
527ms/epoch - 18ms/step
Epoch 76/250
30/30 - 1s - loss: 0.0033 - mae: 0.0323 - val_loss: 0.0040 - val_mae: 0.0347 -
626ms/epoch - 21ms/step
Epoch 77/250
30/30 - 1s - loss: 0.0032 - mae: 0.0309 - val_loss: 0.0036 - val_mae: 0.0350 -
514ms/epoch - 17ms/step
Epoch 78/250
30/30 - 0s - loss: 0.0034 - mae: 0.0335 - val_loss: 0.0038 - val_mae: 0.0351 -
494ms/epoch - 16ms/step
Epoch 79/250
30/30 - 0s - loss: 0.0032 - mae: 0.0315 - val_loss: 0.0034 - val_mae: 0.0346 -
471ms/epoch - 16ms/step
Epoch 80/250
30/30 - 0s - loss: 0.0033 - mae: 0.0319 - val_loss: 0.0035 - val_mae: 0.0358 -
484ms/epoch - 16ms/step
Epoch 81/250
30/30 - 0s - loss: 0.0032 - mae: 0.0312 - val_loss: 0.0035 - val_mae: 0.0345 -
478ms/epoch - 16ms/step
Epoch 82/250
30/30 - 0s - loss: 0.0032 - mae: 0.0310 - val_loss: 0.0034 - val_mae: 0.0353 -
484ms/epoch - 16ms/step
Epoch 83/250
30/30 - 0s - loss: 0.0032 - mae: 0.0322 - val_loss: 0.0047 - val_mae: 0.0368 -
471ms/epoch - 16ms/step
Epoch 84/250
30/30 - 0s - loss: 0.0035 - mae: 0.0319 - val_loss: 0.0035 - val_mae: 0.0349 -
467ms/epoch - 16ms/step
Epoch 85/250
30/30 - 0s - loss: 0.0032 - mae: 0.0318 - val_loss: 0.0036 - val_mae: 0.0349 -
474ms/epoch - 16ms/step
```

```
Epoch 86/250
30/30 - 0s - loss: 0.0032 - mae: 0.0319 - val_loss: 0.0042 - val_mae: 0.0371 -
479ms/epoch - 16ms/step
Epoch 87/250
30/30 - 0s - loss: 0.0032 - mae: 0.0319 - val_loss: 0.0036 - val_mae: 0.0356 -
472ms/epoch - 16ms/step
Epoch 88/250
30/30 - 0s - loss: 0.0033 - mae: 0.0322 - val_loss: 0.0035 - val_mae: 0.0351 -
481ms/epoch - 16ms/step
Epoch 89/250
30/30 - 0s - loss: 0.0032 - mae: 0.0312 - val_loss: 0.0038 - val_mae: 0.0359 -
480ms/epoch - 16ms/step
Epoch 90/250
30/30 - 0s - loss: 0.0031 - mae: 0.0314 - val_loss: 0.0035 - val_mae: 0.0349 -
472ms/epoch - 16ms/step
Epoch 91/250
30/30 - 0s - loss: 0.0031 - mae: 0.0311 - val_loss: 0.0035 - val_mae: 0.0358 -
478ms/epoch - 16ms/step
Epoch 92/250
30/30 - 0s - loss: 0.0031 - mae: 0.0314 - val_loss: 0.0040 - val_mae: 0.0368 -
466ms/epoch - 16ms/step
Epoch 93/250
30/30 - 0s - loss: 0.0031 - mae: 0.0312 - val_loss: 0.0035 - val_mae: 0.0353 -
474ms/epoch - 16ms/step
Epoch 94/250
30/30 - 0s - loss: 0.0031 - mae: 0.0317 - val_loss: 0.0039 - val_mae: 0.0351 -
464ms/epoch - 15ms/step
Epoch 95/250
30/30 - 0s - loss: 0.0032 - mae: 0.0314 - val_loss: 0.0037 - val_mae: 0.0357 -
481ms/epoch - 16ms/step
Epoch 96/250
30/30 - 0s - loss: 0.0030 - mae: 0.0302 - val_loss: 0.0034 - val_mae: 0.0363 -
477ms/epoch - 16ms/step
Epoch 97/250
30/30 - 0s - loss: 0.0030 - mae: 0.0301 - val_loss: 0.0034 - val_mae: 0.0350 -
465ms/epoch - 15ms/step
Epoch 98/250
30/30 - 1s - loss: 0.0030 - mae: 0.0306 - val_loss: 0.0035 - val_mae: 0.0356 -
508ms/epoch - 17ms/step
Epoch 99/250
30/30 - 1s - loss: 0.0029 - mae: 0.0301 - val_loss: 0.0038 - val_mae: 0.0359 -
563ms/epoch - 19ms/step
Epoch 100/250
30/30 - 1s - loss: 0.0029 - mae: 0.0303 - val_loss: 0.0036 - val_mae: 0.0363 -
511ms/epoch - 17ms/step
Epoch 101/250
30/30 - 1s - loss: 0.0030 - mae: 0.0306 - val_loss: 0.0035 - val_mae: 0.0360 -
557ms/epoch - 19ms/step
```

```
Epoch 102/250
30/30 - 0s - loss: 0.0030 - mae: 0.0298 - val_loss: 0.0036 - val_mae: 0.0403 -
463ms/epoch - 15ms/step
Epoch 103/250
30/30 - 0s - loss: 0.0029 - mae: 0.0312 - val_loss: 0.0039 - val_mae: 0.0363 -
489ms/epoch - 16ms/step
Epoch 104/250
30/30 - 0s - loss: 0.0029 - mae: 0.0304 - val_loss: 0.0036 - val_mae: 0.0356 -
482ms/epoch - 16ms/step
Epoch 105/250
30/30 - 0s - loss: 0.0029 - mae: 0.0302 - val_loss: 0.0037 - val_mae: 0.0365 -
475ms/epoch - 16ms/step
Epoch 106/250
30/30 - 0s - loss: 0.0029 - mae: 0.0312 - val_loss: 0.0041 - val_mae: 0.0384 -
484ms/epoch - 16ms/step
Epoch 107/250
30/30 - 0s - loss: 0.0029 - mae: 0.0307 - val_loss: 0.0035 - val_mae: 0.0352 -
461ms/epoch - 15ms/step
Epoch 108/250
30/30 - 0s - loss: 0.0028 - mae: 0.0298 - val_loss: 0.0037 - val_mae: 0.0356 -
467ms/epoch - 16ms/step
Epoch 109/250
30/30 - 0s - loss: 0.0028 - mae: 0.0306 - val_loss: 0.0040 - val_mae: 0.0376 -
481ms/epoch - 16ms/step
Epoch 110/250
30/30 - 0s - loss: 0.0029 - mae: 0.0321 - val_loss: 0.0040 - val_mae: 0.0374 -
470ms/epoch - 16ms/step
Epoch 111/250
30/30 - 0s - loss: 0.0030 - mae: 0.0318 - val_loss: 0.0036 - val_mae: 0.0360 -
464ms/epoch - 15ms/step
Epoch 112/250
30/30 - 0s - loss: 0.0030 - mae: 0.0306 - val_loss: 0.0036 - val_mae: 0.0354 -
484ms/epoch - 16ms/step
Epoch 113/250
30/30 - 0s - loss: 0.0029 - mae: 0.0301 - val_loss: 0.0036 - val_mae: 0.0351 -
472ms/epoch - 16ms/step
Epoch 114/250
30/30 - 0s - loss: 0.0028 - mae: 0.0307 - val_loss: 0.0040 - val_mae: 0.0364 -
463ms/epoch - 15ms/step
Epoch 115/250
30/30 - 0s - loss: 0.0027 - mae: 0.0298 - val_loss: 0.0038 - val_mae: 0.0370 -
463ms/epoch - 15ms/step
Epoch 116/250
30/30 - 0s - loss: 0.0027 - mae: 0.0304 - val_loss: 0.0038 - val_mae: 0.0373 -
475ms/epoch - 16ms/step
Epoch 117/250
30/30 - 0s - loss: 0.0034 - mae: 0.0341 - val_loss: 0.0041 - val_mae: 0.0364 -
472ms/epoch - 16ms/step
```

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Epoch 118/250
30/30 - 0s - loss: 0.0032 - mae: 0.0308 - val_loss: 0.0036 - val_mae: 0.0362 -
465ms/epoch - 16ms/step
Epoch 119/250
30/30 - 0s - loss: 0.0029 - mae: 0.0298 - val_loss: 0.0037 - val_mae: 0.0424 -
462ms/epoch - 15ms/step
Epoch 120/250
30/30 - 0s - loss: 0.0029 - mae: 0.0312 - val_loss: 0.0038 - val_mae: 0.0362 -
469ms/epoch - 16ms/step
Epoch 121/250
30/30 - 0s - loss: 0.0028 - mae: 0.0296 - val_loss: 0.0037 - val_mae: 0.0399 -
463ms/epoch - 15ms/step
Epoch 122/250
30/30 - 0s - loss: 0.0029 - mae: 0.0319 - val_loss: 0.0037 - val_mae: 0.0374 -
473ms/epoch - 16ms/step
Epoch 123/250
30/30 - 1s - loss: 0.0031 - mae: 0.0324 - val_loss: 0.0041 - val_mae: 0.0382 -
528ms/epoch - 18ms/step
Epoch 124/250
30/30 - 1s - loss: 0.0032 - mae: 0.0320 - val_loss: 0.0047 - val_mae: 0.0379 -
519ms/epoch - 17ms/step
Epoch 125/250
30/30 - 1s - loss: 0.0033 - mae: 0.0329 - val_loss: 0.0040 - val_mae: 0.0409 -
536ms/epoch - 18ms/step
Epoch 126/250
30/30 - 1s - loss: 0.0031 - mae: 0.0313 - val_loss: 0.0037 - val_mae: 0.0386 -
515ms/epoch - 17ms/step
Epoch 127/250
30/30 - 0s - loss: 0.0029 - mae: 0.0314 - val_loss: 0.0039 - val_mae: 0.0355 -
483ms/epoch - 16ms/step
Epoch 128/250
30/30 - 0s - loss: 0.0029 - mae: 0.0293 - val_loss: 0.0035 - val_mae: 0.0362 -
463ms/epoch - 15ms/step
Epoch 129/250
30/30 - 0s - loss: 0.0028 - mae: 0.0300 - val_loss: 0.0037 - val_mae: 0.0366 -
480ms/epoch - 16ms/step
Epoch 130/250
30/30 - 0s - loss: 0.0029 - mae: 0.0301 - val_loss: 0.0035 - val_mae: 0.0368 -
459ms/epoch - 15ms/step
Epoch 131/250
30/30 - 0s - loss: 0.0030 - mae: 0.0313 - val_loss: 0.0037 - val_mae: 0.0359 -
477ms/epoch - 16ms/step
Epoch 132/250
30/30 - 0s - loss: 0.0028 - mae: 0.0296 - val_loss: 0.0038 - val_mae: 0.0361 -
468ms/epoch - 16ms/step
Epoch 133/250
30/30 - 0s - loss: 0.0027 - mae: 0.0297 - val_loss: 0.0036 - val_mae: 0.0357 -
464ms/epoch - 15ms/step
```

```
Epoch 134/250
30/30 - 0s - loss: 0.0027 - mae: 0.0293 - val_loss: 0.0037 - val_mae: 0.0360 -
469ms/epoch - 16ms/step
Epoch 135/250
30/30 - 0s - loss: 0.0027 - mae: 0.0294 - val_loss: 0.0040 - val_mae: 0.0379 -
480ms/epoch - 16ms/step
Epoch 136/250
30/30 - 0s - loss: 0.0027 - mae: 0.0293 - val_loss: 0.0036 - val_mae: 0.0367 -
463ms/epoch - 15ms/step
Epoch 137/250
30/30 - 0s - loss: 0.0028 - mae: 0.0303 - val_loss: 0.0041 - val_mae: 0.0376 -
471ms/epoch - 16ms/step
Epoch 138/250
30/30 - 0s - loss: 0.0028 - mae: 0.0306 - val_loss: 0.0040 - val_mae: 0.0368 -
464ms/epoch - 15ms/step
Epoch 139/250
30/30 - 0s - loss: 0.0026 - mae: 0.0300 - val_loss: 0.0042 - val_mae: 0.0383 -
459ms/epoch - 15ms/step
Epoch 140/250
30/30 - 0s - loss: 0.0025 - mae: 0.0287 - val_loss: 0.0041 - val_mae: 0.0386 -
465ms/epoch - 15ms/step
Epoch 141/250
30/30 - 0s - loss: 0.0028 - mae: 0.0304 - val_loss: 0.0044 - val_mae: 0.0403 -
463ms/epoch - 15ms/step
Epoch 142/250
30/30 - 0s - loss: 0.0028 - mae: 0.0312 - val_loss: 0.0040 - val_mae: 0.0373 -
463ms/epoch - 15ms/step
Epoch 143/250
30/30 - 0s - loss: 0.0024 - mae: 0.0291 - val_loss: 0.0040 - val_mae: 0.0380 -
470ms/epoch - 16ms/step
Epoch 144/250
30/30 - 0s - loss: 0.0024 - mae: 0.0300 - val_loss: 0.0041 - val_mae: 0.0382 -
476ms/epoch - 16ms/step
Epoch 145/250
30/30 - 0s - loss: 0.0025 - mae: 0.0295 - val_loss: 0.0043 - val_mae: 0.0431 -
471ms/epoch - 16ms/step
Epoch 146/250
30/30 - 0s - loss: 0.0025 - mae: 0.0313 - val_loss: 0.0047 - val_mae: 0.0416 -
458ms/epoch - 15ms/step
Epoch 147/250
30/30 - 0s - loss: 0.0022 - mae: 0.0291 - val_loss: 0.0046 - val_mae: 0.0403 -
491ms/epoch - 16ms/step
Epoch 148/250
30/30 - 1s - loss: 0.0023 - mae: 0.0295 - val_loss: 0.0042 - val_mae: 0.0369 -
535ms/epoch - 18ms/step
Epoch 149/250
30/30 - 1s - loss: 0.0031 - mae: 0.0321 - val_loss: 0.0043 - val_mae: 0.0384 -
531ms/epoch - 18ms/step
```

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Epoch 150/250
30/30 - 1s - loss: 0.0031 - mae: 0.0313 - val_loss: 0.0038 - val_mae: 0.0373 -
535ms/epoch - 18ms/step
Epoch 151/250
30/30 - 0s - loss: 0.0028 - mae: 0.0304 - val_loss: 0.0036 - val_mae: 0.0354 -
487ms/epoch - 16ms/step
Epoch 152/250
30/30 - 0s - loss: 0.0024 - mae: 0.0298 - val_loss: 0.0043 - val_mae: 0.0411 -
470ms/epoch - 16ms/step
Epoch 153/250
30/30 - 0s - loss: 0.0030 - mae: 0.0310 - val_loss: 0.0040 - val_mae: 0.0363 -
464ms/epoch - 15ms/step
Epoch 154/250
30/30 - 0s - loss: 0.0025 - mae: 0.0297 - val_loss: 0.0040 - val_mae: 0.0377 -
472ms/epoch - 16ms/step
Epoch 155/250
30/30 - 0s - loss: 0.0025 - mae: 0.0300 - val_loss: 0.0051 - val_mae: 0.0419 -
481ms/epoch - 16ms/step
Epoch 156/250
30/30 - 0s - loss: 0.0025 - mae: 0.0312 - val_loss: 0.0057 - val_mae: 0.0428 -
474ms/epoch - 16ms/step
Epoch 157/250
30/30 - 0s - loss: 0.0028 - mae: 0.0327 - val_loss: 0.0041 - val_mae: 0.0397 -
479ms/epoch - 16ms/step
Epoch 158/250
30/30 - 0s - loss: 0.0024 - mae: 0.0307 - val_loss: 0.0041 - val_mae: 0.0390 -
464ms/epoch - 15ms/step
Epoch 159/250
30/30 - 0s - loss: 0.0025 - mae: 0.0294 - val_loss: 0.0044 - val_mae: 0.0418 -
476ms/epoch - 16ms/step
Epoch 160/250
30/30 - 0s - loss: 0.0022 - mae: 0.0304 - val_loss: 0.0057 - val_mae: 0.0399 -
461ms/epoch - 15ms/step
Epoch 161/250
30/30 - 0s - loss: 0.0029 - mae: 0.0320 - val_loss: 0.0047 - val_mae: 0.0399 -
477ms/epoch - 16ms/step
Epoch 162/250
30/30 - 0s - loss: 0.0023 - mae: 0.0292 - val_loss: 0.0042 - val_mae: 0.0407 -
461ms/epoch - 15ms/step
Epoch 163/250
30/30 - 0s - loss: 0.0020 - mae: 0.0286 - val_loss: 0.0044 - val_mae: 0.0402 -
476ms/epoch - 16ms/step
Epoch 164/250
30/30 - 0s - loss: 0.0022 - mae: 0.0292 - val_loss: 0.0050 - val_mae: 0.0411 -
471ms/epoch - 16ms/step
Epoch 165/250
30/30 - 0s - loss: 0.0017 - mae: 0.0280 - val_loss: 0.0048 - val_mae: 0.0405 -
463ms/epoch - 15ms/step
```

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Epoch 166/250
30/30 - 0s - loss: 0.0016 - mae: 0.0269 - val_loss: 0.0047 - val_mae: 0.0395 -
461ms/epoch - 15ms/step
Epoch 167/250
30/30 - 0s - loss: 0.0015 - mae: 0.0260 - val_loss: 0.0049 - val_mae: 0.0399 -
465ms/epoch - 16ms/step
Epoch 168/250
30/30 - 0s - loss: 0.0014 - mae: 0.0251 - val_loss: 0.0047 - val_mae: 0.0404 -
472ms/epoch - 16ms/step
Epoch 169/250
30/30 - 0s - loss: 0.0014 - mae: 0.0256 - val_loss: 0.0051 - val_mae: 0.0423 -
472ms/epoch - 16ms/step
Epoch 170/250
30/30 - 0s - loss: 0.0015 - mae: 0.0267 - val_loss: 0.0051 - val_mae: 0.0397 -
456ms/epoch - 15ms/step
Epoch 171/250
30/30 - 0s - loss: 0.0016 - mae: 0.0258 - val_loss: 0.0045 - val_mae: 0.0386 -
474ms/epoch - 16ms/step
Epoch 172/250
30/30 - 1s - loss: 0.0013 - mae: 0.0251 - val_loss: 0.0055 - val_mae: 0.0415 -
506ms/epoch - 17ms/step
Epoch 173/250
30/30 - 1s - loss: 0.0012 - mae: 0.0246 - val_loss: 0.0048 - val_mae: 0.0392 -
516ms/epoch - 17ms/step
Epoch 174/250
30/30 - 1s - loss: 0.0011 - mae: 0.0236 - val_loss: 0.0051 - val_mae: 0.0404 -
535ms/epoch - 18ms/step
Epoch 175/250
30/30 - 1s - loss: 0.0010 - mae: 0.0227 - val_loss: 0.0049 - val_mae: 0.0403 -
544ms/epoch - 18ms/step
Epoch 176/250
30/30 - 0s - loss: 0.0010 - mae: 0.0231 - val_loss: 0.0051 - val_mae: 0.0415 -
480ms/epoch - 16ms/step
Epoch 177/250
30/30 - 0s - loss: 9.7837e-04 - mae: 0.0222 - val_loss: 0.0054 - val_mae: 0.0412
- 465ms/epoch - 15ms/step
Epoch 178/250
30/30 - 0s - loss: 9.5862e-04 - mae: 0.0217 - val_loss: 0.0048 - val_mae: 0.0401
- 463ms/epoch - 15ms/step
Epoch 179/250
30/30 - 0s - loss: 9.4654e-04 - mae: 0.0216 - val_loss: 0.0054 - val_mae: 0.0416
- 459ms/epoch - 15ms/step
Epoch 180/250
30/30 - 0s - loss: 9.4102e-04 - mae: 0.0220 - val_loss: 0.0050 - val_mae: 0.0409
- 464ms/epoch - 15ms/step
Epoch 181/250
30/30 - 0s - loss: 9.5030e-04 - mae: 0.0217 - val_loss: 0.0063 - val_mae: 0.0430
- 479ms/epoch - 16ms/step
```

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Epoch 182/250
30/30 - 0s - loss: 9.5537e-04 - mae: 0.0216 - val_loss: 0.0053 - val_mae: 0.0415
- 464ms/epoch - 15ms/step
Epoch 183/250
30/30 - 0s - loss: 9.6273e-04 - mae: 0.0219 - val_loss: 0.0057 - val_mae: 0.0419
- 477ms/epoch - 16ms/step
Epoch 184/250
30/30 - 0s - loss: 9.6589e-04 - mae: 0.0222 - val_loss: 0.0048 - val_mae: 0.0402
- 462ms/epoch - 15ms/step
Epoch 185/250
30/30 - 0s - loss: 9.6206e-04 - mae: 0.0218 - val_loss: 0.0056 - val_mae: 0.0423
- 474ms/epoch - 16ms/step
Epoch 186/250
30/30 - 0s - loss: 9.6898e-04 - mae: 0.0222 - val_loss: 0.0050 - val_mae: 0.0406
- 469ms/epoch - 16ms/step
Epoch 187/250
30/30 - 0s - loss: 9.9364e-04 - mae: 0.0221 - val_loss: 0.0057 - val_mae: 0.0410
- 461ms/epoch - 15ms/step
Epoch 188/250
30/30 - 0s - loss: 0.0011 - mae: 0.0223 - val_loss: 0.0050 - val_mae: 0.0409 -
457ms/epoch - 15ms/step
Epoch 189/250
30/30 - 0s - loss: 0.0011 - mae: 0.0230 - val_loss: 0.0055 - val_mae: 0.0414 -
461ms/epoch - 15ms/step
Epoch 190/250
30/30 - 0s - loss: 0.0011 - mae: 0.0231 - val_loss: 0.0048 - val_mae: 0.0402 -
462ms/epoch - 15ms/step
Epoch 191/250
30/30 - 0s - loss: 0.0013 - mae: 0.0245 - val_loss: 0.0064 - val_mae: 0.0434 -
461ms/epoch - 15ms/step
Epoch 192/250
30/30 - 0s - loss: 0.0013 - mae: 0.0246 - val_loss: 0.0047 - val_mae: 0.0387 -
460ms/epoch - 15ms/step
Epoch 193/250
30/30 - 0s - loss: 0.0017 - mae: 0.0255 - val_loss: 0.0046 - val_mae: 0.0399 -
478ms/epoch - 16ms/step
Epoch 194/250
30/30 - 0s - loss: 0.0014 - mae: 0.0256 - val_loss: 0.0053 - val_mae: 0.0414 -
476ms/epoch - 16ms/step
Epoch 195/250
30/30 - 0s - loss: 0.0019 - mae: 0.0284 - val_loss: 0.0042 - val_mae: 0.0393 -
464ms/epoch - 15ms/step
Epoch 196/250
30/30 - 0s - loss: 0.0016 - mae: 0.0269 - val_loss: 0.0049 - val_mae: 0.0424 -
462ms/epoch - 15ms/step
Epoch 197/250
30/30 - 1s - loss: 0.0013 - mae: 0.0246 - val_loss: 0.0052 - val_mae: 0.0401 -
526ms/epoch - 18ms/step
```

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Epoch 198/250
30/30 - 1s - loss: 0.0014 - mae: 0.0242 - val_loss: 0.0048 - val_mae: 0.0393 -
525ms/epoch - 18ms/step
Epoch 199/250
30/30 - 1s - loss: 9.7770e-04 - mae: 0.0222 - val_loss: 0.0055 - val_mae: 0.0413
- 539ms/epoch - 18ms/step
Epoch 200/250
30/30 - 1s - loss: 8.7940e-04 - mae: 0.0209 - val_loss: 0.0050 - val_mae: 0.0409
- 527ms/epoch - 18ms/step
Epoch 201/250
30/30 - 0s - loss: 8.9011e-04 - mae: 0.0208 - val_loss: 0.0058 - val_mae: 0.0424
- 479ms/epoch - 16ms/step
Epoch 202/250
30/30 - 0s - loss: 8.5248e-04 - mae: 0.0207 - val_loss: 0.0052 - val_mae: 0.0416
- 474ms/epoch - 16ms/step
Epoch 203/250
30/30 - 0s - loss: 8.2428e-04 - mae: 0.0201 - val_loss: 0.0052 - val_mae: 0.0417
- 479ms/epoch - 16ms/step
Epoch 204/250
30/30 - 0s - loss: 8.0007e-04 - mae: 0.0197 - val_loss: 0.0053 - val_mae: 0.0413
- 480ms/epoch - 16ms/step
Epoch 205/250
30/30 - 0s - loss: 7.6619e-04 - mae: 0.0192 - val_loss: 0.0051 - val_mae: 0.0414
- 464ms/epoch - 15ms/step
Epoch 206/250
30/30 - 0s - loss: 7.5851e-04 - mae: 0.0190 - val_loss: 0.0053 - val_mae: 0.0414
- 475ms/epoch - 16ms/step
Epoch 207/250
30/30 - 0s - loss: 7.5735e-04 - mae: 0.0192 - val_loss: 0.0053 - val_mae: 0.0419
- 474ms/epoch - 16ms/step
Epoch 208/250
30/30 - 0s - loss: 7.6697e-04 - mae: 0.0192 - val_loss: 0.0053 - val_mae: 0.0417
- 478ms/epoch - 16ms/step
Epoch 209/250
30/30 - 0s - loss: 8.0079e-04 - mae: 0.0194 - val_loss: 0.0053 - val_mae: 0.0419
- 475ms/epoch - 16ms/step
Epoch 210/250
30/30 - 0s - loss: 7.9736e-04 - mae: 0.0199 - val_loss: 0.0057 - val_mae: 0.0418
- 469ms/epoch - 16ms/step
Epoch 211/250
30/30 - 0s - loss: 7.8417e-04 - mae: 0.0194 - val_loss: 0.0053 - val_mae: 0.0416
- 480ms/epoch - 16ms/step
Epoch 212/250
30/30 - 0s - loss: 7.6131e-04 - mae: 0.0190 - val_loss: 0.0055 - val_mae: 0.0419
- 468ms/epoch - 16ms/step
Epoch 213/250
30/30 - 0s - loss: 7.8760e-04 - mae: 0.0194 - val_loss: 0.0054 - val_mae: 0.0422
- 460ms/epoch - 15ms/step
```

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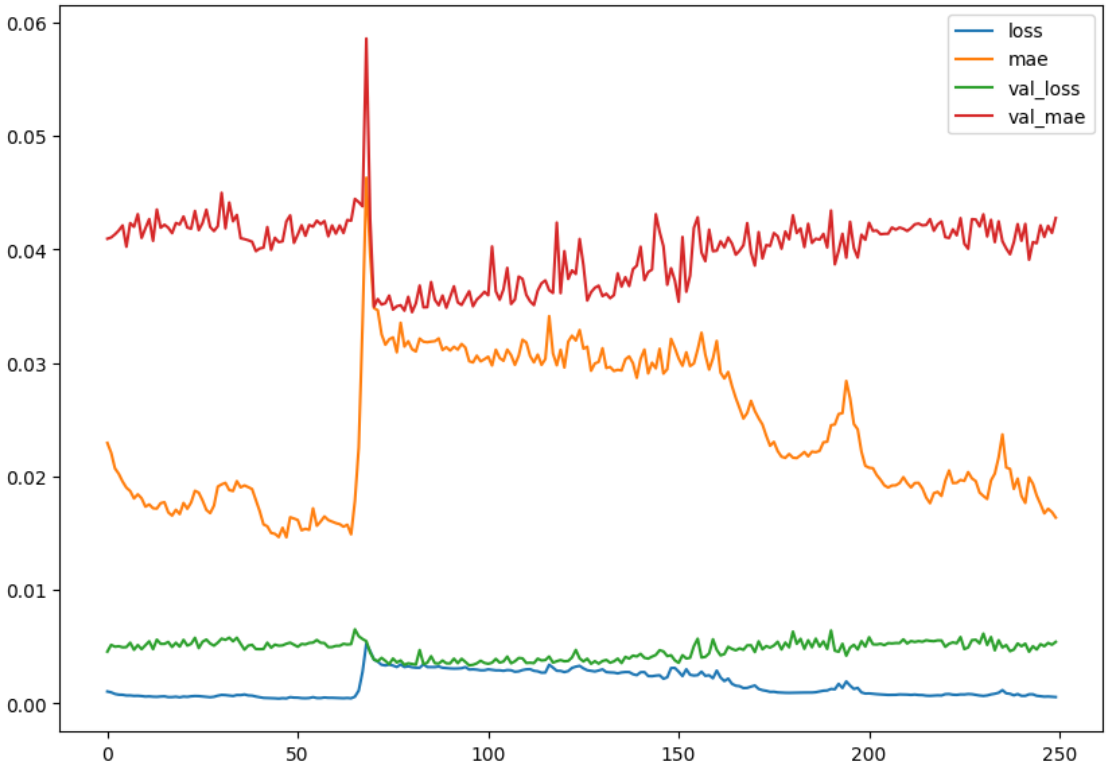
Epoch 214/250
30/30 - 0s - loss: 7.5060e-04 - mae: 0.0194 - val_loss: 0.0055 - val_mae: 0.0423
- 474ms/epoch - 16ms/step
Epoch 215/250
30/30 - 0s - loss: 7.4340e-04 - mae: 0.0189 - val_loss: 0.0054 - val_mae: 0.0421
- 478ms/epoch - 16ms/step
Epoch 216/250
30/30 - 0s - loss: 6.9165e-04 - mae: 0.0181 - val_loss: 0.0056 - val_mae: 0.0422
- 466ms/epoch - 16ms/step
Epoch 217/250
30/30 - 0s - loss: 6.7851e-04 - mae: 0.0176 - val_loss: 0.0055 - val_mae: 0.0427
- 479ms/epoch - 16ms/step
Epoch 218/250
30/30 - 0s - loss: 6.9858e-04 - mae: 0.0185 - val_loss: 0.0055 - val_mae: 0.0417
- 470ms/epoch - 16ms/step
Epoch 219/250
30/30 - 0s - loss: 7.2071e-04 - mae: 0.0187 - val_loss: 0.0056 - val_mae: 0.0422
- 475ms/epoch - 16ms/step
Epoch 220/250
30/30 - 0s - loss: 7.0885e-04 - mae: 0.0183 - val_loss: 0.0056 - val_mae: 0.0425
- 465ms/epoch - 15ms/step
Epoch 221/250
30/30 - 0s - loss: 8.2479e-04 - mae: 0.0196 - val_loss: 0.0050 - val_mae: 0.0411
- 493ms/epoch - 16ms/step
Epoch 222/250
30/30 - 1s - loss: 8.3608e-04 - mae: 0.0205 - val_loss: 0.0053 - val_mae: 0.0410
- 531ms/epoch - 18ms/step
Epoch 223/250
30/30 - 1s - loss: 7.7633e-04 - mae: 0.0194 - val_loss: 0.0054 - val_mae: 0.0418
- 514ms/epoch - 17ms/step
Epoch 224/250
30/30 - 1s - loss: 7.6130e-04 - mae: 0.0194 - val_loss: 0.0053 - val_mae: 0.0413
- 536ms/epoch - 18ms/step
Epoch 225/250
30/30 - 0s - loss: 8.0138e-04 - mae: 0.0197 - val_loss: 0.0059 - val_mae: 0.0428
- 480ms/epoch - 16ms/step
Epoch 226/250
30/30 - 0s - loss: 7.9779e-04 - mae: 0.0196 - val_loss: 0.0048 - val_mae: 0.0405
- 481ms/epoch - 16ms/step
Epoch 227/250
30/30 - 0s - loss: 8.3630e-04 - mae: 0.0204 - val_loss: 0.0049 - val_mae: 0.0401
- 462ms/epoch - 15ms/step
Epoch 228/250
30/30 - 0s - loss: 8.1998e-04 - mae: 0.0198 - val_loss: 0.0056 - val_mae: 0.0427
- 463ms/epoch - 15ms/step
Epoch 229/250
30/30 - 0s - loss: 7.5870e-04 - mae: 0.0196 - val_loss: 0.0056 - val_mae: 0.0426
- 466ms/epoch - 16ms/step
```

```
Epoch 230/250
30/30 - 0s - loss: 7.0602e-04 - mae: 0.0186 - val_loss: 0.0053 - val_mae: 0.0420
- 463ms/epoch - 15ms/step
Epoch 231/250
30/30 - 0s - loss: 6.6940e-04 - mae: 0.0183 - val_loss: 0.0062 - val_mae: 0.0431
- 466ms/epoch - 16ms/step
Epoch 232/250
30/30 - 0s - loss: 7.1223e-04 - mae: 0.0180 - val_loss: 0.0052 - val_mae: 0.0412
- 466ms/epoch - 16ms/step
Epoch 233/250
30/30 - 0s - loss: 8.0283e-04 - mae: 0.0197 - val_loss: 0.0059 - val_mae: 0.0426
- 468ms/epoch - 16ms/step
Epoch 234/250
30/30 - 0s - loss: 8.5948e-04 - mae: 0.0203 - val_loss: 0.0047 - val_mae: 0.0407
- 465ms/epoch - 16ms/step
Epoch 235/250
30/30 - 0s - loss: 9.4823e-04 - mae: 0.0217 - val_loss: 0.0056 - val_mae: 0.0425
- 482ms/epoch - 16ms/step
Epoch 236/250
30/30 - 0s - loss: 0.0012 - mae: 0.0237 - val_loss: 0.0049 - val_mae: 0.0407 -
462ms/epoch - 15ms/step
Epoch 237/250
30/30 - 0s - loss: 8.9753e-04 - mae: 0.0208 - val_loss: 0.0052 - val_mae: 0.0401
- 469ms/epoch - 16ms/step
Epoch 238/250
30/30 - 0s - loss: 8.5664e-04 - mae: 0.0207 - val_loss: 0.0046 - val_mae: 0.0396
- 479ms/epoch - 16ms/step
Epoch 239/250
30/30 - 0s - loss: 7.2308e-04 - mae: 0.0189 - val_loss: 0.0048 - val_mae: 0.0407
- 488ms/epoch - 16ms/step
Epoch 240/250
30/30 - 0s - loss: 8.3322e-04 - mae: 0.0198 - val_loss: 0.0053 - val_mae: 0.0422
- 461ms/epoch - 15ms/step
Epoch 241/250
30/30 - 0s - loss: 6.7659e-04 - mae: 0.0183 - val_loss: 0.0050 - val_mae: 0.0408
- 476ms/epoch - 16ms/step
Epoch 242/250
30/30 - 0s - loss: 6.7617e-04 - mae: 0.0177 - val_loss: 0.0053 - val_mae: 0.0423
- 480ms/epoch - 16ms/step
Epoch 243/250
30/30 - 0s - loss: 8.1048e-04 - mae: 0.0199 - val_loss: 0.0046 - val_mae: 0.0391
- 471ms/epoch - 16ms/step
Epoch 244/250
30/30 - 0s - loss: 8.1213e-04 - mae: 0.0194 - val_loss: 0.0050 - val_mae: 0.0407
- 469ms/epoch - 16ms/step
Epoch 245/250
30/30 - 0s - loss: 6.7962e-04 - mae: 0.0183 - val_loss: 0.0048 - val_mae: 0.0406
- 463ms/epoch - 15ms/step
```

```
Epoch 246/250
30/30 - 1s - loss: 6.3933e-04 - mae: 0.0176 - val_loss: 0.0052 - val_mae: 0.0421
- 519ms/epoch - 17ms/step
Epoch 247/250
30/30 - 1s - loss: 6.0300e-04 - mae: 0.0168 - val_loss: 0.0050 - val_mae: 0.0411
- 521ms/epoch - 17ms/step
Epoch 248/250
30/30 - 1s - loss: 6.1591e-04 - mae: 0.0172 - val_loss: 0.0053 - val_mae: 0.0421
- 525ms/epoch - 17ms/step
Epoch 249/250
30/30 - 1s - loss: 5.9682e-04 - mae: 0.0169 - val_loss: 0.0052 - val_mae: 0.0415
- 543ms/epoch - 18ms/step
Epoch 250/250
30/30 - 0s - loss: 5.7137e-04 - mae: 0.0164 - val_loss: 0.0054 - val_mae: 0.0428
- 468ms/epoch - 16ms/step
```

[51]:
```
pd.DataFrame(history.history).plot(figsize=(10,7))
```

[51]: <Axes: >



[53]:
```
model.evaluate(x_test, y_test)
```

```
8/8 [==============================] - 0s 10ms/step - loss: 0.0054 - mae: 0.0428
```

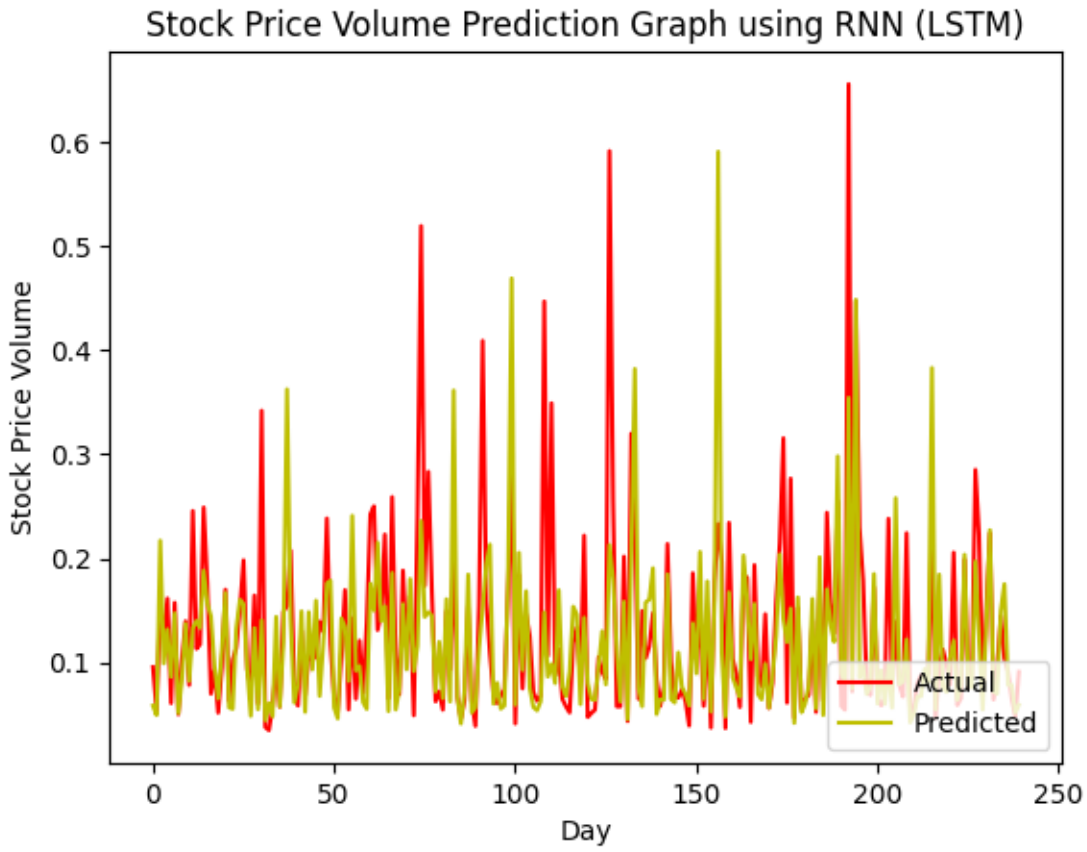
[53]: [0.005427846219390631, 0.04277690872550011]

[55]:
```
predictions = model.predict(x_test)
predictions.shape
```

```
8/8 [==============================] - 0s 7ms/step
```

[55]: (240, 1)

[57]:
```
plt.plot(y_test, c = 'r')
plt.plot(predictions, c = 'y')
plt.xlabel('Day')
plt.ylabel('Stock Price Volume')
plt.title('Stock Price Volume Prediction Graph using RNN (LSTM)')
plt.legend(['Actual','Predicted'], loc = 'lower right')
plt.figure(figsize=(10,7))
plt.show()
```



<Figure size 1000x700 with 0 Axes>