Auctioning Used-Car Classifier

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## Blog Post Inspiration and Objectives

In this blog post, I was hoping to look into using Machine Learning to make a prediction system. In particular, I was hoping to imitate ones used for stock prediction. However, since there were too many tutorials on this topic, I decided to investigate into another global, financial factor that governs trade internationally: international currency rates. In the news recently, I have heard rumors of how the international standard of utilizing the US dollar could be compromised with other global powers such as China and India rise in global dominance. Thus, I focused my efforts on analyzing the US currency conversion rates to other countries. With that said, let’s try to analyze this topic with some Machine Learning:

## Data Preprocessing - Cleaning and Analytics

```{python}  
# Import needed libraries  
import numpy as np  
import pandas as pd  
import matplotlib.pyplot as plt  
from tensorflow.keras.models import Sequential  
from tensorflow.keras.optimizers import Adam  
from tensorflow.keras import layers  
from copy import deepcopy  
import datetime as dt  
plt.style.use("fivethirtyeight")  
```

First, we will read and display the initial dataset in our file system for this blog post, downloaded from Kaggle. This dataset contains loads of valuable information such as almost every major world power’s international US currency conversion rate.

```{python}  
# Reading and displaying the initial dataset  
df = pd.read\_csv("datasets/foreign\_exchange\_rates.csv")  
df  
```

|  | Unnamed: 0 | Time Serie | AUSTRALIA - AUSTRALIAN DOLLAR/US$ | EURO AREA - EURO/US$ | NEW ZEALAND - NEW ZELAND DOLLAR/US$ | UNITED KINGDOM - UNITED KINGDOM POUND/US$ | BRAZIL - REAL/US$ | CANADA - CANADIAN DOLLAR/US$ | CHINA - YUAN/US$ | HONG KONG - HONG KONG DOLLAR/US$ | ... | SINGAPORE - SINGAPORE DOLLAR/US$ | DENMARK - DANISH KRONE/US$ | JAPAN - YEN/US$ | MALAYSIA - RINGGIT/US$ | NORWAY - NORWEGIAN KRONE/US$ | SWEDEN - KRONA/US$ | SRI LANKA - SRI LANKAN RUPEE/US$ | SWITZERLAND - FRANC/US$ | TAIWAN - NEW TAIWAN DOLLAR/US$ | THAILAND - BAHT/US$ |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 2000-01-03 | 1.5172 | 0.9847 | 1.9033 | 0.6146 | 1.805 | 1.4465 | 8.2798 | 7.7765 | ... | 1.6563 | 7.329 | 101.7 | 3.8 | 7.964 | 8.443 | 72.3 | 1.5808 | 31.38 | 36.97 |
| 1 | 1 | 2000-01-04 | 1.5239 | 0.97 | 1.9238 | 0.6109 | 1.8405 | 1.4518 | 8.2799 | 7.7775 | ... | 1.6535 | 7.218 | 103.09 | 3.8 | 7.934 | 8.36 | 72.65 | 1.5565 | 30.6 | 37.13 |
| 2 | 2 | 2000-01-05 | 1.5267 | 0.9676 | 1.9339 | 0.6092 | 1.856 | 1.4518 | 8.2798 | 7.778 | ... | 1.656 | 7.208 | 103.77 | 3.8 | 7.935 | 8.353 | 72.95 | 1.5526 | 30.8 | 37.1 |
| 3 | 3 | 2000-01-06 | 1.5291 | 0.9686 | 1.9436 | 0.607 | 1.84 | 1.4571 | 8.2797 | 7.7785 | ... | 1.6655 | 7.2125 | 105.19 | 3.8 | 7.94 | 8.3675 | 72.95 | 1.554 | 31.75 | 37.62 |
| 4 | 4 | 2000-01-07 | 1.5272 | 0.9714 | 1.938 | 0.6104 | 1.831 | 1.4505 | 8.2794 | 7.7783 | ... | 1.6625 | 7.2285 | 105.17 | 3.8 | 7.966 | 8.415 | 73.15 | 1.5623 | 30.85 | 37.3 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 5212 | 5212 | 2019-12-25 | ND | ND | ND | ND | ND | ND | ND | ND | ... | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 5213 | 5213 | 2019-12-26 | 1.4411 | 0.9007 | 1.5002 | 0.7688 | 4.0602 | 1.3124 | 6.9949 | 7.788 | ... | 1.354 | 6.7295 | 109.67 | 4.1337 | 8.8799 | 9.4108 | 181.3 | 0.9808 | 30.11 | 30.15 |
| 5214 | 5214 | 2019-12-27 | 1.4331 | 0.8949 | 1.4919 | 0.7639 | 4.0507 | 1.3073 | 6.9954 | 7.7874 | ... | 1.352 | 6.6829 | 109.47 | 4.126 | 8.8291 | 9.3405 | 181.35 | 0.9741 | 30.09 | 30.14 |
| 5215 | 5215 | 2019-12-30 | 1.4278 | 0.8915 | 1.4846 | 0.761 | 4.0152 | 1.3058 | 6.9864 | 7.7857 | ... | 1.3483 | 6.6589 | 108.85 | 4.1053 | 8.7839 | 9.3145 | 181.6 | 0.9677 | 30.04 | 29.94 |
| 5216 | 5216 | 2019-12-31 | 1.4225 | 0.8907 | 1.4826 | 0.7536 | 4.019 | 1.2962 | 6.9618 | 7.7894 | ... | 1.3446 | 6.6554 | 108.67 | 4.0918 | 8.7823 | 9.3425 | 181.3 | 0.9677 | 29.91 | 29.75 |

For clarity on the constraints and parameters of the working datasets, I went to find high-level exploratory statistics on all of the datasets: shape, information about all of the entries, etc.

```{python}  
# Determining the shape of the initial dataset  
df.shape  
```

(5217, 24)

```{python}  
# Getting a sample of the initial dataset through the seeing the first 10 entries  
# completely in the dataset  
df.head()  
```

|  | Unnamed: 0 | Time Serie | AUSTRALIA - AUSTRALIAN DOLLAR/US$ | EURO AREA - EURO/US$ | NEW ZEALAND - NEW ZELAND DOLLAR/US$ | UNITED KINGDOM - UNITED KINGDOM POUND/US$ | BRAZIL - REAL/US$ | CANADA - CANADIAN DOLLAR/US$ | CHINA - YUAN/US$ | HONG KONG - HONG KONG DOLLAR/US$ | ... | SINGAPORE - SINGAPORE DOLLAR/US$ | DENMARK - DANISH KRONE/US$ | JAPAN - YEN/US$ | MALAYSIA - RINGGIT/US$ | NORWAY - NORWEGIAN KRONE/US$ | SWEDEN - KRONA/US$ | SRI LANKA - SRI LANKAN RUPEE/US$ | SWITZERLAND - FRANC/US$ | TAIWAN - NEW TAIWAN DOLLAR/US$ | THAILAND - BAHT/US$ |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 2000-01-03 | 1.5172 | 0.9847 | 1.9033 | 0.6146 | 1.805 | 1.4465 | 8.2798 | 7.7765 | ... | 1.6563 | 7.329 | 101.7 | 3.8 | 7.964 | 8.443 | 72.3 | 1.5808 | 31.38 | 36.97 |
| 1 | 1 | 2000-01-04 | 1.5239 | 0.97 | 1.9238 | 0.6109 | 1.8405 | 1.4518 | 8.2799 | 7.7775 | ... | 1.6535 | 7.218 | 103.09 | 3.8 | 7.934 | 8.36 | 72.65 | 1.5565 | 30.6 | 37.13 |
| 2 | 2 | 2000-01-05 | 1.5267 | 0.9676 | 1.9339 | 0.6092 | 1.856 | 1.4518 | 8.2798 | 7.778 | ... | 1.656 | 7.208 | 103.77 | 3.8 | 7.935 | 8.353 | 72.95 | 1.5526 | 30.8 | 37.1 |
| 3 | 3 | 2000-01-06 | 1.5291 | 0.9686 | 1.9436 | 0.607 | 1.84 | 1.4571 | 8.2797 | 7.7785 | ... | 1.6655 | 7.2125 | 105.19 | 3.8 | 7.94 | 8.3675 | 72.95 | 1.554 | 31.75 | 37.62 |
| 4 | 4 | 2000-01-07 | 1.5272 | 0.9714 | 1.938 | 0.6104 | 1.831 | 1.4505 | 8.2794 | 7.7783 | ... | 1.6625 | 7.2285 | 105.17 | 3.8 | 7.966 | 8.415 | 73.15 | 1.5623 | 30.85 | 37.3 |

```{python}  
# Figuring out all of the columns (and their names) available for me to use in the dataset  
df.columns  
```

Index(['Unnamed: 0', 'Time Serie', 'AUSTRALIA - AUSTRALIAN DOLLAR/US$',  
 'EURO AREA - EURO/US$', 'NEW ZEALAND - NEW ZELAND DOLLAR/US$',  
 'UNITED KINGDOM - UNITED KINGDOM POUND/US$', 'BRAZIL - REAL/US$',  
 'CANADA - CANADIAN DOLLAR/US$', 'CHINA - YUAN/US$',  
 'HONG KONG - HONG KONG DOLLAR/US$', 'INDIA - INDIAN RUPEE/US$',  
 'KOREA - WON/US$', 'MEXICO - MEXICAN PESO/US$',  
 'SOUTH AFRICA - RAND/US$', 'SINGAPORE - SINGAPORE DOLLAR/US$',  
 'DENMARK - DANISH KRONE/US$', 'JAPAN - YEN/US$',  
 'MALAYSIA - RINGGIT/US$', 'NORWAY - NORWEGIAN KRONE/US$',  
 'SWEDEN - KRONA/US$', 'SRI LANKA - SRI LANKAN RUPEE/US$',  
 'SWITZERLAND - FRANC/US$', 'TAIWAN - NEW TAIWAN DOLLAR/US$',  
 'THAILAND - BAHT/US$'],  
 dtype='object')

```{python}  
# Figuring out the number of duplicated elements in the dataset  
# (could be problematic if not resolved)  
df.duplicated().sum()  
```

0

```{python}  
# Figuring out the number of 'null'/'NaN' elements in the dataset   
# (if NaN filling is needed or not)  
(df.isnull().sum() / df.shape[0]) \* 100  
```

Unnamed: 0 0.0  
Time Serie 0.0  
AUSTRALIA - AUSTRALIAN DOLLAR/US$ 0.0  
EURO AREA - EURO/US$ 0.0  
NEW ZEALAND - NEW ZELAND DOLLAR/US$ 0.0  
UNITED KINGDOM - UNITED KINGDOM POUND/US$ 0.0  
BRAZIL - REAL/US$ 0.0  
CANADA - CANADIAN DOLLAR/US$ 0.0  
CHINA - YUAN/US$ 0.0  
HONG KONG - HONG KONG DOLLAR/US$ 0.0  
INDIA - INDIAN RUPEE/US$ 0.0  
KOREA - WON/US$ 0.0  
MEXICO - MEXICAN PESO/US$ 0.0  
SOUTH AFRICA - RAND/US$ 0.0  
SINGAPORE - SINGAPORE DOLLAR/US$ 0.0  
DENMARK - DANISH KRONE/US$ 0.0  
JAPAN - YEN/US$ 0.0  
MALAYSIA - RINGGIT/US$ 0.0  
NORWAY - NORWEGIAN KRONE/US$ 0.0  
SWEDEN - KRONA/US$ 0.0  
SRI LANKA - SRI LANKAN RUPEE/US$ 0.0  
SWITZERLAND - FRANC/US$ 0.0  
TAIWAN - NEW TAIWAN DOLLAR/US$ 0.0  
THAILAND - BAHT/US$ 0.0  
dtype: float64

```{python}  
# Getting basic information about the dataset  
df.info()  
```

<class 'pandas.core.frame.DataFrame'>  
RangeIndex: 5217 entries, 0 to 5216  
Data columns (total 24 columns):  
 # Column Non-Null Count Dtype   
--- ------ -------------- -----   
 0 Unnamed: 0 5217 non-null int64   
 1 Time Serie 5217 non-null object  
 2 AUSTRALIA - AUSTRALIAN DOLLAR/US$ 5217 non-null object  
 3 EURO AREA - EURO/US$ 5217 non-null object  
 4 NEW ZEALAND - NEW ZELAND DOLLAR/US$ 5217 non-null object  
 5 UNITED KINGDOM - UNITED KINGDOM POUND/US$ 5217 non-null object  
 6 BRAZIL - REAL/US$ 5217 non-null object  
 7 CANADA - CANADIAN DOLLAR/US$ 5217 non-null object  
 8 CHINA - YUAN/US$ 5217 non-null object  
 9 HONG KONG - HONG KONG DOLLAR/US$ 5217 non-null object  
 10 INDIA - INDIAN RUPEE/US$ 5217 non-null object  
 11 KOREA - WON/US$ 5217 non-null object  
 12 MEXICO - MEXICAN PESO/US$ 5217 non-null object  
 13 SOUTH AFRICA - RAND/US$ 5217 non-null object  
 14 SINGAPORE - SINGAPORE DOLLAR/US$ 5217 non-null object  
 15 DENMARK - DANISH KRONE/US$ 5217 non-null object  
 16 JAPAN - YEN/US$ 5217 non-null object  
 17 MALAYSIA - RINGGIT/US$ 5217 non-null object  
 18 NORWAY - NORWEGIAN KRONE/US$ 5217 non-null object  
 19 SWEDEN - KRONA/US$ 5217 non-null object  
 20 SRI LANKA - SRI LANKAN RUPEE/US$ 5217 non-null object  
 21 SWITZERLAND - FRANC/US$ 5217 non-null object  
 22 TAIWAN - NEW TAIWAN DOLLAR/US$ 5217 non-null object  
 23 THAILAND - BAHT/US$ 5217 non-null object  
dtypes: int64(1), object(23)  
memory usage: 978.3+ KB

Additionally, before handing my combined Book dataset over for Machine Learning training and prediction, I need to clean the data prior to the analysis stage: removing duplicates, deleting null/NaN vales, fixing types of columns, filling invalid values with suitable alternatives, etc.

```{python}  
# Removing unnecessary/unnamed columns in the dataset  
df = df.drop("Unnamed: 0", axis=1)  
df  
```

|  | Time Serie | AUSTRALIA - AUSTRALIAN DOLLAR/US$ | EURO AREA - EURO/US$ | NEW ZEALAND - NEW ZELAND DOLLAR/US$ | UNITED KINGDOM - UNITED KINGDOM POUND/US$ | BRAZIL - REAL/US$ | CANADA - CANADIAN DOLLAR/US$ | CHINA - YUAN/US$ | HONG KONG - HONG KONG DOLLAR/US$ | INDIA - INDIAN RUPEE/US$ | ... | SINGAPORE - SINGAPORE DOLLAR/US$ | DENMARK - DANISH KRONE/US$ | JAPAN - YEN/US$ | MALAYSIA - RINGGIT/US$ | NORWAY - NORWEGIAN KRONE/US$ | SWEDEN - KRONA/US$ | SRI LANKA - SRI LANKAN RUPEE/US$ | SWITZERLAND - FRANC/US$ | TAIWAN - NEW TAIWAN DOLLAR/US$ | THAILAND - BAHT/US$ |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 2000-01-03 | 1.5172 | 0.9847 | 1.9033 | 0.6146 | 1.805 | 1.4465 | 8.2798 | 7.7765 | 43.55 | ... | 1.6563 | 7.329 | 101.7 | 3.8 | 7.964 | 8.443 | 72.3 | 1.5808 | 31.38 | 36.97 |
| 1 | 2000-01-04 | 1.5239 | 0.97 | 1.9238 | 0.6109 | 1.8405 | 1.4518 | 8.2799 | 7.7775 | 43.55 | ... | 1.6535 | 7.218 | 103.09 | 3.8 | 7.934 | 8.36 | 72.65 | 1.5565 | 30.6 | 37.13 |
| 2 | 2000-01-05 | 1.5267 | 0.9676 | 1.9339 | 0.6092 | 1.856 | 1.4518 | 8.2798 | 7.778 | 43.55 | ... | 1.656 | 7.208 | 103.77 | 3.8 | 7.935 | 8.353 | 72.95 | 1.5526 | 30.8 | 37.1 |
| 3 | 2000-01-06 | 1.5291 | 0.9686 | 1.9436 | 0.607 | 1.84 | 1.4571 | 8.2797 | 7.7785 | 43.55 | ... | 1.6655 | 7.2125 | 105.19 | 3.8 | 7.94 | 8.3675 | 72.95 | 1.554 | 31.75 | 37.62 |
| 4 | 2000-01-07 | 1.5272 | 0.9714 | 1.938 | 0.6104 | 1.831 | 1.4505 | 8.2794 | 7.7783 | 43.55 | ... | 1.6625 | 7.2285 | 105.17 | 3.8 | 7.966 | 8.415 | 73.15 | 1.5623 | 30.85 | 37.3 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 5212 | 2019-12-25 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ... | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 5213 | 2019-12-26 | 1.4411 | 0.9007 | 1.5002 | 0.7688 | 4.0602 | 1.3124 | 6.9949 | 7.788 | 71.28 | ... | 1.354 | 6.7295 | 109.67 | 4.1337 | 8.8799 | 9.4108 | 181.3 | 0.9808 | 30.11 | 30.15 |
| 5214 | 2019-12-27 | 1.4331 | 0.8949 | 1.4919 | 0.7639 | 4.0507 | 1.3073 | 6.9954 | 7.7874 | 71.45 | ... | 1.352 | 6.6829 | 109.47 | 4.126 | 8.8291 | 9.3405 | 181.35 | 0.9741 | 30.09 | 30.14 |
| 5215 | 2019-12-30 | 1.4278 | 0.8915 | 1.4846 | 0.761 | 4.0152 | 1.3058 | 6.9864 | 7.7857 | 71.3 | ... | 1.3483 | 6.6589 | 108.85 | 4.1053 | 8.7839 | 9.3145 | 181.6 | 0.9677 | 30.04 | 29.94 |
| 5216 | 2019-12-31 | 1.4225 | 0.8907 | 1.4826 | 0.7536 | 4.019 | 1.2962 | 6.9618 | 7.7894 | 71.36 | ... | 1.3446 | 6.6554 | 108.67 | 4.0918 | 8.7823 | 9.3425 | 181.3 | 0.9677 | 29.91 | 29.75 |

```{python}  
# Converting the date column into a string representation to a parsable  
# Datetime object (needed for later)  
df = df.rename(columns={"Time Serie": "DATE"})  
  
def str\_to\_datetime(date\_str: str):  
 split = tuple(date\_str.split("-"))  
 year, month, day = int(split[0]), int(split[1]), int(split[2])  
 return dt.datetime(year, month, day)  
  
df["DATE"] = df["DATE"].apply(str\_to\_datetime)  
df["DATE"]  
```

0 2000-01-03  
1 2000-01-04  
2 2000-01-05  
3 2000-01-06  
4 2000-01-07  
 ...   
5212 2019-12-25  
5213 2019-12-26  
5214 2019-12-27  
5215 2019-12-30  
5216 2019-12-31  
Name: DATE, Length: 5217, dtype: datetime64[ns]

As shown below, I had decided to filter out all of the countries except Austrailia, Canada, the United Kingdom, and Switzerland because those countries had the most stable and consistent international currency rates as well as the most comparable (1:1) currency rates with the United States. One additional reason that these countries were selected for this blog post was do the geographical diversity covered most landmass continents across the world, representative of the global market interactions that the United States deals with on a day-to-day basis.

```{python}  
# Making the "Date" column the new index (better identifer/key in dataset)  
# Taking out other countries except Austrailia, Canada, UK, and   
# Switzerland from dataset for Machine Learning blog post  
df.index = df.pop("DATE")  
df = df[["AUSTRALIA - AUSTRALIAN DOLLAR/US$",   
 "CANADA - CANADIAN DOLLAR/US$",  
 "UNITED KINGDOM - UNITED KINGDOM POUND/US$",  
 "SWITZERLAND - FRANC/US$"]]  
df  
```

|  | AUSTRALIA - AUSTRALIAN DOLLAR/US$ | CANADA - CANADIAN DOLLAR/US$ | UNITED KINGDOM - UNITED KINGDOM POUND/US$ | SWITZERLAND - FRANC/US$ |
| --- | --- | --- | --- | --- |
| DATE |  |  |  |  |
| 2000-01-03 | 1.5172 | 1.4465 | 0.6146 | 1.5808 |
| 2000-01-04 | 1.5239 | 1.4518 | 0.6109 | 1.5565 |
| 2000-01-05 | 1.5267 | 1.4518 | 0.6092 | 1.5526 |
| 2000-01-06 | 1.5291 | 1.4571 | 0.607 | 1.554 |
| 2000-01-07 | 1.5272 | 1.4505 | 0.6104 | 1.5623 |
| ... | ... | ... | ... | ... |
| 2019-12-25 | ND | ND | ND | ND |
| 2019-12-26 | 1.4411 | 1.3124 | 0.7688 | 0.9808 |
| 2019-12-27 | 1.4331 | 1.3073 | 0.7639 | 0.9741 |
| 2019-12-30 | 1.4278 | 1.3058 | 0.761 | 0.9677 |
| 2019-12-31 | 1.4225 | 1.2962 | 0.7536 | 0.9677 |

```{python}  
# Converting of all numerical international currency rates to 2-decimal   
# rates (easier to work with for later)  
for col in df:  
 df[col] = df[col].map(lambda entry: entry if entry == "ND" else round(float(entry), 2))  
df  
```

|  | AUSTRALIA - AUSTRALIAN DOLLAR/US$ | CANADA - CANADIAN DOLLAR/US$ | UNITED KINGDOM - UNITED KINGDOM POUND/US$ | SWITZERLAND - FRANC/US$ |
| --- | --- | --- | --- | --- |
| DATE |  |  |  |  |
| 2000-01-03 | 1.52 | 1.45 | 0.61 | 1.58 |
| 2000-01-04 | 1.52 | 1.45 | 0.61 | 1.56 |
| 2000-01-05 | 1.53 | 1.45 | 0.61 | 1.55 |
| 2000-01-06 | 1.53 | 1.46 | 0.61 | 1.55 |
| 2000-01-07 | 1.53 | 1.45 | 0.61 | 1.56 |
| ... | ... | ... | ... | ... |
| 2019-12-25 | ND | ND | ND | ND |
| 2019-12-26 | 1.44 | 1.31 | 0.77 | 0.98 |
| 2019-12-27 | 1.43 | 1.31 | 0.76 | 0.97 |
| 2019-12-30 | 1.43 | 1.31 | 0.76 | 0.97 |
| 2019-12-31 | 1.42 | 1.3 | 0.75 | 0.97 |

```{python}  
# Removing all of the dated rows that contains "ND" as a way to avoid problems   
# when trying to interlay Machine Learning algorithms that require only  
# quantitative data with categorical entries  
nd\_index\_list: set[str] = set()  
for row\_index, \_ in df.iterrows():  
 for col\_entry in df.loc[row\_index]:  
 if col\_entry == "ND":  
 nd\_index\_list.add(row\_index)  
  
df = df.drop(labels=list(nd\_index\_list), axis=0)  
df  
```

|  | AUSTRALIA - AUSTRALIAN DOLLAR/US$ | CANADA - CANADIAN DOLLAR/US$ | UNITED KINGDOM - UNITED KINGDOM POUND/US$ | SWITZERLAND - FRANC/US$ |
| --- | --- | --- | --- | --- |
| DATE |  |  |  |  |
| 2000-01-03 | 1.52 | 1.45 | 0.61 | 1.58 |
| 2000-01-04 | 1.52 | 1.45 | 0.61 | 1.56 |
| 2000-01-05 | 1.53 | 1.45 | 0.61 | 1.55 |
| 2000-01-06 | 1.53 | 1.46 | 0.61 | 1.55 |
| 2000-01-07 | 1.53 | 1.45 | 0.61 | 1.56 |
| ... | ... | ... | ... | ... |
| 2019-12-24 | 1.44 | 1.32 | 0.77 | 0.98 |
| 2019-12-26 | 1.44 | 1.31 | 0.77 | 0.98 |
| 2019-12-27 | 1.43 | 1.31 | 0.76 | 0.97 |
| 2019-12-30 | 1.43 | 1.31 | 0.76 | 0.97 |
| 2019-12-31 | 1.42 | 1.3 | 0.75 | 0.97 |

As shown in the code snippet below, with some online references, the df\_to\_windowed\_df function describes a way to use prediction values. A new international currency rate dataframe is created which includes the rows encompassing the 3 previous dates prior to the current date of when the international currency rate was reported as well as the current rate that day. This would be helpful for later Machine Learning predictions because the previous 3 dates and the current will provide it enough context to make more insightful predictions on the future of the international currency rates between that respective country specified and the United States. Later, as you will see, the 3 previous days are going to be the input and the current currency rate (Target) will be our output.

```{python}  
def df\_to\_windowed\_df(data\_frame: pd.DataFrame, first\_date\_str: str, last\_date\_str: str, n: int, col\_name: str):  
 first\_date = str\_to\_datetime(first\_date\_str)  
 last\_date = str\_to\_datetime(last\_date\_str)  
   
 target\_date = first\_date  
   
 dates: list = []  
 X: list = []  
 Y: list = []  
   
 last\_time = False  
 while True:  
 df\_subset = data\_frame.loc[:target\_date].tail(n + 1)  
   
 if (len(df\_subset) != n + 1):  
 print("Error: Window of size " + str(n) + " is too large for date " + str(target\_date))  
 return  
   
 values = df\_subset[col\_name].to\_numpy()  
 x, y = values[:-1], values[-1]  
   
 dates.append(target\_date)  
 X.append(x)  
 Y.append(y)  
   
 next\_week = data\_frame.loc[target\_date:target\_date + dt.timedelta(days=7)]  
 next\_datetime\_str = str(next\_week.head(2).tail(1).index.values[0])  
 next\_date\_str = next\_datetime\_str.split("T")[0]  
 year\_month\_day = next\_date\_str.split("-")  
 year, month, day = year\_month\_day  
 next\_date = dt.datetime(year=int(year), month=int(month), day=int(day))  
   
 if last\_time:  
 break  
   
 target\_date = next\_date  
 if (target\_date == last\_date):  
 last\_time = True  
   
 returned\_df = pd.DataFrame({})  
 returned\_df["Target Date"] = dates  
   
 X = np.array(X)  
 for i in range(0, n):  
 X[:, i]  
 returned\_df["Target-" + str(n - i)] = X[:, i]  
 returned\_df["Target"] = Y  
   
 return returned\_df   
```

Thus, with the df\_to\_windowed\_df function created, we created one for every country to later use for Machine Learning model training and eventual predictions of future rates: Austrailia, Canada, the United Kingdom, and Switzerland.

```{python}  
# Convert Austrailia's dataframe to a windowed dataframe  
windowed\_df\_austrailia = df\_to\_windowed\_df(data\_frame=df,   
 first\_date\_str="2000-01-06",  
 last\_date\_str="2019-12-31",  
 n=3,  
 col\_name="AUSTRALIA - AUSTRALIAN DOLLAR/US$")  
windowed\_df\_austrailia   
```

|  | Target Date | Target-3 | Target-2 | Target-1 | Target |
| --- | --- | --- | --- | --- | --- |
| 0 | 2000-01-06 | 1.52 | 1.52 | 1.53 | 1.53 |
| 1 | 2000-01-07 | 1.52 | 1.53 | 1.53 | 1.53 |
| 2 | 2000-01-10 | 1.53 | 1.53 | 1.53 | 1.52 |
| 3 | 2000-01-11 | 1.53 | 1.53 | 1.52 | 1.52 |
| 4 | 2000-01-12 | 1.53 | 1.52 | 1.52 | 1.52 |
| ... | ... | ... | ... | ... | ... |
| 5011 | 2019-12-24 | 1.45 | 1.45 | 1.45 | 1.44 |
| 5012 | 2019-12-26 | 1.45 | 1.45 | 1.44 | 1.44 |
| 5013 | 2019-12-27 | 1.45 | 1.44 | 1.44 | 1.43 |
| 5014 | 2019-12-30 | 1.44 | 1.44 | 1.43 | 1.43 |
| 5015 | 2019-12-31 | 1.44 | 1.43 | 1.43 | 1.42 |

```{python}  
# Convert Canada's dataframe to a windowed dataframe  
windowed\_df\_canada = df\_to\_windowed\_df(data\_frame=df,   
 first\_date\_str="2000-01-06",  
 last\_date\_str="2019-12-31",  
 n=3,  
 col\_name="CANADA - CANADIAN DOLLAR/US$")  
windowed\_df\_canada  
```

|  | Target Date | Target-3 | Target-2 | Target-1 | Target |
| --- | --- | --- | --- | --- | --- |
| 0 | 2000-01-06 | 1.45 | 1.45 | 1.45 | 1.46 |
| 1 | 2000-01-07 | 1.45 | 1.45 | 1.46 | 1.45 |
| 2 | 2000-01-10 | 1.45 | 1.46 | 1.45 | 1.46 |
| 3 | 2000-01-11 | 1.46 | 1.45 | 1.46 | 1.46 |
| 4 | 2000-01-12 | 1.45 | 1.46 | 1.46 | 1.46 |
| ... | ... | ... | ... | ... | ... |
| 5011 | 2019-12-24 | 1.31 | 1.32 | 1.32 | 1.32 |
| 5012 | 2019-12-26 | 1.32 | 1.32 | 1.32 | 1.31 |
| 5013 | 2019-12-27 | 1.32 | 1.32 | 1.31 | 1.31 |
| 5014 | 2019-12-30 | 1.32 | 1.31 | 1.31 | 1.31 |
| 5015 | 2019-12-31 | 1.31 | 1.31 | 1.31 | 1.30 |

```{python}  
# Convert United Kingdom's dataframe to a windowed dataframe  
windowed\_df\_united\_kingdom = df\_to\_windowed\_df(data\_frame=df,   
 first\_date\_str="2000-01-06",  
 last\_date\_str="2019-12-31",  
 n=3,  
 col\_name="UNITED KINGDOM - UNITED KINGDOM POUND/US$")  
windowed\_df\_united\_kingdom  
```

|  | Target Date | Target-3 | Target-2 | Target-1 | Target |
| --- | --- | --- | --- | --- | --- |
| 0 | 2000-01-06 | 0.61 | 0.61 | 0.61 | 0.61 |
| 1 | 2000-01-07 | 0.61 | 0.61 | 0.61 | 0.61 |
| 2 | 2000-01-10 | 0.61 | 0.61 | 0.61 | 0.61 |
| 3 | 2000-01-11 | 0.61 | 0.61 | 0.61 | 0.61 |
| 4 | 2000-01-12 | 0.61 | 0.61 | 0.61 | 0.61 |
| ... | ... | ... | ... | ... | ... |
| 5011 | 2019-12-24 | 0.77 | 0.77 | 0.77 | 0.77 |
| 5012 | 2019-12-26 | 0.77 | 0.77 | 0.77 | 0.77 |
| 5013 | 2019-12-27 | 0.77 | 0.77 | 0.77 | 0.76 |
| 5014 | 2019-12-30 | 0.77 | 0.77 | 0.76 | 0.76 |
| 5015 | 2019-12-31 | 0.77 | 0.76 | 0.76 | 0.75 |

```{python}  
# Convert Switzerland's dataframe to a windowed dataframe  
windowed\_df\_switzerland = df\_to\_windowed\_df(data\_frame=df,   
 first\_date\_str="2000-01-06",  
 last\_date\_str="2019-12-31",  
 n=3,  
 col\_name="SWITZERLAND - FRANC/US$")  
windowed\_df\_switzerland  
```

|  | Target Date | Target-3 | Target-2 | Target-1 | Target |
| --- | --- | --- | --- | --- | --- |
| 0 | 2000-01-06 | 1.58 | 1.56 | 1.55 | 1.55 |
| 1 | 2000-01-07 | 1.56 | 1.55 | 1.55 | 1.56 |
| 2 | 2000-01-10 | 1.55 | 1.55 | 1.56 | 1.57 |
| 3 | 2000-01-11 | 1.55 | 1.56 | 1.57 | 1.56 |
| 4 | 2000-01-12 | 1.56 | 1.57 | 1.56 | 1.57 |
| ... | ... | ... | ... | ... | ... |
| 5011 | 2019-12-24 | 0.98 | 0.98 | 0.98 | 0.98 |
| 5012 | 2019-12-26 | 0.98 | 0.98 | 0.98 | 0.98 |
| 5013 | 2019-12-27 | 0.98 | 0.98 | 0.98 | 0.97 |
| 5014 | 2019-12-30 | 0.98 | 0.98 | 0.97 | 0.97 |
| 5015 | 2019-12-31 | 0.98 | 0.97 | 0.97 | 0.97 |

As the Machine Learning model that will be used later in this blog post only accepts numpy arrays, we need to extract each of the following quantities from each respective country’s dataframe: the dates as an np.array, the X-values for input as an 3-dimensional np.array, and the Y-values for output as an np.array. Thus, with some online references, our codebase now has a function called windowed\_df\_to\_date\_X\_y as shown below to account for this needed transformation.

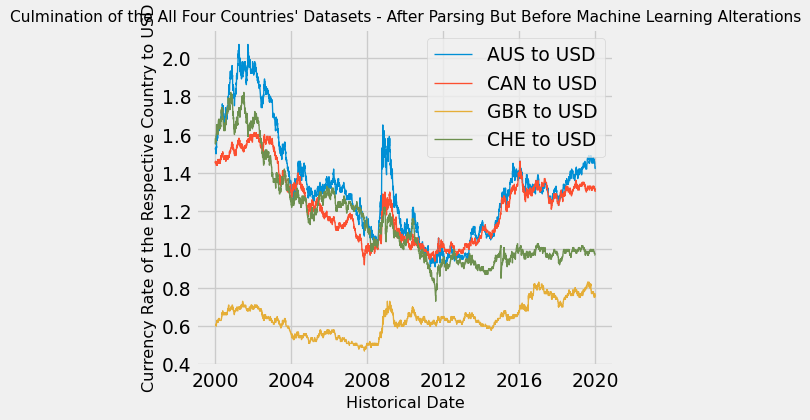
```{python}  
def windowed\_df\_to\_date\_X\_y(windowed\_dataframe: pd.DataFrame):  
 df\_as\_np = windowed\_dataframe.to\_numpy()  
   
 dates = df\_as\_np[:, 0]  
   
 middle\_matrix = df\_as\_np[:, 1:-1]  
 X = middle\_matrix.reshape((len(dates), middle\_matrix.shape[1], 1))  
 Y = df\_as\_np[:, -1]  
   
 return dates, X.astype(np.float32), Y.astype(np.float32)  
  
dates\_austrailia, X\_austrailia, y\_austrailia = windowed\_df\_to\_date\_X\_y(windowed\_dataframe=windowed\_df\_austrailia)  
dates\_canada, X\_canada, y\_canada = windowed\_df\_to\_date\_X\_y(windowed\_dataframe=windowed\_df\_canada)  
dates\_united\_kingdom, X\_united\_kingdom, y\_united\_kingdom = windowed\_df\_to\_date\_X\_y(windowed\_dataframe=windowed\_df\_united\_kingdom)  
dates\_switzerland, X\_switzerland, y\_switzerland = windowed\_df\_to\_date\_X\_y(windowed\_dataframe=windowed\_df\_switzerland)  
  
print(dates\_austrailia.shape, X\_austrailia.shape, y\_austrailia.shape)  
print(dates\_canada.shape, X\_canada.shape, y\_canada.shape)  
print(dates\_united\_kingdom.shape, X\_united\_kingdom.shape, y\_united\_kingdom.shape)  
print(dates\_switzerland.shape, X\_switzerland.shape, y\_switzerland.shape)  
len(windowed\_df\_austrailia), len(windowed\_df\_canada), len(windowed\_df\_united\_kingdom), len(windowed\_df\_switzerland)  
```

(5016,) (5016, 3, 1) (5016,)  
(5016,) (5016, 3, 1) (5016,)  
(5016,) (5016, 3, 1) (5016,)  
(5016,) (5016, 3, 1) (5016,)

(5016, 5016, 5016, 5016)

Here, I am trying to a visualization of the cleaned dataset before we pass it over for Machine Learning training and prediction. To show the rate of change for the International Currency Rates for Austrailia, Canada, the United Kingdom, and Switzerland over the 20-year period as collected in the data set, I put together a line graph as shown below.

```{python}  
# Plotting the each four countries currency rates (per US dollar) from   
# 2000 - 2020  
plt.plot(df.index, df["AUSTRALIA - AUSTRALIAN DOLLAR/US$"], label="AUS to USD", linewidth=1)  
plt.plot(df.index, df[ "CANADA - CANADIAN DOLLAR/US$"], label="CAN to USD", linewidth=1)  
plt.plot(df.index, df["UNITED KINGDOM - UNITED KINGDOM POUND/US$"], label="GBR to USD", linewidth=1)  
plt.plot(df.index, df["SWITZERLAND - FRANC/US$"], label="CHE to USD", linewidth=1)  
  
plt.legend(loc="upper right")  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date", fontsize=12)  
plt.ylabel("Currency Rate of the Respective Country to USD", fontsize=12)  
plt.title("Culmination of the All Four Countries' Datasets - After Parsing But Before Machine Learning Alterations")  
plt.show()  
```



## Machine Learning - Model Training and Evaluation

Great, now we are onto the Machine Learning part of the blog post!

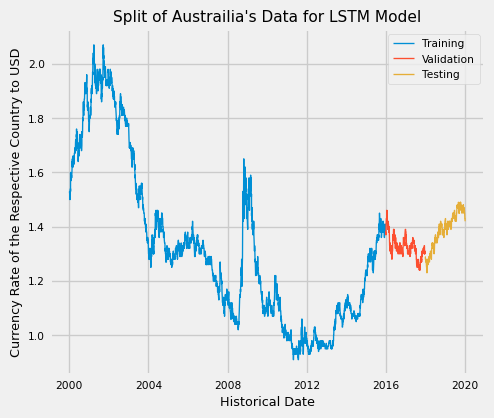
For this blog post, I worked to create Machine Learning models for each country’s dataset separately. I started with Austrailia’s data first (as shown below):

```{python}  
# Getting the location of the 80th and 90th percentile of the number of points   
# in the dataset for later train, vailidation, and test category splitting  
percentile\_80 = int(len(windowed\_df\_austrailia) \* 0.8)  
percentile\_90 = int(len(windowed\_df\_austrailia) \* 0.9)  
percentile\_80, percentile\_90  
```

(4012, 4514)

Since the data (date, X, and y) is split into three np.arrays and to be more efficient, I will manually split Austrailia’s data into train, test, and validation datasets for the Machine Learning model with 80% going to the training dataset, the next 10% going to the validation dataset, and the last 10% going to the test dataset for each np.array respectively. This split should be acceptable because I did not mix-and-match training & validation datasets with my testing datasets, wihch would invalidate my entire Machine Learning model. Additionally, looking at the presented in the validation and testing datasets, the range of these respective datasets have been reached before in my training dataset, meaning I anticipated my model should be able to reasonably predict these expected ranges with considerable accuracy.

```{python}  
# Splitting Austrailia's data into train, test, and validation sets on 3   
# mediums: the X-axis, the y-axis, and the indices (represented by dates)  
dates\_austrailia\_train, X\_austrailia\_train, y\_austrailia\_train = dates\_austrailia[:percentile\_80], X\_austrailia[:percentile\_80], y\_austrailia[:percentile\_80]  
dates\_austrailia\_val, X\_austrailia\_val, y\_austrailia\_val = dates\_austrailia[percentile\_80:percentile\_90], X\_austrailia[percentile\_80:percentile\_90], y\_austrailia[percentile\_80:percentile\_90]  
dates\_austrailia\_test, X\_austrailia\_test, y\_austrailia\_test = dates\_austrailia[percentile\_90:], X\_austrailia[percentile\_90:], y\_austrailia[percentile\_90:]  
  
plt.plot(dates\_austrailia\_train, y\_austrailia\_train, linewidth=1)  
plt.plot(dates\_austrailia\_val, y\_austrailia\_val, linewidth=1)  
plt.plot(dates\_austrailia\_test, y\_austrailia\_test, linewidth=1)  
  
plt.legend(["Training", "Validation", "Testing"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Split of Austrailia's Data for LSTM Model")  
plt.show()  
```



Now, I began to configure the Machine Learning model. We added Sequential layers: an Input layer 3 by 1 because we will have 3 np.arrays of Input and 1 np.array as output, utilize a LSTM (Long Short-Term Memory) layer of 64 neurons, apply 2 levels of dense layers with 32 neurons and folliowing recommendations online to use the RELU (Rectified Linear Unit) Activiation Function, and I followed up with one last dense layer of 1 neuron as our output layer since we are just trying to linearly-predict the next currency-rate on a near-future date. Once I configured the Sequential layers, we are ready to compile the model, utilzing the mean\_square\_error as our minimizing loss function, using the Adam optimizer, and comparing our trained model against our data with the mean\_absolute\_error metric. Lastly, I fitted our model, utilzing our X\_train and Y\_train datasets for fitting with validation from our X\_valid and Y\_valid datasets at 100 epochs.

```{python}  
# Configuring the Machine Learning Tensorflow Model for Austrailia  
austrailia\_model = Sequential([layers.Input((3, 1)),  
 layers.LSTM(64),  
 layers.Dense(32, activation="relu"),  
 layers.Dense(32, activation="relu"),  
 layers.Dense(1)])  
  
austrailia\_model.compile(loss="mse",  
 optimizer=Adam(learning\_rate=0.001),  
 metrics=["mean\_absolute\_error"])  
  
austrailia\_model.fit(X\_austrailia\_train, y\_austrailia\_train, validation\_data=(X\_austrailia\_val, y\_austrailia\_val), epochs=100)  
```

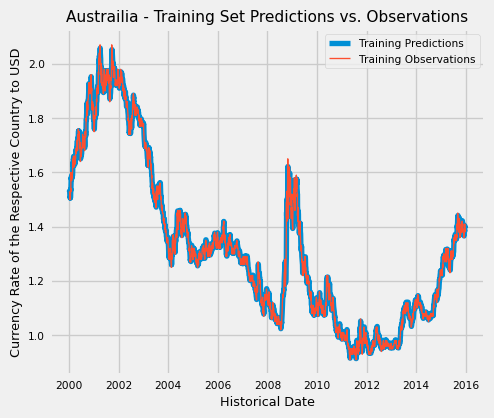
Epoch 1/100  
 1/126 [..............................] - ETA: 4:02 - loss: 1.6210 - mean\_absolute\_error: 1.2526 15/126 [==>...........................] - ETA: 0s - loss: 1.4295 - mean\_absolute\_error: 1.1596 29/126 [=====>........................] - ETA: 0s - loss: 0.9764 - mean\_absolute\_error: 0.9123 42/126 [=========>....................] - ETA: 0s - loss: 0.6870 - mean\_absolute\_error: 0.6857 53/126 [===========>..................] - ETA: 0s - loss: 0.5486 - mean\_absolute\_error: 0.5680 60/126 [=============>................] - ETA: 0s - loss: 0.4861 - mean\_absolute\_error: 0.5116 66/126 [==============>...............] - ETA: 0s - loss: 0.4428 - mean\_absolute\_error: 0.4717 72/126 [================>.............] - ETA: 0s - loss: 0.4064 - mean\_absolute\_error: 0.4378 78/126 [=================>............] - ETA: 0s - loss: 0.3757 - mean\_absolute\_error: 0.4100 84/126 [===================>..........] - ETA: 0s - loss: 0.3493 - mean\_absolute\_error: 0.3853 90/126 [====================>.........] - ETA: 0s - loss: 0.3263 - mean\_absolute\_error: 0.3631 96/126 [=====================>........] - ETA: 0s - loss: 0.3062 - mean\_absolute\_error: 0.3437102/126 [=======================>......] - ETA: 0s - loss: 0.2885 - mean\_absolute\_error: 0.3270108/126 [========================>.....] - ETA: 0s - loss: 0.2727 - mean\_absolute\_error: 0.3121115/126 [==========================>...] - ETA: 0s - loss: 0.2563 - mean\_absolute\_error: 0.2964121/126 [===========================>..] - ETA: 0s - loss: 0.2438 - mean\_absolute\_error: 0.2841126/126 [==============================] - 3s 12ms/step - loss: 0.2354 - mean\_absolute\_error: 0.2760 - val\_loss: 1.6729e-04 - val\_mean\_absolute\_error: 0.0104  
Epoch 2/100  
 1/126 [..............................] - ETA: 0s - loss: 0.0033 - mean\_absolute\_error: 0.0494 16/126 [==>...........................] - ETA: 0s - loss: 0.0031 - mean\_absolute\_error: 0.0473 30/126 [======>.......................] - ETA: 0s - loss: 0.0029 - mean\_absolute\_error: 0.0458 46/126 [=========>....................] - ETA: 0s - loss: 0.0027 - mean\_absolute\_error: 0.0432 60/126 [=============>................] - ETA: 0s - loss: 0.0025 - mean\_absolute\_error: 0.0420 76/126 [=================>............] - ETA: 0s - loss: 0.0023 - mean\_absolute\_error: 0.0400 90/126 [====================>.........] - ETA: 0s - loss: 0.0021 - mean\_absolute\_error: 0.0382106/126 [========================>.....] - ETA: 0s - loss: 0.0020 - mean\_absolute\_error: 0.0366121/126 [===========================>..] - ETA: 0s - loss: 0.0019 - mean\_absolute\_error: 0.0351126/126 [==============================] - 0s 4ms/step - loss: 0.0018 - mean\_absolute\_error: 0.0347 - val\_loss: 1.2592e-04 - val\_mean\_absolute\_error: 0.0089  
Epoch 3/100  
 1/126 [..............................] - ETA: 0s - loss: 0.0012 - mean\_absolute\_error: 0.0271 17/126 [===>..........................] - ETA: 0s - loss: 7.8820e-04 - mean\_absolute\_error: 0.0223 33/126 [======>.......................] - ETA: 0s - loss: 7.2089e-04 - mean\_absolute\_error: 0.0213 48/126 [==========>...................] - ETA: 0s - loss: 6.4159e-04 - mean\_absolute\_error: 0.0202 64/126 [==============>...............] - ETA: 0s - loss: 5.8420e-04 - mean\_absolute\_error: 0.0190 79/126 [=================>............] - ETA: 0s - loss: 5.3971e-04 - mean\_absolute\_error: 0.0183 95/126 [=====================>........] - ETA: 0s - loss: 5.0261e-04 - mean\_absolute\_error: 0.0175111/126 [=========================>....] - ETA: 0s - loss: 4.7793e-04 - mean\_absolute\_error: 0.0171126/126 [==============================] - ETA: 0s - loss: 4.5309e-04 - mean\_absolute\_error: 0.0165126/126 [==============================] - 0s 4ms/step - loss: 4.5309e-04 - mean\_absolute\_error: 0.0165 - val\_loss: 1.3467e-04 - val\_mean\_absolute\_error: 0.0090  
Epoch 4/100  
 1/126 [..............................] - ETA: 0s - loss: 2.9565e-04 - mean\_absolute\_error: 0.0128 16/126 [==>...........................] - ETA: 0s - loss: 2.4293e-04 - mean\_absolute\_error: 0.0119 31/126 [======>.......................] - ETA: 0s - loss: 3.2589e-04 - mean\_absolute\_error: 0.0128 47/126 [==========>...................] - ETA: 0s - loss: 3.0739e-04 - mean\_absolute\_error: 0.0127 62/126 [=============>................] - ETA: 0s - loss: 3.0707e-04 - mean\_absolute\_error: 0.0128 77/126 [=================>............] - ETA: 0s - loss: 2.9773e-04 - mean\_absolute\_error: 0.0126 92/126 [====================>.........] - ETA: 0s - loss: 2.9910e-04 - mean\_absolute\_error: 0.0126106/126 [========================>.....] - ETA: 0s - loss: 2.8951e-04 - mean\_absolute\_error: 0.0125121/126 [===========================>..] - ETA: 0s - loss: 2.7917e-04 - mean\_absolute\_error: 0.0124126/126 [==============================] - 0s 4ms/step - loss: 2.7662e-04 - mean\_absolute\_error: 0.0123 - val\_loss: 1.5748e-04 - val\_mean\_absolute\_error: 0.0098  
Epoch 5/100  
 1/126 [..............................] - ETA: 0s - loss: 3.0005e-04 - mean\_absolute\_error: 0.0112 16/126 [==>...........................] - ETA: 0s - loss: 2.6031e-04 - mean\_absolute\_error: 0.0117 32/126 [======>.......................] - ETA: 0s - loss: 2.7293e-04 - mean\_absolute\_error: 0.0119 47/126 [==========>...................] - ETA: 0s - loss: 2.6401e-04 - mean\_absolute\_error: 0.0118 63/126 [==============>...............] - ETA: 0s - loss: 2.6925e-04 - mean\_absolute\_error: 0.0120 79/126 [=================>............] - ETA: 0s - loss: 2.7170e-04 - mean\_absolute\_error: 0.0121 95/126 [=====================>........] - ETA: 0s - loss: 2.6219e-04 - mean\_absolute\_error: 0.0119111/126 [=========================>....] - ETA: 0s - loss: 2.6341e-04 - mean\_absolute\_error: 0.0119126/126 [==============================] - 0s 4ms/step - loss: 2.7205e-04 - mean\_absolute\_error: 0.0120 - val\_loss: 2.3776e-04 - val\_mean\_absolute\_error: 0.0125  
Epoch 6/100  
 1/126 [..............................] - ETA: 0s - loss: 1.9803e-04 - mean\_absolute\_error: 0.0114 16/126 [==>...........................] - ETA: 0s - loss: 2.2854e-04 - mean\_absolute\_error: 0.0116 31/126 [======>.......................] - ETA: 0s - loss: 2.2327e-04 - mean\_absolute\_error: 0.0114 46/126 [=========>....................] - ETA: 0s - loss: 2.3755e-04 - mean\_absolute\_error: 0.0115 62/126 [=============>................] - ETA: 0s - loss: 2.4140e-04 - mean\_absolute\_error: 0.0115 77/126 [=================>............] - ETA: 0s - loss: 2.5832e-04 - mean\_absolute\_error: 0.0118 92/126 [====================>.........] - ETA: 0s - loss: 2.7097e-04 - mean\_absolute\_error: 0.0119107/126 [========================>.....] - ETA: 0s - loss: 2.6504e-04 - mean\_absolute\_error: 0.0119122/126 [============================>.] - ETA: 0s - loss: 2.7256e-04 - mean\_absolute\_error: 0.0120126/126 [==============================] - 0s 4ms/step - loss: 2.7124e-04 - mean\_absolute\_error: 0.0120 - val\_loss: 2.4434e-04 - val\_mean\_absolute\_error: 0.0127  
Epoch 7/100  
 1/126 [..............................] - ETA: 0s - loss: 3.2729e-04 - mean\_absolute\_error: 0.0130 12/126 [=>............................] - ETA: 0s - loss: 2.3819e-04 - mean\_absolute\_error: 0.0116 24/126 [====>.........................] - ETA: 0s - loss: 2.5496e-04 - mean\_absolute\_error: 0.0120 36/126 [=======>......................] - ETA: 0s - loss: 2.4471e-04 - mean\_absolute\_error: 0.0119 50/126 [==========>...................] - ETA: 0s - loss: 2.7032e-04 - mean\_absolute\_error: 0.0122 67/126 [==============>...............] - ETA: 0s - loss: 2.7561e-04 - mean\_absolute\_error: 0.0121 81/126 [==================>...........] - ETA: 0s - loss: 2.7204e-04 - mean\_absolute\_error: 0.0120 95/126 [=====================>........] - ETA: 0s - loss: 2.6517e-04 - mean\_absolute\_error: 0.0120110/126 [=========================>....] - ETA: 0s - loss: 2.7237e-04 - mean\_absolute\_error: 0.0120125/126 [============================>.] - ETA: 0s - loss: 2.7141e-04 - mean\_absolute\_error: 0.0120126/126 [==============================] - 1s 4ms/step - loss: 2.7202e-04 - mean\_absolute\_error: 0.0120 - val\_loss: 1.4074e-04 - val\_mean\_absolute\_error: 0.0092  
Epoch 8/100  
 1/126 [..............................] - ETA: 0s - loss: 3.6049e-04 - mean\_absolute\_error: 0.0149 19/126 [===>..........................] - ETA: 0s - loss: 2.1984e-04 - mean\_absolute\_error: 0.0113 37/126 [=======>......................] - ETA: 0s - loss: 3.1779e-04 - mean\_absolute\_error: 0.0123 55/126 [============>.................] - ETA: 0s - loss: 2.8587e-04 - mean\_absolute\_error: 0.0120 73/126 [================>.............] - ETA: 0s - loss: 2.8247e-04 - mean\_absolute\_error: 0.0120 88/126 [===================>..........] - ETA: 0s - loss: 2.7346e-04 - mean\_absolute\_error: 0.0119103/126 [=======================>......] - ETA: 0s - loss: 2.6442e-04 - mean\_absolute\_error: 0.0118116/126 [==========================>...] - ETA: 0s - loss: 2.6766e-04 - mean\_absolute\_error: 0.0119126/126 [==============================] - 0s 4ms/step - loss: 2.6587e-04 - mean\_absolute\_error: 0.0119 - val\_loss: 2.3438e-04 - val\_mean\_absolute\_error: 0.0124  
Epoch 9/100  
 1/126 [..............................] - ETA: 0s - loss: 1.3713e-04 - mean\_absolute\_error: 0.0091 15/126 [==>...........................] - ETA: 0s - loss: 2.5215e-04 - mean\_absolute\_error: 0.0122 30/126 [======>.......................] - ETA: 0s - loss: 2.4463e-04 - mean\_absolute\_error: 0.0119 47/126 [==========>...................] - ETA: 0s - loss: 2.5032e-04 - mean\_absolute\_error: 0.0119 63/126 [==============>...............] - ETA: 0s - loss: 2.6416e-04 - mean\_absolute\_error: 0.0120 79/126 [=================>............] - ETA: 0s - loss: 2.6115e-04 - mean\_absolute\_error: 0.0121 95/126 [=====================>........] - ETA: 0s - loss: 2.6936e-04 - mean\_absolute\_error: 0.0121109/126 [========================>.....] - ETA: 0s - loss: 2.7006e-04 - mean\_absolute\_error: 0.0121124/126 [============================>.] - ETA: 0s - loss: 2.7311e-04 - mean\_absolute\_error: 0.0121126/126 [==============================] - 0s 4ms/step - loss: 2.7348e-04 - mean\_absolute\_error: 0.0121 - val\_loss: 1.7171e-04 - val\_mean\_absolute\_error: 0.0103  
Epoch 10/100  
 1/126 [..............................] - ETA: 0s - loss: 2.2263e-04 - mean\_absolute\_error: 0.0116 17/126 [===>..........................] - ETA: 0s - loss: 2.5966e-04 - mean\_absolute\_error: 0.0121 31/126 [======>.......................] - ETA: 0s - loss: 2.6573e-04 - mean\_absolute\_error: 0.0121 46/126 [=========>....................] - ETA: 0s - loss: 2.6770e-04 - mean\_absolute\_error: 0.0120 61/126 [=============>................] - ETA: 0s - loss: 2.8499e-04 - mean\_absolute\_error: 0.0122 76/126 [=================>............] - ETA: 0s - loss: 2.7931e-04 - mean\_absolute\_error: 0.0121 92/126 [====================>.........] - ETA: 0s - loss: 2.7932e-04 - mean\_absolute\_error: 0.0120107/126 [========================>.....] - ETA: 0s - loss: 2.7503e-04 - mean\_absolute\_error: 0.0120122/126 [============================>.] - ETA: 0s - loss: 2.6974e-04 - mean\_absolute\_error: 0.0119126/126 [==============================] - 0s 4ms/step - loss: 2.6944e-04 - mean\_absolute\_error: 0.0119 - val\_loss: 1.8154e-04 - val\_mean\_absolute\_error: 0.0106  
Epoch 11/100  
 1/126 [..............................] - ETA: 0s - loss: 2.3886e-04 - mean\_absolute\_error: 0.0107 16/126 [==>...........................] - ETA: 0s - loss: 2.3817e-04 - mean\_absolute\_error: 0.0117 31/126 [======>.......................] - ETA: 0s - loss: 2.4002e-04 - mean\_absolute\_error: 0.0114 46/126 [=========>....................] - ETA: 0s - loss: 2.4100e-04 - mean\_absolute\_error: 0.0115 61/126 [=============>................] - ETA: 0s - loss: 2.5833e-04 - mean\_absolute\_error: 0.0117 75/126 [================>.............] - ETA: 0s - loss: 2.6701e-04 - mean\_absolute\_error: 0.0118 90/126 [====================>.........] - ETA: 0s - loss: 2.6780e-04 - mean\_absolute\_error: 0.0119105/126 [========================>.....] - ETA: 0s - loss: 2.6485e-04 - mean\_absolute\_error: 0.0119119/126 [===========================>..] - ETA: 0s - loss: 2.7243e-04 - mean\_absolute\_error: 0.0119126/126 [==============================] - 0s 4ms/step - loss: 2.7386e-04 - mean\_absolute\_error: 0.0120 - val\_loss: 1.2213e-04 - val\_mean\_absolute\_error: 0.0086  
Epoch 12/100  
 1/126 [..............................] - ETA: 0s - loss: 2.5222e-04 - mean\_absolute\_error: 0.0134 14/126 [==>...........................] - ETA: 0s - loss: 2.5586e-04 - mean\_absolute\_error: 0.0120 30/126 [======>.......................] - ETA: 0s - loss: 2.8187e-04 - mean\_absolute\_error: 0.0122 45/126 [=========>....................] - ETA: 0s - loss: 2.5971e-04 - mean\_absolute\_error: 0.0120 60/126 [=============>................] - ETA: 0s - loss: 2.7555e-04 - mean\_absolute\_error: 0.0121 75/126 [================>.............] - ETA: 0s - loss: 2.7592e-04 - mean\_absolute\_error: 0.0122 90/126 [====================>.........] - ETA: 0s - loss: 2.6719e-04 - mean\_absolute\_error: 0.0120105/126 [========================>.....] - ETA: 0s - loss: 2.6292e-04 - mean\_absolute\_error: 0.0119121/126 [===========================>..] - ETA: 0s - loss: 2.7006e-04 - mean\_absolute\_error: 0.0119126/126 [==============================] - 0s 4ms/step - loss: 2.6718e-04 - mean\_absolute\_error: 0.0119 - val\_loss: 1.4003e-04 - val\_mean\_absolute\_error: 0.0092  
Epoch 13/100  
 1/126 [..............................] - ETA: 0s - loss: 4.7936e-04 - mean\_absolute\_error: 0.0150 17/126 [===>..........................] - ETA: 0s - loss: 3.0042e-04 - mean\_absolute\_error: 0.0126 31/126 [======>.......................] - ETA: 0s - loss: 2.7047e-04 - mean\_absolute\_error: 0.0122 44/126 [=========>....................] - ETA: 0s - loss: 2.5060e-04 - mean\_absolute\_error: 0.0119 56/126 [============>.................] - ETA: 0s - loss: 2.5229e-04 - mean\_absolute\_error: 0.0120 66/126 [==============>...............] - ETA: 0s - loss: 2.6241e-04 - mean\_absolute\_error: 0.0121 79/126 [=================>............] - ETA: 0s - loss: 2.5875e-04 - mean\_absolute\_error: 0.0120 86/126 [===================>..........] - ETA: 0s - loss: 2.6176e-04 - mean\_absolute\_error: 0.0119 92/126 [====================>.........] - ETA: 0s - loss: 2.6790e-04 - mean\_absolute\_error: 0.0120 98/126 [======================>.......] - ETA: 0s - loss: 2.7324e-04 - mean\_absolute\_error: 0.0120104/126 [=======================>......] - ETA: 0s - loss: 2.6880e-04 - mean\_absolute\_error: 0.0120110/126 [=========================>....] - ETA: 0s - loss: 2.6621e-04 - mean\_absolute\_error: 0.0119116/126 [==========================>...] - ETA: 0s - loss: 2.7201e-04 - mean\_absolute\_error: 0.0120122/126 [============================>.] - ETA: 0s - loss: 2.7039e-04 - mean\_absolute\_error: 0.0119126/126 [==============================] - 1s 6ms/step - loss: 2.6905e-04 - mean\_absolute\_error: 0.0119 - val\_loss: 1.5071e-04 - val\_mean\_absolute\_error: 0.0096  
Epoch 14/100  
 1/126 [..............................] - ETA: 0s - loss: 1.8196e-04 - mean\_absolute\_error: 0.0109 14/126 [==>...........................] - ETA: 0s - loss: 2.4939e-04 - mean\_absolute\_error: 0.0115 25/126 [====>.........................] - ETA: 0s - loss: 2.3987e-04 - mean\_absolute\_error: 0.0112 36/126 [=======>......................] - ETA: 0s - loss: 2.4846e-04 - mean\_absolute\_error: 0.0114 47/126 [==========>...................] - ETA: 0s - loss: 2.5236e-04 - mean\_absolute\_error: 0.0117 59/126 [=============>................] - ETA: 0s - loss: 2.5414e-04 - mean\_absolute\_error: 0.0118 71/126 [===============>..............] - ETA: 0s - loss: 2.5511e-04 - mean\_absolute\_error: 0.0117 83/126 [==================>...........] - ETA: 0s - loss: 2.5763e-04 - mean\_absolute\_error: 0.0117 96/126 [=====================>........] - ETA: 0s - loss: 2.6874e-04 - mean\_absolute\_error: 0.0118108/126 [========================>.....] - ETA: 0s - loss: 2.7737e-04 - mean\_absolute\_error: 0.0119121/126 [===========================>..] - ETA: 0s - loss: 2.6890e-04 - mean\_absolute\_error: 0.0118126/126 [==============================] - 1s 5ms/step - loss: 2.6784e-04 - mean\_absolute\_error: 0.0118 - val\_loss: 1.8583e-04 - val\_mean\_absolute\_error: 0.0108  
Epoch 15/100  
 1/126 [..............................] - ETA: 0s - loss: 2.7512e-04 - mean\_absolute\_error: 0.0125 12/126 [=>............................] - ETA: 0s - loss: 2.2272e-04 - mean\_absolute\_error: 0.0114 25/126 [====>.........................] - ETA: 0s - loss: 2.6041e-04 - mean\_absolute\_error: 0.0117 37/126 [=======>......................] - ETA: 0s - loss: 2.5301e-04 - mean\_absolute\_error: 0.0116 45/126 [=========>....................] - ETA: 0s - loss: 2.5835e-04 - mean\_absolute\_error: 0.0118 52/126 [===========>..................] - ETA: 0s - loss: 2.4982e-04 - mean\_absolute\_error: 0.0116 59/126 [=============>................] - ETA: 0s - loss: 2.5362e-04 - mean\_absolute\_error: 0.0116 66/126 [==============>...............] - ETA: 0s - loss: 2.5459e-04 - mean\_absolute\_error: 0.0117 73/126 [================>.............] - ETA: 0s - loss: 2.5999e-04 - mean\_absolute\_error: 0.0118 80/126 [==================>...........] - ETA: 0s - loss: 2.6069e-04 - mean\_absolute\_error: 0.0119 87/126 [===================>..........] - ETA: 0s - loss: 2.5815e-04 - mean\_absolute\_error: 0.0118 93/126 [=====================>........] - ETA: 0s - loss: 2.6275e-04 - mean\_absolute\_error: 0.0119 99/126 [======================>.......] - ETA: 0s - loss: 2.6998e-04 - mean\_absolute\_error: 0.0119110/126 [=========================>....] - ETA: 0s - loss: 2.7098e-04 - mean\_absolute\_error: 0.0120122/126 [============================>.] - ETA: 0s - loss: 2.7238e-04 - mean\_absolute\_error: 0.0120126/126 [==============================] - 1s 7ms/step - loss: 2.7148e-04 - mean\_absolute\_error: 0.0120 - val\_loss: 2.7044e-04 - val\_mean\_absolute\_error: 0.0135  
Epoch 16/100  
 1/126 [..............................] - ETA: 0s - loss: 4.0492e-04 - mean\_absolute\_error: 0.0138 14/126 [==>...........................] - ETA: 0s - loss: 2.5047e-04 - mean\_absolute\_error: 0.0123 27/126 [=====>........................] - ETA: 0s - loss: 2.7892e-04 - mean\_absolute\_error: 0.0125 40/126 [========>.....................] - ETA: 0s - loss: 2.7992e-04 - mean\_absolute\_error: 0.0124 53/126 [===========>..................] - ETA: 0s - loss: 2.7121e-04 - mean\_absolute\_error: 0.0123 65/126 [==============>...............] - ETA: 0s - loss: 2.7536e-04 - mean\_absolute\_error: 0.0123 78/126 [=================>............] - ETA: 0s - loss: 2.6816e-04 - mean\_absolute\_error: 0.0122 90/126 [====================>.........] - ETA: 0s - loss: 2.6651e-04 - mean\_absolute\_error: 0.0122103/126 [=======================>......] - ETA: 0s - loss: 2.7587e-04 - mean\_absolute\_error: 0.0122113/126 [=========================>....] - ETA: 0s - loss: 2.6872e-04 - mean\_absolute\_error: 0.0121120/126 [===========================>..] - ETA: 0s - loss: 2.7203e-04 - mean\_absolute\_error: 0.0121126/126 [==============================] - 1s 5ms/step - loss: 2.7622e-04 - mean\_absolute\_error: 0.0121 - val\_loss: 1.2472e-04 - val\_mean\_absolute\_error: 0.0089  
Epoch 17/100  
 1/126 [..............................] - ETA: 0s - loss: 1.6940e-04 - mean\_absolute\_error: 0.0107 12/126 [=>............................] - ETA: 0s - loss: 2.4983e-04 - mean\_absolute\_error: 0.0118 24/126 [====>.........................] - ETA: 0s - loss: 2.4930e-04 - mean\_absolute\_error: 0.0120 36/126 [=======>......................] - ETA: 0s - loss: 2.4070e-04 - mean\_absolute\_error: 0.0118 47/126 [==========>...................] - ETA: 0s - loss: 2.3697e-04 - mean\_absolute\_error: 0.0117 58/126 [============>.................] - ETA: 0s - loss: 2.4693e-04 - mean\_absolute\_error: 0.0117 71/126 [===============>..............] - ETA: 0s - loss: 2.4410e-04 - mean\_absolute\_error: 0.0116 83/126 [==================>...........] - ETA: 0s - loss: 2.5782e-04 - mean\_absolute\_error: 0.0118 97/126 [======================>.......] - ETA: 0s - loss: 2.6951e-04 - mean\_absolute\_error: 0.0119110/126 [=========================>....] - ETA: 0s - loss: 2.6916e-04 - mean\_absolute\_error: 0.0119119/126 [===========================>..] - ETA: 0s - loss: 2.6655e-04 - mean\_absolute\_error: 0.0119126/126 [==============================] - ETA: 0s - loss: 2.6723e-04 - mean\_absolute\_error: 0.0119126/126 [==============================] - 1s 6ms/step - loss: 2.6723e-04 - mean\_absolute\_error: 0.0119 - val\_loss: 1.3066e-04 - val\_mean\_absolute\_error: 0.0091  
Epoch 18/100  
 1/126 [..............................] - ETA: 1s - loss: 2.8759e-04 - mean\_absolute\_error: 0.0122 8/126 [>.............................] - ETA: 0s - loss: 2.4672e-04 - mean\_absolute\_error: 0.0120 15/126 [==>...........................] - ETA: 0s - loss: 2.2945e-04 - mean\_absolute\_error: 0.0118 22/126 [====>.........................] - ETA: 0s - loss: 2.3986e-04 - mean\_absolute\_error: 0.0117 29/126 [=====>........................] - ETA: 0s - loss: 3.1253e-04 - mean\_absolute\_error: 0.0129 36/126 [=======>......................] - ETA: 0s - loss: 3.0774e-04 - mean\_absolute\_error: 0.0130 43/126 [=========>....................] - ETA: 0s - loss: 3.3139e-04 - mean\_absolute\_error: 0.0133 50/126 [==========>...................] - ETA: 0s - loss: 3.2708e-04 - mean\_absolute\_error: 0.0132 57/126 [============>.................] - ETA: 0s - loss: 3.2006e-04 - mean\_absolute\_error: 0.0131 64/126 [==============>...............] - ETA: 0s - loss: 3.0777e-04 - mean\_absolute\_error: 0.0128 71/126 [===============>..............] - ETA: 0s - loss: 3.0871e-04 - mean\_absolute\_error: 0.0128 78/126 [=================>............] - ETA: 0s - loss: 3.0461e-04 - mean\_absolute\_error: 0.0128 85/126 [===================>..........] - ETA: 0s - loss: 2.9966e-04 - mean\_absolute\_error: 0.0127 92/126 [====================>.........] - ETA: 0s - loss: 2.9596e-04 - mean\_absolute\_error: 0.0126 99/126 [======================>.......] - ETA: 0s - loss: 2.9445e-04 - mean\_absolute\_error: 0.0126106/126 [========================>.....] - ETA: 0s - loss: 2.9029e-04 - mean\_absolute\_error: 0.0125113/126 [=========================>....] - ETA: 0s - loss: 2.8703e-04 - mean\_absolute\_error: 0.0124120/126 [===========================>..] - ETA: 0s - loss: 2.8738e-04 - mean\_absolute\_error: 0.0124126/126 [==============================] - 1s 9ms/step - loss: 2.9168e-04 - mean\_absolute\_error: 0.0124 - val\_loss: 1.3232e-04 - val\_mean\_absolute\_error: 0.0089  
Epoch 19/100  
 1/126 [..............................] - ETA: 1s - loss: 2.0787e-04 - mean\_absolute\_error: 0.0106 8/126 [>.............................] - ETA: 0s - loss: 3.8883e-04 - mean\_absolute\_error: 0.0132 15/126 [==>...........................] - ETA: 0s - loss: 3.6162e-04 - mean\_absolute\_error: 0.0129 23/126 [====>.........................] - ETA: 0s - loss: 3.2052e-04 - mean\_absolute\_error: 0.0121 30/126 [======>.......................] - ETA: 0s - loss: 2.9790e-04 - mean\_absolute\_error: 0.0118 37/126 [=======>......................] - ETA: 0s - loss: 2.8461e-04 - mean\_absolute\_error: 0.0117 44/126 [=========>....................] - ETA: 0s - loss: 2.7502e-04 - mean\_absolute\_error: 0.0116 52/126 [===========>..................] - ETA: 0s - loss: 2.8901e-04 - mean\_absolute\_error: 0.0119 59/126 [=============>................] - ETA: 0s - loss: 2.7811e-04 - mean\_absolute\_error: 0.0117 67/126 [==============>...............] - ETA: 0s - loss: 2.7144e-04 - mean\_absolute\_error: 0.0116 74/126 [================>.............] - ETA: 0s - loss: 2.6521e-04 - mean\_absolute\_error: 0.0115 81/126 [==================>...........] - ETA: 0s - loss: 2.6302e-04 - mean\_absolute\_error: 0.0116 88/126 [===================>..........] - ETA: 0s - loss: 2.6021e-04 - mean\_absolute\_error: 0.0116 95/126 [=====================>........] - ETA: 0s - loss: 2.5605e-04 - mean\_absolute\_error: 0.0115102/126 [=======================>......] - ETA: 0s - loss: 2.5609e-04 - mean\_absolute\_error: 0.0116109/126 [========================>.....] - ETA: 0s - loss: 2.5622e-04 - mean\_absolute\_error: 0.0116116/126 [==========================>...] - ETA: 0s - loss: 2.5762e-04 - mean\_absolute\_error: 0.0117123/126 [============================>.] - ETA: 0s - loss: 2.6022e-04 - mean\_absolute\_error: 0.0117126/126 [==============================] - 1s 8ms/step - loss: 2.6159e-04 - mean\_absolute\_error: 0.0117 - val\_loss: 2.1553e-04 - val\_mean\_absolute\_error: 0.0118  
Epoch 20/100  
 1/126 [..............................] - ETA: 1s - loss: 2.0449e-04 - mean\_absolute\_error: 0.0118 9/126 [=>............................] - ETA: 0s - loss: 2.0556e-04 - mean\_absolute\_error: 0.0110 17/126 [===>..........................] - ETA: 0s - loss: 2.3267e-04 - mean\_absolute\_error: 0.0113 24/126 [====>.........................] - ETA: 0s - loss: 2.5375e-04 - mean\_absolute\_error: 0.0115 37/126 [=======>......................] - ETA: 0s - loss: 2.4074e-04 - mean\_absolute\_error: 0.0114 50/126 [==========>...................] - ETA: 0s - loss: 2.4523e-04 - mean\_absolute\_error: 0.0114 64/126 [==============>...............] - ETA: 0s - loss: 2.5632e-04 - mean\_absolute\_error: 0.0116 74/126 [================>.............] - ETA: 0s - loss: 2.6550e-04 - mean\_absolute\_error: 0.0117 83/126 [==================>...........] - ETA: 0s - loss: 2.6193e-04 - mean\_absolute\_error: 0.0117 92/126 [====================>.........] - ETA: 0s - loss: 2.5874e-04 - mean\_absolute\_error: 0.0117101/126 [=======================>......] - ETA: 0s - loss: 2.5691e-04 - mean\_absolute\_error: 0.0116109/126 [========================>.....] - ETA: 0s - loss: 2.5810e-04 - mean\_absolute\_error: 0.0117117/126 [==========================>...] - ETA: 0s - loss: 2.6044e-04 - mean\_absolute\_error: 0.0117125/126 [============================>.] - ETA: 0s - loss: 2.6368e-04 - mean\_absolute\_error: 0.0118126/126 [==============================] - 1s 6ms/step - loss: 2.6321e-04 - mean\_absolute\_error: 0.0118 - val\_loss: 1.7535e-04 - val\_mean\_absolute\_error: 0.0108  
Epoch 21/100  
 1/126 [..............................] - ETA: 0s - loss: 3.9261e-04 - mean\_absolute\_error: 0.0153 13/126 [==>...........................] - ETA: 0s - loss: 2.7385e-04 - mean\_absolute\_error: 0.0123 23/126 [====>.........................] - ETA: 0s - loss: 2.6620e-04 - mean\_absolute\_error: 0.0121 34/126 [=======>......................] - ETA: 0s - loss: 3.1332e-04 - mean\_absolute\_error: 0.0133 45/126 [=========>....................] - ETA: 0s - loss: 3.0550e-04 - mean\_absolute\_error: 0.0132 57/126 [============>.................] - ETA: 0s - loss: 3.3463e-04 - mean\_absolute\_error: 0.0134 70/126 [===============>..............] - ETA: 0s - loss: 3.2134e-04 - mean\_absolute\_error: 0.0132 78/126 [=================>............] - ETA: 0s - loss: 3.1018e-04 - mean\_absolute\_error: 0.0130 85/126 [===================>..........] - ETA: 0s - loss: 3.1126e-04 - mean\_absolute\_error: 0.0129 91/126 [====================>.........] - ETA: 0s - loss: 3.0504e-04 - mean\_absolute\_error: 0.0128 97/126 [======================>.......] - ETA: 0s - loss: 3.0628e-04 - mean\_absolute\_error: 0.0128103/126 [=======================>......] - ETA: 0s - loss: 3.1226e-04 - mean\_absolute\_error: 0.0129109/126 [========================>.....] - ETA: 0s - loss: 3.0745e-04 - mean\_absolute\_error: 0.0128116/126 [==========================>...] - ETA: 0s - loss: 3.0416e-04 - mean\_absolute\_error: 0.0128122/126 [============================>.] - ETA: 0s - loss: 2.9708e-04 - mean\_absolute\_error: 0.0126126/126 [==============================] - 1s 7ms/step - loss: 2.9317e-04 - mean\_absolute\_error: 0.0125 - val\_loss: 1.2239e-04 - val\_mean\_absolute\_error: 0.0087  
Epoch 22/100  
 1/126 [..............................] - ETA: 1s - loss: 1.9816e-04 - mean\_absolute\_error: 0.0116 8/126 [>.............................] - ETA: 0s - loss: 1.9104e-04 - mean\_absolute\_error: 0.0109 15/126 [==>...........................] - ETA: 0s - loss: 1.8339e-04 - mean\_absolute\_error: 0.0106 21/126 [====>.........................] - ETA: 0s - loss: 2.2973e-04 - mean\_absolute\_error: 0.0113 28/126 [=====>........................] - ETA: 0s - loss: 2.2791e-04 - mean\_absolute\_error: 0.0111 35/126 [=======>......................] - ETA: 0s - loss: 2.4987e-04 - mean\_absolute\_error: 0.0113 41/126 [========>.....................] - ETA: 0s - loss: 2.6299e-04 - mean\_absolute\_error: 0.0116 47/126 [==========>...................] - ETA: 0s - loss: 2.5521e-04 - mean\_absolute\_error: 0.0115 53/126 [===========>..................] - ETA: 0s - loss: 2.5252e-04 - mean\_absolute\_error: 0.0115 60/126 [=============>................] - ETA: 0s - loss: 2.6309e-04 - mean\_absolute\_error: 0.0117 67/126 [==============>...............] - ETA: 0s - loss: 2.7110e-04 - mean\_absolute\_error: 0.0118 74/126 [================>.............] - ETA: 0s - loss: 2.6976e-04 - mean\_absolute\_error: 0.0118 81/126 [==================>...........] - ETA: 0s - loss: 2.7034e-04 - mean\_absolute\_error: 0.0117 87/126 [===================>..........] - ETA: 0s - loss: 2.6875e-04 - mean\_absolute\_error: 0.0117 94/126 [=====================>........] - ETA: 0s - loss: 2.6450e-04 - mean\_absolute\_error: 0.0117101/126 [=======================>......] - ETA: 0s - loss: 2.6543e-04 - mean\_absolute\_error: 0.0118108/126 [========================>.....] - ETA: 0s - loss: 2.6648e-04 - mean\_absolute\_error: 0.0118115/126 [==========================>...] - ETA: 0s - loss: 2.7094e-04 - mean\_absolute\_error: 0.0119121/126 [===========================>..] - ETA: 0s - loss: 2.7060e-04 - mean\_absolute\_error: 0.0119126/126 [==============================] - 1s 9ms/step - loss: 2.6927e-04 - mean\_absolute\_error: 0.0119 - val\_loss: 1.2156e-04 - val\_mean\_absolute\_error: 0.0086  
Epoch 23/100  
 1/126 [..............................] - ETA: 1s - loss: 2.2336e-04 - mean\_absolute\_error: 0.0117 8/126 [>.............................] - ETA: 0s - loss: 2.3853e-04 - mean\_absolute\_error: 0.0117 15/126 [==>...........................] - ETA: 0s - loss: 2.7368e-04 - mean\_absolute\_error: 0.0127 22/126 [====>.........................] - ETA: 0s - loss: 2.7004e-04 - mean\_absolute\_error: 0.0125 29/126 [=====>........................] - ETA: 0s - loss: 2.6816e-04 - mean\_absolute\_error: 0.0123 36/126 [=======>......................] - ETA: 0s - loss: 2.8448e-04 - mean\_absolute\_error: 0.0122 45/126 [=========>....................] - ETA: 0s - loss: 2.6627e-04 - mean\_absolute\_error: 0.0118 54/126 [===========>..................] - ETA: 0s - loss: 2.5654e-04 - mean\_absolute\_error: 0.0117 63/126 [==============>...............] - ETA: 0s - loss: 2.5125e-04 - mean\_absolute\_error: 0.0116 72/126 [================>.............] - ETA: 0s - loss: 2.5150e-04 - mean\_absolute\_error: 0.0116 81/126 [==================>...........] - ETA: 0s - loss: 2.6074e-04 - mean\_absolute\_error: 0.0117 90/126 [====================>.........] - ETA: 0s - loss: 2.5870e-04 - mean\_absolute\_error: 0.0116 99/126 [======================>.......] - ETA: 0s - loss: 2.5542e-04 - mean\_absolute\_error: 0.0116108/126 [========================>.....] - ETA: 0s - loss: 2.6207e-04 - mean\_absolute\_error: 0.0117117/126 [==========================>...] - ETA: 0s - loss: 2.5764e-04 - mean\_absolute\_error: 0.0116126/126 [==============================] - ETA: 0s - loss: 2.5959e-04 - mean\_absolute\_error: 0.0116126/126 [==============================] - 1s 7ms/step - loss: 2.5959e-04 - mean\_absolute\_error: 0.0116 - val\_loss: 1.2435e-04 - val\_mean\_absolute\_error: 0.0087  
Epoch 24/100  
 1/126 [..............................] - ETA: 0s - loss: 1.9542e-04 - mean\_absolute\_error: 0.0113 10/126 [=>............................] - ETA: 0s - loss: 1.8038e-04 - mean\_absolute\_error: 0.0103 19/126 [===>..........................] - ETA: 0s - loss: 1.7395e-04 - mean\_absolute\_error: 0.0102 28/126 [=====>........................] - ETA: 0s - loss: 1.8089e-04 - mean\_absolute\_error: 0.0103 37/126 [=======>......................] - ETA: 0s - loss: 1.9384e-04 - mean\_absolute\_error: 0.0106 46/126 [=========>....................] - ETA: 0s - loss: 2.0626e-04 - mean\_absolute\_error: 0.0107 55/126 [============>.................] - ETA: 0s - loss: 2.1752e-04 - mean\_absolute\_error: 0.0108 64/126 [==============>...............] - ETA: 0s - loss: 2.1571e-04 - mean\_absolute\_error: 0.0107 73/126 [================>.............] - ETA: 0s - loss: 2.1782e-04 - mean\_absolute\_error: 0.0108 83/126 [==================>...........] - ETA: 0s - loss: 2.2914e-04 - mean\_absolute\_error: 0.0111 92/126 [====================>.........] - ETA: 0s - loss: 2.3020e-04 - mean\_absolute\_error: 0.0112101/126 [=======================>......] - ETA: 0s - loss: 2.3583e-04 - mean\_absolute\_error: 0.0112110/126 [=========================>....] - ETA: 0s - loss: 2.3819e-04 - mean\_absolute\_error: 0.0112119/126 [===========================>..] - ETA: 0s - loss: 2.4513e-04 - mean\_absolute\_error: 0.0113126/126 [==============================] - 1s 6ms/step - loss: 2.5090e-04 - mean\_absolute\_error: 0.0114 - val\_loss: 1.6493e-04 - val\_mean\_absolute\_error: 0.0101  
Epoch 25/100  
 1/126 [..............................] - ETA: 0s - loss: 2.5223e-04 - mean\_absolute\_error: 0.0105 9/126 [=>............................] - ETA: 0s - loss: 2.3706e-04 - mean\_absolute\_error: 0.0119 17/126 [===>..........................] - ETA: 0s - loss: 2.3003e-04 - mean\_absolute\_error: 0.0115 26/126 [=====>........................] - ETA: 0s - loss: 2.3309e-04 - mean\_absolute\_error: 0.0115 35/126 [=======>......................] - ETA: 0s - loss: 2.3916e-04 - mean\_absolute\_error: 0.0116 43/126 [=========>....................] - ETA: 0s - loss: 2.4456e-04 - mean\_absolute\_error: 0.0117 52/126 [===========>..................] - ETA: 0s - loss: 2.7045e-04 - mean\_absolute\_error: 0.0119 61/126 [=============>................] - ETA: 0s - loss: 2.6543e-04 - mean\_absolute\_error: 0.0119 70/126 [===============>..............] - ETA: 0s - loss: 2.6326e-04 - mean\_absolute\_error: 0.0119 78/126 [=================>............] - ETA: 0s - loss: 2.6071e-04 - mean\_absolute\_error: 0.0118 86/126 [===================>..........] - ETA: 0s - loss: 2.5888e-04 - mean\_absolute\_error: 0.0118 95/126 [=====================>........] - ETA: 0s - loss: 2.5623e-04 - mean\_absolute\_error: 0.0118106/126 [========================>.....] - ETA: 0s - loss: 2.5473e-04 - mean\_absolute\_error: 0.0117118/126 [===========================>..] - ETA: 0s - loss: 2.5717e-04 - mean\_absolute\_error: 0.0116126/126 [==============================] - 1s 6ms/step - loss: 2.5912e-04 - mean\_absolute\_error: 0.0116 - val\_loss: 1.2575e-04 - val\_mean\_absolute\_error: 0.0087  
Epoch 26/100  
 1/126 [..............................] - ETA: 0s - loss: 2.7931e-04 - mean\_absolute\_error: 0.0120 10/126 [=>............................] - ETA: 0s - loss: 2.1701e-04 - mean\_absolute\_error: 0.0111 17/126 [===>..........................] - ETA: 0s - loss: 2.1022e-04 - mean\_absolute\_error: 0.0110 24/126 [====>.........................] - ETA: 0s - loss: 2.4148e-04 - mean\_absolute\_error: 0.0115 31/126 [======>.......................] - ETA: 0s - loss: 2.5165e-04 - mean\_absolute\_error: 0.0118 38/126 [========>.....................] - ETA: 0s - loss: 2.7248e-04 - mean\_absolute\_error: 0.0122 45/126 [=========>....................] - ETA: 0s - loss: 2.6360e-04 - mean\_absolute\_error: 0.0121 53/126 [===========>..................] - ETA: 0s - loss: 2.6464e-04 - mean\_absolute\_error: 0.0118 60/126 [=============>................] - ETA: 0s - loss: 2.5828e-04 - mean\_absolute\_error: 0.0116 67/126 [==============>...............] - ETA: 0s - loss: 2.6711e-04 - mean\_absolute\_error: 0.0119 75/126 [================>.............] - ETA: 0s - loss: 2.6880e-04 - mean\_absolute\_error: 0.0119 82/126 [==================>...........] - ETA: 0s - loss: 2.7453e-04 - mean\_absolute\_error: 0.0119 90/126 [====================>.........] - ETA: 0s - loss: 2.6811e-04 - mean\_absolute\_error: 0.0118 97/126 [======================>.......] - ETA: 0s - loss: 2.6747e-04 - mean\_absolute\_error: 0.0119105/126 [========================>.....] - ETA: 0s - loss: 2.6574e-04 - mean\_absolute\_error: 0.0119112/126 [=========================>....] - ETA: 0s - loss: 2.6831e-04 - mean\_absolute\_error: 0.0120120/126 [===========================>..] - ETA: 0s - loss: 2.6729e-04 - mean\_absolute\_error: 0.0119126/126 [==============================] - 1s 8ms/step - loss: 2.7182e-04 - mean\_absolute\_error: 0.0120 - val\_loss: 3.7723e-04 - val\_mean\_absolute\_error: 0.0167  
Epoch 27/100  
 1/126 [..............................] - ETA: 0s - loss: 3.9524e-04 - mean\_absolute\_error: 0.0145 9/126 [=>............................] - ETA: 0s - loss: 3.7382e-04 - mean\_absolute\_error: 0.0148 17/126 [===>..........................] - ETA: 0s - loss: 3.4600e-04 - mean\_absolute\_error: 0.0140 25/126 [====>.........................] - ETA: 0s - loss: 3.4951e-04 - mean\_absolute\_error: 0.0141 33/126 [======>.......................] - ETA: 0s - loss: 3.5717e-04 - mean\_absolute\_error: 0.0139 41/126 [========>.....................] - ETA: 0s - loss: 3.7125e-04 - mean\_absolute\_error: 0.0142 49/126 [==========>...................] - ETA: 0s - loss: 3.6047e-04 - mean\_absolute\_error: 0.0141 56/126 [============>.................] - ETA: 0s - loss: 3.5502e-04 - mean\_absolute\_error: 0.0141 64/126 [==============>...............] - ETA: 0s - loss: 3.5277e-04 - mean\_absolute\_error: 0.0141 72/126 [================>.............] - ETA: 0s - loss: 3.4811e-04 - mean\_absolute\_error: 0.0140 80/126 [==================>...........] - ETA: 0s - loss: 3.3557e-04 - mean\_absolute\_error: 0.0137 87/126 [===================>..........] - ETA: 0s - loss: 3.2774e-04 - mean\_absolute\_error: 0.0135 94/126 [=====================>........] - ETA: 0s - loss: 3.1702e-04 - mean\_absolute\_error: 0.0133101/126 [=======================>......] - ETA: 0s - loss: 3.1184e-04 - mean\_absolute\_error: 0.0131108/126 [========================>.....] - ETA: 0s - loss: 3.1157e-04 - mean\_absolute\_error: 0.0130115/126 [==========================>...] - ETA: 0s - loss: 3.0388e-04 - mean\_absolute\_error: 0.0129123/126 [============================>.] - ETA: 0s - loss: 3.0000e-04 - mean\_absolute\_error: 0.0128126/126 [==============================] - 1s 8ms/step - loss: 2.9754e-04 - mean\_absolute\_error: 0.0128 - val\_loss: 1.3697e-04 - val\_mean\_absolute\_error: 0.0091  
Epoch 28/100  
 1/126 [..............................] - ETA: 1s - loss: 2.4484e-04 - mean\_absolute\_error: 0.0109 9/126 [=>............................] - ETA: 0s - loss: 3.7137e-04 - mean\_absolute\_error: 0.0133 17/126 [===>..........................] - ETA: 0s - loss: 3.0662e-04 - mean\_absolute\_error: 0.0122 25/126 [====>.........................] - ETA: 0s - loss: 2.7875e-04 - mean\_absolute\_error: 0.0119 33/126 [======>.......................] - ETA: 0s - loss: 2.8482e-04 - mean\_absolute\_error: 0.0120 41/126 [========>.....................] - ETA: 0s - loss: 2.6903e-04 - mean\_absolute\_error: 0.0118 49/126 [==========>...................] - ETA: 0s - loss: 2.6445e-04 - mean\_absolute\_error: 0.0118 55/126 [============>.................] - ETA: 0s - loss: 2.5619e-04 - mean\_absolute\_error: 0.0116 64/126 [==============>...............] - ETA: 0s - loss: 2.4828e-04 - mean\_absolute\_error: 0.0114 73/126 [================>.............] - ETA: 0s - loss: 2.4774e-04 - mean\_absolute\_error: 0.0114 82/126 [==================>...........] - ETA: 0s - loss: 2.4477e-04 - mean\_absolute\_error: 0.0113 91/126 [====================>.........] - ETA: 0s - loss: 2.4279e-04 - mean\_absolute\_error: 0.0113100/126 [======================>.......] - ETA: 0s - loss: 2.4415e-04 - mean\_absolute\_error: 0.0113109/126 [========================>.....] - ETA: 0s - loss: 2.4458e-04 - mean\_absolute\_error: 0.0113118/126 [===========================>..] - ETA: 0s - loss: 2.4812e-04 - mean\_absolute\_error: 0.0113126/126 [==============================] - 1s 7ms/step - loss: 2.4829e-04 - mean\_absolute\_error: 0.0114 - val\_loss: 1.2572e-04 - val\_mean\_absolute\_error: 0.0087  
Epoch 29/100  
 1/126 [..............................] - ETA: 1s - loss: 1.4344e-04 - mean\_absolute\_error: 0.0092 10/126 [=>............................] - ETA: 0s - loss: 1.9324e-04 - mean\_absolute\_error: 0.0106 19/126 [===>..........................] - ETA: 0s - loss: 2.0563e-04 - mean\_absolute\_error: 0.0106 28/126 [=====>........................] - ETA: 0s - loss: 2.3600e-04 - mean\_absolute\_error: 0.0110 37/126 [=======>......................] - ETA: 0s - loss: 2.3903e-04 - mean\_absolute\_error: 0.0112 46/126 [=========>....................] - ETA: 0s - loss: 2.4429e-04 - mean\_absolute\_error: 0.0115 55/126 [============>.................] - ETA: 0s - loss: 2.5296e-04 - mean\_absolute\_error: 0.0117 64/126 [==============>...............] - ETA: 0s - loss: 2.4791e-04 - mean\_absolute\_error: 0.0117 73/126 [================>.............] - ETA: 0s - loss: 2.4808e-04 - mean\_absolute\_error: 0.0117 82/126 [==================>...........] - ETA: 0s - loss: 2.5457e-04 - mean\_absolute\_error: 0.0118 91/126 [====================>.........] - ETA: 0s - loss: 2.4994e-04 - mean\_absolute\_error: 0.0118100/126 [======================>.......] - ETA: 0s - loss: 2.6493e-04 - mean\_absolute\_error: 0.0119109/126 [========================>.....] - ETA: 0s - loss: 2.6350e-04 - mean\_absolute\_error: 0.0119118/126 [===========================>..] - ETA: 0s - loss: 2.6664e-04 - mean\_absolute\_error: 0.0119126/126 [==============================] - ETA: 0s - loss: 2.6429e-04 - mean\_absolute\_error: 0.0118126/126 [==============================] - 1s 7ms/step - loss: 2.6429e-04 - mean\_absolute\_error: 0.0118 - val\_loss: 2.1267e-04 - val\_mean\_absolute\_error: 0.0117  
Epoch 30/100  
 1/126 [..............................] - ETA: 1s - loss: 4.3858e-04 - mean\_absolute\_error: 0.0145 8/126 [>.............................] - ETA: 0s - loss: 2.9063e-04 - mean\_absolute\_error: 0.0125 15/126 [==>...........................] - ETA: 0s - loss: 2.5477e-04 - mean\_absolute\_error: 0.0117 22/126 [====>.........................] - ETA: 0s - loss: 2.4679e-04 - mean\_absolute\_error: 0.0118 29/126 [=====>........................] - ETA: 0s - loss: 2.3466e-04 - mean\_absolute\_error: 0.0115 36/126 [=======>......................] - ETA: 0s - loss: 2.5915e-04 - mean\_absolute\_error: 0.0118 43/126 [=========>....................] - ETA: 0s - loss: 2.6704e-04 - mean\_absolute\_error: 0.0121 50/126 [==========>...................] - ETA: 0s - loss: 2.6432e-04 - mean\_absolute\_error: 0.0120 57/126 [============>.................] - ETA: 0s - loss: 2.6096e-04 - mean\_absolute\_error: 0.0120 64/126 [==============>...............] - ETA: 0s - loss: 2.5283e-04 - mean\_absolute\_error: 0.0118 71/126 [===============>..............] - ETA: 0s - loss: 2.4956e-04 - mean\_absolute\_error: 0.0117 78/126 [=================>............] - ETA: 0s - loss: 2.4782e-04 - mean\_absolute\_error: 0.0117 84/126 [===================>..........] - ETA: 0s - loss: 2.4409e-04 - mean\_absolute\_error: 0.0116 91/126 [====================>.........] - ETA: 0s - loss: 2.4206e-04 - mean\_absolute\_error: 0.0115 98/126 [======================>.......] - ETA: 0s - loss: 2.4531e-04 - mean\_absolute\_error: 0.0115105/126 [========================>.....] - ETA: 0s - loss: 2.5650e-04 - mean\_absolute\_error: 0.0116112/126 [=========================>....] - ETA: 0s - loss: 2.5875e-04 - mean\_absolute\_error: 0.0116119/126 [===========================>..] - ETA: 0s - loss: 2.5951e-04 - mean\_absolute\_error: 0.0116126/126 [==============================] - ETA: 0s - loss: 2.5722e-04 - mean\_absolute\_error: 0.0116126/126 [==============================] - 1s 9ms/step - loss: 2.5722e-04 - mean\_absolute\_error: 0.0116 - val\_loss: 1.2256e-04 - val\_mean\_absolute\_error: 0.0088  
Epoch 31/100  
 1/126 [..............................] - ETA: 0s - loss: 1.6166e-04 - mean\_absolute\_error: 0.0099 12/126 [=>............................] - ETA: 0s - loss: 2.5917e-04 - mean\_absolute\_error: 0.0120 23/126 [====>.........................] - ETA: 0s - loss: 2.5199e-04 - mean\_absolute\_error: 0.0113 32/126 [======>.......................] - ETA: 0s - loss: 2.4490e-04 - mean\_absolute\_error: 0.0114 41/126 [========>.....................] - ETA: 0s - loss: 2.7111e-04 - mean\_absolute\_error: 0.0117 50/126 [==========>...................] - ETA: 0s - loss: 2.6866e-04 - mean\_absolute\_error: 0.0116 60/126 [=============>................] - ETA: 0s - loss: 2.5366e-04 - mean\_absolute\_error: 0.0114 68/126 [===============>..............] - ETA: 0s - loss: 2.5171e-04 - mean\_absolute\_error: 0.0114 77/126 [=================>............] - ETA: 0s - loss: 2.5966e-04 - mean\_absolute\_error: 0.0117 85/126 [===================>..........] - ETA: 0s - loss: 2.6951e-04 - mean\_absolute\_error: 0.0118 92/126 [====================>.........] - ETA: 0s - loss: 2.7531e-04 - mean\_absolute\_error: 0.0120 99/126 [======================>.......] - ETA: 0s - loss: 2.7531e-04 - mean\_absolute\_error: 0.0121106/126 [========================>.....] - ETA: 0s - loss: 2.8286e-04 - mean\_absolute\_error: 0.0122113/126 [=========================>....] - ETA: 0s - loss: 2.8822e-04 - mean\_absolute\_error: 0.0124120/126 [===========================>..] - ETA: 0s - loss: 2.8904e-04 - mean\_absolute\_error: 0.0125126/126 [==============================] - 1s 7ms/step - loss: 2.9024e-04 - mean\_absolute\_error: 0.0125 - val\_loss: 1.3385e-04 - val\_mean\_absolute\_error: 0.0090  
Epoch 32/100  
 1/126 [..............................] - ETA: 1s - loss: 1.7510e-04 - mean\_absolute\_error: 0.0098 8/126 [>.............................] - ETA: 0s - loss: 2.6212e-04 - mean\_absolute\_error: 0.0111 15/126 [==>...........................] - ETA: 0s - loss: 2.5104e-04 - mean\_absolute\_error: 0.0115 22/126 [====>.........................] - ETA: 0s - loss: 2.3012e-04 - mean\_absolute\_error: 0.0112 29/126 [=====>........................] - ETA: 0s - loss: 2.2337e-04 - mean\_absolute\_error: 0.0111 36/126 [=======>......................] - ETA: 0s - loss: 2.2207e-04 - mean\_absolute\_error: 0.0112 43/126 [=========>....................] - ETA: 0s - loss: 2.2933e-04 - mean\_absolute\_error: 0.0113 50/126 [==========>...................] - ETA: 0s - loss: 2.3810e-04 - mean\_absolute\_error: 0.0114 57/126 [============>.................] - ETA: 0s - loss: 2.4822e-04 - mean\_absolute\_error: 0.0115 64/126 [==============>...............] - ETA: 0s - loss: 2.6457e-04 - mean\_absolute\_error: 0.0118 71/126 [===============>..............] - ETA: 0s - loss: 2.6083e-04 - mean\_absolute\_error: 0.0117 78/126 [=================>............] - ETA: 0s - loss: 2.7472e-04 - mean\_absolute\_error: 0.0120 85/126 [===================>..........] - ETA: 0s - loss: 2.7313e-04 - mean\_absolute\_error: 0.0120 92/126 [====================>.........] - ETA: 0s - loss: 2.7494e-04 - mean\_absolute\_error: 0.0121 99/126 [======================>.......] - ETA: 0s - loss: 2.7344e-04 - mean\_absolute\_error: 0.0121106/126 [========================>.....] - ETA: 0s - loss: 2.6979e-04 - mean\_absolute\_error: 0.0120113/126 [=========================>....] - ETA: 0s - loss: 2.7506e-04 - mean\_absolute\_error: 0.0121120/126 [===========================>..] - ETA: 0s - loss: 2.7595e-04 - mean\_absolute\_error: 0.0121126/126 [==============================] - 1s 8ms/step - loss: 2.7375e-04 - mean\_absolute\_error: 0.0120 - val\_loss: 2.1243e-04 - val\_mean\_absolute\_error: 0.0121  
Epoch 33/100  
 1/126 [..............................] - ETA: 1s - loss: 2.2604e-04 - mean\_absolute\_error: 0.0123 8/126 [>.............................] - ETA: 0s - loss: 2.9121e-04 - mean\_absolute\_error: 0.0129 15/126 [==>...........................] - ETA: 0s - loss: 2.7333e-04 - mean\_absolute\_error: 0.0125 22/126 [====>.........................] - ETA: 0s - loss: 2.5902e-04 - mean\_absolute\_error: 0.0122 28/126 [=====>........................] - ETA: 0s - loss: 2.5553e-04 - mean\_absolute\_error: 0.0122 33/126 [======>.......................] - ETA: 0s - loss: 2.5085e-04 - mean\_absolute\_error: 0.0121 40/126 [========>.....................] - ETA: 0s - loss: 2.5782e-04 - mean\_absolute\_error: 0.0122 47/126 [==========>...................] - ETA: 0s - loss: 2.7536e-04 - mean\_absolute\_error: 0.0126 54/126 [===========>..................] - ETA: 0s - loss: 2.9184e-04 - mean\_absolute\_error: 0.0129 61/126 [=============>................] - ETA: 0s - loss: 3.1160e-04 - mean\_absolute\_error: 0.0132 68/126 [===============>..............] - ETA: 0s - loss: 3.1241e-04 - mean\_absolute\_error: 0.0132 75/126 [================>.............] - ETA: 0s - loss: 3.1350e-04 - mean\_absolute\_error: 0.0132 82/126 [==================>...........] - ETA: 0s - loss: 3.0551e-04 - mean\_absolute\_error: 0.0131 89/126 [====================>.........] - ETA: 0s - loss: 3.0530e-04 - mean\_absolute\_error: 0.0130 96/126 [=====================>........] - ETA: 0s - loss: 3.0118e-04 - mean\_absolute\_error: 0.0128103/126 [=======================>......] - ETA: 0s - loss: 2.9726e-04 - mean\_absolute\_error: 0.0127110/126 [=========================>....] - ETA: 0s - loss: 2.9441e-04 - mean\_absolute\_error: 0.0127117/126 [==========================>...] - ETA: 0s - loss: 2.9216e-04 - mean\_absolute\_error: 0.0126124/126 [============================>.] - ETA: 0s - loss: 2.8451e-04 - mean\_absolute\_error: 0.0124126/126 [==============================] - 1s 9ms/step - loss: 2.8581e-04 - mean\_absolute\_error: 0.0124 - val\_loss: 1.3703e-04 - val\_mean\_absolute\_error: 0.0091  
Epoch 34/100  
 1/126 [..............................] - ETA: 1s - loss: 1.5726e-04 - mean\_absolute\_error: 0.0106 8/126 [>.............................] - ETA: 0s - loss: 2.0482e-04 - mean\_absolute\_error: 0.0108 15/126 [==>...........................] - ETA: 0s - loss: 2.3303e-04 - mean\_absolute\_error: 0.0114 22/126 [====>.........................] - ETA: 0s - loss: 2.7126e-04 - mean\_absolute\_error: 0.0118 29/126 [=====>........................] - ETA: 0s - loss: 2.6917e-04 - mean\_absolute\_error: 0.0115 36/126 [=======>......................] - ETA: 0s - loss: 2.6502e-04 - mean\_absolute\_error: 0.0116 42/126 [=========>....................] - ETA: 0s - loss: 2.7884e-04 - mean\_absolute\_error: 0.0120 48/126 [==========>...................] - ETA: 0s - loss: 2.8843e-04 - mean\_absolute\_error: 0.0123 55/126 [============>.................] - ETA: 0s - loss: 3.0112e-04 - mean\_absolute\_error: 0.0126 62/126 [=============>................] - ETA: 0s - loss: 3.0461e-04 - mean\_absolute\_error: 0.0126 69/126 [===============>..............] - ETA: 0s - loss: 2.9565e-04 - mean\_absolute\_error: 0.0125 75/126 [================>.............] - ETA: 0s - loss: 2.9001e-04 - mean\_absolute\_error: 0.0123 81/126 [==================>...........] - ETA: 0s - loss: 2.8436e-04 - mean\_absolute\_error: 0.0122 86/126 [===================>..........] - ETA: 0s - loss: 2.7913e-04 - mean\_absolute\_error: 0.0121 98/126 [======================>.......] - ETA: 0s - loss: 2.7398e-04 - mean\_absolute\_error: 0.0119114/126 [==========================>...] - ETA: 0s - loss: 2.7064e-04 - mean\_absolute\_error: 0.0119126/126 [==============================] - 1s 7ms/step - loss: 2.6580e-04 - mean\_absolute\_error: 0.0118 - val\_loss: 1.6977e-04 - val\_mean\_absolute\_error: 0.0106  
Epoch 35/100  
 1/126 [..............................] - ETA: 0s - loss: 3.6239e-04 - mean\_absolute\_error: 0.0148 17/126 [===>..........................] - ETA: 0s - loss: 2.3891e-04 - mean\_absolute\_error: 0.0116 32/126 [======>.......................] - ETA: 0s - loss: 2.6762e-04 - mean\_absolute\_error: 0.0117 48/126 [==========>...................] - ETA: 0s - loss: 2.7275e-04 - mean\_absolute\_error: 0.0118 64/126 [==============>...............] - ETA: 0s - loss: 2.8421e-04 - mean\_absolute\_error: 0.0123 80/126 [==================>...........] - ETA: 0s - loss: 2.8684e-04 - mean\_absolute\_error: 0.0123 95/126 [=====================>........] - ETA: 0s - loss: 2.7360e-04 - mean\_absolute\_error: 0.0121109/126 [========================>.....] - ETA: 0s - loss: 2.7864e-04 - mean\_absolute\_error: 0.0121124/126 [============================>.] - ETA: 0s - loss: 2.7715e-04 - mean\_absolute\_error: 0.0122126/126 [==============================] - 0s 4ms/step - loss: 2.7669e-04 - mean\_absolute\_error: 0.0122 - val\_loss: 2.4914e-04 - val\_mean\_absolute\_error: 0.0129  
Epoch 36/100  
 1/126 [..............................] - ETA: 0s - loss: 2.7927e-04 - mean\_absolute\_error: 0.0131 13/126 [==>...........................] - ETA: 0s - loss: 3.3354e-04 - mean\_absolute\_error: 0.0144 26/126 [=====>........................] - ETA: 0s - loss: 3.3423e-04 - mean\_absolute\_error: 0.0141 40/126 [========>.....................] - ETA: 0s - loss: 2.9316e-04 - mean\_absolute\_error: 0.0130 54/126 [===========>..................] - ETA: 0s - loss: 2.8371e-04 - mean\_absolute\_error: 0.0126 69/126 [===============>..............] - ETA: 0s - loss: 2.9069e-04 - mean\_absolute\_error: 0.0126 85/126 [===================>..........] - ETA: 0s - loss: 2.9470e-04 - mean\_absolute\_error: 0.0125 99/126 [======================>.......] - ETA: 0s - loss: 2.9673e-04 - mean\_absolute\_error: 0.0126114/126 [==========================>...] - ETA: 0s - loss: 2.8224e-04 - mean\_absolute\_error: 0.0123126/126 [==============================] - 1s 4ms/step - loss: 2.8316e-04 - mean\_absolute\_error: 0.0123 - val\_loss: 1.3258e-04 - val\_mean\_absolute\_error: 0.0092  
Epoch 37/100  
 1/126 [..............................] - ETA: 0s - loss: 2.0181e-04 - mean\_absolute\_error: 0.0112 16/126 [==>...........................] - ETA: 0s - loss: 2.8319e-04 - mean\_absolute\_error: 0.0122 31/126 [======>.......................] - ETA: 0s - loss: 2.6510e-04 - mean\_absolute\_error: 0.0121 46/126 [=========>....................] - ETA: 0s - loss: 2.5673e-04 - mean\_absolute\_error: 0.0120 60/126 [=============>................] - ETA: 0s - loss: 2.6382e-04 - mean\_absolute\_error: 0.0120 72/126 [================>.............] - ETA: 0s - loss: 2.7297e-04 - mean\_absolute\_error: 0.0120 86/126 [===================>..........] - ETA: 0s - loss: 2.6696e-04 - mean\_absolute\_error: 0.0120101/126 [=======================>......] - ETA: 0s - loss: 2.5630e-04 - mean\_absolute\_error: 0.0118116/126 [==========================>...] - ETA: 0s - loss: 2.6245e-04 - mean\_absolute\_error: 0.0118126/126 [==============================] - 1s 4ms/step - loss: 2.6013e-04 - mean\_absolute\_error: 0.0118 - val\_loss: 1.2330e-04 - val\_mean\_absolute\_error: 0.0086  
Epoch 38/100  
 1/126 [..............................] - ETA: 0s - loss: 3.5534e-04 - mean\_absolute\_error: 0.0141 16/126 [==>...........................] - ETA: 0s - loss: 3.0650e-04 - mean\_absolute\_error: 0.0123 31/126 [======>.......................] - ETA: 0s - loss: 2.9940e-04 - mean\_absolute\_error: 0.0121 45/126 [=========>....................] - ETA: 0s - loss: 2.7619e-04 - mean\_absolute\_error: 0.0119 61/126 [=============>................] - ETA: 0s - loss: 2.6789e-04 - mean\_absolute\_error: 0.0119 76/126 [=================>............] - ETA: 0s - loss: 2.5957e-04 - mean\_absolute\_error: 0.0116 91/126 [====================>.........] - ETA: 0s - loss: 2.5396e-04 - mean\_absolute\_error: 0.0116106/126 [========================>.....] - ETA: 0s - loss: 2.4869e-04 - mean\_absolute\_error: 0.0114121/126 [===========================>..] - ETA: 0s - loss: 2.4962e-04 - mean\_absolute\_error: 0.0114126/126 [==============================] - 0s 4ms/step - loss: 2.4889e-04 - mean\_absolute\_error: 0.0114 - val\_loss: 2.0154e-04 - val\_mean\_absolute\_error: 0.0114  
Epoch 39/100  
 1/126 [..............................] - ETA: 0s - loss: 3.8863e-04 - mean\_absolute\_error: 0.0153 16/126 [==>...........................] - ETA: 0s - loss: 3.4006e-04 - mean\_absolute\_error: 0.0131 32/126 [======>.......................] - ETA: 0s - loss: 3.2488e-04 - mean\_absolute\_error: 0.0132 48/126 [==========>...................] - ETA: 0s - loss: 2.8785e-04 - mean\_absolute\_error: 0.0125 63/126 [==============>...............] - ETA: 0s - loss: 2.7134e-04 - mean\_absolute\_error: 0.0121 77/126 [=================>............] - ETA: 0s - loss: 2.6380e-04 - mean\_absolute\_error: 0.0119 92/126 [====================>.........] - ETA: 0s - loss: 2.6327e-04 - mean\_absolute\_error: 0.0118105/126 [========================>.....] - ETA: 0s - loss: 2.6778e-04 - mean\_absolute\_error: 0.0119119/126 [===========================>..] - ETA: 0s - loss: 2.7031e-04 - mean\_absolute\_error: 0.0120126/126 [==============================] - 0s 4ms/step - loss: 2.6946e-04 - mean\_absolute\_error: 0.0120 - val\_loss: 1.6729e-04 - val\_mean\_absolute\_error: 0.0105  
Epoch 40/100  
 1/126 [..............................] - ETA: 0s - loss: 3.1059e-04 - mean\_absolute\_error: 0.0135 17/126 [===>..........................] - ETA: 0s - loss: 3.6060e-04 - mean\_absolute\_error: 0.0136 34/126 [=======>......................] - ETA: 0s - loss: 3.1884e-04 - mean\_absolute\_error: 0.0130 52/126 [===========>..................] - ETA: 0s - loss: 2.6991e-04 - mean\_absolute\_error: 0.0120 69/126 [===============>..............] - ETA: 0s - loss: 2.5980e-04 - mean\_absolute\_error: 0.0119 82/126 [==================>...........] - ETA: 0s - loss: 2.5608e-04 - mean\_absolute\_error: 0.0117 98/126 [======================>.......] - ETA: 0s - loss: 2.6118e-04 - mean\_absolute\_error: 0.0117113/126 [=========================>....] - ETA: 0s - loss: 2.5493e-04 - mean\_absolute\_error: 0.0117126/126 [==============================] - 0s 4ms/step - loss: 2.5756e-04 - mean\_absolute\_error: 0.0116 - val\_loss: 1.1866e-04 - val\_mean\_absolute\_error: 0.0086  
Epoch 41/100  
 1/126 [..............................] - ETA: 0s - loss: 2.2125e-04 - mean\_absolute\_error: 0.0111 17/126 [===>..........................] - ETA: 0s - loss: 2.4639e-04 - mean\_absolute\_error: 0.0116 32/126 [======>.......................] - ETA: 0s - loss: 3.0179e-04 - mean\_absolute\_error: 0.0126 46/126 [=========>....................] - ETA: 0s - loss: 3.0263e-04 - mean\_absolute\_error: 0.0125 60/126 [=============>................] - ETA: 0s - loss: 2.7804e-04 - mean\_absolute\_error: 0.0122 75/126 [================>.............] - ETA: 0s - loss: 2.7559e-04 - mean\_absolute\_error: 0.0121 90/126 [====================>.........] - ETA: 0s - loss: 2.6975e-04 - mean\_absolute\_error: 0.0120102/126 [=======================>......] - ETA: 0s - loss: 2.6611e-04 - mean\_absolute\_error: 0.0119114/126 [==========================>...] - ETA: 0s - loss: 2.6835e-04 - mean\_absolute\_error: 0.0120126/126 [==============================] - ETA: 0s - loss: 2.7017e-04 - mean\_absolute\_error: 0.0120126/126 [==============================] - 1s 4ms/step - loss: 2.7017e-04 - mean\_absolute\_error: 0.0120 - val\_loss: 1.3666e-04 - val\_mean\_absolute\_error: 0.0094  
Epoch 42/100  
 1/126 [..............................] - ETA: 0s - loss: 2.4519e-04 - mean\_absolute\_error: 0.0116 14/126 [==>...........................] - ETA: 0s - loss: 2.4316e-04 - mean\_absolute\_error: 0.0118 27/126 [=====>........................] - ETA: 0s - loss: 2.1694e-04 - mean\_absolute\_error: 0.0112 41/126 [========>.....................] - ETA: 0s - loss: 2.3273e-04 - mean\_absolute\_error: 0.0112 54/126 [===========>..................] - ETA: 0s - loss: 2.3440e-04 - mean\_absolute\_error: 0.0113 70/126 [===============>..............] - ETA: 0s - loss: 2.2956e-04 - mean\_absolute\_error: 0.0113 86/126 [===================>..........] - ETA: 0s - loss: 2.4045e-04 - mean\_absolute\_error: 0.0115101/126 [=======================>......] - ETA: 0s - loss: 2.4817e-04 - mean\_absolute\_error: 0.0116118/126 [===========================>..] - ETA: 0s - loss: 2.5315e-04 - mean\_absolute\_error: 0.0116126/126 [==============================] - 0s 4ms/step - loss: 2.5453e-04 - mean\_absolute\_error: 0.0116 - val\_loss: 2.5605e-04 - val\_mean\_absolute\_error: 0.0135  
Epoch 43/100  
 1/126 [..............................] - ETA: 0s - loss: 2.8258e-04 - mean\_absolute\_error: 0.0140 17/126 [===>..........................] - ETA: 0s - loss: 2.5443e-04 - mean\_absolute\_error: 0.0116 34/126 [=======>......................] - ETA: 0s - loss: 2.4221e-04 - mean\_absolute\_error: 0.0113 53/126 [===========>..................] - ETA: 0s - loss: 2.5578e-04 - mean\_absolute\_error: 0.0116 72/126 [================>.............] - ETA: 0s - loss: 2.4814e-04 - mean\_absolute\_error: 0.0114 90/126 [====================>.........] - ETA: 0s - loss: 2.4910e-04 - mean\_absolute\_error: 0.0114106/126 [========================>.....] - ETA: 0s - loss: 2.4476e-04 - mean\_absolute\_error: 0.0113121/126 [===========================>..] - ETA: 0s - loss: 2.4795e-04 - mean\_absolute\_error: 0.0113126/126 [==============================] - 0s 3ms/step - loss: 2.4955e-04 - mean\_absolute\_error: 0.0114 - val\_loss: 1.2032e-04 - val\_mean\_absolute\_error: 0.0087  
Epoch 44/100  
 1/126 [..............................] - ETA: 0s - loss: 2.9782e-04 - mean\_absolute\_error: 0.0116 14/126 [==>...........................] - ETA: 0s - loss: 2.8261e-04 - mean\_absolute\_error: 0.0118 29/126 [=====>........................] - ETA: 0s - loss: 2.7130e-04 - mean\_absolute\_error: 0.0122 47/126 [==========>...................] - ETA: 0s - loss: 2.6926e-04 - mean\_absolute\_error: 0.0121 65/126 [==============>...............] - ETA: 0s - loss: 2.6418e-04 - mean\_absolute\_error: 0.0120 82/126 [==================>...........] - ETA: 0s - loss: 2.5971e-04 - mean\_absolute\_error: 0.0119 99/126 [======================>.......] - ETA: 0s - loss: 2.5897e-04 - mean\_absolute\_error: 0.0119117/126 [==========================>...] - ETA: 0s - loss: 2.6699e-04 - mean\_absolute\_error: 0.0119126/126 [==============================] - 0s 3ms/step - loss: 2.6701e-04 - mean\_absolute\_error: 0.0119 - val\_loss: 1.6895e-04 - val\_mean\_absolute\_error: 0.0106  
Epoch 45/100  
 1/126 [..............................] - ETA: 0s - loss: 5.4919e-04 - mean\_absolute\_error: 0.0143 16/126 [==>...........................] - ETA: 0s - loss: 2.5849e-04 - mean\_absolute\_error: 0.0119 31/126 [======>.......................] - ETA: 0s - loss: 2.4930e-04 - mean\_absolute\_error: 0.0118 44/126 [=========>....................] - ETA: 0s - loss: 2.5165e-04 - mean\_absolute\_error: 0.0117 56/126 [============>.................] - ETA: 0s - loss: 2.5692e-04 - mean\_absolute\_error: 0.0119 69/126 [===============>..............] - ETA: 0s - loss: 2.6154e-04 - mean\_absolute\_error: 0.0119 81/126 [==================>...........] - ETA: 0s - loss: 2.5992e-04 - mean\_absolute\_error: 0.0118 94/126 [=====================>........] - ETA: 0s - loss: 2.5969e-04 - mean\_absolute\_error: 0.0117111/126 [=========================>....] - ETA: 0s - loss: 2.6546e-04 - mean\_absolute\_error: 0.0119126/126 [==============================] - ETA: 0s - loss: 2.6866e-04 - mean\_absolute\_error: 0.0120126/126 [==============================] - 1s 4ms/step - loss: 2.6866e-04 - mean\_absolute\_error: 0.0120 - val\_loss: 1.9764e-04 - val\_mean\_absolute\_error: 0.0116  
Epoch 46/100  
 1/126 [..............................] - ETA: 0s - loss: 2.3650e-04 - mean\_absolute\_error: 0.0122 16/126 [==>...........................] - ETA: 0s - loss: 2.7254e-04 - mean\_absolute\_error: 0.0125 31/126 [======>.......................] - ETA: 0s - loss: 2.6038e-04 - mean\_absolute\_error: 0.0118 47/126 [==========>...................] - ETA: 0s - loss: 2.5333e-04 - mean\_absolute\_error: 0.0119 63/126 [==============>...............] - ETA: 0s - loss: 2.4656e-04 - mean\_absolute\_error: 0.0117 81/126 [==================>...........] - ETA: 0s - loss: 2.6358e-04 - mean\_absolute\_error: 0.0117100/126 [======================>.......] - ETA: 0s - loss: 2.6717e-04 - mean\_absolute\_error: 0.0117119/126 [===========================>..] - ETA: 0s - loss: 2.6569e-04 - mean\_absolute\_error: 0.0118126/126 [==============================] - 0s 3ms/step - loss: 2.6726e-04 - mean\_absolute\_error: 0.0119 - val\_loss: 4.2929e-04 - val\_mean\_absolute\_error: 0.0181  
Epoch 47/100  
 1/126 [..............................] - ETA: 0s - loss: 0.0012 - mean\_absolute\_error: 0.0243 17/126 [===>..........................] - ETA: 0s - loss: 4.1393e-04 - mean\_absolute\_error: 0.0150 32/126 [======>.......................] - ETA: 0s - loss: 3.2696e-04 - mean\_absolute\_error: 0.0135 49/126 [==========>...................] - ETA: 0s - loss: 2.9378e-04 - mean\_absolute\_error: 0.0128 65/126 [==============>...............] - ETA: 0s - loss: 2.8502e-04 - mean\_absolute\_error: 0.0124 82/126 [==================>...........] - ETA: 0s - loss: 2.8014e-04 - mean\_absolute\_error: 0.0122101/126 [=======================>......] - ETA: 0s - loss: 2.7664e-04 - mean\_absolute\_error: 0.0120121/126 [===========================>..] - ETA: 0s - loss: 2.6559e-04 - mean\_absolute\_error: 0.0118126/126 [==============================] - 0s 3ms/step - loss: 2.6604e-04 - mean\_absolute\_error: 0.0118 - val\_loss: 3.9069e-04 - val\_mean\_absolute\_error: 0.0173  
Epoch 48/100  
 1/126 [..............................] - ETA: 0s - loss: 4.5733e-04 - mean\_absolute\_error: 0.0184 19/126 [===>..........................] - ETA: 0s - loss: 2.7753e-04 - mean\_absolute\_error: 0.0131 35/126 [=======>......................] - ETA: 0s - loss: 2.7206e-04 - mean\_absolute\_error: 0.0124 50/126 [==========>...................] - ETA: 0s - loss: 2.6975e-04 - mean\_absolute\_error: 0.0120 66/126 [==============>...............] - ETA: 0s - loss: 2.6805e-04 - mean\_absolute\_error: 0.0120 81/126 [==================>...........] - ETA: 0s - loss: 2.8680e-04 - mean\_absolute\_error: 0.0125 97/126 [======================>.......] - ETA: 0s - loss: 3.1565e-04 - mean\_absolute\_error: 0.0130115/126 [==========================>...] - ETA: 0s - loss: 3.0366e-04 - mean\_absolute\_error: 0.0128126/126 [==============================] - 0s 4ms/step - loss: 2.9584e-04 - mean\_absolute\_error: 0.0126 - val\_loss: 1.2647e-04 - val\_mean\_absolute\_error: 0.0090  
Epoch 49/100  
 1/126 [..............................] - ETA: 0s - loss: 1.5120e-04 - mean\_absolute\_error: 0.0102 16/126 [==>...........................] - ETA: 0s - loss: 1.7978e-04 - mean\_absolute\_error: 0.0101 30/126 [======>.......................] - ETA: 0s - loss: 1.9084e-04 - mean\_absolute\_error: 0.0103 44/126 [=========>....................] - ETA: 0s - loss: 2.2558e-04 - mean\_absolute\_error: 0.0107 59/126 [=============>................] - ETA: 0s - loss: 2.4425e-04 - mean\_absolute\_error: 0.0110 73/126 [================>.............] - ETA: 0s - loss: 2.4813e-04 - mean\_absolute\_error: 0.0110 88/126 [===================>..........] - ETA: 0s - loss: 2.4183e-04 - mean\_absolute\_error: 0.0110102/126 [=======================>......] - ETA: 0s - loss: 2.4055e-04 - mean\_absolute\_error: 0.0110116/126 [==========================>...] - ETA: 0s - loss: 2.4066e-04 - mean\_absolute\_error: 0.0111126/126 [==============================] - 1s 4ms/step - loss: 2.4211e-04 - mean\_absolute\_error: 0.0112 - val\_loss: 1.1454e-04 - val\_mean\_absolute\_error: 0.0084  
Epoch 50/100  
 1/126 [..............................] - ETA: 0s - loss: 1.4789e-04 - mean\_absolute\_error: 0.0098 15/126 [==>...........................] - ETA: 0s - loss: 2.9686e-04 - mean\_absolute\_error: 0.0134 30/126 [======>.......................] - ETA: 0s - loss: 2.7867e-04 - mean\_absolute\_error: 0.0128 45/126 [=========>....................] - ETA: 0s - loss: 2.6125e-04 - mean\_absolute\_error: 0.0123 59/126 [=============>................] - ETA: 0s - loss: 2.5677e-04 - mean\_absolute\_error: 0.0121 73/126 [================>.............] - ETA: 0s - loss: 2.5916e-04 - mean\_absolute\_error: 0.0120 88/126 [===================>..........] - ETA: 0s - loss: 2.6244e-04 - mean\_absolute\_error: 0.0118102/126 [=======================>......] - ETA: 0s - loss: 2.5595e-04 - mean\_absolute\_error: 0.0117116/126 [==========================>...] - ETA: 0s - loss: 2.6065e-04 - mean\_absolute\_error: 0.0118126/126 [==============================] - 1s 4ms/step - loss: 2.6040e-04 - mean\_absolute\_error: 0.0118 - val\_loss: 1.3556e-04 - val\_mean\_absolute\_error: 0.0091  
Epoch 51/100  
 1/126 [..............................] - ETA: 0s - loss: 1.9551e-04 - mean\_absolute\_error: 0.0105 16/126 [==>...........................] - ETA: 0s - loss: 2.0899e-04 - mean\_absolute\_error: 0.0107 30/126 [======>.......................] - ETA: 0s - loss: 2.2406e-04 - mean\_absolute\_error: 0.0112 44/126 [=========>....................] - ETA: 0s - loss: 2.4486e-04 - mean\_absolute\_error: 0.0117 59/126 [=============>................] - ETA: 0s - loss: 2.6297e-04 - mean\_absolute\_error: 0.0119 74/126 [================>.............] - ETA: 0s - loss: 2.6080e-04 - mean\_absolute\_error: 0.0117 88/126 [===================>..........] - ETA: 0s - loss: 2.5820e-04 - mean\_absolute\_error: 0.0116103/126 [=======================>......] - ETA: 0s - loss: 2.5445e-04 - mean\_absolute\_error: 0.0116117/126 [==========================>...] - ETA: 0s - loss: 2.5540e-04 - mean\_absolute\_error: 0.0116126/126 [==============================] - 0s 4ms/step - loss: 2.6000e-04 - mean\_absolute\_error: 0.0117 - val\_loss: 2.5049e-04 - val\_mean\_absolute\_error: 0.0131  
Epoch 52/100  
 1/126 [..............................] - ETA: 0s - loss: 2.5333e-04 - mean\_absolute\_error: 0.0123 16/126 [==>...........................] - ETA: 0s - loss: 4.1736e-04 - mean\_absolute\_error: 0.0162 31/126 [======>.......................] - ETA: 0s - loss: 3.4189e-04 - mean\_absolute\_error: 0.0139 45/126 [=========>....................] - ETA: 0s - loss: 3.0684e-04 - mean\_absolute\_error: 0.0129 60/126 [=============>................] - ETA: 0s - loss: 2.9244e-04 - mean\_absolute\_error: 0.0124 76/126 [=================>............] - ETA: 0s - loss: 2.7741e-04 - mean\_absolute\_error: 0.0121 90/126 [====================>.........] - ETA: 0s - loss: 2.7730e-04 - mean\_absolute\_error: 0.0122105/126 [========================>.....] - ETA: 0s - loss: 2.8135e-04 - mean\_absolute\_error: 0.0123121/126 [===========================>..] - ETA: 0s - loss: 2.8985e-04 - mean\_absolute\_error: 0.0125126/126 [==============================] - 0s 4ms/step - loss: 2.9165e-04 - mean\_absolute\_error: 0.0126 - val\_loss: 3.2107e-04 - val\_mean\_absolute\_error: 0.0152  
Epoch 53/100  
 1/126 [..............................] - ETA: 0s - loss: 2.3193e-04 - mean\_absolute\_error: 0.0127 16/126 [==>...........................] - ETA: 0s - loss: 2.5292e-04 - mean\_absolute\_error: 0.0117 31/126 [======>.......................] - ETA: 0s - loss: 2.4470e-04 - mean\_absolute\_error: 0.0115 46/126 [=========>....................] - ETA: 0s - loss: 2.4208e-04 - mean\_absolute\_error: 0.0113 62/126 [=============>................] - ETA: 0s - loss: 2.4713e-04 - mean\_absolute\_error: 0.0112 77/126 [=================>............] - ETA: 0s - loss: 2.5241e-04 - mean\_absolute\_error: 0.0113 92/126 [====================>.........] - ETA: 0s - loss: 2.5000e-04 - mean\_absolute\_error: 0.0113107/126 [========================>.....] - ETA: 0s - loss: 2.4376e-04 - mean\_absolute\_error: 0.0112121/126 [===========================>..] - ETA: 0s - loss: 2.4647e-04 - mean\_absolute\_error: 0.0113126/126 [==============================] - 0s 4ms/step - loss: 2.4602e-04 - mean\_absolute\_error: 0.0113 - val\_loss: 2.3723e-04 - val\_mean\_absolute\_error: 0.0129  
Epoch 54/100  
 1/126 [..............................] - ETA: 0s - loss: 1.9579e-04 - mean\_absolute\_error: 0.0105 15/126 [==>...........................] - ETA: 0s - loss: 3.2796e-04 - mean\_absolute\_error: 0.0137 30/126 [======>.......................] - ETA: 0s - loss: 2.7909e-04 - mean\_absolute\_error: 0.0124 45/126 [=========>....................] - ETA: 0s - loss: 2.7978e-04 - mean\_absolute\_error: 0.0122 59/126 [=============>................] - ETA: 0s - loss: 2.6500e-04 - mean\_absolute\_error: 0.0120 74/126 [================>.............] - ETA: 0s - loss: 2.6609e-04 - mean\_absolute\_error: 0.0121 88/126 [===================>..........] - ETA: 0s - loss: 2.8117e-04 - mean\_absolute\_error: 0.0124104/126 [=======================>......] - ETA: 0s - loss: 2.9927e-04 - mean\_absolute\_error: 0.0129116/126 [==========================>...] - ETA: 0s - loss: 3.0660e-04 - mean\_absolute\_error: 0.0131126/126 [==============================] - 1s 4ms/step - loss: 3.0927e-04 - mean\_absolute\_error: 0.0131 - val\_loss: 2.0730e-04 - val\_mean\_absolute\_error: 0.0119  
Epoch 55/100  
 1/126 [..............................] - ETA: 0s - loss: 2.2363e-04 - mean\_absolute\_error: 0.0122 17/126 [===>..........................] - ETA: 0s - loss: 2.8411e-04 - mean\_absolute\_error: 0.0124 36/126 [=======>......................] - ETA: 0s - loss: 2.9948e-04 - mean\_absolute\_error: 0.0130 55/126 [============>.................] - ETA: 0s - loss: 3.3429e-04 - mean\_absolute\_error: 0.0136 72/126 [================>.............] - ETA: 0s - loss: 3.0722e-04 - mean\_absolute\_error: 0.0131 88/126 [===================>..........] - ETA: 0s - loss: 3.1208e-04 - mean\_absolute\_error: 0.0133103/126 [=======================>......] - ETA: 0s - loss: 3.0402e-04 - mean\_absolute\_error: 0.0131117/126 [==========================>...] - ETA: 0s - loss: 2.9791e-04 - mean\_absolute\_error: 0.0129126/126 [==============================] - 0s 4ms/step - loss: 2.9546e-04 - mean\_absolute\_error: 0.0128 - val\_loss: 1.2135e-04 - val\_mean\_absolute\_error: 0.0088  
Epoch 56/100  
 1/126 [..............................] - ETA: 0s - loss: 2.8738e-04 - mean\_absolute\_error: 0.0117 15/126 [==>...........................] - ETA: 0s - loss: 3.3426e-04 - mean\_absolute\_error: 0.0129 30/126 [======>.......................] - ETA: 0s - loss: 2.7684e-04 - mean\_absolute\_error: 0.0120 44/126 [=========>....................] - ETA: 0s - loss: 2.8891e-04 - mean\_absolute\_error: 0.0124 58/126 [============>.................] - ETA: 0s - loss: 2.8363e-04 - mean\_absolute\_error: 0.0122 72/126 [================>.............] - ETA: 0s - loss: 2.6286e-04 - mean\_absolute\_error: 0.0117 87/126 [===================>..........] - ETA: 0s - loss: 2.5593e-04 - mean\_absolute\_error: 0.0115102/126 [=======================>......] - ETA: 0s - loss: 2.4858e-04 - mean\_absolute\_error: 0.0114117/126 [==========================>...] - ETA: 0s - loss: 2.5352e-04 - mean\_absolute\_error: 0.0116126/126 [==============================] - 0s 4ms/step - loss: 2.4879e-04 - mean\_absolute\_error: 0.0114 - val\_loss: 1.1330e-04 - val\_mean\_absolute\_error: 0.0083  
Epoch 57/100  
 1/126 [..............................] - ETA: 0s - loss: 2.5830e-04 - mean\_absolute\_error: 0.0119 15/126 [==>...........................] - ETA: 0s - loss: 2.5412e-04 - mean\_absolute\_error: 0.0116 29/126 [=====>........................] - ETA: 0s - loss: 2.3517e-04 - mean\_absolute\_error: 0.0111 44/126 [=========>....................] - ETA: 0s - loss: 2.3630e-04 - mean\_absolute\_error: 0.0110 59/126 [=============>................] - ETA: 0s - loss: 2.3410e-04 - mean\_absolute\_error: 0.0111 74/126 [================>.............] - ETA: 0s - loss: 2.4813e-04 - mean\_absolute\_error: 0.0115 89/126 [====================>.........] - ETA: 0s - loss: 2.4801e-04 - mean\_absolute\_error: 0.0116103/126 [=======================>......] - ETA: 0s - loss: 2.5010e-04 - mean\_absolute\_error: 0.0115118/126 [===========================>..] - ETA: 0s - loss: 2.4779e-04 - mean\_absolute\_error: 0.0114126/126 [==============================] - 0s 4ms/step - loss: 2.4745e-04 - mean\_absolute\_error: 0.0114 - val\_loss: 1.2744e-04 - val\_mean\_absolute\_error: 0.0090  
Epoch 58/100  
 1/126 [..............................] - ETA: 0s - loss: 1.8701e-04 - mean\_absolute\_error: 0.0093 15/126 [==>...........................] - ETA: 0s - loss: 2.3977e-04 - mean\_absolute\_error: 0.0114 29/126 [=====>........................] - ETA: 0s - loss: 2.5341e-04 - mean\_absolute\_error: 0.0114 43/126 [=========>....................] - ETA: 0s - loss: 2.5933e-04 - mean\_absolute\_error: 0.0118 58/126 [============>.................] - ETA: 0s - loss: 2.6117e-04 - mean\_absolute\_error: 0.0120 72/126 [================>.............] - ETA: 0s - loss: 2.5616e-04 - mean\_absolute\_error: 0.0118 84/126 [===================>..........] - ETA: 0s - loss: 2.6295e-04 - mean\_absolute\_error: 0.0120 96/126 [=====================>........] - ETA: 0s - loss: 2.6303e-04 - mean\_absolute\_error: 0.0120108/126 [========================>.....] - ETA: 0s - loss: 2.6166e-04 - mean\_absolute\_error: 0.0119120/126 [===========================>..] - ETA: 0s - loss: 2.6216e-04 - mean\_absolute\_error: 0.0118126/126 [==============================] - 1s 4ms/step - loss: 2.5910e-04 - mean\_absolute\_error: 0.0117 - val\_loss: 1.1290e-04 - val\_mean\_absolute\_error: 0.0083  
Epoch 59/100  
 1/126 [..............................] - ETA: 0s - loss: 1.5812e-04 - mean\_absolute\_error: 0.0097 16/126 [==>...........................] - ETA: 0s - loss: 2.3268e-04 - mean\_absolute\_error: 0.0111 31/126 [======>.......................] - ETA: 0s - loss: 2.8650e-04 - mean\_absolute\_error: 0.0118 46/126 [=========>....................] - ETA: 0s - loss: 2.7266e-04 - mean\_absolute\_error: 0.0120 61/126 [=============>................] - ETA: 0s - loss: 2.6289e-04 - mean\_absolute\_error: 0.0119 76/126 [=================>............] - ETA: 0s - loss: 2.7440e-04 - mean\_absolute\_error: 0.0122 91/126 [====================>.........] - ETA: 0s - loss: 2.6691e-04 - mean\_absolute\_error: 0.0120106/126 [========================>.....] - ETA: 0s - loss: 2.5757e-04 - mean\_absolute\_error: 0.0117121/126 [===========================>..] - ETA: 0s - loss: 2.5565e-04 - mean\_absolute\_error: 0.0117126/126 [==============================] - 0s 4ms/step - loss: 2.5537e-04 - mean\_absolute\_error: 0.0117 - val\_loss: 2.8786e-04 - val\_mean\_absolute\_error: 0.0143  
Epoch 60/100  
 1/126 [..............................] - ETA: 0s - loss: 2.6196e-04 - mean\_absolute\_error: 0.0132 16/126 [==>...........................] - ETA: 0s - loss: 2.6404e-04 - mean\_absolute\_error: 0.0117 32/126 [======>.......................] - ETA: 0s - loss: 2.4988e-04 - mean\_absolute\_error: 0.0113 48/126 [==========>...................] - ETA: 0s - loss: 2.4353e-04 - mean\_absolute\_error: 0.0111 63/126 [==============>...............] - ETA: 0s - loss: 2.5640e-04 - mean\_absolute\_error: 0.0112 79/126 [=================>............] - ETA: 0s - loss: 2.5484e-04 - mean\_absolute\_error: 0.0114 94/126 [=====================>........] - ETA: 0s - loss: 2.5808e-04 - mean\_absolute\_error: 0.0116109/126 [========================>.....] - ETA: 0s - loss: 2.5764e-04 - mean\_absolute\_error: 0.0116124/126 [============================>.] - ETA: 0s - loss: 2.5295e-04 - mean\_absolute\_error: 0.0116126/126 [==============================] - 0s 4ms/step - loss: 2.5355e-04 - mean\_absolute\_error: 0.0116 - val\_loss: 1.5398e-04 - val\_mean\_absolute\_error: 0.0101  
Epoch 61/100  
 1/126 [..............................] - ETA: 0s - loss: 2.0202e-04 - mean\_absolute\_error: 0.0116 16/126 [==>...........................] - ETA: 0s - loss: 2.6425e-04 - mean\_absolute\_error: 0.0123 30/126 [======>.......................] - ETA: 0s - loss: 2.6491e-04 - mean\_absolute\_error: 0.0121 44/126 [=========>....................] - ETA: 0s - loss: 2.6002e-04 - mean\_absolute\_error: 0.0117 59/126 [=============>................] - ETA: 0s - loss: 2.7797e-04 - mean\_absolute\_error: 0.0121 74/126 [================>.............] - ETA: 0s - loss: 2.7900e-04 - mean\_absolute\_error: 0.0122 88/126 [===================>..........] - ETA: 0s - loss: 2.6875e-04 - mean\_absolute\_error: 0.0120102/126 [=======================>......] - ETA: 0s - loss: 2.6658e-04 - mean\_absolute\_error: 0.0119116/126 [==========================>...] - ETA: 0s - loss: 2.6901e-04 - mean\_absolute\_error: 0.0120126/126 [==============================] - 0s 4ms/step - loss: 2.6667e-04 - mean\_absolute\_error: 0.0120 - val\_loss: 1.5744e-04 - val\_mean\_absolute\_error: 0.0099  
Epoch 62/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0581e-04 - mean\_absolute\_error: 0.0080 15/126 [==>...........................] - ETA: 0s - loss: 2.7085e-04 - mean\_absolute\_error: 0.0116 30/126 [======>.......................] - ETA: 0s - loss: 2.8318e-04 - mean\_absolute\_error: 0.0117 44/126 [=========>....................] - ETA: 0s - loss: 2.7485e-04 - mean\_absolute\_error: 0.0116 59/126 [=============>................] - ETA: 0s - loss: 2.5625e-04 - mean\_absolute\_error: 0.0114 74/126 [================>.............] - ETA: 0s - loss: 2.7031e-04 - mean\_absolute\_error: 0.0119 90/126 [====================>.........] - ETA: 0s - loss: 2.6532e-04 - mean\_absolute\_error: 0.0118105/126 [========================>.....] - ETA: 0s - loss: 2.6097e-04 - mean\_absolute\_error: 0.0117120/126 [===========================>..] - ETA: 0s - loss: 2.5829e-04 - mean\_absolute\_error: 0.0117126/126 [==============================] - 0s 4ms/step - loss: 2.5567e-04 - mean\_absolute\_error: 0.0116 - val\_loss: 1.4503e-04 - val\_mean\_absolute\_error: 0.0094  
Epoch 63/100  
 1/126 [..............................] - ETA: 0s - loss: 3.7118e-04 - mean\_absolute\_error: 0.0129 15/126 [==>...........................] - ETA: 0s - loss: 2.6132e-04 - mean\_absolute\_error: 0.0117 30/126 [======>.......................] - ETA: 0s - loss: 2.4488e-04 - mean\_absolute\_error: 0.0112 45/126 [=========>....................] - ETA: 0s - loss: 2.3564e-04 - mean\_absolute\_error: 0.0110 60/126 [=============>................] - ETA: 0s - loss: 2.3202e-04 - mean\_absolute\_error: 0.0109 75/126 [================>.............] - ETA: 0s - loss: 2.3441e-04 - mean\_absolute\_error: 0.0110 90/126 [====================>.........] - ETA: 0s - loss: 2.3668e-04 - mean\_absolute\_error: 0.0110105/126 [========================>.....] - ETA: 0s - loss: 2.2719e-04 - mean\_absolute\_error: 0.0109120/126 [===========================>..] - ETA: 0s - loss: 2.2786e-04 - mean\_absolute\_error: 0.0109126/126 [==============================] - 0s 4ms/step - loss: 2.3080e-04 - mean\_absolute\_error: 0.0110 - val\_loss: 1.1018e-04 - val\_mean\_absolute\_error: 0.0083  
Epoch 64/100  
 1/126 [..............................] - ETA: 0s - loss: 2.0120e-04 - mean\_absolute\_error: 0.0106 16/126 [==>...........................] - ETA: 0s - loss: 2.3029e-04 - mean\_absolute\_error: 0.0109 31/126 [======>.......................] - ETA: 0s - loss: 2.1685e-04 - mean\_absolute\_error: 0.0108 46/126 [=========>....................] - ETA: 0s - loss: 2.0861e-04 - mean\_absolute\_error: 0.0106 60/126 [=============>................] - ETA: 0s - loss: 2.0468e-04 - mean\_absolute\_error: 0.0107 74/126 [================>.............] - ETA: 0s - loss: 2.1331e-04 - mean\_absolute\_error: 0.0107 89/126 [====================>.........] - ETA: 0s - loss: 2.1269e-04 - mean\_absolute\_error: 0.0107103/126 [=======================>......] - ETA: 0s - loss: 2.2065e-04 - mean\_absolute\_error: 0.0110118/126 [===========================>..] - ETA: 0s - loss: 2.3664e-04 - mean\_absolute\_error: 0.0112126/126 [==============================] - 0s 4ms/step - loss: 2.3481e-04 - mean\_absolute\_error: 0.0112 - val\_loss: 1.2577e-04 - val\_mean\_absolute\_error: 0.0087  
Epoch 65/100  
 1/126 [..............................] - ETA: 0s - loss: 1.7415e-04 - mean\_absolute\_error: 0.0106 16/126 [==>...........................] - ETA: 0s - loss: 2.2901e-04 - mean\_absolute\_error: 0.0113 30/126 [======>.......................] - ETA: 0s - loss: 2.0970e-04 - mean\_absolute\_error: 0.0108 44/126 [=========>....................] - ETA: 0s - loss: 2.2555e-04 - mean\_absolute\_error: 0.0111 59/126 [=============>................] - ETA: 0s - loss: 2.3006e-04 - mean\_absolute\_error: 0.0112 74/126 [================>.............] - ETA: 0s - loss: 2.4237e-04 - mean\_absolute\_error: 0.0114 88/126 [===================>..........] - ETA: 0s - loss: 2.4706e-04 - mean\_absolute\_error: 0.0115103/126 [=======================>......] - ETA: 0s - loss: 2.3979e-04 - mean\_absolute\_error: 0.0114117/126 [==========================>...] - ETA: 0s - loss: 2.5499e-04 - mean\_absolute\_error: 0.0116126/126 [==============================] - 0s 4ms/step - loss: 2.6205e-04 - mean\_absolute\_error: 0.0118 - val\_loss: 1.3239e-04 - val\_mean\_absolute\_error: 0.0093  
Epoch 66/100  
 1/126 [..............................] - ETA: 0s - loss: 1.3910e-04 - mean\_absolute\_error: 0.0095 16/126 [==>...........................] - ETA: 0s - loss: 2.1324e-04 - mean\_absolute\_error: 0.0109 30/126 [======>.......................] - ETA: 0s - loss: 2.0784e-04 - mean\_absolute\_error: 0.0105 44/126 [=========>....................] - ETA: 0s - loss: 2.4747e-04 - mean\_absolute\_error: 0.0117 59/126 [=============>................] - ETA: 0s - loss: 2.9041e-04 - mean\_absolute\_error: 0.0125 74/126 [================>.............] - ETA: 0s - loss: 2.9835e-04 - mean\_absolute\_error: 0.0128 89/126 [====================>.........] - ETA: 0s - loss: 3.3064e-04 - mean\_absolute\_error: 0.0137103/126 [=======================>......] - ETA: 0s - loss: 3.1770e-04 - mean\_absolute\_error: 0.0133118/126 [===========================>..] - ETA: 0s - loss: 3.1834e-04 - mean\_absolute\_error: 0.0133126/126 [==============================] - 0s 4ms/step - loss: 3.2205e-04 - mean\_absolute\_error: 0.0134 - val\_loss: 1.6323e-04 - val\_mean\_absolute\_error: 0.0104  
Epoch 67/100  
 1/126 [..............................] - ETA: 0s - loss: 2.0840e-04 - mean\_absolute\_error: 0.0112 15/126 [==>...........................] - ETA: 0s - loss: 2.4672e-04 - mean\_absolute\_error: 0.0120 29/126 [=====>........................] - ETA: 0s - loss: 2.2377e-04 - mean\_absolute\_error: 0.0111 43/126 [=========>....................] - ETA: 0s - loss: 2.2674e-04 - mean\_absolute\_error: 0.0113 57/126 [============>.................] - ETA: 0s - loss: 2.4409e-04 - mean\_absolute\_error: 0.0118 71/126 [===============>..............] - ETA: 0s - loss: 2.5102e-04 - mean\_absolute\_error: 0.0120 85/126 [===================>..........] - ETA: 0s - loss: 2.4310e-04 - mean\_absolute\_error: 0.0117100/126 [======================>.......] - ETA: 0s - loss: 2.3809e-04 - mean\_absolute\_error: 0.0116115/126 [==========================>...] - ETA: 0s - loss: 2.4461e-04 - mean\_absolute\_error: 0.0116126/126 [==============================] - 1s 4ms/step - loss: 2.4959e-04 - mean\_absolute\_error: 0.0117 - val\_loss: 2.1241e-04 - val\_mean\_absolute\_error: 0.0121  
Epoch 68/100  
 1/126 [..............................] - ETA: 0s - loss: 3.9725e-04 - mean\_absolute\_error: 0.0154 14/126 [==>...........................] - ETA: 0s - loss: 2.6607e-04 - mean\_absolute\_error: 0.0111 28/126 [=====>........................] - ETA: 0s - loss: 2.8772e-04 - mean\_absolute\_error: 0.0121 42/126 [=========>....................] - ETA: 0s - loss: 2.6604e-04 - mean\_absolute\_error: 0.0118 55/126 [============>.................] - ETA: 0s - loss: 2.5247e-04 - mean\_absolute\_error: 0.0115 71/126 [===============>..............] - ETA: 0s - loss: 2.4277e-04 - mean\_absolute\_error: 0.0114 85/126 [===================>..........] - ETA: 0s - loss: 2.3777e-04 - mean\_absolute\_error: 0.0114100/126 [======================>.......] - ETA: 0s - loss: 2.3727e-04 - mean\_absolute\_error: 0.0113114/126 [==========================>...] - ETA: 0s - loss: 2.3277e-04 - mean\_absolute\_error: 0.0113126/126 [==============================] - 1s 4ms/step - loss: 2.4923e-04 - mean\_absolute\_error: 0.0115 - val\_loss: 1.0654e-04 - val\_mean\_absolute\_error: 0.0081  
Epoch 69/100  
 1/126 [..............................] - ETA: 0s - loss: 3.1139e-04 - mean\_absolute\_error: 0.0127 15/126 [==>...........................] - ETA: 0s - loss: 3.3059e-04 - mean\_absolute\_error: 0.0131 29/126 [=====>........................] - ETA: 0s - loss: 2.9587e-04 - mean\_absolute\_error: 0.0128 44/126 [=========>....................] - ETA: 0s - loss: 2.7024e-04 - mean\_absolute\_error: 0.0123 58/126 [============>.................] - ETA: 0s - loss: 2.5030e-04 - mean\_absolute\_error: 0.0118 73/126 [================>.............] - ETA: 0s - loss: 2.4714e-04 - mean\_absolute\_error: 0.0116 86/126 [===================>..........] - ETA: 0s - loss: 2.4280e-04 - mean\_absolute\_error: 0.0114101/126 [=======================>......] - ETA: 0s - loss: 2.4244e-04 - mean\_absolute\_error: 0.0113115/126 [==========================>...] - ETA: 0s - loss: 2.4423e-04 - mean\_absolute\_error: 0.0114126/126 [==============================] - 1s 4ms/step - loss: 2.4289e-04 - mean\_absolute\_error: 0.0113 - val\_loss: 1.0787e-04 - val\_mean\_absolute\_error: 0.0082  
Epoch 70/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1483e-04 - mean\_absolute\_error: 0.0083 14/126 [==>...........................] - ETA: 0s - loss: 2.1769e-04 - mean\_absolute\_error: 0.0098 27/126 [=====>........................] - ETA: 0s - loss: 2.3278e-04 - mean\_absolute\_error: 0.0104 40/126 [========>.....................] - ETA: 0s - loss: 2.2903e-04 - mean\_absolute\_error: 0.0106 53/126 [===========>..................] - ETA: 0s - loss: 2.2432e-04 - mean\_absolute\_error: 0.0107 65/126 [==============>...............] - ETA: 0s - loss: 2.3352e-04 - mean\_absolute\_error: 0.0109 78/126 [=================>............] - ETA: 0s - loss: 2.3944e-04 - mean\_absolute\_error: 0.0111 90/126 [====================>.........] - ETA: 0s - loss: 2.4590e-04 - mean\_absolute\_error: 0.0113102/126 [=======================>......] - ETA: 0s - loss: 2.4394e-04 - mean\_absolute\_error: 0.0113116/126 [==========================>...] - ETA: 0s - loss: 2.4107e-04 - mean\_absolute\_error: 0.0112126/126 [==============================] - 1s 4ms/step - loss: 2.4030e-04 - mean\_absolute\_error: 0.0112 - val\_loss: 1.5862e-04 - val\_mean\_absolute\_error: 0.0103  
Epoch 71/100  
 1/126 [..............................] - ETA: 0s - loss: 3.9206e-04 - mean\_absolute\_error: 0.0150 16/126 [==>...........................] - ETA: 0s - loss: 2.2296e-04 - mean\_absolute\_error: 0.0109 30/126 [======>.......................] - ETA: 0s - loss: 2.4353e-04 - mean\_absolute\_error: 0.0114 43/126 [=========>....................] - ETA: 0s - loss: 2.2298e-04 - mean\_absolute\_error: 0.0109 50/126 [==========>...................] - ETA: 0s - loss: 2.2055e-04 - mean\_absolute\_error: 0.0109 56/126 [============>.................] - ETA: 0s - loss: 2.3766e-04 - mean\_absolute\_error: 0.0111 62/126 [=============>................] - ETA: 0s - loss: 2.4122e-04 - mean\_absolute\_error: 0.0111 68/126 [===============>..............] - ETA: 0s - loss: 2.3454e-04 - mean\_absolute\_error: 0.0110 74/126 [================>.............] - ETA: 0s - loss: 2.3193e-04 - mean\_absolute\_error: 0.0110 80/126 [==================>...........] - ETA: 0s - loss: 2.3595e-04 - mean\_absolute\_error: 0.0110 86/126 [===================>..........] - ETA: 0s - loss: 2.3354e-04 - mean\_absolute\_error: 0.0110 92/126 [====================>.........] - ETA: 0s - loss: 2.3834e-04 - mean\_absolute\_error: 0.0111 98/126 [======================>.......] - ETA: 0s - loss: 2.3430e-04 - mean\_absolute\_error: 0.0110104/126 [=======================>......] - ETA: 0s - loss: 2.4031e-04 - mean\_absolute\_error: 0.0111110/126 [=========================>....] - ETA: 0s - loss: 2.4043e-04 - mean\_absolute\_error: 0.0112116/126 [==========================>...] - ETA: 0s - loss: 2.3975e-04 - mean\_absolute\_error: 0.0112122/126 [============================>.] - ETA: 0s - loss: 2.3836e-04 - mean\_absolute\_error: 0.0112126/126 [==============================] - 1s 8ms/step - loss: 2.3626e-04 - mean\_absolute\_error: 0.0111 - val\_loss: 1.1823e-04 - val\_mean\_absolute\_error: 0.0087  
Epoch 72/100  
 1/126 [..............................] - ETA: 1s - loss: 2.0473e-04 - mean\_absolute\_error: 0.0107 7/126 [>.............................] - ETA: 1s - loss: 2.0346e-04 - mean\_absolute\_error: 0.0106 13/126 [==>...........................] - ETA: 1s - loss: 1.7137e-04 - mean\_absolute\_error: 0.0098 19/126 [===>..........................] - ETA: 0s - loss: 1.8714e-04 - mean\_absolute\_error: 0.0099 25/126 [====>.........................] - ETA: 0s - loss: 1.9629e-04 - mean\_absolute\_error: 0.0101 31/126 [======>.......................] - ETA: 0s - loss: 2.0756e-04 - mean\_absolute\_error: 0.0103 37/126 [=======>......................] - ETA: 0s - loss: 2.0371e-04 - mean\_absolute\_error: 0.0103 43/126 [=========>....................] - ETA: 0s - loss: 2.0646e-04 - mean\_absolute\_error: 0.0105 49/126 [==========>...................] - ETA: 0s - loss: 1.9813e-04 - mean\_absolute\_error: 0.0103 55/126 [============>.................] - ETA: 0s - loss: 1.9763e-04 - mean\_absolute\_error: 0.0103 61/126 [=============>................] - ETA: 0s - loss: 1.9736e-04 - mean\_absolute\_error: 0.0103 67/126 [==============>...............] - ETA: 0s - loss: 2.0846e-04 - mean\_absolute\_error: 0.0104 73/126 [================>.............] - ETA: 0s - loss: 2.1079e-04 - mean\_absolute\_error: 0.0103 79/126 [=================>............] - ETA: 0s - loss: 2.0861e-04 - mean\_absolute\_error: 0.0103 85/126 [===================>..........] - ETA: 0s - loss: 2.0757e-04 - mean\_absolute\_error: 0.0103 91/126 [====================>.........] - ETA: 0s - loss: 2.1256e-04 - mean\_absolute\_error: 0.0103 97/126 [======================>.......] - ETA: 0s - loss: 2.1573e-04 - mean\_absolute\_error: 0.0104103/126 [=======================>......] - ETA: 0s - loss: 2.1259e-04 - mean\_absolute\_error: 0.0104109/126 [========================>.....] - ETA: 0s - loss: 2.1108e-04 - mean\_absolute\_error: 0.0104115/126 [==========================>...] - ETA: 0s - loss: 2.1091e-04 - mean\_absolute\_error: 0.0104121/126 [===========================>..] - ETA: 0s - loss: 2.1280e-04 - mean\_absolute\_error: 0.0105126/126 [==============================] - 1s 10ms/step - loss: 2.1418e-04 - mean\_absolute\_error: 0.0105 - val\_loss: 2.8573e-04 - val\_mean\_absolute\_error: 0.0143  
Epoch 73/100  
 1/126 [..............................] - ETA: 1s - loss: 4.1205e-04 - mean\_absolute\_error: 0.0163 8/126 [>.............................] - ETA: 0s - loss: 3.3679e-04 - mean\_absolute\_error: 0.0130 15/126 [==>...........................] - ETA: 0s - loss: 2.7669e-04 - mean\_absolute\_error: 0.0119 21/126 [====>.........................] - ETA: 0s - loss: 2.4258e-04 - mean\_absolute\_error: 0.0111 27/126 [=====>........................] - ETA: 0s - loss: 2.4317e-04 - mean\_absolute\_error: 0.0111 33/126 [======>.......................] - ETA: 0s - loss: 2.4316e-04 - mean\_absolute\_error: 0.0113 39/126 [========>.....................] - ETA: 0s - loss: 2.6369e-04 - mean\_absolute\_error: 0.0118 45/126 [=========>....................] - ETA: 0s - loss: 2.7748e-04 - mean\_absolute\_error: 0.0123 51/126 [===========>..................] - ETA: 0s - loss: 2.8472e-04 - mean\_absolute\_error: 0.0126 57/126 [============>.................] - ETA: 0s - loss: 3.0282e-04 - mean\_absolute\_error: 0.0131 63/126 [==============>...............] - ETA: 0s - loss: 3.1965e-04 - mean\_absolute\_error: 0.0135 69/126 [===============>..............] - ETA: 0s - loss: 3.2297e-04 - mean\_absolute\_error: 0.0136 75/126 [================>.............] - ETA: 0s - loss: 3.1175e-04 - mean\_absolute\_error: 0.0133 81/126 [==================>...........] - ETA: 0s - loss: 3.0198e-04 - mean\_absolute\_error: 0.0131 87/126 [===================>..........] - ETA: 0s - loss: 2.9628e-04 - mean\_absolute\_error: 0.0130 93/126 [=====================>........] - ETA: 0s - loss: 2.9743e-04 - mean\_absolute\_error: 0.0129100/126 [======================>.......] - ETA: 0s - loss: 2.9270e-04 - mean\_absolute\_error: 0.0127107/126 [========================>.....] - ETA: 0s - loss: 2.8654e-04 - mean\_absolute\_error: 0.0126114/126 [==========================>...] - ETA: 0s - loss: 2.8241e-04 - mean\_absolute\_error: 0.0124120/126 [===========================>..] - ETA: 0s - loss: 2.8020e-04 - mean\_absolute\_error: 0.0123126/126 [==============================] - ETA: 0s - loss: 2.7604e-04 - mean\_absolute\_error: 0.0123126/126 [==============================] - 1s 10ms/step - loss: 2.7604e-04 - mean\_absolute\_error: 0.0123 - val\_loss: 1.3058e-04 - val\_mean\_absolute\_error: 0.0089  
Epoch 74/100  
 1/126 [..............................] - ETA: 1s - loss: 1.8664e-04 - mean\_absolute\_error: 0.0102 7/126 [>.............................] - ETA: 1s - loss: 2.1626e-04 - mean\_absolute\_error: 0.0110 13/126 [==>...........................] - ETA: 0s - loss: 2.7327e-04 - mean\_absolute\_error: 0.0119 19/126 [===>..........................] - ETA: 0s - loss: 2.5532e-04 - mean\_absolute\_error: 0.0115 25/126 [====>.........................] - ETA: 0s - loss: 2.5804e-04 - mean\_absolute\_error: 0.0116 31/126 [======>.......................] - ETA: 0s - loss: 2.4762e-04 - mean\_absolute\_error: 0.0115 37/126 [=======>......................] - ETA: 0s - loss: 2.4153e-04 - mean\_absolute\_error: 0.0114 43/126 [=========>....................] - ETA: 0s - loss: 2.4043e-04 - mean\_absolute\_error: 0.0114 49/126 [==========>...................] - ETA: 0s - loss: 2.3843e-04 - mean\_absolute\_error: 0.0113 55/126 [============>.................] - ETA: 0s - loss: 2.4727e-04 - mean\_absolute\_error: 0.0116 61/126 [=============>................] - ETA: 0s - loss: 2.5214e-04 - mean\_absolute\_error: 0.0116 67/126 [==============>...............] - ETA: 0s - loss: 2.5076e-04 - mean\_absolute\_error: 0.0115 73/126 [================>.............] - ETA: 0s - loss: 2.4640e-04 - mean\_absolute\_error: 0.0115 79/126 [=================>............] - ETA: 0s - loss: 2.4017e-04 - mean\_absolute\_error: 0.0114 86/126 [===================>..........] - ETA: 0s - loss: 2.4019e-04 - mean\_absolute\_error: 0.0114 93/126 [=====================>........] - ETA: 0s - loss: 2.4268e-04 - mean\_absolute\_error: 0.0115 99/126 [======================>.......] - ETA: 0s - loss: 2.4210e-04 - mean\_absolute\_error: 0.0115105/126 [========================>.....] - ETA: 0s - loss: 2.4395e-04 - mean\_absolute\_error: 0.0115111/126 [=========================>....] - ETA: 0s - loss: 2.4647e-04 - mean\_absolute\_error: 0.0115118/126 [===========================>..] - ETA: 0s - loss: 2.4284e-04 - mean\_absolute\_error: 0.0114125/126 [============================>.] - ETA: 0s - loss: 2.3793e-04 - mean\_absolute\_error: 0.0113126/126 [==============================] - 1s 10ms/step - loss: 2.3756e-04 - mean\_absolute\_error: 0.0113 - val\_loss: 1.7211e-04 - val\_mean\_absolute\_error: 0.0108  
Epoch 75/100  
 1/126 [..............................] - ETA: 1s - loss: 2.2460e-04 - mean\_absolute\_error: 0.0129 7/126 [>.............................] - ETA: 1s - loss: 1.9658e-04 - mean\_absolute\_error: 0.0109 13/126 [==>...........................] - ETA: 0s - loss: 2.4509e-04 - mean\_absolute\_error: 0.0115 19/126 [===>..........................] - ETA: 0s - loss: 2.6120e-04 - mean\_absolute\_error: 0.0118 25/126 [====>.........................] - ETA: 0s - loss: 2.5732e-04 - mean\_absolute\_error: 0.0118 31/126 [======>.......................] - ETA: 0s - loss: 2.5509e-04 - mean\_absolute\_error: 0.0118 37/126 [=======>......................] - ETA: 0s - loss: 2.4567e-04 - mean\_absolute\_error: 0.0117 43/126 [=========>....................] - ETA: 0s - loss: 2.3804e-04 - mean\_absolute\_error: 0.0115 49/126 [==========>...................] - ETA: 0s - loss: 2.3472e-04 - mean\_absolute\_error: 0.0114 55/126 [============>.................] - ETA: 0s - loss: 2.3257e-04 - mean\_absolute\_error: 0.0114 61/126 [=============>................] - ETA: 0s - loss: 2.3137e-04 - mean\_absolute\_error: 0.0114 68/126 [===============>..............] - ETA: 0s - loss: 2.2787e-04 - mean\_absolute\_error: 0.0113 75/126 [================>.............] - ETA: 0s - loss: 2.2218e-04 - mean\_absolute\_error: 0.0112 82/126 [==================>...........] - ETA: 0s - loss: 2.2874e-04 - mean\_absolute\_error: 0.0112 89/126 [====================>.........] - ETA: 0s - loss: 2.3489e-04 - mean\_absolute\_error: 0.0113 96/126 [=====================>........] - ETA: 0s - loss: 2.3008e-04 - mean\_absolute\_error: 0.0112103/126 [=======================>......] - ETA: 0s - loss: 2.2714e-04 - mean\_absolute\_error: 0.0111110/126 [=========================>....] - ETA: 0s - loss: 2.2989e-04 - mean\_absolute\_error: 0.0112116/126 [==========================>...] - ETA: 0s - loss: 2.4000e-04 - mean\_absolute\_error: 0.0114123/126 [============================>.] - ETA: 0s - loss: 2.4592e-04 - mean\_absolute\_error: 0.0115126/126 [==============================] - 1s 9ms/step - loss: 2.4575e-04 - mean\_absolute\_error: 0.0115 - val\_loss: 1.0460e-04 - val\_mean\_absolute\_error: 0.0080  
Epoch 76/100  
 1/126 [..............................] - ETA: 0s - loss: 2.8755e-04 - mean\_absolute\_error: 0.0130 16/126 [==>...........................] - ETA: 0s - loss: 2.2489e-04 - mean\_absolute\_error: 0.0104 32/126 [======>.......................] - ETA: 0s - loss: 2.1964e-04 - mean\_absolute\_error: 0.0106 47/126 [==========>...................] - ETA: 0s - loss: 2.2265e-04 - mean\_absolute\_error: 0.0109 62/126 [=============>................] - ETA: 0s - loss: 2.2159e-04 - mean\_absolute\_error: 0.0110 77/126 [=================>............] - ETA: 0s - loss: 2.2933e-04 - mean\_absolute\_error: 0.0111 93/126 [=====================>........] - ETA: 0s - loss: 2.3512e-04 - mean\_absolute\_error: 0.0112108/126 [========================>.....] - ETA: 0s - loss: 2.3856e-04 - mean\_absolute\_error: 0.0113124/126 [============================>.] - ETA: 0s - loss: 2.4149e-04 - mean\_absolute\_error: 0.0114126/126 [==============================] - 0s 4ms/step - loss: 2.4177e-04 - mean\_absolute\_error: 0.0114 - val\_loss: 1.0632e-04 - val\_mean\_absolute\_error: 0.0082  
Epoch 77/100  
 1/126 [..............................] - ETA: 0s - loss: 1.5362e-04 - mean\_absolute\_error: 0.0102 16/126 [==>...........................] - ETA: 0s - loss: 2.4607e-04 - mean\_absolute\_error: 0.0111 31/126 [======>.......................] - ETA: 0s - loss: 2.5952e-04 - mean\_absolute\_error: 0.0111 46/126 [=========>....................] - ETA: 0s - loss: 2.6633e-04 - mean\_absolute\_error: 0.0113 60/126 [=============>................] - ETA: 0s - loss: 2.4240e-04 - mean\_absolute\_error: 0.0108 74/126 [================>.............] - ETA: 0s - loss: 2.3690e-04 - mean\_absolute\_error: 0.0108 90/126 [====================>.........] - ETA: 0s - loss: 2.3556e-04 - mean\_absolute\_error: 0.0109105/126 [========================>.....] - ETA: 0s - loss: 2.3166e-04 - mean\_absolute\_error: 0.0109121/126 [===========================>..] - ETA: 0s - loss: 2.2851e-04 - mean\_absolute\_error: 0.0110126/126 [==============================] - 0s 4ms/step - loss: 2.2927e-04 - mean\_absolute\_error: 0.0110 - val\_loss: 1.1202e-04 - val\_mean\_absolute\_error: 0.0082  
Epoch 78/100  
 1/126 [..............................] - ETA: 0s - loss: 2.5767e-04 - mean\_absolute\_error: 0.0101 16/126 [==>...........................] - ETA: 0s - loss: 2.9771e-04 - mean\_absolute\_error: 0.0121 31/126 [======>.......................] - ETA: 0s - loss: 2.4501e-04 - mean\_absolute\_error: 0.0112 46/126 [=========>....................] - ETA: 0s - loss: 2.3811e-04 - mean\_absolute\_error: 0.0111 61/126 [=============>................] - ETA: 0s - loss: 2.5788e-04 - mean\_absolute\_error: 0.0117 76/126 [=================>............] - ETA: 0s - loss: 2.6432e-04 - mean\_absolute\_error: 0.0119 91/126 [====================>.........] - ETA: 0s - loss: 2.5832e-04 - mean\_absolute\_error: 0.0116106/126 [========================>.....] - ETA: 0s - loss: 2.5167e-04 - mean\_absolute\_error: 0.0116122/126 [============================>.] - ETA: 0s - loss: 2.4972e-04 - mean\_absolute\_error: 0.0115126/126 [==============================] - 0s 4ms/step - loss: 2.4821e-04 - mean\_absolute\_error: 0.0115 - val\_loss: 1.2048e-04 - val\_mean\_absolute\_error: 0.0088  
Epoch 79/100  
 1/126 [..............................] - ETA: 0s - loss: 2.3006e-04 - mean\_absolute\_error: 0.0116 16/126 [==>...........................] - ETA: 0s - loss: 2.1899e-04 - mean\_absolute\_error: 0.0110 31/126 [======>.......................] - ETA: 0s - loss: 2.4258e-04 - mean\_absolute\_error: 0.0111 46/126 [=========>....................] - ETA: 0s - loss: 2.2666e-04 - mean\_absolute\_error: 0.0109 62/126 [=============>................] - ETA: 0s - loss: 2.2128e-04 - mean\_absolute\_error: 0.0106 77/126 [=================>............] - ETA: 0s - loss: 2.2410e-04 - mean\_absolute\_error: 0.0107 93/126 [=====================>........] - ETA: 0s - loss: 2.2532e-04 - mean\_absolute\_error: 0.0107108/126 [========================>.....] - ETA: 0s - loss: 2.1909e-04 - mean\_absolute\_error: 0.0106123/126 [============================>.] - ETA: 0s - loss: 2.1744e-04 - mean\_absolute\_error: 0.0106126/126 [==============================] - 0s 4ms/step - loss: 2.1675e-04 - mean\_absolute\_error: 0.0106 - val\_loss: 1.9243e-04 - val\_mean\_absolute\_error: 0.0115  
Epoch 80/100  
 1/126 [..............................] - ETA: 0s - loss: 3.4783e-04 - mean\_absolute\_error: 0.0157 16/126 [==>...........................] - ETA: 0s - loss: 3.6063e-04 - mean\_absolute\_error: 0.0142 30/126 [======>.......................] - ETA: 0s - loss: 3.4815e-04 - mean\_absolute\_error: 0.0142 45/126 [=========>....................] - ETA: 0s - loss: 3.1640e-04 - mean\_absolute\_error: 0.0134 61/126 [=============>................] - ETA: 0s - loss: 2.9132e-04 - mean\_absolute\_error: 0.0127 76/126 [=================>............] - ETA: 0s - loss: 2.7663e-04 - mean\_absolute\_error: 0.0123 91/126 [====================>.........] - ETA: 0s - loss: 2.6590e-04 - mean\_absolute\_error: 0.0122106/126 [========================>.....] - ETA: 0s - loss: 2.5498e-04 - mean\_absolute\_error: 0.0119122/126 [============================>.] - ETA: 0s - loss: 2.4704e-04 - mean\_absolute\_error: 0.0117126/126 [==============================] - 0s 4ms/step - loss: 2.5208e-04 - mean\_absolute\_error: 0.0118 - val\_loss: 1.0706e-04 - val\_mean\_absolute\_error: 0.0082  
Epoch 81/100  
 1/126 [..............................] - ETA: 0s - loss: 2.7973e-04 - mean\_absolute\_error: 0.0108 17/126 [===>..........................] - ETA: 0s - loss: 3.5997e-04 - mean\_absolute\_error: 0.0136 33/126 [======>.......................] - ETA: 0s - loss: 3.1734e-04 - mean\_absolute\_error: 0.0130 49/126 [==========>...................] - ETA: 0s - loss: 2.6942e-04 - mean\_absolute\_error: 0.0120 65/126 [==============>...............] - ETA: 0s - loss: 2.5351e-04 - mean\_absolute\_error: 0.0117 81/126 [==================>...........] - ETA: 0s - loss: 2.3743e-04 - mean\_absolute\_error: 0.0113 96/126 [=====================>........] - ETA: 0s - loss: 2.3458e-04 - mean\_absolute\_error: 0.0112112/126 [=========================>....] - ETA: 0s - loss: 2.3045e-04 - mean\_absolute\_error: 0.0112126/126 [==============================] - 0s 4ms/step - loss: 2.3923e-04 - mean\_absolute\_error: 0.0114 - val\_loss: 1.5670e-04 - val\_mean\_absolute\_error: 0.0100  
Epoch 82/100  
 1/126 [..............................] - ETA: 0s - loss: 3.2819e-04 - mean\_absolute\_error: 0.0137 17/126 [===>..........................] - ETA: 0s - loss: 2.0438e-04 - mean\_absolute\_error: 0.0107 33/126 [======>.......................] - ETA: 0s - loss: 2.0067e-04 - mean\_absolute\_error: 0.0105 49/126 [==========>...................] - ETA: 0s - loss: 2.1735e-04 - mean\_absolute\_error: 0.0107 65/126 [==============>...............] - ETA: 0s - loss: 2.2722e-04 - mean\_absolute\_error: 0.0110 81/126 [==================>...........] - ETA: 0s - loss: 2.3290e-04 - mean\_absolute\_error: 0.0113 97/126 [======================>.......] - ETA: 0s - loss: 2.4025e-04 - mean\_absolute\_error: 0.0114112/126 [=========================>....] - ETA: 0s - loss: 2.5111e-04 - mean\_absolute\_error: 0.0116126/126 [==============================] - 0s 4ms/step - loss: 2.4542e-04 - mean\_absolute\_error: 0.0115 - val\_loss: 1.0054e-04 - val\_mean\_absolute\_error: 0.0078  
Epoch 83/100  
 1/126 [..............................] - ETA: 0s - loss: 1.6632e-04 - mean\_absolute\_error: 0.0106 17/126 [===>..........................] - ETA: 0s - loss: 2.7463e-04 - mean\_absolute\_error: 0.0115 33/126 [======>.......................] - ETA: 0s - loss: 2.1539e-04 - mean\_absolute\_error: 0.0103 49/126 [==========>...................] - ETA: 0s - loss: 2.2134e-04 - mean\_absolute\_error: 0.0107 65/126 [==============>...............] - ETA: 0s - loss: 2.4671e-04 - mean\_absolute\_error: 0.0114 81/126 [==================>...........] - ETA: 0s - loss: 2.6526e-04 - mean\_absolute\_error: 0.0118 96/126 [=====================>........] - ETA: 0s - loss: 2.6346e-04 - mean\_absolute\_error: 0.0119112/126 [=========================>....] - ETA: 0s - loss: 2.5807e-04 - mean\_absolute\_error: 0.0118126/126 [==============================] - 0s 4ms/step - loss: 2.5161e-04 - mean\_absolute\_error: 0.0116 - val\_loss: 1.0476e-04 - val\_mean\_absolute\_error: 0.0081  
Epoch 84/100  
 1/126 [..............................] - ETA: 0s - loss: 1.4907e-04 - mean\_absolute\_error: 0.0103 17/126 [===>..........................] - ETA: 0s - loss: 2.3656e-04 - mean\_absolute\_error: 0.0110 32/126 [======>.......................] - ETA: 0s - loss: 2.4414e-04 - mean\_absolute\_error: 0.0113 48/126 [==========>...................] - ETA: 0s - loss: 2.2519e-04 - mean\_absolute\_error: 0.0108 64/126 [==============>...............] - ETA: 0s - loss: 2.2340e-04 - mean\_absolute\_error: 0.0110 79/126 [=================>............] - ETA: 0s - loss: 2.1502e-04 - mean\_absolute\_error: 0.0108 94/126 [=====================>........] - ETA: 0s - loss: 2.2299e-04 - mean\_absolute\_error: 0.0110110/126 [=========================>....] - ETA: 0s - loss: 2.2092e-04 - mean\_absolute\_error: 0.0109126/126 [==============================] - ETA: 0s - loss: 2.2294e-04 - mean\_absolute\_error: 0.0109126/126 [==============================] - 0s 4ms/step - loss: 2.2294e-04 - mean\_absolute\_error: 0.0109 - val\_loss: 1.0157e-04 - val\_mean\_absolute\_error: 0.0079  
Epoch 85/100  
 1/126 [..............................] - ETA: 0s - loss: 1.8898e-04 - mean\_absolute\_error: 0.0093 17/126 [===>..........................] - ETA: 0s - loss: 2.5436e-04 - mean\_absolute\_error: 0.0118 33/126 [======>.......................] - ETA: 0s - loss: 2.4147e-04 - mean\_absolute\_error: 0.0112 49/126 [==========>...................] - ETA: 0s - loss: 2.3206e-04 - mean\_absolute\_error: 0.0109 65/126 [==============>...............] - ETA: 0s - loss: 2.1944e-04 - mean\_absolute\_error: 0.0105 81/126 [==================>...........] - ETA: 0s - loss: 2.1809e-04 - mean\_absolute\_error: 0.0105 96/126 [=====================>........] - ETA: 0s - loss: 2.1647e-04 - mean\_absolute\_error: 0.0105112/126 [=========================>....] - ETA: 0s - loss: 2.1322e-04 - mean\_absolute\_error: 0.0105126/126 [==============================] - 0s 4ms/step - loss: 2.1739e-04 - mean\_absolute\_error: 0.0106 - val\_loss: 1.4301e-04 - val\_mean\_absolute\_error: 0.0095  
Epoch 86/100  
 1/126 [..............................] - ETA: 0s - loss: 2.5005e-04 - mean\_absolute\_error: 0.0116 17/126 [===>..........................] - ETA: 0s - loss: 2.2295e-04 - mean\_absolute\_error: 0.0105 33/126 [======>.......................] - ETA: 0s - loss: 2.2105e-04 - mean\_absolute\_error: 0.0104 49/126 [==========>...................] - ETA: 0s - loss: 2.3557e-04 - mean\_absolute\_error: 0.0109 65/126 [==============>...............] - ETA: 0s - loss: 2.7343e-04 - mean\_absolute\_error: 0.0120 81/126 [==================>...........] - ETA: 0s - loss: 2.6667e-04 - mean\_absolute\_error: 0.0121 97/126 [======================>.......] - ETA: 0s - loss: 2.6746e-04 - mean\_absolute\_error: 0.0120113/126 [=========================>....] - ETA: 0s - loss: 2.6508e-04 - mean\_absolute\_error: 0.0120126/126 [==============================] - 0s 4ms/step - loss: 2.5793e-04 - mean\_absolute\_error: 0.0119 - val\_loss: 1.2689e-04 - val\_mean\_absolute\_error: 0.0088  
Epoch 87/100  
 1/126 [..............................] - ETA: 0s - loss: 1.9010e-04 - mean\_absolute\_error: 0.0107 17/126 [===>..........................] - ETA: 0s - loss: 2.2088e-04 - mean\_absolute\_error: 0.0107 33/126 [======>.......................] - ETA: 0s - loss: 2.3234e-04 - mean\_absolute\_error: 0.0106 49/126 [==========>...................] - ETA: 0s - loss: 2.2440e-04 - mean\_absolute\_error: 0.0105 65/126 [==============>...............] - ETA: 0s - loss: 2.3186e-04 - mean\_absolute\_error: 0.0109 81/126 [==================>...........] - ETA: 0s - loss: 2.5353e-04 - mean\_absolute\_error: 0.0117 97/126 [======================>.......] - ETA: 0s - loss: 2.7126e-04 - mean\_absolute\_error: 0.0122113/126 [=========================>....] - ETA: 0s - loss: 2.7835e-04 - mean\_absolute\_error: 0.0125126/126 [==============================] - 0s 4ms/step - loss: 2.6784e-04 - mean\_absolute\_error: 0.0122 - val\_loss: 1.2694e-04 - val\_mean\_absolute\_error: 0.0088  
Epoch 88/100  
 1/126 [..............................] - ETA: 0s - loss: 1.8093e-04 - mean\_absolute\_error: 0.0107 17/126 [===>..........................] - ETA: 0s - loss: 1.5762e-04 - mean\_absolute\_error: 0.0097 33/126 [======>.......................] - ETA: 0s - loss: 2.0231e-04 - mean\_absolute\_error: 0.0107 49/126 [==========>...................] - ETA: 0s - loss: 1.9309e-04 - mean\_absolute\_error: 0.0106 64/126 [==============>...............] - ETA: 0s - loss: 1.9274e-04 - mean\_absolute\_error: 0.0105 79/126 [=================>............] - ETA: 0s - loss: 2.0006e-04 - mean\_absolute\_error: 0.0105 94/126 [=====================>........] - ETA: 0s - loss: 1.9902e-04 - mean\_absolute\_error: 0.0105110/126 [=========================>....] - ETA: 0s - loss: 2.0085e-04 - mean\_absolute\_error: 0.0105126/126 [==============================] - ETA: 0s - loss: 2.1597e-04 - mean\_absolute\_error: 0.0108126/126 [==============================] - 0s 4ms/step - loss: 2.1597e-04 - mean\_absolute\_error: 0.0108 - val\_loss: 9.8561e-05 - val\_mean\_absolute\_error: 0.0078  
Epoch 89/100  
 1/126 [..............................] - ETA: 0s - loss: 1.3228e-04 - mean\_absolute\_error: 0.0090 17/126 [===>..........................] - ETA: 0s - loss: 2.0737e-04 - mean\_absolute\_error: 0.0105 33/126 [======>.......................] - ETA: 0s - loss: 1.8978e-04 - mean\_absolute\_error: 0.0102 50/126 [==========>...................] - ETA: 0s - loss: 1.7931e-04 - mean\_absolute\_error: 0.0100 65/126 [==============>...............] - ETA: 0s - loss: 1.9431e-04 - mean\_absolute\_error: 0.0104 80/126 [==================>...........] - ETA: 0s - loss: 1.9676e-04 - mean\_absolute\_error: 0.0104 95/126 [=====================>........] - ETA: 0s - loss: 2.0157e-04 - mean\_absolute\_error: 0.0104111/126 [=========================>....] - ETA: 0s - loss: 2.0783e-04 - mean\_absolute\_error: 0.0104126/126 [==============================] - 0s 4ms/step - loss: 2.0586e-04 - mean\_absolute\_error: 0.0104 - val\_loss: 1.0125e-04 - val\_mean\_absolute\_error: 0.0078  
Epoch 90/100  
 1/126 [..............................] - ETA: 0s - loss: 3.6133e-04 - mean\_absolute\_error: 0.0099 17/126 [===>..........................] - ETA: 0s - loss: 2.6510e-04 - mean\_absolute\_error: 0.0116 33/126 [======>.......................] - ETA: 0s - loss: 3.0409e-04 - mean\_absolute\_error: 0.0124 48/126 [==========>...................] - ETA: 0s - loss: 2.8917e-04 - mean\_absolute\_error: 0.0124 64/126 [==============>...............] - ETA: 0s - loss: 2.6708e-04 - mean\_absolute\_error: 0.0119 80/126 [==================>...........] - ETA: 0s - loss: 2.4481e-04 - mean\_absolute\_error: 0.0114 95/126 [=====================>........] - ETA: 0s - loss: 2.5960e-04 - mean\_absolute\_error: 0.0119110/126 [=========================>....] - ETA: 0s - loss: 2.7641e-04 - mean\_absolute\_error: 0.0123126/126 [==============================] - ETA: 0s - loss: 2.7115e-04 - mean\_absolute\_error: 0.0122126/126 [==============================] - 0s 4ms/step - loss: 2.7115e-04 - mean\_absolute\_error: 0.0122 - val\_loss: 1.3735e-04 - val\_mean\_absolute\_error: 0.0095  
Epoch 91/100  
 1/126 [..............................] - ETA: 0s - loss: 1.6778e-04 - mean\_absolute\_error: 0.0101 16/126 [==>...........................] - ETA: 0s - loss: 1.9530e-04 - mean\_absolute\_error: 0.0099 32/126 [======>.......................] - ETA: 0s - loss: 2.0924e-04 - mean\_absolute\_error: 0.0100 48/126 [==========>...................] - ETA: 0s - loss: 2.1067e-04 - mean\_absolute\_error: 0.0103 64/126 [==============>...............] - ETA: 0s - loss: 2.1128e-04 - mean\_absolute\_error: 0.0103 80/126 [==================>...........] - ETA: 0s - loss: 2.1400e-04 - mean\_absolute\_error: 0.0104 96/126 [=====================>........] - ETA: 0s - loss: 2.1254e-04 - mean\_absolute\_error: 0.0103112/126 [=========================>....] - ETA: 0s - loss: 2.0737e-04 - mean\_absolute\_error: 0.0102126/126 [==============================] - 0s 4ms/step - loss: 2.0841e-04 - mean\_absolute\_error: 0.0104 - val\_loss: 9.6422e-05 - val\_mean\_absolute\_error: 0.0076  
Epoch 92/100  
 1/126 [..............................] - ETA: 0s - loss: 1.4876e-04 - mean\_absolute\_error: 0.0080 17/126 [===>..........................] - ETA: 0s - loss: 2.1012e-04 - mean\_absolute\_error: 0.0102 34/126 [=======>......................] - ETA: 0s - loss: 2.3294e-04 - mean\_absolute\_error: 0.0110 51/126 [===========>..................] - ETA: 0s - loss: 2.1585e-04 - mean\_absolute\_error: 0.0108 67/126 [==============>...............] - ETA: 0s - loss: 2.2531e-04 - mean\_absolute\_error: 0.0110 83/126 [==================>...........] - ETA: 0s - loss: 2.6132e-04 - mean\_absolute\_error: 0.0119 99/126 [======================>.......] - ETA: 0s - loss: 2.6724e-04 - mean\_absolute\_error: 0.0121115/126 [==========================>...] - ETA: 0s - loss: 2.5324e-04 - mean\_absolute\_error: 0.0118126/126 [==============================] - 0s 4ms/step - loss: 2.5865e-04 - mean\_absolute\_error: 0.0118 - val\_loss: 1.6568e-04 - val\_mean\_absolute\_error: 0.0104  
Epoch 93/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1682e-04 - mean\_absolute\_error: 0.0087 16/126 [==>...........................] - ETA: 0s - loss: 3.4601e-04 - mean\_absolute\_error: 0.0134 32/126 [======>.......................] - ETA: 0s - loss: 2.7362e-04 - mean\_absolute\_error: 0.0119 48/126 [==========>...................] - ETA: 0s - loss: 2.6548e-04 - mean\_absolute\_error: 0.0117 64/126 [==============>...............] - ETA: 0s - loss: 2.5012e-04 - mean\_absolute\_error: 0.0115 80/126 [==================>...........] - ETA: 0s - loss: 2.4579e-04 - mean\_absolute\_error: 0.0115 96/126 [=====================>........] - ETA: 0s - loss: 2.2875e-04 - mean\_absolute\_error: 0.0110112/126 [=========================>....] - ETA: 0s - loss: 2.2909e-04 - mean\_absolute\_error: 0.0110126/126 [==============================] - 0s 4ms/step - loss: 2.2565e-04 - mean\_absolute\_error: 0.0110 - val\_loss: 1.5528e-04 - val\_mean\_absolute\_error: 0.0100  
Epoch 94/100  
 1/126 [..............................] - ETA: 0s - loss: 2.4905e-04 - mean\_absolute\_error: 0.0113 17/126 [===>..........................] - ETA: 0s - loss: 1.6802e-04 - mean\_absolute\_error: 0.0099 34/126 [=======>......................] - ETA: 0s - loss: 1.8661e-04 - mean\_absolute\_error: 0.0101 52/126 [===========>..................] - ETA: 0s - loss: 1.9954e-04 - mean\_absolute\_error: 0.0103 69/126 [===============>..............] - ETA: 0s - loss: 2.0029e-04 - mean\_absolute\_error: 0.0103 85/126 [===================>..........] - ETA: 0s - loss: 2.1514e-04 - mean\_absolute\_error: 0.0106100/126 [======================>.......] - ETA: 0s - loss: 2.0784e-04 - mean\_absolute\_error: 0.0104116/126 [==========================>...] - ETA: 0s - loss: 2.0304e-04 - mean\_absolute\_error: 0.0103126/126 [==============================] - 0s 4ms/step - loss: 2.0774e-04 - mean\_absolute\_error: 0.0104 - val\_loss: 9.8821e-05 - val\_mean\_absolute\_error: 0.0078  
Epoch 95/100  
 1/126 [..............................] - ETA: 0s - loss: 1.5933e-04 - mean\_absolute\_error: 0.0095 17/126 [===>..........................] - ETA: 0s - loss: 2.2068e-04 - mean\_absolute\_error: 0.0111 34/126 [=======>......................] - ETA: 0s - loss: 2.3435e-04 - mean\_absolute\_error: 0.0114 50/126 [==========>...................] - ETA: 0s - loss: 2.1470e-04 - mean\_absolute\_error: 0.0109 65/126 [==============>...............] - ETA: 0s - loss: 2.0281e-04 - mean\_absolute\_error: 0.0106 81/126 [==================>...........] - ETA: 0s - loss: 1.9742e-04 - mean\_absolute\_error: 0.0104 97/126 [======================>.......] - ETA: 0s - loss: 1.9620e-04 - mean\_absolute\_error: 0.0103113/126 [=========================>....] - ETA: 0s - loss: 2.0396e-04 - mean\_absolute\_error: 0.0103126/126 [==============================] - 0s 4ms/step - loss: 2.0358e-04 - mean\_absolute\_error: 0.0103 - val\_loss: 1.0030e-04 - val\_mean\_absolute\_error: 0.0079  
Epoch 96/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0519e-04 - mean\_absolute\_error: 0.0074 17/126 [===>..........................] - ETA: 0s - loss: 2.5106e-04 - mean\_absolute\_error: 0.0125 34/126 [=======>......................] - ETA: 0s - loss: 2.9374e-04 - mean\_absolute\_error: 0.0129 51/126 [===========>..................] - ETA: 0s - loss: 2.6896e-04 - mean\_absolute\_error: 0.0121 67/126 [==============>...............] - ETA: 0s - loss: 2.4466e-04 - mean\_absolute\_error: 0.0115 84/126 [===================>..........] - ETA: 0s - loss: 2.3804e-04 - mean\_absolute\_error: 0.0115100/126 [======================>.......] - ETA: 0s - loss: 2.3826e-04 - mean\_absolute\_error: 0.0114118/126 [===========================>..] - ETA: 0s - loss: 2.3019e-04 - mean\_absolute\_error: 0.0112126/126 [==============================] - 0s 3ms/step - loss: 2.2744e-04 - mean\_absolute\_error: 0.0112 - val\_loss: 1.6364e-04 - val\_mean\_absolute\_error: 0.0103  
Epoch 97/100  
 1/126 [..............................] - ETA: 0s - loss: 2.0078e-04 - mean\_absolute\_error: 0.0100 17/126 [===>..........................] - ETA: 0s - loss: 2.0049e-04 - mean\_absolute\_error: 0.0109 33/126 [======>.......................] - ETA: 0s - loss: 2.1353e-04 - mean\_absolute\_error: 0.0107 50/126 [==========>...................] - ETA: 0s - loss: 2.0950e-04 - mean\_absolute\_error: 0.0103 66/126 [==============>...............] - ETA: 0s - loss: 2.1765e-04 - mean\_absolute\_error: 0.0104 81/126 [==================>...........] - ETA: 0s - loss: 2.1726e-04 - mean\_absolute\_error: 0.0106 97/126 [======================>.......] - ETA: 0s - loss: 2.1855e-04 - mean\_absolute\_error: 0.0106114/126 [==========================>...] - ETA: 0s - loss: 2.1306e-04 - mean\_absolute\_error: 0.0106126/126 [==============================] - 0s 4ms/step - loss: 2.0902e-04 - mean\_absolute\_error: 0.0105 - val\_loss: 9.4986e-05 - val\_mean\_absolute\_error: 0.0076  
Epoch 98/100  
 1/126 [..............................] - ETA: 0s - loss: 2.8551e-04 - mean\_absolute\_error: 0.0101 17/126 [===>..........................] - ETA: 0s - loss: 1.8292e-04 - mean\_absolute\_error: 0.0102 35/126 [=======>......................] - ETA: 0s - loss: 2.0156e-04 - mean\_absolute\_error: 0.0108 52/126 [===========>..................] - ETA: 0s - loss: 2.1183e-04 - mean\_absolute\_error: 0.0110 69/126 [===============>..............] - ETA: 0s - loss: 2.2681e-04 - mean\_absolute\_error: 0.0114 85/126 [===================>..........] - ETA: 0s - loss: 2.1877e-04 - mean\_absolute\_error: 0.0110101/126 [=======================>......] - ETA: 0s - loss: 2.1727e-04 - mean\_absolute\_error: 0.0109116/126 [==========================>...] - ETA: 0s - loss: 2.2170e-04 - mean\_absolute\_error: 0.0109126/126 [==============================] - 0s 4ms/step - loss: 2.1904e-04 - mean\_absolute\_error: 0.0108 - val\_loss: 1.2855e-04 - val\_mean\_absolute\_error: 0.0092  
Epoch 99/100  
 1/126 [..............................] - ETA: 0s - loss: 2.3143e-04 - mean\_absolute\_error: 0.0130 16/126 [==>...........................] - ETA: 0s - loss: 1.6389e-04 - mean\_absolute\_error: 0.0095 31/126 [======>.......................] - ETA: 0s - loss: 1.7600e-04 - mean\_absolute\_error: 0.0100 46/126 [=========>....................] - ETA: 0s - loss: 1.8138e-04 - mean\_absolute\_error: 0.0102 62/126 [=============>................] - ETA: 0s - loss: 1.8343e-04 - mean\_absolute\_error: 0.0102 78/126 [=================>............] - ETA: 0s - loss: 1.9409e-04 - mean\_absolute\_error: 0.0103 94/126 [=====================>........] - ETA: 0s - loss: 1.9251e-04 - mean\_absolute\_error: 0.0102110/126 [=========================>....] - ETA: 0s - loss: 1.9540e-04 - mean\_absolute\_error: 0.0102126/126 [==============================] - ETA: 0s - loss: 2.0969e-04 - mean\_absolute\_error: 0.0105126/126 [==============================] - 0s 4ms/step - loss: 2.0969e-04 - mean\_absolute\_error: 0.0105 - val\_loss: 3.3119e-04 - val\_mean\_absolute\_error: 0.0160  
Epoch 100/100  
 1/126 [..............................] - ETA: 0s - loss: 2.6026e-04 - mean\_absolute\_error: 0.0143 17/126 [===>..........................] - ETA: 0s - loss: 2.3349e-04 - mean\_absolute\_error: 0.0116 32/126 [======>.......................] - ETA: 0s - loss: 2.2247e-04 - mean\_absolute\_error: 0.0113 48/126 [==========>...................] - ETA: 0s - loss: 2.4727e-04 - mean\_absolute\_error: 0.0116 64/126 [==============>...............] - ETA: 0s - loss: 2.3687e-04 - mean\_absolute\_error: 0.0113 80/126 [==================>...........] - ETA: 0s - loss: 2.1978e-04 - mean\_absolute\_error: 0.0109 96/126 [=====================>........] - ETA: 0s - loss: 2.1656e-04 - mean\_absolute\_error: 0.0107112/126 [=========================>....] - ETA: 0s - loss: 2.1465e-04 - mean\_absolute\_error: 0.0106126/126 [==============================] - 0s 4ms/step - loss: 2.0778e-04 - mean\_absolute\_error: 0.0104 - val\_loss: 9.5432e-05 - val\_mean\_absolute\_error: 0.0076

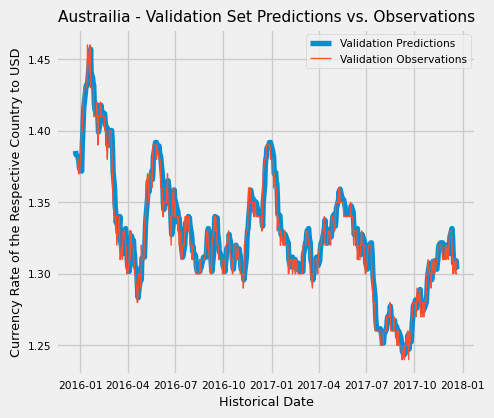
<keras.src.callbacks.History at 0x28e813ebed0>

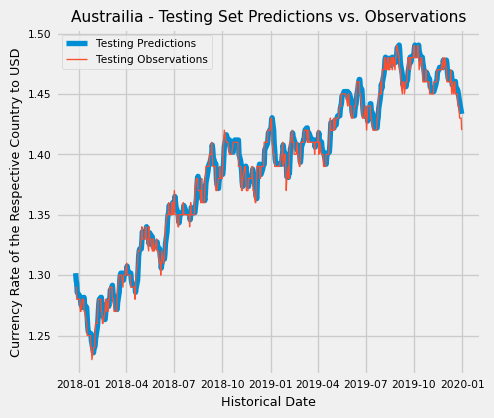
After the training and fitting of the Machine Learning model for Austrailia, I tried to create visualizations comparing the model against the country’s training dataset, validation dataset, but most importantly the testing dataset (as shown below in the line graphs). Note that the darker and thicker blue lines represent the prediction model’s projections and the thinner red lines is the observed/gathered data.

```{python}  
# Testing the Machine Learning Model prediction for Austrailia with the train,   
# validation, and test sets  
# Most important is the test set prediction as this tests the effectiveness  
# of the Machine Learning model on data it has not seen before   
austrailia\_train\_pred = austrailia\_model.predict(X\_austrailia\_train).flatten()  
  
plt.plot(dates\_austrailia\_train, austrailia\_train\_pred, linewidth=4)  
plt.plot(dates\_austrailia\_train, y\_austrailia\_train, linewidth=1)  
plt.legend(["Training Predictions", "Training Observations"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Austrailia - Training Set Predictions vs. Observations")  
plt.show()  
  
austrailia\_val\_pred = austrailia\_model.predict(X\_austrailia\_val).flatten()  
  
plt.plot(dates\_austrailia\_val, austrailia\_val\_pred, linewidth=4)  
plt.plot(dates\_austrailia\_val, y\_austrailia\_val, linewidth=1)  
plt.legend(["Validation Predictions", "Validation Observations"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Austrailia - Validation Set Predictions vs. Observations")  
plt.show()  
  
austrailia\_test\_pred = austrailia\_model.predict(X\_austrailia\_test).flatten()  
  
plt.plot(dates\_austrailia\_test, austrailia\_test\_pred, linewidth=4)  
plt.plot(dates\_austrailia\_test, y\_austrailia\_test, linewidth=1)  
plt.legend(["Testing Predictions", "Testing Observations"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Austrailia - Testing Set Predictions vs. Observations")  
plt.show()  
```

1/126 [..............................] - ETA: 40s 31/126 [======>.......................] - ETA: 0s 60/126 [=============>................] - ETA: 0s 89/126 [====================>.........] - ETA: 0s117/126 [==========================>...] - ETA: 0s126/126 [==============================] - 1s 2ms/step  
 1/16 [>.............................] - ETA: 0s16/16 [==============================] - 0s 2ms/step  
 1/16 [>.............................] - ETA: 0s16/16 [==============================] - 0s 2ms/step

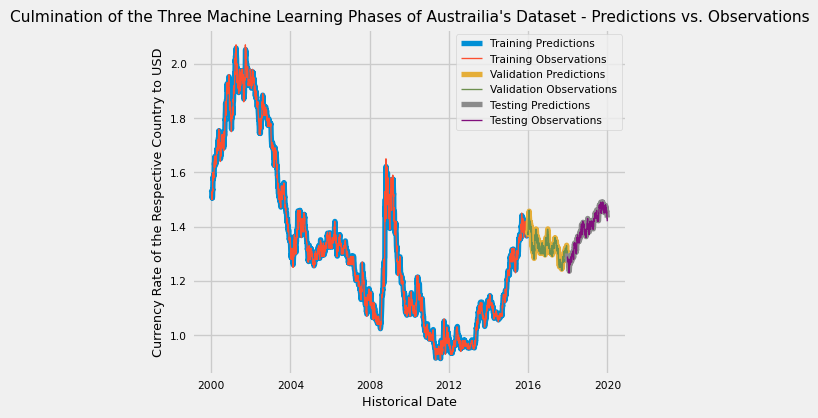






Through careful consideration of all of the prediction-based vs. observation-based contrast visualizations together, I consolidated all of graphics into one singular visualization for you to see below to get a more general perspective of the effectiveness of the Machine Learning model at training and fitting towards predicting Austrailia’s international currency rate with the United States.

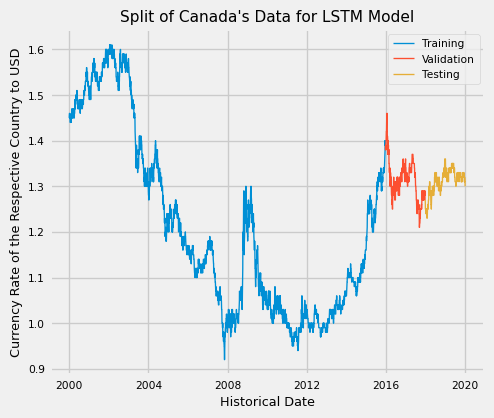
```{python}  
# Plotting Austrailia's observational (reference) data with the predictions of   
# its Machine Learning Model (as a way to visually inspect the effectiveness of   
# the model)   
plt.plot(dates\_austrailia\_train, austrailia\_train\_pred, linewidth=4)  
plt.plot(dates\_austrailia\_train, y\_austrailia\_train, linewidth=1)  
plt.plot(dates\_austrailia\_val, austrailia\_val\_pred, linewidth=4)  
plt.plot(dates\_austrailia\_val, y\_austrailia\_val, linewidth=1)  
plt.plot(dates\_austrailia\_test, austrailia\_test\_pred, linewidth=4)  
plt.plot(dates\_austrailia\_test, y\_austrailia\_test, linewidth=1)  
  
plt.legend(["Training Predictions",  
 "Training Observations",  
 "Validation Predictions",  
 "Validation Observations",  
 "Testing Predictions",  
 "Testing Observations"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Culmination of the Three Machine Learning Phases of Austrailia's Dataset - Predictions vs. Observations")  
plt.show()  
```



Once Austraila’s data was completely trained and visualized, I worked on Canada’s data (as shown below):

Since the data (date, X, and y) is split into three np.arrays and to be more efficient, I will manually split Canada’s data into train, test, and validation datasets for the Machine Learning model with 80% going to the training dataset, the next 10% going to the validation dataset, and the last 10% going to the test dataset for each np.array respectively.

```{python}  
# Splitting Canada's data into train, test, and validation sets on 3 mediums:   
# the X-axis, the y-axis, and the indices (represented by dates)  
dates\_canada\_train, X\_canada\_train, y\_canada\_train = dates\_canada[:percentile\_80], X\_canada[:percentile\_80], y\_canada[:percentile\_80]  
dates\_canada\_val, X\_canada\_val, y\_canada\_val = dates\_canada[percentile\_80:percentile\_90], X\_canada[percentile\_80:percentile\_90], y\_canada[percentile\_80:percentile\_90]  
dates\_canada\_test, X\_canada\_test, y\_canada\_test = dates\_canada[percentile\_90:], X\_canada[percentile\_90:], y\_canada[percentile\_90:]  
  
plt.plot(dates\_canada\_train, y\_canada\_train, linewidth=1)  
plt.plot(dates\_canada\_val, y\_canada\_val, linewidth=1)  
plt.plot(dates\_canada\_test, y\_canada\_test, linewidth=1)  
  
plt.legend(["Training", "Validation", "Testing"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Split of Canada's Data for LSTM Model")  
plt.show()  
```



Now, I began to configure the Machine Learning model. We added Sequential layers: an Input layer 3 by 1 because we will have 3 np.arrays of Input and 1 np.array as output, utilize a LSTM (Long Short-Term Memory) layer of 64 neurons, apply 2 levels of dense layers with 32 neurons and folliowing recommendations online to use the RELU (Rectified Linear Unit) Activiation Function, and I followed up with one last dense layer of 1 neuron as our output layer since we are just trying to linearly-predict the next currency-rate on a near-future date. Once I configured the Sequential layers, we are ready to compile the model, utilzing the mean\_square\_error as our minimizing loss function, using the Adam optimizer, and comparing our trained model against our data with the mean\_absolute\_error metric. Lastly, I fitted our model, utilzing our X\_train and Y\_train datasets for fitting with validation from our X\_valid and Y\_valid datasets at 100 epochs.

```{python}  
# Configuring the Machine Learning Tensorflow Model for Canada  
canada\_model = Sequential([layers.Input((3, 1)),  
 layers.LSTM(64),  
 layers.Dense(32, activation="relu"),  
 layers.Dense(32, activation="relu"),  
 layers.Dense(1)])  
  
canada\_model.compile(loss="mse",  
 optimizer=Adam(learning\_rate=0.001),  
 metrics=["mean\_absolute\_error"])  
  
canada\_model.fit(X\_canada\_train, y\_canada\_train, validation\_data=(X\_canada\_val, y\_canada\_val), epochs=100)  
```

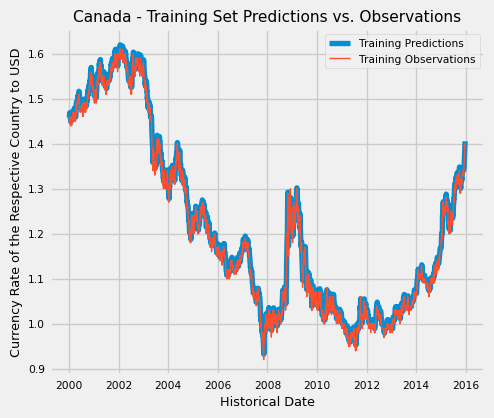
Epoch 1/100  
 1/126 [..............................] - ETA: 3:27 - loss: 1.4100 - mean\_absolute\_error: 1.1695 15/126 [==>...........................] - ETA: 0s - loss: 1.0900 - mean\_absolute\_error: 1.0252 30/126 [======>.......................] - ETA: 0s - loss: 0.7436 - mean\_absolute\_error: 0.8076 48/126 [==========>...................] - ETA: 0s - loss: 0.4758 - mean\_absolute\_error: 0.5634 66/126 [==============>...............] - ETA: 0s - loss: 0.3479 - mean\_absolute\_error: 0.4269 82/126 [==================>...........] - ETA: 0s - loss: 0.2805 - mean\_absolute\_error: 0.3523 97/126 [======================>.......] - ETA: 0s - loss: 0.2375 - mean\_absolute\_error: 0.3042113/126 [=========================>....] - ETA: 0s - loss: 0.2041 - mean\_absolute\_error: 0.2664126/126 [==============================] - 3s 7ms/step - loss: 0.1842 - mean\_absolute\_error: 0.2441 - val\_loss: 2.4936e-04 - val\_mean\_absolute\_error: 0.0125  
Epoch 2/100  
 1/126 [..............................] - ETA: 0s - loss: 0.0024 - mean\_absolute\_error: 0.0445 17/126 [===>..........................] - ETA: 0s - loss: 0.0019 - mean\_absolute\_error: 0.0377 32/126 [======>.......................] - ETA: 0s - loss: 0.0018 - mean\_absolute\_error: 0.0366 48/126 [==========>...................] - ETA: 0s - loss: 0.0016 - mean\_absolute\_error: 0.0353 63/126 [==============>...............] - ETA: 0s - loss: 0.0016 - mean\_absolute\_error: 0.0349 78/126 [=================>............] - ETA: 0s - loss: 0.0016 - mean\_absolute\_error: 0.0345 93/126 [=====================>........] - ETA: 0s - loss: 0.0015 - mean\_absolute\_error: 0.0338110/126 [=========================>....] - ETA: 0s - loss: 0.0014 - mean\_absolute\_error: 0.0326126/126 [==============================] - ETA: 0s - loss: 0.0014 - mean\_absolute\_error: 0.0319126/126 [==============================] - 0s 4ms/step - loss: 0.0014 - mean\_absolute\_error: 0.0319 - val\_loss: 2.5764e-04 - val\_mean\_absolute\_error: 0.0131  
Epoch 3/100  
 1/126 [..............................] - ETA: 0s - loss: 8.8824e-04 - mean\_absolute\_error: 0.0261 17/126 [===>..........................] - ETA: 0s - loss: 8.3110e-04 - mean\_absolute\_error: 0.0252 33/126 [======>.......................] - ETA: 0s - loss: 7.8154e-04 - mean\_absolute\_error: 0.0244 49/126 [==========>...................] - ETA: 0s - loss: 7.4187e-04 - mean\_absolute\_error: 0.0237 65/126 [==============>...............] - ETA: 0s - loss: 6.9680e-04 - mean\_absolute\_error: 0.0229 81/126 [==================>...........] - ETA: 0s - loss: 6.5740e-04 - mean\_absolute\_error: 0.0221 97/126 [======================>.......] - ETA: 0s - loss: 6.1823e-04 - mean\_absolute\_error: 0.0213113/126 [=========================>....] - ETA: 0s - loss: 5.8520e-04 - mean\_absolute\_error: 0.0207126/126 [==============================] - 0s 4ms/step - loss: 5.6090e-04 - mean\_absolute\_error: 0.0202 - val\_loss: 1.4153e-04 - val\_mean\_absolute\_error: 0.0094  
Epoch 4/100  
 1/126 [..............................] - ETA: 0s - loss: 4.5071e-04 - mean\_absolute\_error: 0.0179 17/126 [===>..........................] - ETA: 0s - loss: 3.1608e-04 - mean\_absolute\_error: 0.0150 33/126 [======>.......................] - ETA: 0s - loss: 2.8569e-04 - mean\_absolute\_error: 0.0142 49/126 [==========>...................] - ETA: 0s - loss: 2.6960e-04 - mean\_absolute\_error: 0.0137 66/126 [==============>...............] - ETA: 0s - loss: 2.5640e-04 - mean\_absolute\_error: 0.0133 82/126 [==================>...........] - ETA: 0s - loss: 2.4146e-04 - mean\_absolute\_error: 0.0129 98/126 [======================>.......] - ETA: 0s - loss: 2.2786e-04 - mean\_absolute\_error: 0.0124114/126 [==========================>...] - ETA: 0s - loss: 2.1744e-04 - mean\_absolute\_error: 0.0121126/126 [==============================] - 0s 4ms/step - loss: 2.1128e-04 - mean\_absolute\_error: 0.0119 - val\_loss: 1.2021e-04 - val\_mean\_absolute\_error: 0.0087  
Epoch 5/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0083e-04 - mean\_absolute\_error: 0.0081 16/126 [==>...........................] - ETA: 0s - loss: 1.2232e-04 - mean\_absolute\_error: 0.0089 32/126 [======>.......................] - ETA: 0s - loss: 1.2717e-04 - mean\_absolute\_error: 0.0089 49/126 [==========>...................] - ETA: 0s - loss: 1.1991e-04 - mean\_absolute\_error: 0.0086 65/126 [==============>...............] - ETA: 0s - loss: 1.1688e-04 - mean\_absolute\_error: 0.0085 81/126 [==================>...........] - ETA: 0s - loss: 1.1496e-04 - mean\_absolute\_error: 0.0084 97/126 [======================>.......] - ETA: 0s - loss: 1.1605e-04 - mean\_absolute\_error: 0.0084113/126 [=========================>....] - ETA: 0s - loss: 1.1411e-04 - mean\_absolute\_error: 0.0083126/126 [==============================] - 0s 4ms/step - loss: 1.1357e-04 - mean\_absolute\_error: 0.0083 - val\_loss: 1.1218e-04 - val\_mean\_absolute\_error: 0.0083  
Epoch 6/100  
 1/126 [..............................] - ETA: 0s - loss: 7.8047e-05 - mean\_absolute\_error: 0.0072 17/126 [===>..........................] - ETA: 0s - loss: 8.0407e-05 - mean\_absolute\_error: 0.0071 32/126 [======>.......................] - ETA: 0s - loss: 8.8743e-05 - mean\_absolute\_error: 0.0073 48/126 [==========>...................] - ETA: 0s - loss: 8.7328e-05 - mean\_absolute\_error: 0.0072 64/126 [==============>...............] - ETA: 0s - loss: 9.1600e-05 - mean\_absolute\_error: 0.0073 80/126 [==================>...........] - ETA: 0s - loss: 9.5984e-05 - mean\_absolute\_error: 0.0074 96/126 [=====================>........] - ETA: 0s - loss: 9.7722e-05 - mean\_absolute\_error: 0.0075111/126 [=========================>....] - ETA: 0s - loss: 9.8156e-05 - mean\_absolute\_error: 0.0075126/126 [==============================] - 0s 4ms/step - loss: 9.8094e-05 - mean\_absolute\_error: 0.0075 - val\_loss: 1.1943e-04 - val\_mean\_absolute\_error: 0.0086  
Epoch 7/100  
 1/126 [..............................] - ETA: 0s - loss: 1.3121e-04 - mean\_absolute\_error: 0.0087 17/126 [===>..........................] - ETA: 0s - loss: 1.1120e-04 - mean\_absolute\_error: 0.0078 33/126 [======>.......................] - ETA: 0s - loss: 1.0336e-04 - mean\_absolute\_error: 0.0076 50/126 [==========>...................] - ETA: 0s - loss: 9.6404e-05 - mean\_absolute\_error: 0.0074 66/126 [==============>...............] - ETA: 0s - loss: 9.5012e-05 - mean\_absolute\_error: 0.0074 82/126 [==================>...........] - ETA: 0s - loss: 9.4989e-05 - mean\_absolute\_error: 0.0074 98/126 [======================>.......] - ETA: 0s - loss: 9.6088e-05 - mean\_absolute\_error: 0.0074114/126 [==========================>...] - ETA: 0s - loss: 9.6462e-05 - mean\_absolute\_error: 0.0074126/126 [==============================] - 0s 4ms/step - loss: 9.6038e-05 - mean\_absolute\_error: 0.0074 - val\_loss: 1.0776e-04 - val\_mean\_absolute\_error: 0.0081  
Epoch 8/100  
 1/126 [..............................] - ETA: 0s - loss: 8.0562e-05 - mean\_absolute\_error: 0.0074 17/126 [===>..........................] - ETA: 0s - loss: 1.0106e-04 - mean\_absolute\_error: 0.0074 34/126 [=======>......................] - ETA: 0s - loss: 9.9665e-05 - mean\_absolute\_error: 0.0074 50/126 [==========>...................] - ETA: 0s - loss: 9.6887e-05 - mean\_absolute\_error: 0.0073 66/126 [==============>...............] - ETA: 0s - loss: 9.6802e-05 - mean\_absolute\_error: 0.0073 82/126 [==================>...........] - ETA: 0s - loss: 9.6637e-05 - mean\_absolute\_error: 0.0074 99/126 [======================>.......] - ETA: 0s - loss: 9.3908e-05 - mean\_absolute\_error: 0.0072115/126 [==========================>...] - ETA: 0s - loss: 9.4322e-05 - mean\_absolute\_error: 0.0073126/126 [==============================] - 0s 4ms/step - loss: 9.5203e-05 - mean\_absolute\_error: 0.0073 - val\_loss: 1.1802e-04 - val\_mean\_absolute\_error: 0.0086  
Epoch 9/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0602e-04 - mean\_absolute\_error: 0.0083 17/126 [===>..........................] - ETA: 0s - loss: 9.3652e-05 - mean\_absolute\_error: 0.0073 33/126 [======>.......................] - ETA: 0s - loss: 9.0894e-05 - mean\_absolute\_error: 0.0072 49/126 [==========>...................] - ETA: 0s - loss: 9.0721e-05 - mean\_absolute\_error: 0.0073 65/126 [==============>...............] - ETA: 0s - loss: 9.0839e-05 - mean\_absolute\_error: 0.0073 82/126 [==================>...........] - ETA: 0s - loss: 9.2725e-05 - mean\_absolute\_error: 0.0073 98/126 [======================>.......] - ETA: 0s - loss: 9.1855e-05 - mean\_absolute\_error: 0.0073114/126 [==========================>...] - ETA: 0s - loss: 9.3157e-05 - mean\_absolute\_error: 0.0073126/126 [==============================] - 0s 4ms/step - loss: 9.5422e-05 - mean\_absolute\_error: 0.0073 - val\_loss: 1.3091e-04 - val\_mean\_absolute\_error: 0.0092  
Epoch 10/100  
 1/126 [..............................] - ETA: 0s - loss: 6.0416e-05 - mean\_absolute\_error: 0.0066 17/126 [===>..........................] - ETA: 0s - loss: 1.0089e-04 - mean\_absolute\_error: 0.0076 33/126 [======>.......................] - ETA: 0s - loss: 9.5436e-05 - mean\_absolute\_error: 0.0073 49/126 [==========>...................] - ETA: 0s - loss: 9.1893e-05 - mean\_absolute\_error: 0.0072 65/126 [==============>...............] - ETA: 0s - loss: 9.4987e-05 - mean\_absolute\_error: 0.0073 80/126 [==================>...........] - ETA: 0s - loss: 9.2568e-05 - mean\_absolute\_error: 0.0073 95/126 [=====================>........] - ETA: 0s - loss: 9.4520e-05 - mean\_absolute\_error: 0.0073111/126 [=========================>....] - ETA: 0s - loss: 9.4585e-05 - mean\_absolute\_error: 0.0073126/126 [==============================] - 0s 4ms/step - loss: 9.7156e-05 - mean\_absolute\_error: 0.0074 - val\_loss: 1.1112e-04 - val\_mean\_absolute\_error: 0.0082  
Epoch 11/100  
 1/126 [..............................] - ETA: 0s - loss: 5.3730e-05 - mean\_absolute\_error: 0.0061 17/126 [===>..........................] - ETA: 0s - loss: 9.5826e-05 - mean\_absolute\_error: 0.0076 33/126 [======>.......................] - ETA: 0s - loss: 9.4685e-05 - mean\_absolute\_error: 0.0074 49/126 [==========>...................] - ETA: 0s - loss: 9.9502e-05 - mean\_absolute\_error: 0.0074 65/126 [==============>...............] - ETA: 0s - loss: 9.7479e-05 - mean\_absolute\_error: 0.0074 81/126 [==================>...........] - ETA: 0s - loss: 9.7532e-05 - mean\_absolute\_error: 0.0074 97/126 [======================>.......] - ETA: 0s - loss: 9.6893e-05 - mean\_absolute\_error: 0.0074113/126 [=========================>....] - ETA: 0s - loss: 9.8610e-05 - mean\_absolute\_error: 0.0074126/126 [==============================] - 0s 4ms/step - loss: 9.6651e-05 - mean\_absolute\_error: 0.0074 - val\_loss: 1.0945e-04 - val\_mean\_absolute\_error: 0.0082  
Epoch 12/100  
 1/126 [..............................] - ETA: 0s - loss: 8.6043e-05 - mean\_absolute\_error: 0.0073 17/126 [===>..........................] - ETA: 0s - loss: 9.2547e-05 - mean\_absolute\_error: 0.0074 33/126 [======>.......................] - ETA: 0s - loss: 1.0031e-04 - mean\_absolute\_error: 0.0075 49/126 [==========>...................] - ETA: 0s - loss: 9.5170e-05 - mean\_absolute\_error: 0.0073 65/126 [==============>...............] - ETA: 0s - loss: 9.6841e-05 - mean\_absolute\_error: 0.0073 81/126 [==================>...........] - ETA: 0s - loss: 9.6790e-05 - mean\_absolute\_error: 0.0074 97/126 [======================>.......] - ETA: 0s - loss: 9.6798e-05 - mean\_absolute\_error: 0.0074114/126 [==========================>...] - ETA: 0s - loss: 9.9278e-05 - mean\_absolute\_error: 0.0075126/126 [==============================] - 0s 4ms/step - loss: 9.7697e-05 - mean\_absolute\_error: 0.0075 - val\_loss: 1.0730e-04 - val\_mean\_absolute\_error: 0.0079  
Epoch 13/100  
 1/126 [..............................] - ETA: 0s - loss: 9.0589e-05 - mean\_absolute\_error: 0.0079 17/126 [===>..........................] - ETA: 0s - loss: 9.7503e-05 - mean\_absolute\_error: 0.0072 33/126 [======>.......................] - ETA: 0s - loss: 1.0264e-04 - mean\_absolute\_error: 0.0074 49/126 [==========>...................] - ETA: 0s - loss: 1.0384e-04 - mean\_absolute\_error: 0.0075 65/126 [==============>...............] - ETA: 0s - loss: 9.8236e-05 - mean\_absolute\_error: 0.0074 81/126 [==================>...........] - ETA: 0s - loss: 9.8210e-05 - mean\_absolute\_error: 0.0074 97/126 [======================>.......] - ETA: 0s - loss: 9.6388e-05 - mean\_absolute\_error: 0.0074113/126 [=========================>....] - ETA: 0s - loss: 9.7317e-05 - mean\_absolute\_error: 0.0074126/126 [==============================] - 0s 4ms/step - loss: 9.6359e-05 - mean\_absolute\_error: 0.0074 - val\_loss: 1.2314e-04 - val\_mean\_absolute\_error: 0.0087  
Epoch 14/100  
 1/126 [..............................] - ETA: 0s - loss: 1.5536e-04 - mean\_absolute\_error: 0.0098 17/126 [===>..........................] - ETA: 0s - loss: 1.0840e-04 - mean\_absolute\_error: 0.0075 33/126 [======>.......................] - ETA: 0s - loss: 1.0245e-04 - mean\_absolute\_error: 0.0075 49/126 [==========>...................] - ETA: 0s - loss: 9.9878e-05 - mean\_absolute\_error: 0.0075 64/126 [==============>...............] - ETA: 0s - loss: 9.8470e-05 - mean\_absolute\_error: 0.0074 79/126 [=================>............] - ETA: 0s - loss: 9.7464e-05 - mean\_absolute\_error: 0.0074 95/126 [=====================>........] - ETA: 0s - loss: 9.6149e-05 - mean\_absolute\_error: 0.0073111/126 [=========================>....] - ETA: 0s - loss: 9.4675e-05 - mean\_absolute\_error: 0.0073126/126 [==============================] - 0s 4ms/step - loss: 9.6287e-05 - mean\_absolute\_error: 0.0074 - val\_loss: 1.2560e-04 - val\_mean\_absolute\_error: 0.0089  
Epoch 15/100  
 1/126 [..............................] - ETA: 0s - loss: 1.7251e-04 - mean\_absolute\_error: 0.0087 16/126 [==>...........................] - ETA: 0s - loss: 8.5686e-05 - mean\_absolute\_error: 0.0069 32/126 [======>.......................] - ETA: 0s - loss: 9.1132e-05 - mean\_absolute\_error: 0.0072 48/126 [==========>...................] - ETA: 0s - loss: 9.2002e-05 - mean\_absolute\_error: 0.0072 64/126 [==============>...............] - ETA: 0s - loss: 9.1232e-05 - mean\_absolute\_error: 0.0072 80/126 [==================>...........] - ETA: 0s - loss: 9.4293e-05 - mean\_absolute\_error: 0.0073 96/126 [=====================>........] - ETA: 0s - loss: 9.3556e-05 - mean\_absolute\_error: 0.0073112/126 [=========================>....] - ETA: 0s - loss: 9.6114e-05 - mean\_absolute\_error: 0.0073126/126 [==============================] - 0s 4ms/step - loss: 9.6278e-05 - mean\_absolute\_error: 0.0074 - val\_loss: 1.1278e-04 - val\_mean\_absolute\_error: 0.0084  
Epoch 16/100  
 1/126 [..............................] - ETA: 0s - loss: 7.2804e-05 - mean\_absolute\_error: 0.0063 17/126 [===>..........................] - ETA: 0s - loss: 1.0030e-04 - mean\_absolute\_error: 0.0074 33/126 [======>.......................] - ETA: 0s - loss: 9.8479e-05 - mean\_absolute\_error: 0.0074 49/126 [==========>...................] - ETA: 0s - loss: 9.9416e-05 - mean\_absolute\_error: 0.0074 65/126 [==============>...............] - ETA: 0s - loss: 1.0130e-04 - mean\_absolute\_error: 0.0075 81/126 [==================>...........] - ETA: 0s - loss: 9.8195e-05 - mean\_absolute\_error: 0.0074 96/126 [=====================>........] - ETA: 0s - loss: 9.6764e-05 - mean\_absolute\_error: 0.0074112/126 [=========================>....] - ETA: 0s - loss: 9.5408e-05 - mean\_absolute\_error: 0.0073126/126 [==============================] - 0s 4ms/step - loss: 9.5932e-05 - mean\_absolute\_error: 0.0074 - val\_loss: 1.0973e-04 - val\_mean\_absolute\_error: 0.0082  
Epoch 17/100  
 1/126 [..............................] - ETA: 0s - loss: 9.5788e-05 - mean\_absolute\_error: 0.0081 16/126 [==>...........................] - ETA: 0s - loss: 9.2019e-05 - mean\_absolute\_error: 0.0073 31/126 [======>.......................] - ETA: 0s - loss: 1.0107e-04 - mean\_absolute\_error: 0.0076 47/126 [==========>...................] - ETA: 0s - loss: 1.0515e-04 - mean\_absolute\_error: 0.0077 63/126 [==============>...............] - ETA: 0s - loss: 1.0546e-04 - mean\_absolute\_error: 0.0077 80/126 [==================>...........] - ETA: 0s - loss: 1.0342e-04 - mean\_absolute\_error: 0.0076 97/126 [======================>.......] - ETA: 0s - loss: 1.0331e-04 - mean\_absolute\_error: 0.0077114/126 [==========================>...] - ETA: 0s - loss: 1.0195e-04 - mean\_absolute\_error: 0.0076126/126 [==============================] - 0s 4ms/step - loss: 1.0201e-04 - mean\_absolute\_error: 0.0077 - val\_loss: 1.0773e-04 - val\_mean\_absolute\_error: 0.0081  
Epoch 18/100  
 1/126 [..............................] - ETA: 0s - loss: 7.4084e-05 - mean\_absolute\_error: 0.0071 17/126 [===>..........................] - ETA: 0s - loss: 9.4813e-05 - mean\_absolute\_error: 0.0074 33/126 [======>.......................] - ETA: 0s - loss: 9.3222e-05 - mean\_absolute\_error: 0.0073 49/126 [==========>...................] - ETA: 0s - loss: 9.6151e-05 - mean\_absolute\_error: 0.0074 66/126 [==============>...............] - ETA: 0s - loss: 9.1976e-05 - mean\_absolute\_error: 0.0073 83/126 [==================>...........] - ETA: 0s - loss: 9.2162e-05 - mean\_absolute\_error: 0.0073 99/126 [======================>.......] - ETA: 0s - loss: 9.3603e-05 - mean\_absolute\_error: 0.0073115/126 [==========================>...] - ETA: 0s - loss: 9.4869e-05 - mean\_absolute\_error: 0.0074126/126 [==============================] - 0s 4ms/step - loss: 9.5823e-05 - mean\_absolute\_error: 0.0074 - val\_loss: 1.1506e-04 - val\_mean\_absolute\_error: 0.0084  
Epoch 19/100  
 1/126 [..............................] - ETA: 0s - loss: 1.2964e-04 - mean\_absolute\_error: 0.0086 17/126 [===>..........................] - ETA: 0s - loss: 9.6731e-05 - mean\_absolute\_error: 0.0074 33/126 [======>.......................] - ETA: 0s - loss: 9.4998e-05 - mean\_absolute\_error: 0.0072 49/126 [==========>...................] - ETA: 0s - loss: 9.4945e-05 - mean\_absolute\_error: 0.0073 65/126 [==============>...............] - ETA: 0s - loss: 9.4798e-05 - mean\_absolute\_error: 0.0073 81/126 [==================>...........] - ETA: 0s - loss: 9.8543e-05 - mean\_absolute\_error: 0.0075 97/126 [======================>.......] - ETA: 0s - loss: 9.8412e-05 - mean\_absolute\_error: 0.0075113/126 [=========================>....] - ETA: 0s - loss: 1.0021e-04 - mean\_absolute\_error: 0.0076126/126 [==============================] - 0s 4ms/step - loss: 1.0192e-04 - mean\_absolute\_error: 0.0077 - val\_loss: 1.4757e-04 - val\_mean\_absolute\_error: 0.0098  
Epoch 20/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0454e-04 - mean\_absolute\_error: 0.0077 17/126 [===>..........................] - ETA: 0s - loss: 1.1074e-04 - mean\_absolute\_error: 0.0080 33/126 [======>.......................] - ETA: 0s - loss: 1.0471e-04 - mean\_absolute\_error: 0.0078 49/126 [==========>...................] - ETA: 0s - loss: 9.8866e-05 - mean\_absolute\_error: 0.0076 65/126 [==============>...............] - ETA: 0s - loss: 1.0089e-04 - mean\_absolute\_error: 0.0077 81/126 [==================>...........] - ETA: 0s - loss: 1.0469e-04 - mean\_absolute\_error: 0.0078 97/126 [======================>.......] - ETA: 0s - loss: 1.0370e-04 - mean\_absolute\_error: 0.0077113/126 [=========================>....] - ETA: 0s - loss: 1.0160e-04 - mean\_absolute\_error: 0.0076126/126 [==============================] - 0s 4ms/step - loss: 1.0085e-04 - mean\_absolute\_error: 0.0076 - val\_loss: 1.0744e-04 - val\_mean\_absolute\_error: 0.0081  
Epoch 21/100  
 1/126 [..............................] - ETA: 0s - loss: 9.3910e-05 - mean\_absolute\_error: 0.0080 17/126 [===>..........................] - ETA: 0s - loss: 1.0063e-04 - mean\_absolute\_error: 0.0077 33/126 [======>.......................] - ETA: 0s - loss: 9.8497e-05 - mean\_absolute\_error: 0.0074 49/126 [==========>...................] - ETA: 0s - loss: 9.4891e-05 - mean\_absolute\_error: 0.0074 65/126 [==============>...............] - ETA: 0s - loss: 9.5812e-05 - mean\_absolute\_error: 0.0074 81/126 [==================>...........] - ETA: 0s - loss: 9.4700e-05 - mean\_absolute\_error: 0.0073 97/126 [======================>.......] - ETA: 0s - loss: 9.5902e-05 - mean\_absolute\_error: 0.0074113/126 [=========================>....] - ETA: 0s - loss: 9.6158e-05 - mean\_absolute\_error: 0.0074126/126 [==============================] - 0s 4ms/step - loss: 9.6416e-05 - mean\_absolute\_error: 0.0074 - val\_loss: 1.0802e-04 - val\_mean\_absolute\_error: 0.0081  
Epoch 22/100  
 1/126 [..............................] - ETA: 0s - loss: 7.8256e-05 - mean\_absolute\_error: 0.0064 17/126 [===>..........................] - ETA: 0s - loss: 1.0080e-04 - mean\_absolute\_error: 0.0077 33/126 [======>.......................] - ETA: 0s - loss: 1.0387e-04 - mean\_absolute\_error: 0.0079 49/126 [==========>...................] - ETA: 0s - loss: 1.0398e-04 - mean\_absolute\_error: 0.0077 65/126 [==============>...............] - ETA: 0s - loss: 9.9665e-05 - mean\_absolute\_error: 0.0076 80/126 [==================>...........] - ETA: 0s - loss: 1.0020e-04 - mean\_absolute\_error: 0.0076 96/126 [=====================>........] - ETA: 0s - loss: 9.9544e-05 - mean\_absolute\_error: 0.0076112/126 [=========================>....] - ETA: 0s - loss: 9.6953e-05 - mean\_absolute\_error: 0.0075126/126 [==============================] - 0s 4ms/step - loss: 9.9568e-05 - mean\_absolute\_error: 0.0076 - val\_loss: 1.4915e-04 - val\_mean\_absolute\_error: 0.0098  
Epoch 23/100  
 1/126 [..............................] - ETA: 0s - loss: 7.4250e-05 - mean\_absolute\_error: 0.0064 17/126 [===>..........................] - ETA: 0s - loss: 1.0996e-04 - mean\_absolute\_error: 0.0079 33/126 [======>.......................] - ETA: 0s - loss: 1.0267e-04 - mean\_absolute\_error: 0.0077 49/126 [==========>...................] - ETA: 0s - loss: 9.6309e-05 - mean\_absolute\_error: 0.0074 65/126 [==============>...............] - ETA: 0s - loss: 9.8752e-05 - mean\_absolute\_error: 0.0076 80/126 [==================>...........] - ETA: 0s - loss: 1.0052e-04 - mean\_absolute\_error: 0.0076 95/126 [=====================>........] - ETA: 0s - loss: 9.9767e-05 - mean\_absolute\_error: 0.0076111/126 [=========================>....] - ETA: 0s - loss: 9.9366e-05 - mean\_absolute\_error: 0.0076126/126 [==============================] - 0s 4ms/step - loss: 1.0005e-04 - mean\_absolute\_error: 0.0076 - val\_loss: 1.0671e-04 - val\_mean\_absolute\_error: 0.0079  
Epoch 24/100  
 1/126 [..............................] - ETA: 0s - loss: 6.0999e-05 - mean\_absolute\_error: 0.0061 17/126 [===>..........................] - ETA: 0s - loss: 9.2094e-05 - mean\_absolute\_error: 0.0070 33/126 [======>.......................] - ETA: 0s - loss: 9.9162e-05 - mean\_absolute\_error: 0.0075 50/126 [==========>...................] - ETA: 0s - loss: 1.0074e-04 - mean\_absolute\_error: 0.0074 66/126 [==============>...............] - ETA: 0s - loss: 9.8748e-05 - mean\_absolute\_error: 0.0074 82/126 [==================>...........] - ETA: 0s - loss: 1.0088e-04 - mean\_absolute\_error: 0.0075 98/126 [======================>.......] - ETA: 0s - loss: 9.9664e-05 - mean\_absolute\_error: 0.0075114/126 [==========================>...] - ETA: 0s - loss: 9.8084e-05 - mean\_absolute\_error: 0.0075126/126 [==============================] - 0s 4ms/step - loss: 9.9170e-05 - mean\_absolute\_error: 0.0075 - val\_loss: 1.3135e-04 - val\_mean\_absolute\_error: 0.0090  
Epoch 25/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0455e-04 - mean\_absolute\_error: 0.0082 17/126 [===>..........................] - ETA: 0s - loss: 9.4315e-05 - mean\_absolute\_error: 0.0074 33/126 [======>.......................] - ETA: 0s - loss: 9.5250e-05 - mean\_absolute\_error: 0.0074 49/126 [==========>...................] - ETA: 0s - loss: 1.0238e-04 - mean\_absolute\_error: 0.0078 65/126 [==============>...............] - ETA: 0s - loss: 1.0861e-04 - mean\_absolute\_error: 0.0080 82/126 [==================>...........] - ETA: 0s - loss: 1.0894e-04 - mean\_absolute\_error: 0.0080 98/126 [======================>.......] - ETA: 0s - loss: 1.0714e-04 - mean\_absolute\_error: 0.0080115/126 [==========================>...] - ETA: 0s - loss: 1.0711e-04 - mean\_absolute\_error: 0.0079126/126 [==============================] - 0s 4ms/step - loss: 1.0762e-04 - mean\_absolute\_error: 0.0079 - val\_loss: 1.3044e-04 - val\_mean\_absolute\_error: 0.0091  
Epoch 26/100  
 1/126 [..............................] - ETA: 0s - loss: 1.4922e-04 - mean\_absolute\_error: 0.0084 17/126 [===>..........................] - ETA: 0s - loss: 1.1871e-04 - mean\_absolute\_error: 0.0077 33/126 [======>.......................] - ETA: 0s - loss: 1.0611e-04 - mean\_absolute\_error: 0.0075 49/126 [==========>...................] - ETA: 0s - loss: 1.1153e-04 - mean\_absolute\_error: 0.0078 65/126 [==============>...............] - ETA: 0s - loss: 1.1601e-04 - mean\_absolute\_error: 0.0081 81/126 [==================>...........] - ETA: 0s - loss: 1.1497e-04 - mean\_absolute\_error: 0.0081 97/126 [======================>.......] - ETA: 0s - loss: 1.0887e-04 - mean\_absolute\_error: 0.0079113/126 [=========================>....] - ETA: 0s - loss: 1.0892e-04 - mean\_absolute\_error: 0.0079126/126 [==============================] - 0s 4ms/step - loss: 1.0785e-04 - mean\_absolute\_error: 0.0079 - val\_loss: 1.4508e-04 - val\_mean\_absolute\_error: 0.0097  
Epoch 27/100  
 1/126 [..............................] - ETA: 0s - loss: 2.3211e-04 - mean\_absolute\_error: 0.0122 17/126 [===>..........................] - ETA: 0s - loss: 1.2837e-04 - mean\_absolute\_error: 0.0087 33/126 [======>.......................] - ETA: 0s - loss: 1.2028e-04 - mean\_absolute\_error: 0.0083 49/126 [==========>...................] - ETA: 0s - loss: 1.0887e-04 - mean\_absolute\_error: 0.0079 65/126 [==============>...............] - ETA: 0s - loss: 1.0966e-04 - mean\_absolute\_error: 0.0079 81/126 [==================>...........] - ETA: 0s - loss: 1.0681e-04 - mean\_absolute\_error: 0.0078 97/126 [======================>.......] - ETA: 0s - loss: 1.0458e-04 - mean\_absolute\_error: 0.0078113/126 [=========================>....] - ETA: 0s - loss: 1.0065e-04 - mean\_absolute\_error: 0.0076126/126 [==============================] - 0s 4ms/step - loss: 1.0215e-04 - mean\_absolute\_error: 0.0077 - val\_loss: 1.1245e-04 - val\_mean\_absolute\_error: 0.0083  
Epoch 28/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1156e-04 - mean\_absolute\_error: 0.0080 17/126 [===>..........................] - ETA: 0s - loss: 8.9801e-05 - mean\_absolute\_error: 0.0073 33/126 [======>.......................] - ETA: 0s - loss: 9.6548e-05 - mean\_absolute\_error: 0.0075 49/126 [==========>...................] - ETA: 0s - loss: 9.5855e-05 - mean\_absolute\_error: 0.0074 65/126 [==============>...............] - ETA: 0s - loss: 9.7915e-05 - mean\_absolute\_error: 0.0075 82/126 [==================>...........] - ETA: 0s - loss: 1.0170e-04 - mean\_absolute\_error: 0.0077 98/126 [======================>.......] - ETA: 0s - loss: 1.0231e-04 - mean\_absolute\_error: 0.0077114/126 [==========================>...] - ETA: 0s - loss: 1.0056e-04 - mean\_absolute\_error: 0.0076126/126 [==============================] - 0s 4ms/step - loss: 1.0081e-04 - mean\_absolute\_error: 0.0076 - val\_loss: 1.0726e-04 - val\_mean\_absolute\_error: 0.0079  
Epoch 29/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0333e-04 - mean\_absolute\_error: 0.0076 12/126 [=>............................] - ETA: 0s - loss: 1.2102e-04 - mean\_absolute\_error: 0.0083 22/126 [====>.........................] - ETA: 0s - loss: 1.1866e-04 - mean\_absolute\_error: 0.0083 32/126 [======>.......................] - ETA: 0s - loss: 1.1140e-04 - mean\_absolute\_error: 0.0081 42/126 [=========>....................] - ETA: 0s - loss: 1.1118e-04 - mean\_absolute\_error: 0.0080 52/126 [===========>..................] - ETA: 0s - loss: 1.0944e-04 - mean\_absolute\_error: 0.0080 62/126 [=============>................] - ETA: 0s - loss: 1.0640e-04 - mean\_absolute\_error: 0.0079 72/126 [================>.............] - ETA: 0s - loss: 1.0430e-04 - mean\_absolute\_error: 0.0078 82/126 [==================>...........] - ETA: 0s - loss: 1.0318e-04 - mean\_absolute\_error: 0.0077 84/126 [===================>..........] - ETA: 0s - loss: 1.0252e-04 - mean\_absolute\_error: 0.0077100/126 [======================>.......] - ETA: 0s - loss: 1.0299e-04 - mean\_absolute\_error: 0.0077116/126 [==========================>...] - ETA: 0s - loss: 1.0933e-04 - mean\_absolute\_error: 0.0079126/126 [==============================] - 1s 6ms/step - loss: 1.1153e-04 - mean\_absolute\_error: 0.0080 - val\_loss: 1.5711e-04 - val\_mean\_absolute\_error: 0.0100  
Epoch 30/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1648e-04 - mean\_absolute\_error: 0.0086 16/126 [==>...........................] - ETA: 0s - loss: 1.0446e-04 - mean\_absolute\_error: 0.0078 32/126 [======>.......................] - ETA: 0s - loss: 1.0870e-04 - mean\_absolute\_error: 0.0079 48/126 [==========>...................] - ETA: 0s - loss: 1.0194e-04 - mean\_absolute\_error: 0.0077 64/126 [==============>...............] - ETA: 0s - loss: 1.0281e-04 - mean\_absolute\_error: 0.0076 80/126 [==================>...........] - ETA: 0s - loss: 1.0592e-04 - mean\_absolute\_error: 0.0077 96/126 [=====================>........] - ETA: 0s - loss: 1.0393e-04 - mean\_absolute\_error: 0.0077112/126 [=========================>....] - ETA: 0s - loss: 1.0403e-04 - mean\_absolute\_error: 0.0077126/126 [==============================] - 0s 4ms/step - loss: 1.0425e-04 - mean\_absolute\_error: 0.0078 - val\_loss: 1.0601e-04 - val\_mean\_absolute\_error: 0.0079  
Epoch 31/100  
 1/126 [..............................] - ETA: 0s - loss: 8.7582e-05 - mean\_absolute\_error: 0.0071 18/126 [===>..........................] - ETA: 0s - loss: 1.0812e-04 - mean\_absolute\_error: 0.0080 34/126 [=======>......................] - ETA: 0s - loss: 1.0619e-04 - mean\_absolute\_error: 0.0079 50/126 [==========>...................] - ETA: 0s - loss: 1.0107e-04 - mean\_absolute\_error: 0.0077 66/126 [==============>...............] - ETA: 0s - loss: 1.0403e-04 - mean\_absolute\_error: 0.0078 82/126 [==================>...........] - ETA: 0s - loss: 1.0604e-04 - mean\_absolute\_error: 0.0079 98/126 [======================>.......] - ETA: 0s - loss: 1.0978e-04 - mean\_absolute\_error: 0.0081114/126 [==========================>...] - ETA: 0s - loss: 1.1174e-04 - mean\_absolute\_error: 0.0081126/126 [==============================] - 0s 4ms/step - loss: 1.1079e-04 - mean\_absolute\_error: 0.0081 - val\_loss: 1.4109e-04 - val\_mean\_absolute\_error: 0.0095  
Epoch 32/100  
 1/126 [..............................] - ETA: 0s - loss: 6.9801e-05 - mean\_absolute\_error: 0.0072 17/126 [===>..........................] - ETA: 0s - loss: 1.2879e-04 - mean\_absolute\_error: 0.0088 33/126 [======>.......................] - ETA: 0s - loss: 1.3978e-04 - mean\_absolute\_error: 0.0093 48/126 [==========>...................] - ETA: 0s - loss: 1.3326e-04 - mean\_absolute\_error: 0.0090 65/126 [==============>...............] - ETA: 0s - loss: 1.3538e-04 - mean\_absolute\_error: 0.0092 82/126 [==================>...........] - ETA: 0s - loss: 1.3246e-04 - mean\_absolute\_error: 0.0090 98/126 [======================>.......] - ETA: 0s - loss: 1.2924e-04 - mean\_absolute\_error: 0.0089114/126 [==========================>...] - ETA: 0s - loss: 1.3040e-04 - mean\_absolute\_error: 0.0088126/126 [==============================] - 0s 4ms/step - loss: 1.2837e-04 - mean\_absolute\_error: 0.0088 - val\_loss: 1.1554e-04 - val\_mean\_absolute\_error: 0.0084  
Epoch 33/100  
 1/126 [..............................] - ETA: 0s - loss: 1.2209e-04 - mean\_absolute\_error: 0.0094 16/126 [==>...........................] - ETA: 0s - loss: 1.0689e-04 - mean\_absolute\_error: 0.0078 32/126 [======>.......................] - ETA: 0s - loss: 9.3053e-05 - mean\_absolute\_error: 0.0074 48/126 [==========>...................] - ETA: 0s - loss: 9.2865e-05 - mean\_absolute\_error: 0.0074 63/126 [==============>...............] - ETA: 0s - loss: 9.0726e-05 - mean\_absolute\_error: 0.0073 80/126 [==================>...........] - ETA: 0s - loss: 9.7275e-05 - mean\_absolute\_error: 0.0074 96/126 [=====================>........] - ETA: 0s - loss: 9.6164e-05 - mean\_absolute\_error: 0.0075112/126 [=========================>....] - ETA: 0s - loss: 9.7430e-05 - mean\_absolute\_error: 0.0075126/126 [==============================] - 0s 4ms/step - loss: 9.8103e-05 - mean\_absolute\_error: 0.0075 - val\_loss: 1.0617e-04 - val\_mean\_absolute\_error: 0.0080  
Epoch 34/100  
 1/126 [..............................] - ETA: 0s - loss: 8.2520e-05 - mean\_absolute\_error: 0.0072 17/126 [===>..........................] - ETA: 0s - loss: 1.0856e-04 - mean\_absolute\_error: 0.0082 33/126 [======>.......................] - ETA: 0s - loss: 1.1532e-04 - mean\_absolute\_error: 0.0083 50/126 [==========>...................] - ETA: 0s - loss: 1.1602e-04 - mean\_absolute\_error: 0.0083 66/126 [==============>...............] - ETA: 0s - loss: 1.1003e-04 - mean\_absolute\_error: 0.0080 82/126 [==================>...........] - ETA: 0s - loss: 1.0612e-04 - mean\_absolute\_error: 0.0079 98/126 [======================>.......] - ETA: 0s - loss: 1.0634e-04 - mean\_absolute\_error: 0.0078115/126 [==========================>...] - ETA: 0s - loss: 1.0248e-04 - mean\_absolute\_error: 0.0077126/126 [==============================] - 0s 4ms/step - loss: 1.0258e-04 - mean\_absolute\_error: 0.0077 - val\_loss: 1.5518e-04 - val\_mean\_absolute\_error: 0.0101  
Epoch 35/100  
 1/126 [..............................] - ETA: 0s - loss: 8.0272e-05 - mean\_absolute\_error: 0.0071 17/126 [===>..........................] - ETA: 0s - loss: 9.8517e-05 - mean\_absolute\_error: 0.0077 34/126 [=======>......................] - ETA: 0s - loss: 1.0116e-04 - mean\_absolute\_error: 0.0077 50/126 [==========>...................] - ETA: 0s - loss: 1.0270e-04 - mean\_absolute\_error: 0.0078 66/126 [==============>...............] - ETA: 0s - loss: 1.0085e-04 - mean\_absolute\_error: 0.0077 81/126 [==================>...........] - ETA: 0s - loss: 1.0462e-04 - mean\_absolute\_error: 0.0078 97/126 [======================>.......] - ETA: 0s - loss: 1.0638e-04 - mean\_absolute\_error: 0.0078113/126 [=========================>....] - ETA: 0s - loss: 1.0533e-04 - mean\_absolute\_error: 0.0078126/126 [==============================] - 0s 4ms/step - loss: 1.0540e-04 - mean\_absolute\_error: 0.0078 - val\_loss: 1.4148e-04 - val\_mean\_absolute\_error: 0.0096  
Epoch 36/100  
 1/126 [..............................] - ETA: 0s - loss: 8.2772e-05 - mean\_absolute\_error: 0.0074 17/126 [===>..........................] - ETA: 0s - loss: 1.1844e-04 - mean\_absolute\_error: 0.0086 33/126 [======>.......................] - ETA: 0s - loss: 1.2292e-04 - mean\_absolute\_error: 0.0086 49/126 [==========>...................] - ETA: 0s - loss: 1.1735e-04 - mean\_absolute\_error: 0.0084 65/126 [==============>...............] - ETA: 0s - loss: 1.1331e-04 - mean\_absolute\_error: 0.0082 81/126 [==================>...........] - ETA: 0s - loss: 1.0972e-04 - mean\_absolute\_error: 0.0081 97/126 [======================>.......] - ETA: 0s - loss: 1.0930e-04 - mean\_absolute\_error: 0.0081113/126 [=========================>....] - ETA: 0s - loss: 1.0786e-04 - mean\_absolute\_error: 0.0080126/126 [==============================] - 0s 4ms/step - loss: 1.1243e-04 - mean\_absolute\_error: 0.0082 - val\_loss: 1.1161e-04 - val\_mean\_absolute\_error: 0.0083  
Epoch 37/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0207e-04 - mean\_absolute\_error: 0.0072 17/126 [===>..........................] - ETA: 0s - loss: 1.2164e-04 - mean\_absolute\_error: 0.0085 33/126 [======>.......................] - ETA: 0s - loss: 1.1997e-04 - mean\_absolute\_error: 0.0083 49/126 [==========>...................] - ETA: 0s - loss: 1.1427e-04 - mean\_absolute\_error: 0.0082 65/126 [==============>...............] - ETA: 0s - loss: 1.1342e-04 - mean\_absolute\_error: 0.0082 81/126 [==================>...........] - ETA: 0s - loss: 1.1474e-04 - mean\_absolute\_error: 0.0082 97/126 [======================>.......] - ETA: 0s - loss: 1.1278e-04 - mean\_absolute\_error: 0.0082112/126 [=========================>....] - ETA: 0s - loss: 1.1242e-04 - mean\_absolute\_error: 0.0082126/126 [==============================] - 0s 4ms/step - loss: 1.1734e-04 - mean\_absolute\_error: 0.0083 - val\_loss: 1.5401e-04 - val\_mean\_absolute\_error: 0.0100  
Epoch 38/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1922e-04 - mean\_absolute\_error: 0.0084 17/126 [===>..........................] - ETA: 0s - loss: 1.4008e-04 - mean\_absolute\_error: 0.0095 33/126 [======>.......................] - ETA: 0s - loss: 1.4790e-04 - mean\_absolute\_error: 0.0097 49/126 [==========>...................] - ETA: 0s - loss: 1.3730e-04 - mean\_absolute\_error: 0.0093 65/126 [==============>...............] - ETA: 0s - loss: 1.2808e-04 - mean\_absolute\_error: 0.0089 81/126 [==================>...........] - ETA: 0s - loss: 1.2415e-04 - mean\_absolute\_error: 0.0086 97/126 [======================>.......] - ETA: 0s - loss: 1.2119e-04 - mean\_absolute\_error: 0.0085113/126 [=========================>....] - ETA: 0s - loss: 1.1865e-04 - mean\_absolute\_error: 0.0084126/126 [==============================] - 0s 4ms/step - loss: 1.1791e-04 - mean\_absolute\_error: 0.0083 - val\_loss: 1.3787e-04 - val\_mean\_absolute\_error: 0.0094  
Epoch 39/100  
 1/126 [..............................] - ETA: 0s - loss: 1.3963e-04 - mean\_absolute\_error: 0.0080 17/126 [===>..........................] - ETA: 0s - loss: 1.0400e-04 - mean\_absolute\_error: 0.0079 33/126 [======>.......................] - ETA: 0s - loss: 1.0648e-04 - mean\_absolute\_error: 0.0078 49/126 [==========>...................] - ETA: 0s - loss: 1.0211e-04 - mean\_absolute\_error: 0.0078 66/126 [==============>...............] - ETA: 0s - loss: 1.0330e-04 - mean\_absolute\_error: 0.0077 83/126 [==================>...........] - ETA: 0s - loss: 1.0712e-04 - mean\_absolute\_error: 0.0079 99/126 [======================>.......] - ETA: 0s - loss: 1.0870e-04 - mean\_absolute\_error: 0.0080115/126 [==========================>...] - ETA: 0s - loss: 1.0924e-04 - mean\_absolute\_error: 0.0080126/126 [==============================] - 0s 4ms/step - loss: 1.0874e-04 - mean\_absolute\_error: 0.0080 - val\_loss: 1.0456e-04 - val\_mean\_absolute\_error: 0.0078  
Epoch 40/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0786e-04 - mean\_absolute\_error: 0.0078 17/126 [===>..........................] - ETA: 0s - loss: 1.0372e-04 - mean\_absolute\_error: 0.0078 34/126 [=======>......................] - ETA: 0s - loss: 1.0383e-04 - mean\_absolute\_error: 0.0078 49/126 [==========>...................] - ETA: 0s - loss: 1.0465e-04 - mean\_absolute\_error: 0.0077 65/126 [==============>...............] - ETA: 0s - loss: 1.1024e-04 - mean\_absolute\_error: 0.0080 81/126 [==================>...........] - ETA: 0s - loss: 1.0978e-04 - mean\_absolute\_error: 0.0080 98/126 [======================>.......] - ETA: 0s - loss: 1.0615e-04 - mean\_absolute\_error: 0.0078114/126 [==========================>...] - ETA: 0s - loss: 1.0330e-04 - mean\_absolute\_error: 0.0077126/126 [==============================] - 0s 4ms/step - loss: 1.0196e-04 - mean\_absolute\_error: 0.0077 - val\_loss: 1.0820e-04 - val\_mean\_absolute\_error: 0.0081  
Epoch 41/100  
 1/126 [..............................] - ETA: 0s - loss: 8.0651e-05 - mean\_absolute\_error: 0.0071 17/126 [===>..........................] - ETA: 0s - loss: 1.4390e-04 - mean\_absolute\_error: 0.0094 33/126 [======>.......................] - ETA: 0s - loss: 1.3100e-04 - mean\_absolute\_error: 0.0089 49/126 [==========>...................] - ETA: 0s - loss: 1.4100e-04 - mean\_absolute\_error: 0.0092 65/126 [==============>...............] - ETA: 0s - loss: 1.3849e-04 - mean\_absolute\_error: 0.0092 80/126 [==================>...........] - ETA: 0s - loss: 1.3051e-04 - mean\_absolute\_error: 0.0089 96/126 [=====================>........] - ETA: 0s - loss: 1.2599e-04 - mean\_absolute\_error: 0.0087112/126 [=========================>....] - ETA: 0s - loss: 1.2084e-04 - mean\_absolute\_error: 0.0085126/126 [==============================] - 0s 4ms/step - loss: 1.2009e-04 - mean\_absolute\_error: 0.0085 - val\_loss: 1.4185e-04 - val\_mean\_absolute\_error: 0.0096  
Epoch 42/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0659e-04 - mean\_absolute\_error: 0.0081 17/126 [===>..........................] - ETA: 0s - loss: 1.1090e-04 - mean\_absolute\_error: 0.0080 32/126 [======>.......................] - ETA: 0s - loss: 1.1066e-04 - mean\_absolute\_error: 0.0078 48/126 [==========>...................] - ETA: 0s - loss: 1.1364e-04 - mean\_absolute\_error: 0.0080 63/126 [==============>...............] - ETA: 0s - loss: 1.1551e-04 - mean\_absolute\_error: 0.0081 78/126 [=================>............] - ETA: 0s - loss: 1.2186e-04 - mean\_absolute\_error: 0.0084 94/126 [=====================>........] - ETA: 0s - loss: 1.1995e-04 - mean\_absolute\_error: 0.0083110/126 [=========================>....] - ETA: 0s - loss: 1.2145e-04 - mean\_absolute\_error: 0.0084125/126 [============================>.] - ETA: 0s - loss: 1.3029e-04 - mean\_absolute\_error: 0.0088126/126 [==============================] - 0s 4ms/step - loss: 1.3075e-04 - mean\_absolute\_error: 0.0088 - val\_loss: 1.1595e-04 - val\_mean\_absolute\_error: 0.0085  
Epoch 43/100  
 1/126 [..............................] - ETA: 0s - loss: 4.9000e-05 - mean\_absolute\_error: 0.0052 17/126 [===>..........................] - ETA: 0s - loss: 1.0614e-04 - mean\_absolute\_error: 0.0080 32/126 [======>.......................] - ETA: 0s - loss: 1.0259e-04 - mean\_absolute\_error: 0.0077 48/126 [==========>...................] - ETA: 0s - loss: 1.0345e-04 - mean\_absolute\_error: 0.0077 64/126 [==============>...............] - ETA: 0s - loss: 1.1691e-04 - mean\_absolute\_error: 0.0082 80/126 [==================>...........] - ETA: 0s - loss: 1.1804e-04 - mean\_absolute\_error: 0.0083 96/126 [=====================>........] - ETA: 0s - loss: 1.1572e-04 - mean\_absolute\_error: 0.0083112/126 [=========================>....] - ETA: 0s - loss: 1.1509e-04 - mean\_absolute\_error: 0.0083126/126 [==============================] - 0s 4ms/step - loss: 1.2169e-04 - mean\_absolute\_error: 0.0085 - val\_loss: 2.4220e-04 - val\_mean\_absolute\_error: 0.0132  
Epoch 44/100  
 1/126 [..............................] - ETA: 0s - loss: 1.3253e-04 - mean\_absolute\_error: 0.0092 17/126 [===>..........................] - ETA: 0s - loss: 1.0663e-04 - mean\_absolute\_error: 0.0078 33/126 [======>.......................] - ETA: 0s - loss: 1.1532e-04 - mean\_absolute\_error: 0.0081 49/126 [==========>...................] - ETA: 0s - loss: 1.1097e-04 - mean\_absolute\_error: 0.0081 66/126 [==============>...............] - ETA: 0s - loss: 1.1018e-04 - mean\_absolute\_error: 0.0080 82/126 [==================>...........] - ETA: 0s - loss: 1.1050e-04 - mean\_absolute\_error: 0.0081 97/126 [======================>.......] - ETA: 0s - loss: 1.1672e-04 - mean\_absolute\_error: 0.0083114/126 [==========================>...] - ETA: 0s - loss: 1.1732e-04 - mean\_absolute\_error: 0.0084126/126 [==============================] - 0s 4ms/step - loss: 1.1713e-04 - mean\_absolute\_error: 0.0083 - val\_loss: 1.3288e-04 - val\_mean\_absolute\_error: 0.0091  
Epoch 45/100  
 1/126 [..............................] - ETA: 0s - loss: 1.3570e-04 - mean\_absolute\_error: 0.0103 17/126 [===>..........................] - ETA: 0s - loss: 9.0269e-05 - mean\_absolute\_error: 0.0073 34/126 [=======>......................] - ETA: 0s - loss: 1.1260e-04 - mean\_absolute\_error: 0.0081 50/126 [==========>...................] - ETA: 0s - loss: 1.2290e-04 - mean\_absolute\_error: 0.0085 66/126 [==============>...............] - ETA: 0s - loss: 1.2376e-04 - mean\_absolute\_error: 0.0086 82/126 [==================>...........] - ETA: 0s - loss: 1.2023e-04 - mean\_absolute\_error: 0.0085 98/126 [======================>.......] - ETA: 0s - loss: 1.2183e-04 - mean\_absolute\_error: 0.0085114/126 [==========================>...] - ETA: 0s - loss: 1.2421e-04 - mean\_absolute\_error: 0.0086126/126 [==============================] - 0s 4ms/step - loss: 1.2185e-04 - mean\_absolute\_error: 0.0085 - val\_loss: 1.6414e-04 - val\_mean\_absolute\_error: 0.0105  
Epoch 46/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1285e-04 - mean\_absolute\_error: 0.0079 17/126 [===>..........................] - ETA: 0s - loss: 1.2587e-04 - mean\_absolute\_error: 0.0088 33/126 [======>.......................] - ETA: 0s - loss: 1.2703e-04 - mean\_absolute\_error: 0.0088 49/126 [==========>...................] - ETA: 0s - loss: 1.4010e-04 - mean\_absolute\_error: 0.0091 65/126 [==============>...............] - ETA: 0s - loss: 1.4022e-04 - mean\_absolute\_error: 0.0092 81/126 [==================>...........] - ETA: 0s - loss: 1.3802e-04 - mean\_absolute\_error: 0.0091 97/126 [======================>.......] - ETA: 0s - loss: 1.3384e-04 - mean\_absolute\_error: 0.0090113/126 [=========================>....] - ETA: 0s - loss: 1.3164e-04 - mean\_absolute\_error: 0.0089126/126 [==============================] - 0s 4ms/step - loss: 1.2960e-04 - mean\_absolute\_error: 0.0088 - val\_loss: 1.0680e-04 - val\_mean\_absolute\_error: 0.0080  
Epoch 47/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1722e-04 - mean\_absolute\_error: 0.0087 18/126 [===>..........................] - ETA: 0s - loss: 9.1918e-05 - mean\_absolute\_error: 0.0072 34/126 [=======>......................] - ETA: 0s - loss: 1.0371e-04 - mean\_absolute\_error: 0.0078 50/126 [==========>...................] - ETA: 0s - loss: 1.0398e-04 - mean\_absolute\_error: 0.0078 66/126 [==============>...............] - ETA: 0s - loss: 1.0304e-04 - mean\_absolute\_error: 0.0078 82/126 [==================>...........] - ETA: 0s - loss: 1.0337e-04 - mean\_absolute\_error: 0.0078 98/126 [======================>.......] - ETA: 0s - loss: 1.0357e-04 - mean\_absolute\_error: 0.0078114/126 [==========================>...] - ETA: 0s - loss: 1.0216e-04 - mean\_absolute\_error: 0.0077126/126 [==============================] - 0s 4ms/step - loss: 1.0273e-04 - mean\_absolute\_error: 0.0077 - val\_loss: 1.1710e-04 - val\_mean\_absolute\_error: 0.0086  
Epoch 48/100  
 1/126 [..............................] - ETA: 0s - loss: 6.6949e-05 - mean\_absolute\_error: 0.0066 17/126 [===>..........................] - ETA: 0s - loss: 1.0630e-04 - mean\_absolute\_error: 0.0078 33/126 [======>.......................] - ETA: 0s - loss: 1.0179e-04 - mean\_absolute\_error: 0.0078 49/126 [==========>...................] - ETA: 0s - loss: 9.9957e-05 - mean\_absolute\_error: 0.0076 64/126 [==============>...............] - ETA: 0s - loss: 9.5156e-05 - mean\_absolute\_error: 0.0075 80/126 [==================>...........] - ETA: 0s - loss: 9.8485e-05 - mean\_absolute\_error: 0.0076 96/126 [=====================>........] - ETA: 0s - loss: 1.0528e-04 - mean\_absolute\_error: 0.0078112/126 [=========================>....] - ETA: 0s - loss: 1.1031e-04 - mean\_absolute\_error: 0.0080126/126 [==============================] - 0s 4ms/step - loss: 1.0967e-04 - mean\_absolute\_error: 0.0080 - val\_loss: 1.0308e-04 - val\_mean\_absolute\_error: 0.0078  
Epoch 49/100  
 1/126 [..............................] - ETA: 0s - loss: 8.7045e-05 - mean\_absolute\_error: 0.0075 17/126 [===>..........................] - ETA: 0s - loss: 9.2105e-05 - mean\_absolute\_error: 0.0076 33/126 [======>.......................] - ETA: 0s - loss: 8.6898e-05 - mean\_absolute\_error: 0.0073 50/126 [==========>...................] - ETA: 0s - loss: 9.3786e-05 - mean\_absolute\_error: 0.0074 66/126 [==============>...............] - ETA: 0s - loss: 9.7948e-05 - mean\_absolute\_error: 0.0076 82/126 [==================>...........] - ETA: 0s - loss: 1.0948e-04 - mean\_absolute\_error: 0.0081 98/126 [======================>.......] - ETA: 0s - loss: 1.1418e-04 - mean\_absolute\_error: 0.0083114/126 [==========================>...] - ETA: 0s - loss: 1.1578e-04 - mean\_absolute\_error: 0.0083126/126 [==============================] - 0s 4ms/step - loss: 1.1465e-04 - mean\_absolute\_error: 0.0082 - val\_loss: 1.7189e-04 - val\_mean\_absolute\_error: 0.0108  
Epoch 50/100  
 1/126 [..............................] - ETA: 0s - loss: 6.5542e-05 - mean\_absolute\_error: 0.0065 17/126 [===>..........................] - ETA: 0s - loss: 1.1111e-04 - mean\_absolute\_error: 0.0082 33/126 [======>.......................] - ETA: 0s - loss: 1.2149e-04 - mean\_absolute\_error: 0.0086 49/126 [==========>...................] - ETA: 0s - loss: 1.1302e-04 - mean\_absolute\_error: 0.0083 65/126 [==============>...............] - ETA: 0s - loss: 1.0719e-04 - mean\_absolute\_error: 0.0080 81/126 [==================>...........] - ETA: 0s - loss: 1.0551e-04 - mean\_absolute\_error: 0.0079 97/126 [======================>.......] - ETA: 0s - loss: 1.0818e-04 - mean\_absolute\_error: 0.0080114/126 [==========================>...] - ETA: 0s - loss: 1.0893e-04 - mean\_absolute\_error: 0.0080126/126 [==============================] - 0s 4ms/step - loss: 1.0860e-04 - mean\_absolute\_error: 0.0080 - val\_loss: 1.6434e-04 - val\_mean\_absolute\_error: 0.0105  
Epoch 51/100  
 1/126 [..............................] - ETA: 0s - loss: 9.9513e-05 - mean\_absolute\_error: 0.0086 17/126 [===>..........................] - ETA: 0s - loss: 9.8467e-05 - mean\_absolute\_error: 0.0077 33/126 [======>.......................] - ETA: 0s - loss: 1.0047e-04 - mean\_absolute\_error: 0.0075 49/126 [==========>...................] - ETA: 0s - loss: 1.1167e-04 - mean\_absolute\_error: 0.0080 65/126 [==============>...............] - ETA: 0s - loss: 1.0735e-04 - mean\_absolute\_error: 0.0079 79/126 [=================>............] - ETA: 0s - loss: 1.0641e-04 - mean\_absolute\_error: 0.0079 92/126 [====================>.........] - ETA: 0s - loss: 1.0734e-04 - mean\_absolute\_error: 0.0079105/126 [========================>.....] - ETA: 0s - loss: 1.0915e-04 - mean\_absolute\_error: 0.0080121/126 [===========================>..] - ETA: 0s - loss: 1.0737e-04 - mean\_absolute\_error: 0.0079126/126 [==============================] - 0s 4ms/step - loss: 1.0717e-04 - mean\_absolute\_error: 0.0079 - val\_loss: 1.4227e-04 - val\_mean\_absolute\_error: 0.0096  
Epoch 52/100  
 1/126 [..............................] - ETA: 0s - loss: 1.6798e-04 - mean\_absolute\_error: 0.0088 17/126 [===>..........................] - ETA: 0s - loss: 1.3960e-04 - mean\_absolute\_error: 0.0091 33/126 [======>.......................] - ETA: 0s - loss: 1.2850e-04 - mean\_absolute\_error: 0.0087 49/126 [==========>...................] - ETA: 0s - loss: 1.3510e-04 - mean\_absolute\_error: 0.0090 65/126 [==============>...............] - ETA: 0s - loss: 1.3361e-04 - mean\_absolute\_error: 0.0089 81/126 [==================>...........] - ETA: 0s - loss: 1.2705e-04 - mean\_absolute\_error: 0.0086 97/126 [======================>.......] - ETA: 0s - loss: 1.2233e-04 - mean\_absolute\_error: 0.0085113/126 [=========================>....] - ETA: 0s - loss: 1.2090e-04 - mean\_absolute\_error: 0.0084126/126 [==============================] - 0s 4ms/step - loss: 1.1871e-04 - mean\_absolute\_error: 0.0084 - val\_loss: 1.1401e-04 - val\_mean\_absolute\_error: 0.0085  
Epoch 53/100  
 1/126 [..............................] - ETA: 0s - loss: 6.7766e-05 - mean\_absolute\_error: 0.0062 17/126 [===>..........................] - ETA: 0s - loss: 9.1282e-05 - mean\_absolute\_error: 0.0072 33/126 [======>.......................] - ETA: 0s - loss: 1.0036e-04 - mean\_absolute\_error: 0.0076 49/126 [==========>...................] - ETA: 0s - loss: 1.1254e-04 - mean\_absolute\_error: 0.0081 65/126 [==============>...............] - ETA: 0s - loss: 1.1037e-04 - mean\_absolute\_error: 0.0080 82/126 [==================>...........] - ETA: 0s - loss: 1.0916e-04 - mean\_absolute\_error: 0.0080 98/126 [======================>.......] - ETA: 0s - loss: 1.0939e-04 - mean\_absolute\_error: 0.0080115/126 [==========================>...] - ETA: 0s - loss: 1.1453e-04 - mean\_absolute\_error: 0.0082126/126 [==============================] - 0s 4ms/step - loss: 1.1688e-04 - mean\_absolute\_error: 0.0083 - val\_loss: 2.1773e-04 - val\_mean\_absolute\_error: 0.0124  
Epoch 54/100  
 1/126 [..............................] - ETA: 0s - loss: 1.4027e-04 - mean\_absolute\_error: 0.0099 17/126 [===>..........................] - ETA: 0s - loss: 1.0393e-04 - mean\_absolute\_error: 0.0079 33/126 [======>.......................] - ETA: 0s - loss: 9.7622e-05 - mean\_absolute\_error: 0.0077 49/126 [==========>...................] - ETA: 0s - loss: 9.7835e-05 - mean\_absolute\_error: 0.0077 65/126 [==============>...............] - ETA: 0s - loss: 1.0101e-04 - mean\_absolute\_error: 0.0078 81/126 [==================>...........] - ETA: 0s - loss: 1.0554e-04 - mean\_absolute\_error: 0.0079 98/126 [======================>.......] - ETA: 0s - loss: 1.0823e-04 - mean\_absolute\_error: 0.0080114/126 [==========================>...] - ETA: 0s - loss: 1.0833e-04 - mean\_absolute\_error: 0.0080126/126 [==============================] - 0s 4ms/step - loss: 1.0965e-04 - mean\_absolute\_error: 0.0081 - val\_loss: 1.9799e-04 - val\_mean\_absolute\_error: 0.0114  
Epoch 55/100  
 1/126 [..............................] - ETA: 0s - loss: 1.7997e-04 - mean\_absolute\_error: 0.0117 17/126 [===>..........................] - ETA: 0s - loss: 1.3016e-04 - mean\_absolute\_error: 0.0088 33/126 [======>.......................] - ETA: 0s - loss: 1.1371e-04 - mean\_absolute\_error: 0.0083 48/126 [==========>...................] - ETA: 0s - loss: 1.2017e-04 - mean\_absolute\_error: 0.0085 63/126 [==============>...............] - ETA: 0s - loss: 1.1782e-04 - mean\_absolute\_error: 0.0084 79/126 [=================>............] - ETA: 0s - loss: 1.1922e-04 - mean\_absolute\_error: 0.0084 95/126 [=====================>........] - ETA: 0s - loss: 1.1474e-04 - mean\_absolute\_error: 0.0082111/126 [=========================>....] - ETA: 0s - loss: 1.1178e-04 - mean\_absolute\_error: 0.0081126/126 [==============================] - 0s 4ms/step - loss: 1.0987e-04 - mean\_absolute\_error: 0.0081 - val\_loss: 1.1576e-04 - val\_mean\_absolute\_error: 0.0086  
Epoch 56/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1883e-04 - mean\_absolute\_error: 0.0083 17/126 [===>..........................] - ETA: 0s - loss: 1.2819e-04 - mean\_absolute\_error: 0.0087 33/126 [======>.......................] - ETA: 0s - loss: 1.1551e-04 - mean\_absolute\_error: 0.0083 49/126 [==========>...................] - ETA: 0s - loss: 1.0514e-04 - mean\_absolute\_error: 0.0078 65/126 [==============>...............] - ETA: 0s - loss: 1.0446e-04 - mean\_absolute\_error: 0.0078 81/126 [==================>...........] - ETA: 0s - loss: 1.0429e-04 - mean\_absolute\_error: 0.0078 97/126 [======================>.......] - ETA: 0s - loss: 1.0330e-04 - mean\_absolute\_error: 0.0078113/126 [=========================>....] - ETA: 0s - loss: 1.0511e-04 - mean\_absolute\_error: 0.0078126/126 [==============================] - 0s 4ms/step - loss: 1.0577e-04 - mean\_absolute\_error: 0.0078 - val\_loss: 1.0475e-04 - val\_mean\_absolute\_error: 0.0080  
Epoch 57/100  
 1/126 [..............................] - ETA: 0s - loss: 6.7774e-05 - mean\_absolute\_error: 0.0064 17/126 [===>..........................] - ETA: 0s - loss: 1.0417e-04 - mean\_absolute\_error: 0.0074 33/126 [======>.......................] - ETA: 0s - loss: 9.8417e-05 - mean\_absolute\_error: 0.0074 49/126 [==========>...................] - ETA: 0s - loss: 1.0276e-04 - mean\_absolute\_error: 0.0077 65/126 [==============>...............] - ETA: 0s - loss: 1.0138e-04 - mean\_absolute\_error: 0.0077 81/126 [==================>...........] - ETA: 0s - loss: 9.9502e-05 - mean\_absolute\_error: 0.0076 98/126 [======================>.......] - ETA: 0s - loss: 1.0053e-04 - mean\_absolute\_error: 0.0076113/126 [=========================>....] - ETA: 0s - loss: 1.0317e-04 - mean\_absolute\_error: 0.0077126/126 [==============================] - 0s 4ms/step - loss: 1.0378e-04 - mean\_absolute\_error: 0.0078 - val\_loss: 1.3274e-04 - val\_mean\_absolute\_error: 0.0091  
Epoch 58/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1164e-04 - mean\_absolute\_error: 0.0089 17/126 [===>..........................] - ETA: 0s - loss: 1.3871e-04 - mean\_absolute\_error: 0.0090 33/126 [======>.......................] - ETA: 0s - loss: 1.5783e-04 - mean\_absolute\_error: 0.0099 49/126 [==========>...................] - ETA: 0s - loss: 1.8434e-04 - mean\_absolute\_error: 0.0107 66/126 [==============>...............] - ETA: 0s - loss: 1.8449e-04 - mean\_absolute\_error: 0.0108 82/126 [==================>...........] - ETA: 0s - loss: 1.7003e-04 - mean\_absolute\_error: 0.0104 98/126 [======================>.......] - ETA: 0s - loss: 1.6296e-04 - mean\_absolute\_error: 0.0101115/126 [==========================>...] - ETA: 0s - loss: 1.5783e-04 - mean\_absolute\_error: 0.0099126/126 [==============================] - 0s 4ms/step - loss: 1.5224e-04 - mean\_absolute\_error: 0.0097 - val\_loss: 1.0776e-04 - val\_mean\_absolute\_error: 0.0081  
Epoch 59/100  
 1/126 [..............................] - ETA: 0s - loss: 8.8137e-05 - mean\_absolute\_error: 0.0075 17/126 [===>..........................] - ETA: 0s - loss: 1.1440e-04 - mean\_absolute\_error: 0.0082 33/126 [======>.......................] - ETA: 0s - loss: 1.3029e-04 - mean\_absolute\_error: 0.0088 48/126 [==========>...................] - ETA: 0s - loss: 1.3427e-04 - mean\_absolute\_error: 0.0090 64/126 [==============>...............] - ETA: 0s - loss: 1.2873e-04 - mean\_absolute\_error: 0.0088 80/126 [==================>...........] - ETA: 0s - loss: 1.2081e-04 - mean\_absolute\_error: 0.0085 96/126 [=====================>........] - ETA: 0s - loss: 1.1806e-04 - mean\_absolute\_error: 0.0084112/126 [=========================>....] - ETA: 0s - loss: 1.1774e-04 - mean\_absolute\_error: 0.0084126/126 [==============================] - 0s 4ms/step - loss: 1.1715e-04 - mean\_absolute\_error: 0.0083 - val\_loss: 1.0869e-04 - val\_mean\_absolute\_error: 0.0082  
Epoch 60/100  
 1/126 [..............................] - ETA: 0s - loss: 2.2885e-05 - mean\_absolute\_error: 0.0039 17/126 [===>..........................] - ETA: 0s - loss: 9.4284e-05 - mean\_absolute\_error: 0.0075 33/126 [======>.......................] - ETA: 0s - loss: 9.5991e-05 - mean\_absolute\_error: 0.0075 49/126 [==========>...................] - ETA: 0s - loss: 9.1780e-05 - mean\_absolute\_error: 0.0073 65/126 [==============>...............] - ETA: 0s - loss: 1.0026e-04 - mean\_absolute\_error: 0.0077 81/126 [==================>...........] - ETA: 0s - loss: 1.0479e-04 - mean\_absolute\_error: 0.0078 97/126 [======================>.......] - ETA: 0s - loss: 1.0354e-04 - mean\_absolute\_error: 0.0078113/126 [=========================>....] - ETA: 0s - loss: 1.0319e-04 - mean\_absolute\_error: 0.0078126/126 [==============================] - 0s 4ms/step - loss: 1.0063e-04 - mean\_absolute\_error: 0.0077 - val\_loss: 1.0623e-04 - val\_mean\_absolute\_error: 0.0081  
Epoch 61/100  
 1/126 [..............................] - ETA: 0s - loss: 4.0404e-05 - mean\_absolute\_error: 0.0048 15/126 [==>...........................] - ETA: 0s - loss: 8.8860e-05 - mean\_absolute\_error: 0.0073 31/126 [======>.......................] - ETA: 0s - loss: 9.4005e-05 - mean\_absolute\_error: 0.0074 47/126 [==========>...................] - ETA: 0s - loss: 9.7339e-05 - mean\_absolute\_error: 0.0075 63/126 [==============>...............] - ETA: 0s - loss: 1.0215e-04 - mean\_absolute\_error: 0.0076 79/126 [=================>............] - ETA: 0s - loss: 1.0284e-04 - mean\_absolute\_error: 0.0077 95/126 [=====================>........] - ETA: 0s - loss: 1.0343e-04 - mean\_absolute\_error: 0.0078111/126 [=========================>....] - ETA: 0s - loss: 1.0229e-04 - mean\_absolute\_error: 0.0077126/126 [==============================] - 0s 4ms/step - loss: 1.0719e-04 - mean\_absolute\_error: 0.0079 - val\_loss: 1.1239e-04 - val\_mean\_absolute\_error: 0.0084  
Epoch 62/100  
 1/126 [..............................] - ETA: 0s - loss: 8.8189e-05 - mean\_absolute\_error: 0.0075 17/126 [===>..........................] - ETA: 0s - loss: 9.7727e-05 - mean\_absolute\_error: 0.0075 33/126 [======>.......................] - ETA: 0s - loss: 9.0206e-05 - mean\_absolute\_error: 0.0073 49/126 [==========>...................] - ETA: 0s - loss: 8.9603e-05 - mean\_absolute\_error: 0.0073 65/126 [==============>...............] - ETA: 0s - loss: 9.8289e-05 - mean\_absolute\_error: 0.0076 81/126 [==================>...........] - ETA: 0s - loss: 1.0225e-04 - mean\_absolute\_error: 0.0078 97/126 [======================>.......] - ETA: 0s - loss: 1.0418e-04 - mean\_absolute\_error: 0.0079113/126 [=========================>....] - ETA: 0s - loss: 1.0358e-04 - mean\_absolute\_error: 0.0078126/126 [==============================] - 0s 4ms/step - loss: 1.0248e-04 - mean\_absolute\_error: 0.0078 - val\_loss: 1.0559e-04 - val\_mean\_absolute\_error: 0.0080  
Epoch 63/100  
 1/126 [..............................] - ETA: 0s - loss: 8.2239e-05 - mean\_absolute\_error: 0.0065 18/126 [===>..........................] - ETA: 0s - loss: 9.9417e-05 - mean\_absolute\_error: 0.0079 34/126 [=======>......................] - ETA: 0s - loss: 1.0259e-04 - mean\_absolute\_error: 0.0077 50/126 [==========>...................] - ETA: 0s - loss: 9.8597e-05 - mean\_absolute\_error: 0.0075 67/126 [==============>...............] - ETA: 0s - loss: 9.5907e-05 - mean\_absolute\_error: 0.0074 83/126 [==================>...........] - ETA: 0s - loss: 9.8649e-05 - mean\_absolute\_error: 0.0076 99/126 [======================>.......] - ETA: 0s - loss: 1.0080e-04 - mean\_absolute\_error: 0.0076116/126 [==========================>...] - ETA: 0s - loss: 1.0387e-04 - mean\_absolute\_error: 0.0078126/126 [==============================] - 0s 4ms/step - loss: 1.0248e-04 - mean\_absolute\_error: 0.0077 - val\_loss: 1.0081e-04 - val\_mean\_absolute\_error: 0.0077  
Epoch 64/100  
 1/126 [..............................] - ETA: 0s - loss: 9.3566e-05 - mean\_absolute\_error: 0.0076 17/126 [===>..........................] - ETA: 0s - loss: 1.3114e-04 - mean\_absolute\_error: 0.0091 32/126 [======>.......................] - ETA: 0s - loss: 1.6885e-04 - mean\_absolute\_error: 0.0105 49/126 [==========>...................] - ETA: 0s - loss: 1.5368e-04 - mean\_absolute\_error: 0.0099 63/126 [==============>...............] - ETA: 0s - loss: 1.4211e-04 - mean\_absolute\_error: 0.0094 79/126 [=================>............] - ETA: 0s - loss: 1.4180e-04 - mean\_absolute\_error: 0.0095 94/126 [=====================>........] - ETA: 0s - loss: 1.3453e-04 - mean\_absolute\_error: 0.0092110/126 [=========================>....] - ETA: 0s - loss: 1.2994e-04 - mean\_absolute\_error: 0.0089126/126 [==============================] - ETA: 0s - loss: 1.3642e-04 - mean\_absolute\_error: 0.0091126/126 [==============================] - 0s 4ms/step - loss: 1.3642e-04 - mean\_absolute\_error: 0.0091 - val\_loss: 3.3927e-04 - val\_mean\_absolute\_error: 0.0160  
Epoch 65/100  
 1/126 [..............................] - ETA: 0s - loss: 2.5367e-04 - mean\_absolute\_error: 0.0145 17/126 [===>..........................] - ETA: 0s - loss: 1.7211e-04 - mean\_absolute\_error: 0.0106 33/126 [======>.......................] - ETA: 0s - loss: 1.6602e-04 - mean\_absolute\_error: 0.0102 49/126 [==========>...................] - ETA: 0s - loss: 1.5426e-04 - mean\_absolute\_error: 0.0099 65/126 [==============>...............] - ETA: 0s - loss: 1.4080e-04 - mean\_absolute\_error: 0.0094 81/126 [==================>...........] - ETA: 0s - loss: 1.4360e-04 - mean\_absolute\_error: 0.0094 97/126 [======================>.......] - ETA: 0s - loss: 1.4503e-04 - mean\_absolute\_error: 0.0095113/126 [=========================>....] - ETA: 0s - loss: 1.4351e-04 - mean\_absolute\_error: 0.0093126/126 [==============================] - 0s 4ms/step - loss: 1.3911e-04 - mean\_absolute\_error: 0.0092 - val\_loss: 1.0007e-04 - val\_mean\_absolute\_error: 0.0078  
Epoch 66/100  
 1/126 [..............................] - ETA: 0s - loss: 8.6022e-05 - mean\_absolute\_error: 0.0065 17/126 [===>..........................] - ETA: 0s - loss: 8.4030e-05 - mean\_absolute\_error: 0.0071 34/126 [=======>......................] - ETA: 0s - loss: 1.0055e-04 - mean\_absolute\_error: 0.0077 51/126 [===========>..................] - ETA: 0s - loss: 1.0156e-04 - mean\_absolute\_error: 0.0078 67/126 [==============>...............] - ETA: 0s - loss: 1.0052e-04 - mean\_absolute\_error: 0.0077 84/126 [===================>..........] - ETA: 0s - loss: 9.9248e-05 - mean\_absolute\_error: 0.0076100/126 [======================>.......] - ETA: 0s - loss: 9.6833e-05 - mean\_absolute\_error: 0.0075116/126 [==========================>...] - ETA: 0s - loss: 9.7352e-05 - mean\_absolute\_error: 0.0075126/126 [==============================] - 0s 4ms/step - loss: 9.8095e-05 - mean\_absolute\_error: 0.0075 - val\_loss: 9.8823e-05 - val\_mean\_absolute\_error: 0.0076  
Epoch 67/100  
 1/126 [..............................] - ETA: 0s - loss: 6.5861e-05 - mean\_absolute\_error: 0.0064 17/126 [===>..........................] - ETA: 0s - loss: 9.2446e-05 - mean\_absolute\_error: 0.0072 33/126 [======>.......................] - ETA: 0s - loss: 1.0377e-04 - mean\_absolute\_error: 0.0077 50/126 [==========>...................] - ETA: 0s - loss: 1.1585e-04 - mean\_absolute\_error: 0.0083 66/126 [==============>...............] - ETA: 0s - loss: 1.1820e-04 - mean\_absolute\_error: 0.0084 82/126 [==================>...........] - ETA: 0s - loss: 1.1343e-04 - mean\_absolute\_error: 0.0082 99/126 [======================>.......] - ETA: 0s - loss: 1.1215e-04 - mean\_absolute\_error: 0.0081115/126 [==========================>...] - ETA: 0s - loss: 1.1174e-04 - mean\_absolute\_error: 0.0081126/126 [==============================] - 0s 4ms/step - loss: 1.1538e-04 - mean\_absolute\_error: 0.0082 - val\_loss: 9.9372e-05 - val\_mean\_absolute\_error: 0.0078  
Epoch 68/100  
 1/126 [..............................] - ETA: 0s - loss: 5.1301e-05 - mean\_absolute\_error: 0.0059 16/126 [==>...........................] - ETA: 0s - loss: 1.3104e-04 - mean\_absolute\_error: 0.0091 32/126 [======>.......................] - ETA: 0s - loss: 1.1719e-04 - mean\_absolute\_error: 0.0084 48/126 [==========>...................] - ETA: 0s - loss: 1.0887e-04 - mean\_absolute\_error: 0.0080 64/126 [==============>...............] - ETA: 0s - loss: 1.0408e-04 - mean\_absolute\_error: 0.0078 80/126 [==================>...........] - ETA: 0s - loss: 1.0618e-04 - mean\_absolute\_error: 0.0079 95/126 [=====================>........] - ETA: 0s - loss: 1.0514e-04 - mean\_absolute\_error: 0.0078111/126 [=========================>....] - ETA: 0s - loss: 1.0346e-04 - mean\_absolute\_error: 0.0078126/126 [==============================] - 0s 4ms/step - loss: 1.1041e-04 - mean\_absolute\_error: 0.0080 - val\_loss: 7.1087e-04 - val\_mean\_absolute\_error: 0.0249  
Epoch 69/100  
 1/126 [..............................] - ETA: 0s - loss: 5.7993e-04 - mean\_absolute\_error: 0.0208 17/126 [===>..........................] - ETA: 0s - loss: 2.4530e-04 - mean\_absolute\_error: 0.0126 33/126 [======>.......................] - ETA: 0s - loss: 2.0100e-04 - mean\_absolute\_error: 0.0113 48/126 [==========>...................] - ETA: 0s - loss: 1.6417e-04 - mean\_absolute\_error: 0.0100 64/126 [==============>...............] - ETA: 0s - loss: 1.4542e-04 - mean\_absolute\_error: 0.0093 80/126 [==================>...........] - ETA: 0s - loss: 1.3500e-04 - mean\_absolute\_error: 0.0089 96/126 [=====================>........] - ETA: 0s - loss: 1.3187e-04 - mean\_absolute\_error: 0.0088112/126 [=========================>....] - ETA: 0s - loss: 1.3000e-04 - mean\_absolute\_error: 0.0087126/126 [==============================] - 0s 4ms/step - loss: 1.2901e-04 - mean\_absolute\_error: 0.0087 - val\_loss: 1.0146e-04 - val\_mean\_absolute\_error: 0.0079  
Epoch 70/100  
 1/126 [..............................] - ETA: 0s - loss: 7.4280e-05 - mean\_absolute\_error: 0.0063 17/126 [===>..........................] - ETA: 0s - loss: 9.2051e-05 - mean\_absolute\_error: 0.0072 33/126 [======>.......................] - ETA: 0s - loss: 1.1559e-04 - mean\_absolute\_error: 0.0080 49/126 [==========>...................] - ETA: 0s - loss: 1.2155e-04 - mean\_absolute\_error: 0.0084 65/126 [==============>...............] - ETA: 0s - loss: 1.2420e-04 - mean\_absolute\_error: 0.0086 81/126 [==================>...........] - ETA: 0s - loss: 1.2142e-04 - mean\_absolute\_error: 0.0085 97/126 [======================>.......] - ETA: 0s - loss: 1.1818e-04 - mean\_absolute\_error: 0.0084113/126 [=========================>....] - ETA: 0s - loss: 1.1454e-04 - mean\_absolute\_error: 0.0083126/126 [==============================] - 0s 4ms/step - loss: 1.1212e-04 - mean\_absolute\_error: 0.0082 - val\_loss: 1.0826e-04 - val\_mean\_absolute\_error: 0.0082  
Epoch 71/100  
 1/126 [..............................] - ETA: 0s - loss: 9.3204e-05 - mean\_absolute\_error: 0.0075 16/126 [==>...........................] - ETA: 0s - loss: 8.8215e-05 - mean\_absolute\_error: 0.0072 32/126 [======>.......................] - ETA: 0s - loss: 9.6702e-05 - mean\_absolute\_error: 0.0075 48/126 [==========>...................] - ETA: 0s - loss: 1.2076e-04 - mean\_absolute\_error: 0.0085 64/126 [==============>...............] - ETA: 0s - loss: 1.2216e-04 - mean\_absolute\_error: 0.0085 81/126 [==================>...........] - ETA: 0s - loss: 1.1601e-04 - mean\_absolute\_error: 0.0083 97/126 [======================>.......] - ETA: 0s - loss: 1.1611e-04 - mean\_absolute\_error: 0.0083113/126 [=========================>....] - ETA: 0s - loss: 1.1086e-04 - mean\_absolute\_error: 0.0081126/126 [==============================] - 0s 4ms/step - loss: 1.1188e-04 - mean\_absolute\_error: 0.0081 - val\_loss: 1.4115e-04 - val\_mean\_absolute\_error: 0.0096  
Epoch 72/100  
 1/126 [..............................] - ETA: 0s - loss: 1.2765e-04 - mean\_absolute\_error: 0.0084 17/126 [===>..........................] - ETA: 0s - loss: 9.7907e-05 - mean\_absolute\_error: 0.0075 33/126 [======>.......................] - ETA: 0s - loss: 9.2342e-05 - mean\_absolute\_error: 0.0073 49/126 [==========>...................] - ETA: 0s - loss: 9.5370e-05 - mean\_absolute\_error: 0.0074 65/126 [==============>...............] - ETA: 0s - loss: 9.8103e-05 - mean\_absolute\_error: 0.0075 81/126 [==================>...........] - ETA: 0s - loss: 1.0317e-04 - mean\_absolute\_error: 0.0077 97/126 [======================>.......] - ETA: 0s - loss: 1.0570e-04 - mean\_absolute\_error: 0.0079113/126 [=========================>....] - ETA: 0s - loss: 1.0434e-04 - mean\_absolute\_error: 0.0078126/126 [==============================] - 0s 4ms/step - loss: 1.0692e-04 - mean\_absolute\_error: 0.0079 - val\_loss: 1.0648e-04 - val\_mean\_absolute\_error: 0.0081  
Epoch 73/100  
 1/126 [..............................] - ETA: 0s - loss: 1.2193e-04 - mean\_absolute\_error: 0.0088 17/126 [===>..........................] - ETA: 0s - loss: 9.6873e-05 - mean\_absolute\_error: 0.0074 33/126 [======>.......................] - ETA: 0s - loss: 1.2083e-04 - mean\_absolute\_error: 0.0084 49/126 [==========>...................] - ETA: 0s - loss: 1.1564e-04 - mean\_absolute\_error: 0.0082 65/126 [==============>...............] - ETA: 0s - loss: 1.1074e-04 - mean\_absolute\_error: 0.0080 81/126 [==================>...........] - ETA: 0s - loss: 1.1569e-04 - mean\_absolute\_error: 0.0082 97/126 [======================>.......] - ETA: 0s - loss: 1.1439e-04 - mean\_absolute\_error: 0.0082113/126 [=========================>....] - ETA: 0s - loss: 1.1019e-04 - mean\_absolute\_error: 0.0081126/126 [==============================] - 0s 4ms/step - loss: 1.0826e-04 - mean\_absolute\_error: 0.0080 - val\_loss: 1.2148e-04 - val\_mean\_absolute\_error: 0.0088  
Epoch 74/100  
 1/126 [..............................] - ETA: 0s - loss: 1.7451e-04 - mean\_absolute\_error: 0.0089 16/126 [==>...........................] - ETA: 0s - loss: 1.3822e-04 - mean\_absolute\_error: 0.0091 32/126 [======>.......................] - ETA: 0s - loss: 1.3159e-04 - mean\_absolute\_error: 0.0090 48/126 [==========>...................] - ETA: 0s - loss: 1.1912e-04 - mean\_absolute\_error: 0.0086 64/126 [==============>...............] - ETA: 0s - loss: 1.1662e-04 - mean\_absolute\_error: 0.0085 81/126 [==================>...........] - ETA: 0s - loss: 1.1177e-04 - mean\_absolute\_error: 0.0083 97/126 [======================>.......] - ETA: 0s - loss: 1.1200e-04 - mean\_absolute\_error: 0.0082114/126 [==========================>...] - ETA: 0s - loss: 1.1110e-04 - mean\_absolute\_error: 0.0081126/126 [==============================] - 0s 4ms/step - loss: 1.1055e-04 - mean\_absolute\_error: 0.0081 - val\_loss: 1.0314e-04 - val\_mean\_absolute\_error: 0.0079  
Epoch 75/100  
 1/126 [..............................] - ETA: 0s - loss: 8.9338e-05 - mean\_absolute\_error: 0.0075 17/126 [===>..........................] - ETA: 0s - loss: 8.4730e-05 - mean\_absolute\_error: 0.0068 33/126 [======>.......................] - ETA: 0s - loss: 9.4519e-05 - mean\_absolute\_error: 0.0071 49/126 [==========>...................] - ETA: 0s - loss: 1.0126e-04 - mean\_absolute\_error: 0.0074 65/126 [==============>...............] - ETA: 0s - loss: 1.0111e-04 - mean\_absolute\_error: 0.0075 82/126 [==================>...........] - ETA: 0s - loss: 1.0146e-04 - mean\_absolute\_error: 0.0075 98/126 [======================>.......] - ETA: 0s - loss: 9.9310e-05 - mean\_absolute\_error: 0.0075115/126 [==========================>...] - ETA: 0s - loss: 9.7453e-05 - mean\_absolute\_error: 0.0075126/126 [==============================] - 0s 4ms/step - loss: 9.8743e-05 - mean\_absolute\_error: 0.0075 - val\_loss: 1.9676e-04 - val\_mean\_absolute\_error: 0.0117  
Epoch 76/100  
 1/126 [..............................] - ETA: 0s - loss: 1.3452e-04 - mean\_absolute\_error: 0.0092 17/126 [===>..........................] - ETA: 0s - loss: 1.3332e-04 - mean\_absolute\_error: 0.0090 33/126 [======>.......................] - ETA: 0s - loss: 1.3858e-04 - mean\_absolute\_error: 0.0091 49/126 [==========>...................] - ETA: 0s - loss: 1.3309e-04 - mean\_absolute\_error: 0.0089 65/126 [==============>...............] - ETA: 0s - loss: 1.2604e-04 - mean\_absolute\_error: 0.0088 81/126 [==================>...........] - ETA: 0s - loss: 1.2099e-04 - mean\_absolute\_error: 0.0085 98/126 [======================>.......] - ETA: 0s - loss: 1.1641e-04 - mean\_absolute\_error: 0.0083114/126 [==========================>...] - ETA: 0s - loss: 1.1155e-04 - mean\_absolute\_error: 0.0081126/126 [==============================] - 0s 4ms/step - loss: 1.0948e-04 - mean\_absolute\_error: 0.0080 - val\_loss: 9.7965e-05 - val\_mean\_absolute\_error: 0.0076  
Epoch 77/100  
 1/126 [..............................] - ETA: 0s - loss: 7.0657e-05 - mean\_absolute\_error: 0.0065 17/126 [===>..........................] - ETA: 0s - loss: 7.4974e-05 - mean\_absolute\_error: 0.0068 27/126 [=====>........................] - ETA: 0s - loss: 8.9469e-05 - mean\_absolute\_error: 0.0071 34/126 [=======>......................] - ETA: 0s - loss: 9.7368e-05 - mean\_absolute\_error: 0.0074 41/126 [========>.....................] - ETA: 0s - loss: 9.5318e-05 - mean\_absolute\_error: 0.0074 48/126 [==========>...................] - ETA: 0s - loss: 9.9773e-05 - mean\_absolute\_error: 0.0075 55/126 [============>.................] - ETA: 0s - loss: 9.8887e-05 - mean\_absolute\_error: 0.0075 62/126 [=============>................] - ETA: 0s - loss: 1.0113e-04 - mean\_absolute\_error: 0.0076 69/126 [===============>..............] - ETA: 0s - loss: 1.0080e-04 - mean\_absolute\_error: 0.0077 76/126 [=================>............] - ETA: 0s - loss: 9.9944e-05 - mean\_absolute\_error: 0.0076 83/126 [==================>...........] - ETA: 0s - loss: 1.0055e-04 - mean\_absolute\_error: 0.0076 90/126 [====================>.........] - ETA: 0s - loss: 9.9089e-05 - mean\_absolute\_error: 0.0076 97/126 [======================>.......] - ETA: 0s - loss: 1.0000e-04 - mean\_absolute\_error: 0.0076104/126 [=======================>......] - ETA: 0s - loss: 1.0004e-04 - mean\_absolute\_error: 0.0076111/126 [=========================>....] - ETA: 0s - loss: 9.9133e-05 - mean\_absolute\_error: 0.0075118/126 [===========================>..] - ETA: 0s - loss: 9.7729e-05 - mean\_absolute\_error: 0.0075125/126 [============================>.] - ETA: 0s - loss: 9.9757e-05 - mean\_absolute\_error: 0.0076126/126 [==============================] - 1s 8ms/step - loss: 1.0004e-04 - mean\_absolute\_error: 0.0076 - val\_loss: 4.0062e-04 - val\_mean\_absolute\_error: 0.0177  
Epoch 78/100  
 1/126 [..............................] - ETA: 1s - loss: 3.4723e-04 - mean\_absolute\_error: 0.0165 8/126 [>.............................] - ETA: 0s - loss: 1.8372e-04 - mean\_absolute\_error: 0.0113 15/126 [==>...........................] - ETA: 0s - loss: 1.5419e-04 - mean\_absolute\_error: 0.0100 22/126 [====>.........................] - ETA: 0s - loss: 1.3304e-04 - mean\_absolute\_error: 0.0092 29/126 [=====>........................] - ETA: 0s - loss: 1.2340e-04 - mean\_absolute\_error: 0.0086 36/126 [=======>......................] - ETA: 0s - loss: 1.1482e-04 - mean\_absolute\_error: 0.0083 43/126 [=========>....................] - ETA: 0s - loss: 1.1692e-04 - mean\_absolute\_error: 0.0084 50/126 [==========>...................] - ETA: 0s - loss: 1.2210e-04 - mean\_absolute\_error: 0.0086 57/126 [============>.................] - ETA: 0s - loss: 1.1899e-04 - mean\_absolute\_error: 0.0084 64/126 [==============>...............] - ETA: 0s - loss: 1.1434e-04 - mean\_absolute\_error: 0.0082 71/126 [===============>..............] - ETA: 0s - loss: 1.1169e-04 - mean\_absolute\_error: 0.0081 78/126 [=================>............] - ETA: 0s - loss: 1.1440e-04 - mean\_absolute\_error: 0.0082 85/126 [===================>..........] - ETA: 0s - loss: 1.1297e-04 - mean\_absolute\_error: 0.0081 92/126 [====================>.........] - ETA: 0s - loss: 1.1068e-04 - mean\_absolute\_error: 0.0080 99/126 [======================>.......] - ETA: 0s - loss: 1.0991e-04 - mean\_absolute\_error: 0.0080106/126 [========================>.....] - ETA: 0s - loss: 1.0924e-04 - mean\_absolute\_error: 0.0080113/126 [=========================>....] - ETA: 0s - loss: 1.1160e-04 - mean\_absolute\_error: 0.0081120/126 [===========================>..] - ETA: 0s - loss: 1.1332e-04 - mean\_absolute\_error: 0.0082126/126 [==============================] - 1s 8ms/step - loss: 1.1339e-04 - mean\_absolute\_error: 0.0082 - val\_loss: 1.0254e-04 - val\_mean\_absolute\_error: 0.0079  
Epoch 79/100  
 1/126 [..............................] - ETA: 0s - loss: 9.9462e-05 - mean\_absolute\_error: 0.0079 14/126 [==>...........................] - ETA: 0s - loss: 1.6306e-04 - mean\_absolute\_error: 0.0100 30/126 [======>.......................] - ETA: 0s - loss: 1.3401e-04 - mean\_absolute\_error: 0.0090 46/126 [=========>....................] - ETA: 0s - loss: 1.1707e-04 - mean\_absolute\_error: 0.0084 62/126 [=============>................] - ETA: 0s - loss: 1.1308e-04 - mean\_absolute\_error: 0.0082 78/126 [=================>............] - ETA: 0s - loss: 1.1031e-04 - mean\_absolute\_error: 0.0081 93/126 [=====================>........] - ETA: 0s - loss: 1.1103e-04 - mean\_absolute\_error: 0.0082109/126 [========================>.....] - ETA: 0s - loss: 1.1266e-04 - mean\_absolute\_error: 0.0082126/126 [==============================] - ETA: 0s - loss: 1.0926e-04 - mean\_absolute\_error: 0.0080126/126 [==============================] - 0s 4ms/step - loss: 1.0926e-04 - mean\_absolute\_error: 0.0080 - val\_loss: 1.7607e-04 - val\_mean\_absolute\_error: 0.0107  
Epoch 80/100  
 1/126 [..............................] - ETA: 0s - loss: 1.6217e-04 - mean\_absolute\_error: 0.0101 17/126 [===>..........................] - ETA: 0s - loss: 8.0117e-05 - mean\_absolute\_error: 0.0068 33/126 [======>.......................] - ETA: 0s - loss: 9.0170e-05 - mean\_absolute\_error: 0.0072 49/126 [==========>...................] - ETA: 0s - loss: 9.7685e-05 - mean\_absolute\_error: 0.0074 65/126 [==============>...............] - ETA: 0s - loss: 9.6735e-05 - mean\_absolute\_error: 0.0074 81/126 [==================>...........] - ETA: 0s - loss: 9.1334e-05 - mean\_absolute\_error: 0.0073 97/126 [======================>.......] - ETA: 0s - loss: 9.4214e-05 - mean\_absolute\_error: 0.0074113/126 [=========================>....] - ETA: 0s - loss: 9.2781e-05 - mean\_absolute\_error: 0.0073126/126 [==============================] - 0s 4ms/step - loss: 9.3233e-05 - mean\_absolute\_error: 0.0073 - val\_loss: 1.0566e-04 - val\_mean\_absolute\_error: 0.0080  
Epoch 81/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0048e-04 - mean\_absolute\_error: 0.0084 17/126 [===>..........................] - ETA: 0s - loss: 9.6409e-05 - mean\_absolute\_error: 0.0071 35/126 [=======>......................] - ETA: 0s - loss: 9.1944e-05 - mean\_absolute\_error: 0.0071 52/126 [===========>..................] - ETA: 0s - loss: 9.3576e-05 - mean\_absolute\_error: 0.0072 69/126 [===============>..............] - ETA: 0s - loss: 1.0063e-04 - mean\_absolute\_error: 0.0077 86/126 [===================>..........] - ETA: 0s - loss: 1.1441e-04 - mean\_absolute\_error: 0.0082102/126 [=======================>......] - ETA: 0s - loss: 1.1980e-04 - mean\_absolute\_error: 0.0083118/126 [===========================>..] - ETA: 0s - loss: 1.2051e-04 - mean\_absolute\_error: 0.0084126/126 [==============================] - 0s 3ms/step - loss: 1.1927e-04 - mean\_absolute\_error: 0.0084 - val\_loss: 1.4324e-04 - val\_mean\_absolute\_error: 0.0095  
Epoch 82/100  
 1/126 [..............................] - ETA: 0s - loss: 1.8979e-04 - mean\_absolute\_error: 0.0098 17/126 [===>..........................] - ETA: 0s - loss: 1.0264e-04 - mean\_absolute\_error: 0.0077 33/126 [======>.......................] - ETA: 0s - loss: 1.1868e-04 - mean\_absolute\_error: 0.0084 49/126 [==========>...................] - ETA: 0s - loss: 1.4482e-04 - mean\_absolute\_error: 0.0093 65/126 [==============>...............] - ETA: 0s - loss: 1.5712e-04 - mean\_absolute\_error: 0.0098 81/126 [==================>...........] - ETA: 0s - loss: 1.4812e-04 - mean\_absolute\_error: 0.0095 98/126 [======================>.......] - ETA: 0s - loss: 1.3565e-04 - mean\_absolute\_error: 0.0090115/126 [==========================>...] - ETA: 0s - loss: 1.3416e-04 - mean\_absolute\_error: 0.0090126/126 [==============================] - 0s 4ms/step - loss: 1.3124e-04 - mean\_absolute\_error: 0.0089 - val\_loss: 2.6282e-04 - val\_mean\_absolute\_error: 0.0137  
Epoch 83/100  
 1/126 [..............................] - ETA: 0s - loss: 2.3848e-04 - mean\_absolute\_error: 0.0131 17/126 [===>..........................] - ETA: 0s - loss: 1.1170e-04 - mean\_absolute\_error: 0.0081 33/126 [======>.......................] - ETA: 0s - loss: 1.0267e-04 - mean\_absolute\_error: 0.0077 49/126 [==========>...................] - ETA: 0s - loss: 1.0111e-04 - mean\_absolute\_error: 0.0077 66/126 [==============>...............] - ETA: 0s - loss: 1.0138e-04 - mean\_absolute\_error: 0.0077 82/126 [==================>...........] - ETA: 0s - loss: 1.0488e-04 - mean\_absolute\_error: 0.0079 97/126 [======================>.......] - ETA: 0s - loss: 1.0310e-04 - mean\_absolute\_error: 0.0078113/126 [=========================>....] - ETA: 0s - loss: 1.0177e-04 - mean\_absolute\_error: 0.0077126/126 [==============================] - 0s 4ms/step - loss: 1.0104e-04 - mean\_absolute\_error: 0.0077 - val\_loss: 1.0344e-04 - val\_mean\_absolute\_error: 0.0079  
Epoch 84/100  
 1/126 [..............................] - ETA: 0s - loss: 9.2361e-05 - mean\_absolute\_error: 0.0073 12/126 [=>............................] - ETA: 0s - loss: 7.5033e-05 - mean\_absolute\_error: 0.0068 26/126 [=====>........................] - ETA: 0s - loss: 9.5004e-05 - mean\_absolute\_error: 0.0074 42/126 [=========>....................] - ETA: 0s - loss: 9.4653e-05 - mean\_absolute\_error: 0.0075 58/126 [============>.................] - ETA: 0s - loss: 1.0012e-04 - mean\_absolute\_error: 0.0077 74/126 [================>.............] - ETA: 0s - loss: 1.0259e-04 - mean\_absolute\_error: 0.0079 91/126 [====================>.........] - ETA: 0s - loss: 1.0346e-04 - mean\_absolute\_error: 0.0079106/126 [========================>.....] - ETA: 0s - loss: 1.0373e-04 - mean\_absolute\_error: 0.0079122/126 [============================>.] - ETA: 0s - loss: 1.0459e-04 - mean\_absolute\_error: 0.0079126/126 [==============================] - 0s 4ms/step - loss: 1.0400e-04 - mean\_absolute\_error: 0.0079 - val\_loss: 1.0096e-04 - val\_mean\_absolute\_error: 0.0079  
Epoch 85/100  
 1/126 [..............................] - ETA: 0s - loss: 1.4655e-04 - mean\_absolute\_error: 0.0065 18/126 [===>..........................] - ETA: 0s - loss: 8.5739e-05 - mean\_absolute\_error: 0.0069 34/126 [=======>......................] - ETA: 0s - loss: 8.4441e-05 - mean\_absolute\_error: 0.0070 50/126 [==========>...................] - ETA: 0s - loss: 8.9514e-05 - mean\_absolute\_error: 0.0072 65/126 [==============>...............] - ETA: 0s - loss: 9.3069e-05 - mean\_absolute\_error: 0.0073 82/126 [==================>...........] - ETA: 0s - loss: 9.3386e-05 - mean\_absolute\_error: 0.0073 99/126 [======================>.......] - ETA: 0s - loss: 9.8110e-05 - mean\_absolute\_error: 0.0075115/126 [==========================>...] - ETA: 0s - loss: 1.0460e-04 - mean\_absolute\_error: 0.0078126/126 [==============================] - 0s 4ms/step - loss: 1.0925e-04 - mean\_absolute\_error: 0.0080 - val\_loss: 2.9173e-04 - val\_mean\_absolute\_error: 0.0149  
Epoch 86/100  
 1/126 [..............................] - ETA: 0s - loss: 1.6503e-04 - mean\_absolute\_error: 0.0107 17/126 [===>..........................] - ETA: 0s - loss: 1.3340e-04 - mean\_absolute\_error: 0.0089 33/126 [======>.......................] - ETA: 0s - loss: 1.1725e-04 - mean\_absolute\_error: 0.0084 50/126 [==========>...................] - ETA: 0s - loss: 1.0765e-04 - mean\_absolute\_error: 0.0081 66/126 [==============>...............] - ETA: 0s - loss: 1.0568e-04 - mean\_absolute\_error: 0.0079 82/126 [==================>...........] - ETA: 0s - loss: 1.0595e-04 - mean\_absolute\_error: 0.0079 98/126 [======================>.......] - ETA: 0s - loss: 1.0311e-04 - mean\_absolute\_error: 0.0078114/126 [==========================>...] - ETA: 0s - loss: 1.0367e-04 - mean\_absolute\_error: 0.0079126/126 [==============================] - 0s 4ms/step - loss: 1.0824e-04 - mean\_absolute\_error: 0.0080 - val\_loss: 2.1613e-04 - val\_mean\_absolute\_error: 0.0121  
Epoch 87/100  
 1/126 [..............................] - ETA: 0s - loss: 2.2301e-04 - mean\_absolute\_error: 0.0131 17/126 [===>..........................] - ETA: 0s - loss: 1.6071e-04 - mean\_absolute\_error: 0.0098 33/126 [======>.......................] - ETA: 0s - loss: 1.6432e-04 - mean\_absolute\_error: 0.0101 49/126 [==========>...................] - ETA: 0s - loss: 1.4659e-04 - mean\_absolute\_error: 0.0095 65/126 [==============>...............] - ETA: 0s - loss: 1.3333e-04 - mean\_absolute\_error: 0.0090 79/126 [=================>............] - ETA: 0s - loss: 1.3516e-04 - mean\_absolute\_error: 0.0091 96/126 [=====================>........] - ETA: 0s - loss: 1.2904e-04 - mean\_absolute\_error: 0.0088110/126 [=========================>....] - ETA: 0s - loss: 1.2459e-04 - mean\_absolute\_error: 0.0086124/126 [============================>.] - ETA: 0s - loss: 1.1995e-04 - mean\_absolute\_error: 0.0085126/126 [==============================] - 0s 4ms/step - loss: 1.1925e-04 - mean\_absolute\_error: 0.0084 - val\_loss: 9.4289e-05 - val\_mean\_absolute\_error: 0.0074  
Epoch 88/100  
 1/126 [..............................] - ETA: 0s - loss: 9.0533e-05 - mean\_absolute\_error: 0.0063 14/126 [==>...........................] - ETA: 0s - loss: 1.0670e-04 - mean\_absolute\_error: 0.0080 30/126 [======>.......................] - ETA: 0s - loss: 9.9151e-05 - mean\_absolute\_error: 0.0076 45/126 [=========>....................] - ETA: 0s - loss: 9.8131e-05 - mean\_absolute\_error: 0.0075 61/126 [=============>................] - ETA: 0s - loss: 1.0154e-04 - mean\_absolute\_error: 0.0076 77/126 [=================>............] - ETA: 0s - loss: 1.0265e-04 - mean\_absolute\_error: 0.0076 93/126 [=====================>........] - ETA: 0s - loss: 1.0490e-04 - mean\_absolute\_error: 0.0078107/126 [========================>.....] - ETA: 0s - loss: 1.0760e-04 - mean\_absolute\_error: 0.0079123/126 [============================>.] - ETA: 0s - loss: 1.0587e-04 - mean\_absolute\_error: 0.0078126/126 [==============================] - 0s 4ms/step - loss: 1.0553e-04 - mean\_absolute\_error: 0.0078 - val\_loss: 1.3741e-04 - val\_mean\_absolute\_error: 0.0093  
Epoch 89/100  
 1/126 [..............................] - ETA: 0s - loss: 1.9629e-04 - mean\_absolute\_error: 0.0105 14/126 [==>...........................] - ETA: 0s - loss: 9.7264e-05 - mean\_absolute\_error: 0.0074 27/126 [=====>........................] - ETA: 0s - loss: 9.9105e-05 - mean\_absolute\_error: 0.0076 41/126 [========>.....................] - ETA: 0s - loss: 9.4432e-05 - mean\_absolute\_error: 0.0073 53/126 [===========>..................] - ETA: 0s - loss: 9.7092e-05 - mean\_absolute\_error: 0.0075 67/126 [==============>...............] - ETA: 0s - loss: 9.7050e-05 - mean\_absolute\_error: 0.0074 76/126 [=================>............] - ETA: 0s - loss: 9.6473e-05 - mean\_absolute\_error: 0.0075 82/126 [==================>...........] - ETA: 0s - loss: 9.5656e-05 - mean\_absolute\_error: 0.0074 88/126 [===================>..........] - ETA: 0s - loss: 9.4433e-05 - mean\_absolute\_error: 0.0074 94/126 [=====================>........] - ETA: 0s - loss: 9.3561e-05 - mean\_absolute\_error: 0.0073100/126 [======================>.......] - ETA: 0s - loss: 9.3043e-05 - mean\_absolute\_error: 0.0073106/126 [========================>.....] - ETA: 0s - loss: 9.4126e-05 - mean\_absolute\_error: 0.0074113/126 [=========================>....] - ETA: 0s - loss: 9.7247e-05 - mean\_absolute\_error: 0.0075119/126 [===========================>..] - ETA: 0s - loss: 1.0005e-04 - mean\_absolute\_error: 0.0076125/126 [============================>.] - ETA: 0s - loss: 1.0118e-04 - mean\_absolute\_error: 0.0077126/126 [==============================] - 1s 7ms/step - loss: 1.0099e-04 - mean\_absolute\_error: 0.0077 - val\_loss: 9.3517e-05 - val\_mean\_absolute\_error: 0.0074  
Epoch 90/100  
 1/126 [..............................] - ETA: 0s - loss: 1.2294e-04 - mean\_absolute\_error: 0.0084 17/126 [===>..........................] - ETA: 0s - loss: 1.0045e-04 - mean\_absolute\_error: 0.0078 33/126 [======>.......................] - ETA: 0s - loss: 8.8502e-05 - mean\_absolute\_error: 0.0073 49/126 [==========>...................] - ETA: 0s - loss: 9.2911e-05 - mean\_absolute\_error: 0.0074 65/126 [==============>...............] - ETA: 0s - loss: 9.5024e-05 - mean\_absolute\_error: 0.0076 81/126 [==================>...........] - ETA: 0s - loss: 9.6706e-05 - mean\_absolute\_error: 0.0075 97/126 [======================>.......] - ETA: 0s - loss: 9.6660e-05 - mean\_absolute\_error: 0.0075113/126 [=========================>....] - ETA: 0s - loss: 9.7178e-05 - mean\_absolute\_error: 0.0075126/126 [==============================] - 0s 4ms/step - loss: 9.8030e-05 - mean\_absolute\_error: 0.0076 - val\_loss: 9.5239e-05 - val\_mean\_absolute\_error: 0.0076  
Epoch 91/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1470e-04 - mean\_absolute\_error: 0.0085 17/126 [===>..........................] - ETA: 0s - loss: 1.0505e-04 - mean\_absolute\_error: 0.0079 33/126 [======>.......................] - ETA: 0s - loss: 1.0146e-04 - mean\_absolute\_error: 0.0077 49/126 [==========>...................] - ETA: 0s - loss: 1.0019e-04 - mean\_absolute\_error: 0.0077 65/126 [==============>...............] - ETA: 0s - loss: 1.0712e-04 - mean\_absolute\_error: 0.0079 81/126 [==================>...........] - ETA: 0s - loss: 1.0497e-04 - mean\_absolute\_error: 0.0079 97/126 [======================>.......] - ETA: 0s - loss: 1.0383e-04 - mean\_absolute\_error: 0.0078113/126 [=========================>....] - ETA: 0s - loss: 1.0199e-04 - mean\_absolute\_error: 0.0078126/126 [==============================] - 0s 4ms/step - loss: 1.0081e-04 - mean\_absolute\_error: 0.0077 - val\_loss: 9.7309e-05 - val\_mean\_absolute\_error: 0.0077  
Epoch 92/100  
 1/126 [..............................] - ETA: 0s - loss: 1.8217e-04 - mean\_absolute\_error: 0.0097 17/126 [===>..........................] - ETA: 0s - loss: 1.0866e-04 - mean\_absolute\_error: 0.0079 33/126 [======>.......................] - ETA: 0s - loss: 9.7035e-05 - mean\_absolute\_error: 0.0074 49/126 [==========>...................] - ETA: 0s - loss: 9.4366e-05 - mean\_absolute\_error: 0.0073 65/126 [==============>...............] - ETA: 0s - loss: 9.6583e-05 - mean\_absolute\_error: 0.0075 81/126 [==================>...........] - ETA: 0s - loss: 9.2885e-05 - mean\_absolute\_error: 0.0073 97/126 [======================>.......] - ETA: 0s - loss: 9.3982e-05 - mean\_absolute\_error: 0.0074113/126 [=========================>....] - ETA: 0s - loss: 9.2846e-05 - mean\_absolute\_error: 0.0073126/126 [==============================] - 0s 4ms/step - loss: 9.2024e-05 - mean\_absolute\_error: 0.0073 - val\_loss: 1.0349e-04 - val\_mean\_absolute\_error: 0.0079  
Epoch 93/100  
 1/126 [..............................] - ETA: 0s - loss: 9.6436e-05 - mean\_absolute\_error: 0.0078 17/126 [===>..........................] - ETA: 0s - loss: 8.2929e-05 - mean\_absolute\_error: 0.0071 33/126 [======>.......................] - ETA: 0s - loss: 8.2396e-05 - mean\_absolute\_error: 0.0070 49/126 [==========>...................] - ETA: 0s - loss: 8.3203e-05 - mean\_absolute\_error: 0.0070 65/126 [==============>...............] - ETA: 0s - loss: 8.4894e-05 - mean\_absolute\_error: 0.0071 81/126 [==================>...........] - ETA: 0s - loss: 9.0786e-05 - mean\_absolute\_error: 0.0073 97/126 [======================>.......] - ETA: 0s - loss: 9.6022e-05 - mean\_absolute\_error: 0.0075113/126 [=========================>....] - ETA: 0s - loss: 9.5536e-05 - mean\_absolute\_error: 0.0074126/126 [==============================] - 0s 4ms/step - loss: 9.6502e-05 - mean\_absolute\_error: 0.0075 - val\_loss: 9.7268e-05 - val\_mean\_absolute\_error: 0.0077  
Epoch 94/100  
 1/126 [..............................] - ETA: 0s - loss: 6.4297e-05 - mean\_absolute\_error: 0.0063 18/126 [===>..........................] - ETA: 0s - loss: 9.7179e-05 - mean\_absolute\_error: 0.0076 34/126 [=======>......................] - ETA: 0s - loss: 9.8473e-05 - mean\_absolute\_error: 0.0076 49/126 [==========>...................] - ETA: 0s - loss: 9.2169e-05 - mean\_absolute\_error: 0.0073 65/126 [==============>...............] - ETA: 0s - loss: 9.0216e-05 - mean\_absolute\_error: 0.0072 81/126 [==================>...........] - ETA: 0s - loss: 9.1494e-05 - mean\_absolute\_error: 0.0073 97/126 [======================>.......] - ETA: 0s - loss: 9.2680e-05 - mean\_absolute\_error: 0.0074113/126 [=========================>....] - ETA: 0s - loss: 9.6168e-05 - mean\_absolute\_error: 0.0075126/126 [==============================] - 0s 4ms/step - loss: 9.6380e-05 - mean\_absolute\_error: 0.0075 - val\_loss: 1.0927e-04 - val\_mean\_absolute\_error: 0.0083  
Epoch 95/100  
 1/126 [..............................] - ETA: 0s - loss: 8.2120e-05 - mean\_absolute\_error: 0.0075 17/126 [===>..........................] - ETA: 0s - loss: 1.1062e-04 - mean\_absolute\_error: 0.0082 33/126 [======>.......................] - ETA: 0s - loss: 1.2358e-04 - mean\_absolute\_error: 0.0087 49/126 [==========>...................] - ETA: 0s - loss: 1.3043e-04 - mean\_absolute\_error: 0.0089 65/126 [==============>...............] - ETA: 0s - loss: 1.4723e-04 - mean\_absolute\_error: 0.0095 81/126 [==================>...........] - ETA: 0s - loss: 1.3639e-04 - mean\_absolute\_error: 0.0091 97/126 [======================>.......] - ETA: 0s - loss: 1.2759e-04 - mean\_absolute\_error: 0.0087112/126 [=========================>....] - ETA: 0s - loss: 1.2216e-04 - mean\_absolute\_error: 0.0085126/126 [==============================] - 0s 4ms/step - loss: 1.2153e-04 - mean\_absolute\_error: 0.0085 - val\_loss: 9.9233e-05 - val\_mean\_absolute\_error: 0.0078  
Epoch 96/100  
 1/126 [..............................] - ETA: 0s - loss: 5.2231e-05 - mean\_absolute\_error: 0.0059 16/126 [==>...........................] - ETA: 0s - loss: 1.1130e-04 - mean\_absolute\_error: 0.0084 32/126 [======>.......................] - ETA: 0s - loss: 1.0758e-04 - mean\_absolute\_error: 0.0082 49/126 [==========>...................] - ETA: 0s - loss: 1.0333e-04 - mean\_absolute\_error: 0.0080 65/126 [==============>...............] - ETA: 0s - loss: 1.1306e-04 - mean\_absolute\_error: 0.0083 81/126 [==================>...........] - ETA: 0s - loss: 1.0862e-04 - mean\_absolute\_error: 0.0081 96/126 [=====================>........] - ETA: 0s - loss: 1.1026e-04 - mean\_absolute\_error: 0.0081112/126 [=========================>....] - ETA: 0s - loss: 1.0863e-04 - mean\_absolute\_error: 0.0080126/126 [==============================] - 0s 4ms/step - loss: 1.0788e-04 - mean\_absolute\_error: 0.0080 - val\_loss: 1.1591e-04 - val\_mean\_absolute\_error: 0.0086  
Epoch 97/100  
 1/126 [..............................] - ETA: 0s - loss: 9.3382e-05 - mean\_absolute\_error: 0.0082 17/126 [===>..........................] - ETA: 0s - loss: 9.0217e-05 - mean\_absolute\_error: 0.0075 33/126 [======>.......................] - ETA: 0s - loss: 9.7849e-05 - mean\_absolute\_error: 0.0075 49/126 [==========>...................] - ETA: 0s - loss: 9.6784e-05 - mean\_absolute\_error: 0.0074 65/126 [==============>...............] - ETA: 0s - loss: 9.3773e-05 - mean\_absolute\_error: 0.0073 81/126 [==================>...........] - ETA: 0s - loss: 9.4286e-05 - mean\_absolute\_error: 0.0073 97/126 [======================>.......] - ETA: 0s - loss: 9.6483e-05 - mean\_absolute\_error: 0.0074113/126 [=========================>....] - ETA: 0s - loss: 9.8092e-05 - mean\_absolute\_error: 0.0075126/126 [==============================] - 0s 4ms/step - loss: 9.8931e-05 - mean\_absolute\_error: 0.0076 - val\_loss: 1.2428e-04 - val\_mean\_absolute\_error: 0.0089  
Epoch 98/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0593e-04 - mean\_absolute\_error: 0.0085 16/126 [==>...........................] - ETA: 0s - loss: 9.0301e-05 - mean\_absolute\_error: 0.0071 30/126 [======>.......................] - ETA: 0s - loss: 8.4122e-05 - mean\_absolute\_error: 0.0069 46/126 [=========>....................] - ETA: 0s - loss: 9.0096e-05 - mean\_absolute\_error: 0.0072 62/126 [=============>................] - ETA: 0s - loss: 1.1851e-04 - mean\_absolute\_error: 0.0083 78/126 [=================>............] - ETA: 0s - loss: 1.1098e-04 - mean\_absolute\_error: 0.0080 94/126 [=====================>........] - ETA: 0s - loss: 1.0688e-04 - mean\_absolute\_error: 0.0079110/126 [=========================>....] - ETA: 0s - loss: 1.0338e-04 - mean\_absolute\_error: 0.0077126/126 [==============================] - ETA: 0s - loss: 1.0764e-04 - mean\_absolute\_error: 0.0079126/126 [==============================] - 0s 4ms/step - loss: 1.0764e-04 - mean\_absolute\_error: 0.0079 - val\_loss: 1.5355e-04 - val\_mean\_absolute\_error: 0.0102  
Epoch 99/100  
 1/126 [..............................] - ETA: 0s - loss: 5.9782e-05 - mean\_absolute\_error: 0.0069 17/126 [===>..........................] - ETA: 0s - loss: 1.9899e-04 - mean\_absolute\_error: 0.0116 33/126 [======>.......................] - ETA: 0s - loss: 1.7521e-04 - mean\_absolute\_error: 0.0107 49/126 [==========>...................] - ETA: 0s - loss: 1.6123e-04 - mean\_absolute\_error: 0.0102 65/126 [==============>...............] - ETA: 0s - loss: 1.4132e-04 - mean\_absolute\_error: 0.0093 81/126 [==================>...........] - ETA: 0s - loss: 1.2912e-04 - mean\_absolute\_error: 0.0088 97/126 [======================>.......] - ETA: 0s - loss: 1.2466e-04 - mean\_absolute\_error: 0.0086113/126 [=========================>....] - ETA: 0s - loss: 1.1958e-04 - mean\_absolute\_error: 0.0084126/126 [==============================] - 0s 4ms/step - loss: 1.1586e-04 - mean\_absolute\_error: 0.0083 - val\_loss: 9.3498e-05 - val\_mean\_absolute\_error: 0.0074  
Epoch 100/100  
 1/126 [..............................] - ETA: 0s - loss: 8.7813e-05 - mean\_absolute\_error: 0.0073 17/126 [===>..........................] - ETA: 0s - loss: 7.7785e-05 - mean\_absolute\_error: 0.0069 32/126 [======>.......................] - ETA: 0s - loss: 9.3697e-05 - mean\_absolute\_error: 0.0075 48/126 [==========>...................] - ETA: 0s - loss: 1.0129e-04 - mean\_absolute\_error: 0.0078 64/126 [==============>...............] - ETA: 0s - loss: 1.0346e-04 - mean\_absolute\_error: 0.0079 80/126 [==================>...........] - ETA: 0s - loss: 9.8994e-05 - mean\_absolute\_error: 0.0077 96/126 [=====================>........] - ETA: 0s - loss: 1.0141e-04 - mean\_absolute\_error: 0.0077112/126 [=========================>....] - ETA: 0s - loss: 1.0093e-04 - mean\_absolute\_error: 0.0077126/126 [==============================] - 0s 4ms/step - loss: 1.0193e-04 - mean\_absolute\_error: 0.0077 - val\_loss: 1.6293e-04 - val\_mean\_absolute\_error: 0.0103

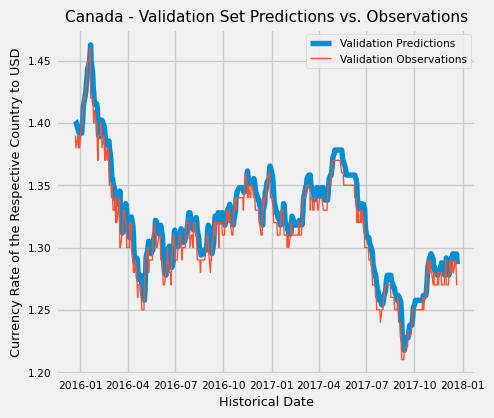
<keras.src.callbacks.History at 0x28ee20176d0>

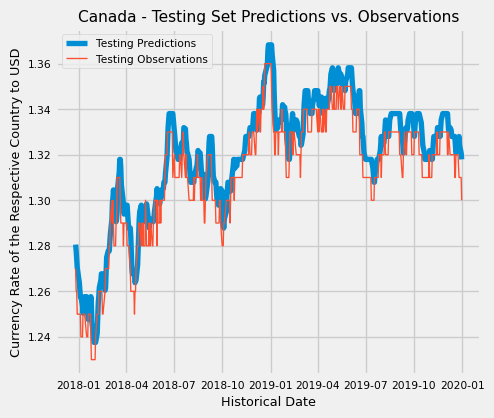
After the training and fitting of the Machine Learning model for Canada, I tried to create visualizations comparing the model against the country’s training dataset, validation dataset, but most importantly the testing dataset (as shown below in the line graphs). Note that the darker and thicker blue lines represent the prediction model’s projections and the thinner red lines is the observed/gathered data.

```{python}  
# Testing the Machine Learning Model prediction for Austrailia with the train,   
# validation, and test sets  
# Most important is the test set prediction as this tests the effectiveness  
# of the Machine Learning model on data it has not seen before   
canada\_train\_pred = canada\_model.predict(X\_canada\_train).flatten()  
  
plt.plot(dates\_canada\_train, canada\_train\_pred, linewidth=4)  
plt.plot(dates\_canada\_train, y\_canada\_train, linewidth=1)  
plt.legend(["Training Predictions", "Training Observations"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Canada - Training Set Predictions vs. Observations")  
plt.show()  
  
canada\_val\_pred = canada\_model.predict(X\_canada\_val).flatten()  
  
plt.plot(dates\_canada\_val, canada\_val\_pred, linewidth=4)  
plt.plot(dates\_canada\_val, y\_canada\_val, linewidth=1)  
plt.legend(["Validation Predictions", "Validation Observations"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Canada - Validation Set Predictions vs. Observations")  
plt.show()  
  
canada\_test\_pred = canada\_model.predict(X\_canada\_test).flatten()  
  
plt.plot(dates\_canada\_test, canada\_test\_pred, linewidth=4)  
plt.plot(dates\_canada\_test, y\_canada\_test, linewidth=1)  
plt.legend(["Testing Predictions", "Testing Observations"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Canada - Testing Set Predictions vs. Observations")  
plt.show()  
```

1/126 [..............................] - ETA: 39s 31/126 [======>.......................] - ETA: 0s 60/126 [=============>................] - ETA: 0s 90/126 [====================>.........] - ETA: 0s120/126 [===========================>..] - ETA: 0s126/126 [==============================] - 1s 2ms/step  
 1/16 [>.............................] - ETA: 0s16/16 [==============================] - 0s 2ms/step  
 1/16 [>.............................] - ETA: 0s16/16 [==============================] - 0s 2ms/step

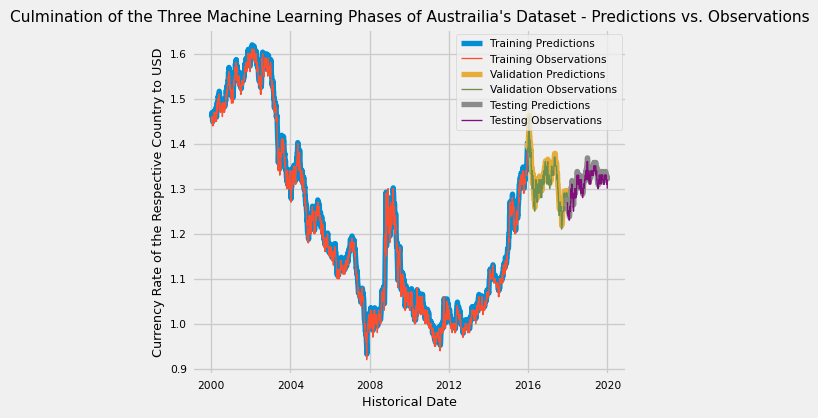






Through careful consideration of all of the prediction-based vs. observation-based contrast visualizations together, I consolidated all of graphics into one singular visualization for you to see below to get a more general perspective of the effectiveness of the Machine Learning model at training and fitting towards predicting Canada’s international currency rate with the United States.

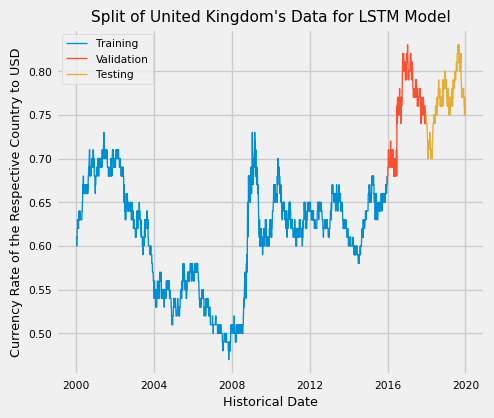
```{python}  
# Plotting Canada's observational (reference) data with the predictions of its   
# Machine Learning Model (as a way to visually inspect the effectiveness of the   
# model)   
plt.plot(dates\_canada\_train, canada\_train\_pred, linewidth=4)  
plt.plot(dates\_canada\_train, y\_canada\_train, linewidth=1)  
plt.plot(dates\_canada\_val, canada\_val\_pred, linewidth=4)  
plt.plot(dates\_canada\_val, y\_canada\_val, linewidth=1)  
plt.plot(dates\_canada\_test, canada\_test\_pred, linewidth=4)  
plt.plot(dates\_canada\_test, y\_canada\_test, linewidth=1)  
  
plt.legend(["Training Predictions",  
 "Training Observations",  
 "Validation Predictions",  
 "Validation Observations",  
 "Testing Predictions",  
 "Testing Observations"], loc="upper right")  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Culmination of the Three Machine Learning Phases of Austrailia's Dataset - Predictions vs. Observations")  
plt.show()  
```



Then, I worked on the United Kingdom’s data (as shown below):

Since the data (date, X, and y) is split into three np.arrays and to be more efficient, I will manually split the United Kingdom’s data into train, test, and validation datasets for the Machine Learning model with 80% going to the training dataset, the next 10% going to the validation dataset, and the last 10% going to the test dataset for each np.array respectively.

```{python}  
# Splitting United Kingdom's data into train, test, and validation sets on 3   
# mediums: the X-axis, the y-axis, and the indices (represented by dates)  
dates\_united\_kingdom\_train, X\_united\_kingdom\_train, y\_united\_kingdom\_train = dates\_united\_kingdom[:percentile\_80], X\_united\_kingdom[:percentile\_80], y\_united\_kingdom[:percentile\_80]  
dates\_united\_kingdom\_val, X\_united\_kingdom\_val, y\_united\_kingdom\_val = dates\_united\_kingdom[percentile\_80:percentile\_90], X\_united\_kingdom[percentile\_80:percentile\_90], y\_united\_kingdom[percentile\_80:percentile\_90]  
dates\_united\_kingdom\_test, X\_united\_kingdom\_test, y\_united\_kingdom\_test = dates\_united\_kingdom[percentile\_90:], X\_united\_kingdom[percentile\_90:], y\_united\_kingdom[percentile\_90:]  
  
plt.plot(dates\_united\_kingdom\_train, y\_united\_kingdom\_train, linewidth=1)  
plt.plot(dates\_united\_kingdom\_val, y\_united\_kingdom\_val, linewidth=1)  
plt.plot(dates\_united\_kingdom\_test, y\_united\_kingdom\_test, linewidth=1)  
  
plt.legend(["Training", "Validation", "Testing"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Split of United Kingdom's Data for LSTM Model")  
plt.show()  
```



Now, I began to configure the Machine Learning model. We added Sequential layers: an Input layer 3 by 1 because we will have 3 np.arrays of Input and 1 np.array as output, utilize a LSTM (Long Short-Term Memory) layer of 64 neurons, apply 2 levels of dense layers with 32 neurons and folliowing recommendations online to use the RELU (Rectified Linear Unit) Activiation Function, and I followed up with one last dense layer of 1 neuron as our output layer since we are just trying to linearly-predict the next currency-rate on a near-future date. Once I configured the Sequential layers, we are ready to compile the model, utilzing the mean\_square\_error as our minimizing loss function, using the Adam optimizer, and comparing our trained model against our data with the mean\_absolute\_error metric. Lastly, I fitted our model, utilzing our X\_train and Y\_train datasets for fitting with validation from our X\_valid and Y\_valid datasets at 100 epochs.

```{python}  
# Configuring the Machine Learning Tensorflow Model for United Kingdom  
united\_kingdom\_model = Sequential([layers.Input((3, 1)),  
 layers.LSTM(64),  
 layers.Dense(32, activation="relu"),  
 layers.Dense(32, activation="relu"),  
 layers.Dense(1)])  
  
united\_kingdom\_model.compile(loss="mse",  
 optimizer=Adam(learning\_rate=0.001),  
 metrics=["mean\_absolute\_error"])  
  
united\_kingdom\_model.fit(X\_united\_kingdom\_train, y\_united\_kingdom\_train, validation\_data=(X\_united\_kingdom\_val, y\_united\_kingdom\_val), epochs=100)  
```

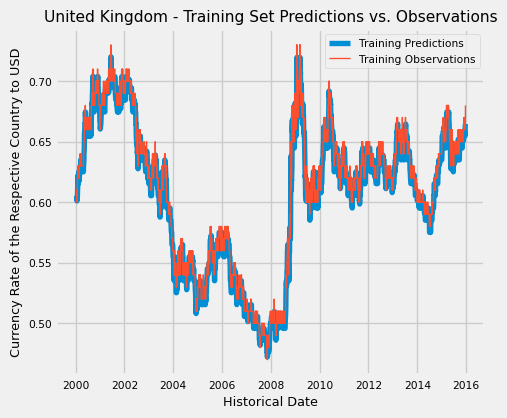
Epoch 1/100  
 1/126 [..............................] - ETA: 3:38 - loss: 0.3606 - mean\_absolute\_error: 0.5976 16/126 [==>...........................] - ETA: 0s - loss: 0.2585 - mean\_absolute\_error: 0.5028 31/126 [======>.......................] - ETA: 0s - loss: 0.1673 - mean\_absolute\_error: 0.3765 46/126 [=========>....................] - ETA: 0s - loss: 0.1149 - mean\_absolute\_error: 0.2778 61/126 [=============>................] - ETA: 0s - loss: 0.0871 - mean\_absolute\_error: 0.2179 77/126 [=================>............] - ETA: 0s - loss: 0.0692 - mean\_absolute\_error: 0.1779 92/126 [====================>.........] - ETA: 0s - loss: 0.0580 - mean\_absolute\_error: 0.1522108/126 [========================>.....] - ETA: 0s - loss: 0.0495 - mean\_absolute\_error: 0.1326124/126 [============================>.] - ETA: 0s - loss: 0.0432 - mean\_absolute\_error: 0.1179126/126 [==============================] - 3s 7ms/step - loss: 0.0427 - mean\_absolute\_error: 0.1168 - val\_loss: 0.0035 - val\_mean\_absolute\_error: 0.0566  
Epoch 2/100  
 1/126 [..............................] - ETA: 0s - loss: 4.6412e-04 - mean\_absolute\_error: 0.0171 17/126 [===>..........................] - ETA: 0s - loss: 5.0966e-04 - mean\_absolute\_error: 0.0178 33/126 [======>.......................] - ETA: 0s - loss: 5.2818e-04 - mean\_absolute\_error: 0.0184 49/126 [==========>...................] - ETA: 0s - loss: 5.1644e-04 - mean\_absolute\_error: 0.0182 64/126 [==============>...............] - ETA: 0s - loss: 5.1914e-04 - mean\_absolute\_error: 0.0184 80/126 [==================>...........] - ETA: 0s - loss: 5.2738e-04 - mean\_absolute\_error: 0.0186 95/126 [=====================>........] - ETA: 0s - loss: 5.2245e-04 - mean\_absolute\_error: 0.0185110/126 [=========================>....] - ETA: 0s - loss: 5.1883e-04 - mean\_absolute\_error: 0.0185126/126 [==============================] - ETA: 0s - loss: 5.1256e-04 - mean\_absolute\_error: 0.0184126/126 [==============================] - 0s 4ms/step - loss: 5.1256e-04 - mean\_absolute\_error: 0.0184 - val\_loss: 0.0028 - val\_mean\_absolute\_error: 0.0504  
Epoch 3/100  
 1/126 [..............................] - ETA: 0s - loss: 4.9379e-04 - mean\_absolute\_error: 0.0186 17/126 [===>..........................] - ETA: 0s - loss: 4.7602e-04 - mean\_absolute\_error: 0.0177 33/126 [======>.......................] - ETA: 0s - loss: 4.5600e-04 - mean\_absolute\_error: 0.0174 49/126 [==========>...................] - ETA: 0s - loss: 4.4361e-04 - mean\_absolute\_error: 0.0171 65/126 [==============>...............] - ETA: 0s - loss: 4.3103e-04 - mean\_absolute\_error: 0.0169 81/126 [==================>...........] - ETA: 0s - loss: 4.1832e-04 - mean\_absolute\_error: 0.0166 97/126 [======================>.......] - ETA: 0s - loss: 4.0542e-04 - mean\_absolute\_error: 0.0163112/126 [=========================>....] - ETA: 0s - loss: 4.0018e-04 - mean\_absolute\_error: 0.0162125/126 [============================>.] - ETA: 0s - loss: 3.9257e-04 - mean\_absolute\_error: 0.0160126/126 [==============================] - 0s 4ms/step - loss: 3.9196e-04 - mean\_absolute\_error: 0.0160 - val\_loss: 0.0020 - val\_mean\_absolute\_error: 0.0425  
Epoch 4/100  
 1/126 [..............................] - ETA: 0s - loss: 2.6549e-04 - mean\_absolute\_error: 0.0130 17/126 [===>..........................] - ETA: 0s - loss: 3.3279e-04 - mean\_absolute\_error: 0.0150 32/126 [======>.......................] - ETA: 0s - loss: 3.1271e-04 - mean\_absolute\_error: 0.0143 47/126 [==========>...................] - ETA: 0s - loss: 3.0879e-04 - mean\_absolute\_error: 0.0143 63/126 [==============>...............] - ETA: 0s - loss: 2.9622e-04 - mean\_absolute\_error: 0.0139 79/126 [=================>............] - ETA: 0s - loss: 2.8866e-04 - mean\_absolute\_error: 0.0138 96/126 [=====================>........] - ETA: 0s - loss: 2.8119e-04 - mean\_absolute\_error: 0.0136112/126 [=========================>....] - ETA: 0s - loss: 2.7477e-04 - mean\_absolute\_error: 0.0134126/126 [==============================] - 0s 4ms/step - loss: 2.6887e-04 - mean\_absolute\_error: 0.0132 - val\_loss: 9.9254e-04 - val\_mean\_absolute\_error: 0.0296  
Epoch 5/100  
 1/126 [..............................] - ETA: 0s - loss: 2.6176e-04 - mean\_absolute\_error: 0.0147 17/126 [===>..........................] - ETA: 0s - loss: 2.0806e-04 - mean\_absolute\_error: 0.0118 33/126 [======>.......................] - ETA: 0s - loss: 2.0217e-04 - mean\_absolute\_error: 0.0116 49/126 [==========>...................] - ETA: 0s - loss: 1.8718e-04 - mean\_absolute\_error: 0.0110 66/126 [==============>...............] - ETA: 0s - loss: 1.8514e-04 - mean\_absolute\_error: 0.0110 83/126 [==================>...........] - ETA: 0s - loss: 1.7700e-04 - mean\_absolute\_error: 0.0107 99/126 [======================>.......] - ETA: 0s - loss: 1.6942e-04 - mean\_absolute\_error: 0.0105115/126 [==========================>...] - ETA: 0s - loss: 1.6176e-04 - mean\_absolute\_error: 0.0102126/126 [==============================] - 0s 4ms/step - loss: 1.5752e-04 - mean\_absolute\_error: 0.0101 - val\_loss: 3.4491e-04 - val\_mean\_absolute\_error: 0.0166  
Epoch 6/100  
 1/126 [..............................] - ETA: 0s - loss: 7.9299e-05 - mean\_absolute\_error: 0.0065 17/126 [===>..........................] - ETA: 0s - loss: 9.7294e-05 - mean\_absolute\_error: 0.0077 33/126 [======>.......................] - ETA: 0s - loss: 7.9891e-05 - mean\_absolute\_error: 0.0070 49/126 [==========>...................] - ETA: 0s - loss: 7.2840e-05 - mean\_absolute\_error: 0.0067 65/126 [==============>...............] - ETA: 0s - loss: 6.7276e-05 - mean\_absolute\_error: 0.0064 81/126 [==================>...........] - ETA: 0s - loss: 6.2530e-05 - mean\_absolute\_error: 0.0061 97/126 [======================>.......] - ETA: 0s - loss: 5.9461e-05 - mean\_absolute\_error: 0.0059113/126 [=========================>....] - ETA: 0s - loss: 5.6882e-05 - mean\_absolute\_error: 0.0057126/126 [==============================] - 0s 4ms/step - loss: 5.4576e-05 - mean\_absolute\_error: 0.0056 - val\_loss: 1.0162e-04 - val\_mean\_absolute\_error: 0.0077  
Epoch 7/100  
 1/126 [..............................] - ETA: 0s - loss: 3.9297e-05 - mean\_absolute\_error: 0.0047 16/126 [==>...........................] - ETA: 0s - loss: 3.5571e-05 - mean\_absolute\_error: 0.0041 32/126 [======>.......................] - ETA: 0s - loss: 3.4981e-05 - mean\_absolute\_error: 0.0043 48/126 [==========>...................] - ETA: 0s - loss: 3.4174e-05 - mean\_absolute\_error: 0.0042 64/126 [==============>...............] - ETA: 0s - loss: 3.4772e-05 - mean\_absolute\_error: 0.0043 80/126 [==================>...........] - ETA: 0s - loss: 3.4700e-05 - mean\_absolute\_error: 0.0043 95/126 [=====================>........] - ETA: 0s - loss: 3.3966e-05 - mean\_absolute\_error: 0.0042111/126 [=========================>....] - ETA: 0s - loss: 3.3233e-05 - mean\_absolute\_error: 0.0042126/126 [==============================] - 0s 4ms/step - loss: 3.4802e-05 - mean\_absolute\_error: 0.0042 - val\_loss: 1.0020e-04 - val\_mean\_absolute\_error: 0.0076  
Epoch 8/100  
 1/126 [..............................] - ETA: 0s - loss: 4.0958e-05 - mean\_absolute\_error: 0.0048 17/126 [===>..........................] - ETA: 0s - loss: 3.2100e-05 - mean\_absolute\_error: 0.0039 33/126 [======>.......................] - ETA: 0s - loss: 3.3425e-05 - mean\_absolute\_error: 0.0041 49/126 [==========>...................] - ETA: 0s - loss: 3.4784e-05 - mean\_absolute\_error: 0.0043 65/126 [==============>...............] - ETA: 0s - loss: 3.4359e-05 - mean\_absolute\_error: 0.0043 81/126 [==================>...........] - ETA: 0s - loss: 3.5075e-05 - mean\_absolute\_error: 0.0043 96/126 [=====================>........] - ETA: 0s - loss: 3.6314e-05 - mean\_absolute\_error: 0.0043112/126 [=========================>....] - ETA: 0s - loss: 3.5849e-05 - mean\_absolute\_error: 0.0043125/126 [============================>.] - ETA: 0s - loss: 3.5669e-05 - mean\_absolute\_error: 0.0043126/126 [==============================] - 0s 4ms/step - loss: 3.5605e-05 - mean\_absolute\_error: 0.0043 - val\_loss: 9.9297e-05 - val\_mean\_absolute\_error: 0.0076  
Epoch 9/100  
 1/126 [..............................] - ETA: 0s - loss: 3.9299e-05 - mean\_absolute\_error: 0.0050 17/126 [===>..........................] - ETA: 0s - loss: 3.9939e-05 - mean\_absolute\_error: 0.0046 33/126 [======>.......................] - ETA: 0s - loss: 3.9001e-05 - mean\_absolute\_error: 0.0046 49/126 [==========>...................] - ETA: 0s - loss: 4.0289e-05 - mean\_absolute\_error: 0.0047 65/126 [==============>...............] - ETA: 0s - loss: 4.0358e-05 - mean\_absolute\_error: 0.0046 81/126 [==================>...........] - ETA: 0s - loss: 3.8537e-05 - mean\_absolute\_error: 0.0045 97/126 [======================>.......] - ETA: 0s - loss: 3.7966e-05 - mean\_absolute\_error: 0.0045113/126 [=========================>....] - ETA: 0s - loss: 3.8002e-05 - mean\_absolute\_error: 0.0045126/126 [==============================] - 0s 4ms/step - loss: 3.7063e-05 - mean\_absolute\_error: 0.0045 - val\_loss: 1.1748e-04 - val\_mean\_absolute\_error: 0.0085  
Epoch 10/100  
 1/126 [..............................] - ETA: 0s - loss: 3.6020e-05 - mean\_absolute\_error: 0.0048 16/126 [==>...........................] - ETA: 0s - loss: 3.1209e-05 - mean\_absolute\_error: 0.0041 32/126 [======>.......................] - ETA: 0s - loss: 3.5093e-05 - mean\_absolute\_error: 0.0042 48/126 [==========>...................] - ETA: 0s - loss: 3.4732e-05 - mean\_absolute\_error: 0.0042 64/126 [==============>...............] - ETA: 0s - loss: 3.4208e-05 - mean\_absolute\_error: 0.0042 79/126 [=================>............] - ETA: 0s - loss: 3.5985e-05 - mean\_absolute\_error: 0.0044 95/126 [=====================>........] - ETA: 0s - loss: 3.5286e-05 - mean\_absolute\_error: 0.0044111/126 [=========================>....] - ETA: 0s - loss: 3.5669e-05 - mean\_absolute\_error: 0.0044126/126 [==============================] - 0s 4ms/step - loss: 3.6014e-05 - mean\_absolute\_error: 0.0044 - val\_loss: 7.8761e-05 - val\_mean\_absolute\_error: 0.0066  
Epoch 11/100  
 1/126 [..............................] - ETA: 0s - loss: 7.8150e-05 - mean\_absolute\_error: 0.0055 17/126 [===>..........................] - ETA: 0s - loss: 3.7295e-05 - mean\_absolute\_error: 0.0043 33/126 [======>.......................] - ETA: 0s - loss: 3.4276e-05 - mean\_absolute\_error: 0.0042 49/126 [==========>...................] - ETA: 0s - loss: 3.4788e-05 - mean\_absolute\_error: 0.0042 64/126 [==============>...............] - ETA: 0s - loss: 3.5591e-05 - mean\_absolute\_error: 0.0043 77/126 [=================>............] - ETA: 0s - loss: 3.6191e-05 - mean\_absolute\_error: 0.0044 91/126 [====================>.........] - ETA: 0s - loss: 3.7112e-05 - mean\_absolute\_error: 0.0044106/126 [========================>.....] - ETA: 0s - loss: 3.6260e-05 - mean\_absolute\_error: 0.0044122/126 [============================>.] - ETA: 0s - loss: 3.5972e-05 - mean\_absolute\_error: 0.0043126/126 [==============================] - 0s 4ms/step - loss: 3.5687e-05 - mean\_absolute\_error: 0.0043 - val\_loss: 1.0498e-04 - val\_mean\_absolute\_error: 0.0079  
Epoch 12/100  
 1/126 [..............................] - ETA: 0s - loss: 3.7189e-05 - mean\_absolute\_error: 0.0048 17/126 [===>..........................] - ETA: 0s - loss: 3.7102e-05 - mean\_absolute\_error: 0.0045 33/126 [======>.......................] - ETA: 0s - loss: 3.5499e-05 - mean\_absolute\_error: 0.0045 49/126 [==========>...................] - ETA: 0s - loss: 3.5691e-05 - mean\_absolute\_error: 0.0044 65/126 [==============>...............] - ETA: 0s - loss: 3.6090e-05 - mean\_absolute\_error: 0.0044 81/126 [==================>...........] - ETA: 0s - loss: 3.6548e-05 - mean\_absolute\_error: 0.0044 97/126 [======================>.......] - ETA: 0s - loss: 3.5748e-05 - mean\_absolute\_error: 0.0043112/126 [=========================>....] - ETA: 0s - loss: 3.5035e-05 - mean\_absolute\_error: 0.0043126/126 [==============================] - 0s 4ms/step - loss: 3.5483e-05 - mean\_absolute\_error: 0.0043 - val\_loss: 1.1904e-04 - val\_mean\_absolute\_error: 0.0086  
Epoch 13/100  
 1/126 [..............................] - ETA: 0s - loss: 3.8554e-05 - mean\_absolute\_error: 0.0047 17/126 [===>..........................] - ETA: 0s - loss: 4.1489e-05 - mean\_absolute\_error: 0.0042 32/126 [======>.......................] - ETA: 0s - loss: 3.7572e-05 - mean\_absolute\_error: 0.0042 48/126 [==========>...................] - ETA: 0s - loss: 4.0790e-05 - mean\_absolute\_error: 0.0045 64/126 [==============>...............] - ETA: 0s - loss: 3.8399e-05 - mean\_absolute\_error: 0.0044 79/126 [=================>............] - ETA: 0s - loss: 3.7742e-05 - mean\_absolute\_error: 0.0044 94/126 [=====================>........] - ETA: 0s - loss: 3.6851e-05 - mean\_absolute\_error: 0.0044110/126 [=========================>....] - ETA: 0s - loss: 3.6701e-05 - mean\_absolute\_error: 0.0044125/126 [============================>.] - ETA: 0s - loss: 3.6695e-05 - mean\_absolute\_error: 0.0044126/126 [==============================] - 0s 4ms/step - loss: 3.6709e-05 - mean\_absolute\_error: 0.0044 - val\_loss: 1.2962e-04 - val\_mean\_absolute\_error: 0.0090  
Epoch 14/100  
 1/126 [..............................] - ETA: 0s - loss: 1.7769e-05 - mean\_absolute\_error: 0.0036 17/126 [===>..........................] - ETA: 0s - loss: 3.6471e-05 - mean\_absolute\_error: 0.0045 33/126 [======>.......................] - ETA: 0s - loss: 3.4075e-05 - mean\_absolute\_error: 0.0043 50/126 [==========>...................] - ETA: 0s - loss: 3.5834e-05 - mean\_absolute\_error: 0.0043 66/126 [==============>...............] - ETA: 0s - loss: 3.4881e-05 - mean\_absolute\_error: 0.0043 82/126 [==================>...........] - ETA: 0s - loss: 3.5871e-05 - mean\_absolute\_error: 0.0043 98/126 [======================>.......] - ETA: 0s - loss: 3.5658e-05 - mean\_absolute\_error: 0.0044114/126 [==========================>...] - ETA: 0s - loss: 3.5463e-05 - mean\_absolute\_error: 0.0044126/126 [==============================] - 0s 4ms/step - loss: 3.6149e-05 - mean\_absolute\_error: 0.0044 - val\_loss: 8.8406e-05 - val\_mean\_absolute\_error: 0.0071  
Epoch 15/100  
 1/126 [..............................] - ETA: 0s - loss: 2.2344e-05 - mean\_absolute\_error: 0.0040 17/126 [===>..........................] - ETA: 0s - loss: 3.1527e-05 - mean\_absolute\_error: 0.0041 33/126 [======>.......................] - ETA: 0s - loss: 3.5325e-05 - mean\_absolute\_error: 0.0042 48/126 [==========>...................] - ETA: 0s - loss: 3.4999e-05 - mean\_absolute\_error: 0.0042 64/126 [==============>...............] - ETA: 0s - loss: 3.5199e-05 - mean\_absolute\_error: 0.0042 80/126 [==================>...........] - ETA: 0s - loss: 3.5263e-05 - mean\_absolute\_error: 0.0042 96/126 [=====================>........] - ETA: 0s - loss: 3.5531e-05 - mean\_absolute\_error: 0.0042112/126 [=========================>....] - ETA: 0s - loss: 3.5925e-05 - mean\_absolute\_error: 0.0043126/126 [==============================] - 0s 4ms/step - loss: 3.6209e-05 - mean\_absolute\_error: 0.0044 - val\_loss: 8.4071e-05 - val\_mean\_absolute\_error: 0.0069  
Epoch 16/100  
 1/126 [..............................] - ETA: 0s - loss: 2.6903e-05 - mean\_absolute\_error: 0.0041 17/126 [===>..........................] - ETA: 0s - loss: 3.1773e-05 - mean\_absolute\_error: 0.0041 33/126 [======>.......................] - ETA: 0s - loss: 3.4925e-05 - mean\_absolute\_error: 0.0043 49/126 [==========>...................] - ETA: 0s - loss: 3.5067e-05 - mean\_absolute\_error: 0.0043 66/126 [==============>...............] - ETA: 0s - loss: 3.7338e-05 - mean\_absolute\_error: 0.0045 82/126 [==================>...........] - ETA: 0s - loss: 3.8424e-05 - mean\_absolute\_error: 0.0046 98/126 [======================>.......] - ETA: 0s - loss: 3.7887e-05 - mean\_absolute\_error: 0.0046114/126 [==========================>...] - ETA: 0s - loss: 3.7807e-05 - mean\_absolute\_error: 0.0045126/126 [==============================] - 0s 4ms/step - loss: 3.7366e-05 - mean\_absolute\_error: 0.0045 - val\_loss: 1.0785e-04 - val\_mean\_absolute\_error: 0.0080  
Epoch 17/100  
 1/126 [..............................] - ETA: 0s - loss: 1.3714e-05 - mean\_absolute\_error: 0.0027 17/126 [===>..........................] - ETA: 0s - loss: 3.6002e-05 - mean\_absolute\_error: 0.0045 33/126 [======>.......................] - ETA: 0s - loss: 4.0611e-05 - mean\_absolute\_error: 0.0047 47/126 [==========>...................] - ETA: 0s - loss: 4.0068e-05 - mean\_absolute\_error: 0.0046 63/126 [==============>...............] - ETA: 0s - loss: 3.9370e-05 - mean\_absolute\_error: 0.0046 79/126 [=================>............] - ETA: 0s - loss: 3.8279e-05 - mean\_absolute\_error: 0.0046 95/126 [=====================>........] - ETA: 0s - loss: 3.7648e-05 - mean\_absolute\_error: 0.0045111/126 [=========================>....] - ETA: 0s - loss: 3.6987e-05 - mean\_absolute\_error: 0.0045126/126 [==============================] - 0s 4ms/step - loss: 3.6646e-05 - mean\_absolute\_error: 0.0044 - val\_loss: 9.8183e-05 - val\_mean\_absolute\_error: 0.0076  
Epoch 18/100  
 1/126 [..............................] - ETA: 0s - loss: 2.3723e-05 - mean\_absolute\_error: 0.0037 17/126 [===>..........................] - ETA: 0s - loss: 4.2230e-05 - mean\_absolute\_error: 0.0049 33/126 [======>.......................] - ETA: 0s - loss: 4.6873e-05 - mean\_absolute\_error: 0.0052 49/126 [==========>...................] - ETA: 0s - loss: 4.2192e-05 - mean\_absolute\_error: 0.0049 65/126 [==============>...............] - ETA: 0s - loss: 4.1820e-05 - mean\_absolute\_error: 0.0049 81/126 [==================>...........] - ETA: 0s - loss: 4.0874e-05 - mean\_absolute\_error: 0.0048 97/126 [======================>.......] - ETA: 0s - loss: 3.9454e-05 - mean\_absolute\_error: 0.0047113/126 [=========================>....] - ETA: 0s - loss: 3.8860e-05 - mean\_absolute\_error: 0.0046126/126 [==============================] - 0s 4ms/step - loss: 3.8520e-05 - mean\_absolute\_error: 0.0046 - val\_loss: 7.0666e-05 - val\_mean\_absolute\_error: 0.0060  
Epoch 19/100  
 1/126 [..............................] - ETA: 0s - loss: 7.9021e-05 - mean\_absolute\_error: 0.0066 16/126 [==>...........................] - ETA: 0s - loss: 3.7576e-05 - mean\_absolute\_error: 0.0042 30/126 [======>.......................] - ETA: 0s - loss: 3.4750e-05 - mean\_absolute\_error: 0.0042 46/126 [=========>....................] - ETA: 0s - loss: 3.5297e-05 - mean\_absolute\_error: 0.0042 61/126 [=============>................] - ETA: 0s - loss: 3.6828e-05 - mean\_absolute\_error: 0.0044 77/126 [=================>............] - ETA: 0s - loss: 3.6710e-05 - mean\_absolute\_error: 0.0044 93/126 [=====================>........] - ETA: 0s - loss: 3.6104e-05 - mean\_absolute\_error: 0.0044109/126 [========================>.....] - ETA: 0s - loss: 3.6817e-05 - mean\_absolute\_error: 0.0045126/126 [==============================] - ETA: 0s - loss: 3.7002e-05 - mean\_absolute\_error: 0.0045126/126 [==============================] - 0s 4ms/step - loss: 3.7002e-05 - mean\_absolute\_error: 0.0045 - val\_loss: 7.7770e-05 - val\_mean\_absolute\_error: 0.0065  
Epoch 20/100  
 1/126 [..............................] - ETA: 0s - loss: 3.5401e-05 - mean\_absolute\_error: 0.0044 17/126 [===>..........................] - ETA: 0s - loss: 4.0495e-05 - mean\_absolute\_error: 0.0049 33/126 [======>.......................] - ETA: 0s - loss: 3.8596e-05 - mean\_absolute\_error: 0.0047 49/126 [==========>...................] - ETA: 0s - loss: 3.8249e-05 - mean\_absolute\_error: 0.0046 65/126 [==============>...............] - ETA: 0s - loss: 3.6683e-05 - mean\_absolute\_error: 0.0045 81/126 [==================>...........] - ETA: 0s - loss: 3.6403e-05 - mean\_absolute\_error: 0.0045 97/126 [======================>.......] - ETA: 0s - loss: 3.6739e-05 - mean\_absolute\_error: 0.0045113/126 [=========================>....] - ETA: 0s - loss: 3.6653e-05 - mean\_absolute\_error: 0.0045126/126 [==============================] - 0s 4ms/step - loss: 3.6973e-05 - mean\_absolute\_error: 0.0045 - val\_loss: 7.6331e-05 - val\_mean\_absolute\_error: 0.0064  
Epoch 21/100  
 1/126 [..............................] - ETA: 0s - loss: 3.2055e-05 - mean\_absolute\_error: 0.0044 17/126 [===>..........................] - ETA: 0s - loss: 3.4147e-05 - mean\_absolute\_error: 0.0044 33/126 [======>.......................] - ETA: 0s - loss: 3.4329e-05 - mean\_absolute\_error: 0.0044 49/126 [==========>...................] - ETA: 0s - loss: 3.5025e-05 - mean\_absolute\_error: 0.0045 65/126 [==============>...............] - ETA: 0s - loss: 3.5269e-05 - mean\_absolute\_error: 0.0044 81/126 [==================>...........] - ETA: 0s - loss: 3.5904e-05 - mean\_absolute\_error: 0.0044 96/126 [=====================>........] - ETA: 0s - loss: 3.6518e-05 - mean\_absolute\_error: 0.0044112/126 [=========================>....] - ETA: 0s - loss: 3.6520e-05 - mean\_absolute\_error: 0.0044126/126 [==============================] - 0s 4ms/step - loss: 3.6621e-05 - mean\_absolute\_error: 0.0044 - val\_loss: 7.7594e-05 - val\_mean\_absolute\_error: 0.0065  
Epoch 22/100  
 1/126 [..............................] - ETA: 0s - loss: 2.2894e-05 - mean\_absolute\_error: 0.0038 17/126 [===>..........................] - ETA: 0s - loss: 3.1134e-05 - mean\_absolute\_error: 0.0042 33/126 [======>.......................] - ETA: 0s - loss: 3.4624e-05 - mean\_absolute\_error: 0.0044 48/126 [==========>...................] - ETA: 0s - loss: 3.6407e-05 - mean\_absolute\_error: 0.0046 63/126 [==============>...............] - ETA: 0s - loss: 3.9587e-05 - mean\_absolute\_error: 0.0047 76/126 [=================>............] - ETA: 0s - loss: 3.8644e-05 - mean\_absolute\_error: 0.0047 90/126 [====================>.........] - ETA: 0s - loss: 3.8312e-05 - mean\_absolute\_error: 0.0046107/126 [========================>.....] - ETA: 0s - loss: 3.7724e-05 - mean\_absolute\_error: 0.0046119/126 [===========================>..] - ETA: 0s - loss: 3.7635e-05 - mean\_absolute\_error: 0.0045126/126 [==============================] - 0s 4ms/step - loss: 3.7500e-05 - mean\_absolute\_error: 0.0045 - val\_loss: 9.3176e-05 - val\_mean\_absolute\_error: 0.0073  
Epoch 23/100  
 1/126 [..............................] - ETA: 0s - loss: 3.8992e-05 - mean\_absolute\_error: 0.0044 14/126 [==>...........................] - ETA: 0s - loss: 3.7113e-05 - mean\_absolute\_error: 0.0043 29/126 [=====>........................] - ETA: 0s - loss: 3.7063e-05 - mean\_absolute\_error: 0.0044 42/126 [=========>....................] - ETA: 0s - loss: 3.6722e-05 - mean\_absolute\_error: 0.0044 50/126 [==========>...................] - ETA: 0s - loss: 3.7800e-05 - mean\_absolute\_error: 0.0045 56/126 [============>.................] - ETA: 0s - loss: 3.7973e-05 - mean\_absolute\_error: 0.0046 61/126 [=============>................] - ETA: 0s - loss: 3.8365e-05 - mean\_absolute\_error: 0.0046 66/126 [==============>...............] - ETA: 0s - loss: 3.8116e-05 - mean\_absolute\_error: 0.0046 72/126 [================>.............] - ETA: 0s - loss: 3.7663e-05 - mean\_absolute\_error: 0.0046 78/126 [=================>............] - ETA: 0s - loss: 3.7599e-05 - mean\_absolute\_error: 0.0046 84/126 [===================>..........] - ETA: 0s - loss: 3.7579e-05 - mean\_absolute\_error: 0.0045 90/126 [====================>.........] - ETA: 0s - loss: 3.7783e-05 - mean\_absolute\_error: 0.0046 97/126 [======================>.......] - ETA: 0s - loss: 3.8795e-05 - mean\_absolute\_error: 0.0046104/126 [=======================>......] - ETA: 0s - loss: 3.8901e-05 - mean\_absolute\_error: 0.0047110/126 [=========================>....] - ETA: 0s - loss: 3.9115e-05 - mean\_absolute\_error: 0.0047117/126 [==========================>...] - ETA: 0s - loss: 3.8864e-05 - mean\_absolute\_error: 0.0047124/126 [============================>.] - ETA: 0s - loss: 3.9620e-05 - mean\_absolute\_error: 0.0047126/126 [==============================] - 1s 8ms/step - loss: 3.9522e-05 - mean\_absolute\_error: 0.0047 - val\_loss: 6.9031e-05 - val\_mean\_absolute\_error: 0.0059  
Epoch 24/100  
 1/126 [..............................] - ETA: 0s - loss: 5.6727e-05 - mean\_absolute\_error: 0.0064 15/126 [==>...........................] - ETA: 0s - loss: 4.4396e-05 - mean\_absolute\_error: 0.0050 31/126 [======>.......................] - ETA: 0s - loss: 4.0075e-05 - mean\_absolute\_error: 0.0046 48/126 [==========>...................] - ETA: 0s - loss: 3.7683e-05 - mean\_absolute\_error: 0.0044 64/126 [==============>...............] - ETA: 0s - loss: 3.7720e-05 - mean\_absolute\_error: 0.0045 80/126 [==================>...........] - ETA: 0s - loss: 3.8107e-05 - mean\_absolute\_error: 0.0045 96/126 [=====================>........] - ETA: 0s - loss: 3.7830e-05 - mean\_absolute\_error: 0.0044111/126 [=========================>....] - ETA: 0s - loss: 3.7711e-05 - mean\_absolute\_error: 0.0045126/126 [==============================] - 0s 4ms/step - loss: 3.7307e-05 - mean\_absolute\_error: 0.0045 - val\_loss: 1.6230e-04 - val\_mean\_absolute\_error: 0.0105  
Epoch 25/100  
 1/126 [..............................] - ETA: 0s - loss: 8.5808e-05 - mean\_absolute\_error: 0.0069 12/126 [=>............................] - ETA: 0s - loss: 6.0871e-05 - mean\_absolute\_error: 0.0063 23/126 [====>.........................] - ETA: 0s - loss: 5.8461e-05 - mean\_absolute\_error: 0.0061 34/126 [=======>......................] - ETA: 0s - loss: 5.3809e-05 - mean\_absolute\_error: 0.0058 44/126 [=========>....................] - ETA: 0s - loss: 5.0421e-05 - mean\_absolute\_error: 0.0055 55/126 [============>.................] - ETA: 0s - loss: 4.7248e-05 - mean\_absolute\_error: 0.0052 66/126 [==============>...............] - ETA: 0s - loss: 4.5482e-05 - mean\_absolute\_error: 0.0051 77/126 [=================>............] - ETA: 0s - loss: 4.4267e-05 - mean\_absolute\_error: 0.0050 90/126 [====================>.........] - ETA: 0s - loss: 4.3260e-05 - mean\_absolute\_error: 0.0049106/126 [========================>.....] - ETA: 0s - loss: 4.1516e-05 - mean\_absolute\_error: 0.0048122/126 [============================>.] - ETA: 0s - loss: 4.1419e-05 - mean\_absolute\_error: 0.0048126/126 [==============================] - 1s 5ms/step - loss: 4.1355e-05 - mean\_absolute\_error: 0.0048 - val\_loss: 1.5340e-04 - val\_mean\_absolute\_error: 0.0101  
Epoch 26/100  
 1/126 [..............................] - ETA: 0s - loss: 8.6290e-05 - mean\_absolute\_error: 0.0063 17/126 [===>..........................] - ETA: 0s - loss: 5.3567e-05 - mean\_absolute\_error: 0.0056 33/126 [======>.......................] - ETA: 0s - loss: 5.2331e-05 - mean\_absolute\_error: 0.0057 50/126 [==========>...................] - ETA: 0s - loss: 5.0418e-05 - mean\_absolute\_error: 0.0056 66/126 [==============>...............] - ETA: 0s - loss: 4.6722e-05 - mean\_absolute\_error: 0.0052 82/126 [==================>...........] - ETA: 0s - loss: 4.5745e-05 - mean\_absolute\_error: 0.0052 98/126 [======================>.......] - ETA: 0s - loss: 4.4250e-05 - mean\_absolute\_error: 0.0050116/126 [==========================>...] - ETA: 0s - loss: 4.2380e-05 - mean\_absolute\_error: 0.0049126/126 [==============================] - 0s 3ms/step - loss: 4.1760e-05 - mean\_absolute\_error: 0.0049 - val\_loss: 6.7976e-05 - val\_mean\_absolute\_error: 0.0057  
Epoch 27/100  
 1/126 [..............................] - ETA: 0s - loss: 2.0400e-05 - mean\_absolute\_error: 0.0034 18/126 [===>..........................] - ETA: 0s - loss: 3.3994e-05 - mean\_absolute\_error: 0.0043 34/126 [=======>......................] - ETA: 0s - loss: 3.6399e-05 - mean\_absolute\_error: 0.0043 50/126 [==========>...................] - ETA: 0s - loss: 3.5774e-05 - mean\_absolute\_error: 0.0043 66/126 [==============>...............] - ETA: 0s - loss: 3.5561e-05 - mean\_absolute\_error: 0.0042 81/126 [==================>...........] - ETA: 0s - loss: 3.6068e-05 - mean\_absolute\_error: 0.0043 96/126 [=====================>........] - ETA: 0s - loss: 3.6350e-05 - mean\_absolute\_error: 0.0044112/126 [=========================>....] - ETA: 0s - loss: 3.7123e-05 - mean\_absolute\_error: 0.0044126/126 [==============================] - 0s 4ms/step - loss: 3.7404e-05 - mean\_absolute\_error: 0.0045 - val\_loss: 8.3327e-05 - val\_mean\_absolute\_error: 0.0068  
Epoch 28/100  
 1/126 [..............................] - ETA: 0s - loss: 2.4835e-05 - mean\_absolute\_error: 0.0038 16/126 [==>...........................] - ETA: 0s - loss: 4.1519e-05 - mean\_absolute\_error: 0.0049 32/126 [======>.......................] - ETA: 0s - loss: 4.6042e-05 - mean\_absolute\_error: 0.0051 48/126 [==========>...................] - ETA: 0s - loss: 4.3912e-05 - mean\_absolute\_error: 0.0051 64/126 [==============>...............] - ETA: 0s - loss: 4.1242e-05 - mean\_absolute\_error: 0.0049 80/126 [==================>...........] - ETA: 0s - loss: 4.2062e-05 - mean\_absolute\_error: 0.0049 96/126 [=====================>........] - ETA: 0s - loss: 4.1976e-05 - mean\_absolute\_error: 0.0049111/126 [=========================>....] - ETA: 0s - loss: 4.1327e-05 - mean\_absolute\_error: 0.0049126/126 [==============================] - 0s 4ms/step - loss: 4.2674e-05 - mean\_absolute\_error: 0.0050 - val\_loss: 1.2743e-04 - val\_mean\_absolute\_error: 0.0090  
Epoch 29/100  
 1/126 [..............................] - ETA: 0s - loss: 2.9635e-05 - mean\_absolute\_error: 0.0042 16/126 [==>...........................] - ETA: 0s - loss: 4.3216e-05 - mean\_absolute\_error: 0.0052 32/126 [======>.......................] - ETA: 0s - loss: 3.9088e-05 - mean\_absolute\_error: 0.0048 48/126 [==========>...................] - ETA: 0s - loss: 3.8315e-05 - mean\_absolute\_error: 0.0046 63/126 [==============>...............] - ETA: 0s - loss: 3.7883e-05 - mean\_absolute\_error: 0.0047 78/126 [=================>............] - ETA: 0s - loss: 3.7528e-05 - mean\_absolute\_error: 0.0046 94/126 [=====================>........] - ETA: 0s - loss: 3.7491e-05 - mean\_absolute\_error: 0.0046109/126 [========================>.....] - ETA: 0s - loss: 3.8685e-05 - mean\_absolute\_error: 0.0047125/126 [============================>.] - ETA: 0s - loss: 3.9156e-05 - mean\_absolute\_error: 0.0047126/126 [==============================] - 0s 4ms/step - loss: 3.9140e-05 - mean\_absolute\_error: 0.0047 - val\_loss: 2.1960e-04 - val\_mean\_absolute\_error: 0.0127  
Epoch 30/100  
 1/126 [..............................] - ETA: 0s - loss: 6.4670e-05 - mean\_absolute\_error: 0.0068 17/126 [===>..........................] - ETA: 0s - loss: 6.1434e-05 - mean\_absolute\_error: 0.0062 33/126 [======>.......................] - ETA: 0s - loss: 4.9698e-05 - mean\_absolute\_error: 0.0055 50/126 [==========>...................] - ETA: 0s - loss: 4.9563e-05 - mean\_absolute\_error: 0.0054 66/126 [==============>...............] - ETA: 0s - loss: 4.6342e-05 - mean\_absolute\_error: 0.0051 82/126 [==================>...........] - ETA: 0s - loss: 4.3798e-05 - mean\_absolute\_error: 0.0049 98/126 [======================>.......] - ETA: 0s - loss: 4.1888e-05 - mean\_absolute\_error: 0.0048114/126 [==========================>...] - ETA: 0s - loss: 4.1331e-05 - mean\_absolute\_error: 0.0048126/126 [==============================] - 0s 4ms/step - loss: 4.1878e-05 - mean\_absolute\_error: 0.0048 - val\_loss: 1.5178e-04 - val\_mean\_absolute\_error: 0.0100  
Epoch 31/100  
 1/126 [..............................] - ETA: 0s - loss: 4.2962e-05 - mean\_absolute\_error: 0.0053 17/126 [===>..........................] - ETA: 0s - loss: 6.4740e-05 - mean\_absolute\_error: 0.0066 33/126 [======>.......................] - ETA: 0s - loss: 5.3939e-05 - mean\_absolute\_error: 0.0059 49/126 [==========>...................] - ETA: 0s - loss: 4.7148e-05 - mean\_absolute\_error: 0.0053 65/126 [==============>...............] - ETA: 0s - loss: 4.5269e-05 - mean\_absolute\_error: 0.0052 81/126 [==================>...........] - ETA: 0s - loss: 4.3432e-05 - mean\_absolute\_error: 0.0050 99/126 [======================>.......] - ETA: 0s - loss: 4.5049e-05 - mean\_absolute\_error: 0.0051116/126 [==========================>...] - ETA: 0s - loss: 4.5670e-05 - mean\_absolute\_error: 0.0051126/126 [==============================] - 0s 4ms/step - loss: 4.5032e-05 - mean\_absolute\_error: 0.0051 - val\_loss: 1.4838e-04 - val\_mean\_absolute\_error: 0.0099  
Epoch 32/100  
 1/126 [..............................] - ETA: 0s - loss: 4.4059e-05 - mean\_absolute\_error: 0.0055 18/126 [===>..........................] - ETA: 0s - loss: 3.7943e-05 - mean\_absolute\_error: 0.0046 34/126 [=======>......................] - ETA: 0s - loss: 4.3059e-05 - mean\_absolute\_error: 0.0050 49/126 [==========>...................] - ETA: 0s - loss: 4.3032e-05 - mean\_absolute\_error: 0.0051 65/126 [==============>...............] - ETA: 0s - loss: 4.0275e-05 - mean\_absolute\_error: 0.0048 81/126 [==================>...........] - ETA: 0s - loss: 4.0642e-05 - mean\_absolute\_error: 0.0048 97/126 [======================>.......] - ETA: 0s - loss: 4.2198e-05 - mean\_absolute\_error: 0.0049113/126 [=========================>....] - ETA: 0s - loss: 4.2237e-05 - mean\_absolute\_error: 0.0049126/126 [==============================] - 0s 4ms/step - loss: 4.2180e-05 - mean\_absolute\_error: 0.0050 - val\_loss: 1.5312e-04 - val\_mean\_absolute\_error: 0.0101  
Epoch 33/100  
 1/126 [..............................] - ETA: 0s - loss: 4.9464e-05 - mean\_absolute\_error: 0.0061 17/126 [===>..........................] - ETA: 0s - loss: 4.6042e-05 - mean\_absolute\_error: 0.0052 32/126 [======>.......................] - ETA: 0s - loss: 4.6648e-05 - mean\_absolute\_error: 0.0053 48/126 [==========>...................] - ETA: 0s - loss: 4.7646e-05 - mean\_absolute\_error: 0.0054 64/126 [==============>...............] - ETA: 0s - loss: 4.9244e-05 - mean\_absolute\_error: 0.0055 80/126 [==================>...........] - ETA: 0s - loss: 4.7829e-05 - mean\_absolute\_error: 0.0054 95/126 [=====================>........] - ETA: 0s - loss: 4.5468e-05 - mean\_absolute\_error: 0.0051111/126 [=========================>....] - ETA: 0s - loss: 4.3578e-05 - mean\_absolute\_error: 0.0050126/126 [==============================] - 0s 4ms/step - loss: 4.3762e-05 - mean\_absolute\_error: 0.0050 - val\_loss: 7.3440e-05 - val\_mean\_absolute\_error: 0.0063  
Epoch 34/100  
 1/126 [..............................] - ETA: 0s - loss: 6.1425e-05 - mean\_absolute\_error: 0.0067 16/126 [==>...........................] - ETA: 0s - loss: 5.5238e-05 - mean\_absolute\_error: 0.0059 32/126 [======>.......................] - ETA: 0s - loss: 4.5750e-05 - mean\_absolute\_error: 0.0051 48/126 [==========>...................] - ETA: 0s - loss: 4.4209e-05 - mean\_absolute\_error: 0.0051 64/126 [==============>...............] - ETA: 0s - loss: 4.2083e-05 - mean\_absolute\_error: 0.0049 80/126 [==================>...........] - ETA: 0s - loss: 4.0984e-05 - mean\_absolute\_error: 0.0049 96/126 [=====================>........] - ETA: 0s - loss: 4.3311e-05 - mean\_absolute\_error: 0.0050112/126 [=========================>....] - ETA: 0s - loss: 4.3907e-05 - mean\_absolute\_error: 0.0051126/126 [==============================] - 0s 4ms/step - loss: 4.4490e-05 - mean\_absolute\_error: 0.0051 - val\_loss: 8.6277e-05 - val\_mean\_absolute\_error: 0.0070  
Epoch 35/100  
 1/126 [..............................] - ETA: 0s - loss: 1.6551e-05 - mean\_absolute\_error: 0.0029 18/126 [===>..........................] - ETA: 0s - loss: 3.5409e-05 - mean\_absolute\_error: 0.0044 34/126 [=======>......................] - ETA: 0s - loss: 4.0261e-05 - mean\_absolute\_error: 0.0048 50/126 [==========>...................] - ETA: 0s - loss: 4.1193e-05 - mean\_absolute\_error: 0.0047 66/126 [==============>...............] - ETA: 0s - loss: 4.0216e-05 - mean\_absolute\_error: 0.0047 82/126 [==================>...........] - ETA: 0s - loss: 3.8124e-05 - mean\_absolute\_error: 0.0045 98/126 [======================>.......] - ETA: 0s - loss: 3.7061e-05 - mean\_absolute\_error: 0.0044113/126 [=========================>....] - ETA: 0s - loss: 3.6771e-05 - mean\_absolute\_error: 0.0044126/126 [==============================] - 0s 4ms/step - loss: 3.6640e-05 - mean\_absolute\_error: 0.0044 - val\_loss: 1.2681e-04 - val\_mean\_absolute\_error: 0.0089  
Epoch 36/100  
 1/126 [..............................] - ETA: 0s - loss: 2.5506e-05 - mean\_absolute\_error: 0.0040 17/126 [===>..........................] - ETA: 0s - loss: 3.2995e-05 - mean\_absolute\_error: 0.0043 33/126 [======>.......................] - ETA: 0s - loss: 3.3807e-05 - mean\_absolute\_error: 0.0044 49/126 [==========>...................] - ETA: 0s - loss: 3.5711e-05 - mean\_absolute\_error: 0.0045 65/126 [==============>...............] - ETA: 0s - loss: 3.7399e-05 - mean\_absolute\_error: 0.0046 80/126 [==================>...........] - ETA: 0s - loss: 3.6923e-05 - mean\_absolute\_error: 0.0045 97/126 [======================>.......] - ETA: 0s - loss: 3.7307e-05 - mean\_absolute\_error: 0.0046113/126 [=========================>....] - ETA: 0s - loss: 3.9368e-05 - mean\_absolute\_error: 0.0048126/126 [==============================] - 0s 4ms/step - loss: 3.9844e-05 - mean\_absolute\_error: 0.0048 - val\_loss: 1.4554e-04 - val\_mean\_absolute\_error: 0.0098  
Epoch 37/100  
 1/126 [..............................] - ETA: 0s - loss: 4.1124e-05 - mean\_absolute\_error: 0.0054 16/126 [==>...........................] - ETA: 0s - loss: 3.9065e-05 - mean\_absolute\_error: 0.0048 32/126 [======>.......................] - ETA: 0s - loss: 3.7674e-05 - mean\_absolute\_error: 0.0047 48/126 [==========>...................] - ETA: 0s - loss: 3.8641e-05 - mean\_absolute\_error: 0.0047 65/126 [==============>...............] - ETA: 0s - loss: 3.7486e-05 - mean\_absolute\_error: 0.0046 80/126 [==================>...........] - ETA: 0s - loss: 3.7289e-05 - mean\_absolute\_error: 0.0046 96/126 [=====================>........] - ETA: 0s - loss: 3.8187e-05 - mean\_absolute\_error: 0.0047112/126 [=========================>....] - ETA: 0s - loss: 3.8451e-05 - mean\_absolute\_error: 0.0047126/126 [==============================] - 0s 4ms/step - loss: 3.9646e-05 - mean\_absolute\_error: 0.0047 - val\_loss: 7.3147e-05 - val\_mean\_absolute\_error: 0.0062  
Epoch 38/100  
 1/126 [..............................] - ETA: 0s - loss: 2.5945e-05 - mean\_absolute\_error: 0.0038 17/126 [===>..........................] - ETA: 0s - loss: 4.1012e-05 - mean\_absolute\_error: 0.0048 33/126 [======>.......................] - ETA: 0s - loss: 4.0687e-05 - mean\_absolute\_error: 0.0047 49/126 [==========>...................] - ETA: 0s - loss: 3.8356e-05 - mean\_absolute\_error: 0.0046 65/126 [==============>...............] - ETA: 0s - loss: 3.7839e-05 - mean\_absolute\_error: 0.0046 80/126 [==================>...........] - ETA: 0s - loss: 3.7158e-05 - mean\_absolute\_error: 0.0045 96/126 [=====================>........] - ETA: 0s - loss: 3.8801e-05 - mean\_absolute\_error: 0.0046112/126 [=========================>....] - ETA: 0s - loss: 3.8643e-05 - mean\_absolute\_error: 0.0046126/126 [==============================] - 0s 4ms/step - loss: 3.7659e-05 - mean\_absolute\_error: 0.0045 - val\_loss: 6.9189e-05 - val\_mean\_absolute\_error: 0.0059  
Epoch 39/100  
 1/126 [..............................] - ETA: 0s - loss: 4.5169e-05 - mean\_absolute\_error: 0.0053 17/126 [===>..........................] - ETA: 0s - loss: 5.0640e-05 - mean\_absolute\_error: 0.0056 33/126 [======>.......................] - ETA: 0s - loss: 4.9268e-05 - mean\_absolute\_error: 0.0056 48/126 [==========>...................] - ETA: 0s - loss: 4.5033e-05 - mean\_absolute\_error: 0.0052 64/126 [==============>...............] - ETA: 0s - loss: 4.4508e-05 - mean\_absolute\_error: 0.0051 80/126 [==================>...........] - ETA: 0s - loss: 4.4993e-05 - mean\_absolute\_error: 0.0051 96/126 [=====================>........] - ETA: 0s - loss: 4.3390e-05 - mean\_absolute\_error: 0.0050112/126 [=========================>....] - ETA: 0s - loss: 4.2381e-05 - mean\_absolute\_error: 0.0050126/126 [==============================] - 0s 4ms/step - loss: 4.1431e-05 - mean\_absolute\_error: 0.0049 - val\_loss: 9.9341e-05 - val\_mean\_absolute\_error: 0.0077  
Epoch 40/100  
 1/126 [..............................] - ETA: 0s - loss: 2.7094e-05 - mean\_absolute\_error: 0.0040 16/126 [==>...........................] - ETA: 0s - loss: 3.2781e-05 - mean\_absolute\_error: 0.0041 31/126 [======>.......................] - ETA: 0s - loss: 3.3430e-05 - mean\_absolute\_error: 0.0042 47/126 [==========>...................] - ETA: 0s - loss: 3.6979e-05 - mean\_absolute\_error: 0.0044 62/126 [=============>................] - ETA: 0s - loss: 4.0866e-05 - mean\_absolute\_error: 0.0047 78/126 [=================>............] - ETA: 0s - loss: 4.0435e-05 - mean\_absolute\_error: 0.0047 94/126 [=====================>........] - ETA: 0s - loss: 4.0527e-05 - mean\_absolute\_error: 0.0047110/126 [=========================>....] - ETA: 0s - loss: 3.8851e-05 - mean\_absolute\_error: 0.0046126/126 [==============================] - ETA: 0s - loss: 3.9212e-05 - mean\_absolute\_error: 0.0046126/126 [==============================] - 0s 4ms/step - loss: 3.9212e-05 - mean\_absolute\_error: 0.0046 - val\_loss: 6.7343e-05 - val\_mean\_absolute\_error: 0.0058  
Epoch 41/100  
 1/126 [..............................] - ETA: 0s - loss: 4.8397e-05 - mean\_absolute\_error: 0.0041 17/126 [===>..........................] - ETA: 0s - loss: 5.1021e-05 - mean\_absolute\_error: 0.0053 33/126 [======>.......................] - ETA: 0s - loss: 4.9077e-05 - mean\_absolute\_error: 0.0053 48/126 [==========>...................] - ETA: 0s - loss: 4.5209e-05 - mean\_absolute\_error: 0.0051 64/126 [==============>...............] - ETA: 0s - loss: 4.4488e-05 - mean\_absolute\_error: 0.0051 80/126 [==================>...........] - ETA: 0s - loss: 4.3822e-05 - mean\_absolute\_error: 0.0051 96/126 [=====================>........] - ETA: 0s - loss: 4.3950e-05 - mean\_absolute\_error: 0.0051111/126 [=========================>....] - ETA: 0s - loss: 4.5748e-05 - mean\_absolute\_error: 0.0052126/126 [==============================] - ETA: 0s - loss: 4.5323e-05 - mean\_absolute\_error: 0.0053126/126 [==============================] - 0s 4ms/step - loss: 4.5323e-05 - mean\_absolute\_error: 0.0053 - val\_loss: 1.8399e-04 - val\_mean\_absolute\_error: 0.0114  
Epoch 42/100  
 1/126 [..............................] - ETA: 0s - loss: 9.0104e-05 - mean\_absolute\_error: 0.0077 17/126 [===>..........................] - ETA: 0s - loss: 3.6051e-05 - mean\_absolute\_error: 0.0045 32/126 [======>.......................] - ETA: 0s - loss: 3.9969e-05 - mean\_absolute\_error: 0.0048 48/126 [==========>...................] - ETA: 0s - loss: 3.9490e-05 - mean\_absolute\_error: 0.0048 64/126 [==============>...............] - ETA: 0s - loss: 4.0038e-05 - mean\_absolute\_error: 0.0048 80/126 [==================>...........] - ETA: 0s - loss: 4.1201e-05 - mean\_absolute\_error: 0.0048 96/126 [=====================>........] - ETA: 0s - loss: 3.9732e-05 - mean\_absolute\_error: 0.0047112/126 [=========================>....] - ETA: 0s - loss: 3.9627e-05 - mean\_absolute\_error: 0.0047126/126 [==============================] - 0s 4ms/step - loss: 3.9289e-05 - mean\_absolute\_error: 0.0047 - val\_loss: 6.5648e-05 - val\_mean\_absolute\_error: 0.0057  
Epoch 43/100  
 1/126 [..............................] - ETA: 0s - loss: 2.0666e-05 - mean\_absolute\_error: 0.0035 17/126 [===>..........................] - ETA: 0s - loss: 3.5063e-05 - mean\_absolute\_error: 0.0043 33/126 [======>.......................] - ETA: 0s - loss: 3.8084e-05 - mean\_absolute\_error: 0.0044 48/126 [==========>...................] - ETA: 0s - loss: 3.7478e-05 - mean\_absolute\_error: 0.0045 64/126 [==============>...............] - ETA: 0s - loss: 3.9329e-05 - mean\_absolute\_error: 0.0047 79/126 [=================>............] - ETA: 0s - loss: 3.9135e-05 - mean\_absolute\_error: 0.0047 95/126 [=====================>........] - ETA: 0s - loss: 3.8579e-05 - mean\_absolute\_error: 0.0046111/126 [=========================>....] - ETA: 0s - loss: 3.8098e-05 - mean\_absolute\_error: 0.0046126/126 [==============================] - ETA: 0s - loss: 3.7652e-05 - mean\_absolute\_error: 0.0045126/126 [==============================] - 0s 4ms/step - loss: 3.7652e-05 - mean\_absolute\_error: 0.0045 - val\_loss: 6.8581e-05 - val\_mean\_absolute\_error: 0.0059  
Epoch 44/100  
 1/126 [..............................] - ETA: 0s - loss: 3.2753e-05 - mean\_absolute\_error: 0.0043 16/126 [==>...........................] - ETA: 0s - loss: 3.8528e-05 - mean\_absolute\_error: 0.0047 32/126 [======>.......................] - ETA: 0s - loss: 4.0536e-05 - mean\_absolute\_error: 0.0049 47/126 [==========>...................] - ETA: 0s - loss: 4.0175e-05 - mean\_absolute\_error: 0.0049 63/126 [==============>...............] - ETA: 0s - loss: 4.0607e-05 - mean\_absolute\_error: 0.0049 78/126 [=================>............] - ETA: 0s - loss: 4.1072e-05 - mean\_absolute\_error: 0.0049 94/126 [=====================>........] - ETA: 0s - loss: 4.3331e-05 - mean\_absolute\_error: 0.0051110/126 [=========================>....] - ETA: 0s - loss: 4.3474e-05 - mean\_absolute\_error: 0.0050126/126 [==============================] - 0s 4ms/step - loss: 4.2326e-05 - mean\_absolute\_error: 0.0050 - val\_loss: 7.7900e-05 - val\_mean\_absolute\_error: 0.0065  
Epoch 45/100  
 1/126 [..............................] - ETA: 0s - loss: 4.2655e-05 - mean\_absolute\_error: 0.0048 17/126 [===>..........................] - ETA: 0s - loss: 3.6712e-05 - mean\_absolute\_error: 0.0047 33/126 [======>.......................] - ETA: 0s - loss: 3.9887e-05 - mean\_absolute\_error: 0.0049 49/126 [==========>...................] - ETA: 0s - loss: 5.5067e-05 - mean\_absolute\_error: 0.0057 65/126 [==============>...............] - ETA: 0s - loss: 5.1932e-05 - mean\_absolute\_error: 0.0056 81/126 [==================>...........] - ETA: 0s - loss: 4.9562e-05 - mean\_absolute\_error: 0.0054 98/126 [======================>.......] - ETA: 0s - loss: 4.9254e-05 - mean\_absolute\_error: 0.0054114/126 [==========================>...] - ETA: 0s - loss: 4.7693e-05 - mean\_absolute\_error: 0.0053126/126 [==============================] - 0s 4ms/step - loss: 4.7311e-05 - mean\_absolute\_error: 0.0053 - val\_loss: 1.2528e-04 - val\_mean\_absolute\_error: 0.0089  
Epoch 46/100  
 1/126 [..............................] - ETA: 0s - loss: 2.8860e-05 - mean\_absolute\_error: 0.0047 18/126 [===>..........................] - ETA: 0s - loss: 3.8754e-05 - mean\_absolute\_error: 0.0047 34/126 [=======>......................] - ETA: 0s - loss: 4.0997e-05 - mean\_absolute\_error: 0.0049 50/126 [==========>...................] - ETA: 0s - loss: 3.8673e-05 - mean\_absolute\_error: 0.0047 66/126 [==============>...............] - ETA: 0s - loss: 3.9528e-05 - mean\_absolute\_error: 0.0047 82/126 [==================>...........] - ETA: 0s - loss: 4.1709e-05 - mean\_absolute\_error: 0.0049 97/126 [======================>.......] - ETA: 0s - loss: 4.1245e-05 - mean\_absolute\_error: 0.0048113/126 [=========================>....] - ETA: 0s - loss: 4.0269e-05 - mean\_absolute\_error: 0.0048126/126 [==============================] - 0s 4ms/step - loss: 4.0747e-05 - mean\_absolute\_error: 0.0048 - val\_loss: 1.0148e-04 - val\_mean\_absolute\_error: 0.0078  
Epoch 47/100  
 1/126 [..............................] - ETA: 0s - loss: 3.6502e-05 - mean\_absolute\_error: 0.0050 17/126 [===>..........................] - ETA: 0s - loss: 3.6596e-05 - mean\_absolute\_error: 0.0047 33/126 [======>.......................] - ETA: 0s - loss: 3.5683e-05 - mean\_absolute\_error: 0.0045 49/126 [==========>...................] - ETA: 0s - loss: 3.5801e-05 - mean\_absolute\_error: 0.0044 65/126 [==============>...............] - ETA: 0s - loss: 3.7542e-05 - mean\_absolute\_error: 0.0046 81/126 [==================>...........] - ETA: 0s - loss: 3.7478e-05 - mean\_absolute\_error: 0.0046 97/126 [======================>.......] - ETA: 0s - loss: 3.7724e-05 - mean\_absolute\_error: 0.0046113/126 [=========================>....] - ETA: 0s - loss: 3.7358e-05 - mean\_absolute\_error: 0.0046126/126 [==============================] - 0s 4ms/step - loss: 3.8014e-05 - mean\_absolute\_error: 0.0046 - val\_loss: 6.5671e-05 - val\_mean\_absolute\_error: 0.0057  
Epoch 48/100  
 1/126 [..............................] - ETA: 0s - loss: 5.3905e-05 - mean\_absolute\_error: 0.0063 17/126 [===>..........................] - ETA: 0s - loss: 5.3123e-05 - mean\_absolute\_error: 0.0058 33/126 [======>.......................] - ETA: 0s - loss: 4.6261e-05 - mean\_absolute\_error: 0.0053 49/126 [==========>...................] - ETA: 0s - loss: 4.2199e-05 - mean\_absolute\_error: 0.0050 66/126 [==============>...............] - ETA: 0s - loss: 3.9712e-05 - mean\_absolute\_error: 0.0048 82/126 [==================>...........] - ETA: 0s - loss: 3.9971e-05 - mean\_absolute\_error: 0.0048 98/126 [======================>.......] - ETA: 0s - loss: 3.9450e-05 - mean\_absolute\_error: 0.0047114/126 [==========================>...] - ETA: 0s - loss: 3.9952e-05 - mean\_absolute\_error: 0.0048126/126 [==============================] - 0s 4ms/step - loss: 4.1836e-05 - mean\_absolute\_error: 0.0049 - val\_loss: 6.5488e-05 - val\_mean\_absolute\_error: 0.0057  
Epoch 49/100  
 1/126 [..............................] - ETA: 0s - loss: 4.1385e-05 - mean\_absolute\_error: 0.0052 17/126 [===>..........................] - ETA: 0s - loss: 4.1442e-05 - mean\_absolute\_error: 0.0047 33/126 [======>.......................] - ETA: 0s - loss: 3.6691e-05 - mean\_absolute\_error: 0.0045 50/126 [==========>...................] - ETA: 0s - loss: 3.7140e-05 - mean\_absolute\_error: 0.0044 66/126 [==============>...............] - ETA: 0s - loss: 3.6160e-05 - mean\_absolute\_error: 0.0044 82/126 [==================>...........] - ETA: 0s - loss: 3.5640e-05 - mean\_absolute\_error: 0.0043 98/126 [======================>.......] - ETA: 0s - loss: 3.5333e-05 - mean\_absolute\_error: 0.0043115/126 [==========================>...] - ETA: 0s - loss: 3.6771e-05 - mean\_absolute\_error: 0.0044126/126 [==============================] - 0s 4ms/step - loss: 3.6606e-05 - mean\_absolute\_error: 0.0044 - val\_loss: 7.0570e-05 - val\_mean\_absolute\_error: 0.0060  
Epoch 50/100  
 1/126 [..............................] - ETA: 0s - loss: 5.3634e-05 - mean\_absolute\_error: 0.0061 18/126 [===>..........................] - ETA: 0s - loss: 3.6149e-05 - mean\_absolute\_error: 0.0043 34/126 [=======>......................] - ETA: 0s - loss: 3.9928e-05 - mean\_absolute\_error: 0.0047 50/126 [==========>...................] - ETA: 0s - loss: 3.9581e-05 - mean\_absolute\_error: 0.0047 66/126 [==============>...............] - ETA: 0s - loss: 4.2410e-05 - mean\_absolute\_error: 0.0049 82/126 [==================>...........] - ETA: 0s - loss: 4.0986e-05 - mean\_absolute\_error: 0.0048 97/126 [======================>.......] - ETA: 0s - loss: 4.0324e-05 - mean\_absolute\_error: 0.0048112/126 [=========================>....] - ETA: 0s - loss: 3.9743e-05 - mean\_absolute\_error: 0.0047126/126 [==============================] - 0s 4ms/step - loss: 3.9576e-05 - mean\_absolute\_error: 0.0047 - val\_loss: 7.1779e-05 - val\_mean\_absolute\_error: 0.0061  
Epoch 51/100  
 1/126 [..............................] - ETA: 0s - loss: 2.9699e-05 - mean\_absolute\_error: 0.0042 17/126 [===>..........................] - ETA: 0s - loss: 6.3306e-05 - mean\_absolute\_error: 0.0063 32/126 [======>.......................] - ETA: 0s - loss: 5.4149e-05 - mean\_absolute\_error: 0.0057 48/126 [==========>...................] - ETA: 0s - loss: 4.7177e-05 - mean\_absolute\_error: 0.0053 64/126 [==============>...............] - ETA: 0s - loss: 4.7322e-05 - mean\_absolute\_error: 0.0053 79/126 [=================>............] - ETA: 0s - loss: 4.5816e-05 - mean\_absolute\_error: 0.0051 96/126 [=====================>........] - ETA: 0s - loss: 4.3702e-05 - mean\_absolute\_error: 0.0050114/126 [==========================>...] - ETA: 0s - loss: 4.2330e-05 - mean\_absolute\_error: 0.0049126/126 [==============================] - 0s 4ms/step - loss: 4.1216e-05 - mean\_absolute\_error: 0.0048 - val\_loss: 6.8428e-05 - val\_mean\_absolute\_error: 0.0059  
Epoch 52/100  
 1/126 [..............................] - ETA: 0s - loss: 2.5557e-05 - mean\_absolute\_error: 0.0038 17/126 [===>..........................] - ETA: 0s - loss: 4.4783e-05 - mean\_absolute\_error: 0.0051 33/126 [======>.......................] - ETA: 0s - loss: 3.8432e-05 - mean\_absolute\_error: 0.0047 49/126 [==========>...................] - ETA: 0s - loss: 3.8846e-05 - mean\_absolute\_error: 0.0047 64/126 [==============>...............] - ETA: 0s - loss: 3.8090e-05 - mean\_absolute\_error: 0.0047 80/126 [==================>...........] - ETA: 0s - loss: 4.0139e-05 - mean\_absolute\_error: 0.0049 95/126 [=====================>........] - ETA: 0s - loss: 4.1639e-05 - mean\_absolute\_error: 0.0050110/126 [=========================>....] - ETA: 0s - loss: 4.1825e-05 - mean\_absolute\_error: 0.0050125/126 [============================>.] - ETA: 0s - loss: 4.1344e-05 - mean\_absolute\_error: 0.0049126/126 [==============================] - 0s 4ms/step - loss: 4.1316e-05 - mean\_absolute\_error: 0.0049 - val\_loss: 6.4026e-05 - val\_mean\_absolute\_error: 0.0055  
Epoch 53/100  
 1/126 [..............................] - ETA: 0s - loss: 7.4198e-05 - mean\_absolute\_error: 0.0072 17/126 [===>..........................] - ETA: 0s - loss: 3.6874e-05 - mean\_absolute\_error: 0.0047 33/126 [======>.......................] - ETA: 0s - loss: 3.6677e-05 - mean\_absolute\_error: 0.0046 49/126 [==========>...................] - ETA: 0s - loss: 3.8714e-05 - mean\_absolute\_error: 0.0046 65/126 [==============>...............] - ETA: 0s - loss: 3.9409e-05 - mean\_absolute\_error: 0.0046 81/126 [==================>...........] - ETA: 0s - loss: 4.0886e-05 - mean\_absolute\_error: 0.0047 97/126 [======================>.......] - ETA: 0s - loss: 4.1149e-05 - mean\_absolute\_error: 0.0048113/126 [=========================>....] - ETA: 0s - loss: 3.9258e-05 - mean\_absolute\_error: 0.0047126/126 [==============================] - 0s 4ms/step - loss: 3.8590e-05 - mean\_absolute\_error: 0.0046 - val\_loss: 6.3990e-05 - val\_mean\_absolute\_error: 0.0056  
Epoch 54/100  
 1/126 [..............................] - ETA: 0s - loss: 3.1967e-05 - mean\_absolute\_error: 0.0043 17/126 [===>..........................] - ETA: 0s - loss: 3.8484e-05 - mean\_absolute\_error: 0.0046 33/126 [======>.......................] - ETA: 0s - loss: 3.5853e-05 - mean\_absolute\_error: 0.0045 49/126 [==========>...................] - ETA: 0s - loss: 3.5604e-05 - mean\_absolute\_error: 0.0044 65/126 [==============>...............] - ETA: 0s - loss: 3.5556e-05 - mean\_absolute\_error: 0.0044 81/126 [==================>...........] - ETA: 0s - loss: 3.5963e-05 - mean\_absolute\_error: 0.0045 97/126 [======================>.......] - ETA: 0s - loss: 3.8400e-05 - mean\_absolute\_error: 0.0047113/126 [=========================>....] - ETA: 0s - loss: 3.8624e-05 - mean\_absolute\_error: 0.0047126/126 [==============================] - 0s 4ms/step - loss: 3.8788e-05 - mean\_absolute\_error: 0.0047 - val\_loss: 7.0085e-05 - val\_mean\_absolute\_error: 0.0060  
Epoch 55/100  
 1/126 [..............................] - ETA: 0s - loss: 3.5703e-05 - mean\_absolute\_error: 0.0046 17/126 [===>..........................] - ETA: 0s - loss: 3.4658e-05 - mean\_absolute\_error: 0.0044 32/126 [======>.......................] - ETA: 0s - loss: 3.9074e-05 - mean\_absolute\_error: 0.0047 46/126 [=========>....................] - ETA: 0s - loss: 3.9561e-05 - mean\_absolute\_error: 0.0046 62/126 [=============>................] - ETA: 0s - loss: 4.0312e-05 - mean\_absolute\_error: 0.0048 78/126 [=================>............] - ETA: 0s - loss: 4.0451e-05 - mean\_absolute\_error: 0.0048 94/126 [=====================>........] - ETA: 0s - loss: 3.9495e-05 - mean\_absolute\_error: 0.0047109/126 [========================>.....] - ETA: 0s - loss: 3.8507e-05 - mean\_absolute\_error: 0.0046125/126 [============================>.] - ETA: 0s - loss: 3.8722e-05 - mean\_absolute\_error: 0.0046126/126 [==============================] - 0s 4ms/step - loss: 3.8771e-05 - mean\_absolute\_error: 0.0046 - val\_loss: 6.4752e-05 - val\_mean\_absolute\_error: 0.0056  
Epoch 56/100  
 1/126 [..............................] - ETA: 0s - loss: 6.2102e-05 - mean\_absolute\_error: 0.0064 16/126 [==>...........................] - ETA: 0s - loss: 3.9486e-05 - mean\_absolute\_error: 0.0048 32/126 [======>.......................] - ETA: 0s - loss: 4.0721e-05 - mean\_absolute\_error: 0.0049 48/126 [==========>...................] - ETA: 0s - loss: 4.0349e-05 - mean\_absolute\_error: 0.0049 64/126 [==============>...............] - ETA: 0s - loss: 3.8296e-05 - mean\_absolute\_error: 0.0047 80/126 [==================>...........] - ETA: 0s - loss: 3.7973e-05 - mean\_absolute\_error: 0.0047 96/126 [=====================>........] - ETA: 0s - loss: 3.8482e-05 - mean\_absolute\_error: 0.0047112/126 [=========================>....] - ETA: 0s - loss: 4.0345e-05 - mean\_absolute\_error: 0.0048126/126 [==============================] - 0s 4ms/step - loss: 4.0287e-05 - mean\_absolute\_error: 0.0048 - val\_loss: 9.9055e-05 - val\_mean\_absolute\_error: 0.0077  
Epoch 57/100  
 1/126 [..............................] - ETA: 0s - loss: 2.9835e-05 - mean\_absolute\_error: 0.0045 17/126 [===>..........................] - ETA: 0s - loss: 4.4488e-05 - mean\_absolute\_error: 0.0049 33/126 [======>.......................] - ETA: 0s - loss: 4.0614e-05 - mean\_absolute\_error: 0.0046 49/126 [==========>...................] - ETA: 0s - loss: 4.7365e-05 - mean\_absolute\_error: 0.0051 65/126 [==============>...............] - ETA: 0s - loss: 4.6032e-05 - mean\_absolute\_error: 0.0051 81/126 [==================>...........] - ETA: 0s - loss: 4.4371e-05 - mean\_absolute\_error: 0.0050 96/126 [=====================>........] - ETA: 0s - loss: 4.4038e-05 - mean\_absolute\_error: 0.0050112/126 [=========================>....] - ETA: 0s - loss: 4.2810e-05 - mean\_absolute\_error: 0.0049126/126 [==============================] - 0s 4ms/step - loss: 4.1530e-05 - mean\_absolute\_error: 0.0048 - val\_loss: 6.8078e-05 - val\_mean\_absolute\_error: 0.0059  
Epoch 58/100  
 1/126 [..............................] - ETA: 0s - loss: 2.0412e-05 - mean\_absolute\_error: 0.0037 17/126 [===>..........................] - ETA: 0s - loss: 3.9425e-05 - mean\_absolute\_error: 0.0047 33/126 [======>.......................] - ETA: 0s - loss: 3.7054e-05 - mean\_absolute\_error: 0.0046 49/126 [==========>...................] - ETA: 0s - loss: 3.7297e-05 - mean\_absolute\_error: 0.0047 65/126 [==============>...............] - ETA: 0s - loss: 3.8505e-05 - mean\_absolute\_error: 0.0048 81/126 [==================>...........] - ETA: 0s - loss: 4.0312e-05 - mean\_absolute\_error: 0.0049 96/126 [=====================>........] - ETA: 0s - loss: 4.0541e-05 - mean\_absolute\_error: 0.0049112/126 [=========================>....] - ETA: 0s - loss: 3.9405e-05 - mean\_absolute\_error: 0.0048126/126 [==============================] - 0s 4ms/step - loss: 3.9147e-05 - mean\_absolute\_error: 0.0047 - val\_loss: 1.6490e-04 - val\_mean\_absolute\_error: 0.0106  
Epoch 59/100  
 1/126 [..............................] - ETA: 0s - loss: 6.7701e-05 - mean\_absolute\_error: 0.0069 17/126 [===>..........................] - ETA: 0s - loss: 6.0533e-05 - mean\_absolute\_error: 0.0062 33/126 [======>.......................] - ETA: 0s - loss: 5.8098e-05 - mean\_absolute\_error: 0.0061 49/126 [==========>...................] - ETA: 0s - loss: 5.3707e-05 - mean\_absolute\_error: 0.0059 64/126 [==============>...............] - ETA: 0s - loss: 5.0408e-05 - mean\_absolute\_error: 0.0056 80/126 [==================>...........] - ETA: 0s - loss: 4.9818e-05 - mean\_absolute\_error: 0.0056 95/126 [=====================>........] - ETA: 0s - loss: 4.8955e-05 - mean\_absolute\_error: 0.0055111/126 [=========================>....] - ETA: 0s - loss: 4.7190e-05 - mean\_absolute\_error: 0.0054126/126 [==============================] - 0s 4ms/step - loss: 4.6978e-05 - mean\_absolute\_error: 0.0053 - val\_loss: 1.2872e-04 - val\_mean\_absolute\_error: 0.0091  
Epoch 60/100  
 1/126 [..............................] - ETA: 0s - loss: 3.0905e-05 - mean\_absolute\_error: 0.0046 16/126 [==>...........................] - ETA: 0s - loss: 3.8801e-05 - mean\_absolute\_error: 0.0047 32/126 [======>.......................] - ETA: 0s - loss: 4.4619e-05 - mean\_absolute\_error: 0.0051 48/126 [==========>...................] - ETA: 0s - loss: 4.1841e-05 - mean\_absolute\_error: 0.0049 63/126 [==============>...............] - ETA: 0s - loss: 3.9378e-05 - mean\_absolute\_error: 0.0047 79/126 [=================>............] - ETA: 0s - loss: 3.8646e-05 - mean\_absolute\_error: 0.0046 95/126 [=====================>........] - ETA: 0s - loss: 3.7726e-05 - mean\_absolute\_error: 0.0046111/126 [=========================>....] - ETA: 0s - loss: 3.6715e-05 - mean\_absolute\_error: 0.0045126/126 [==============================] - ETA: 0s - loss: 3.7575e-05 - mean\_absolute\_error: 0.0045126/126 [==============================] - 0s 4ms/step - loss: 3.7575e-05 - mean\_absolute\_error: 0.0045 - val\_loss: 7.3258e-05 - val\_mean\_absolute\_error: 0.0062  
Epoch 61/100  
 1/126 [..............................] - ETA: 0s - loss: 2.7841e-05 - mean\_absolute\_error: 0.0037 17/126 [===>..........................] - ETA: 0s - loss: 3.5889e-05 - mean\_absolute\_error: 0.0043 32/126 [======>.......................] - ETA: 0s - loss: 3.5741e-05 - mean\_absolute\_error: 0.0043 48/126 [==========>...................] - ETA: 0s - loss: 3.6118e-05 - mean\_absolute\_error: 0.0044 64/126 [==============>...............] - ETA: 0s - loss: 3.7312e-05 - mean\_absolute\_error: 0.0045 80/126 [==================>...........] - ETA: 0s - loss: 3.6889e-05 - mean\_absolute\_error: 0.0045 96/126 [=====================>........] - ETA: 0s - loss: 3.7690e-05 - mean\_absolute\_error: 0.0046112/126 [=========================>....] - ETA: 0s - loss: 3.7860e-05 - mean\_absolute\_error: 0.0046126/126 [==============================] - 0s 4ms/step - loss: 3.9713e-05 - mean\_absolute\_error: 0.0047 - val\_loss: 1.2578e-04 - val\_mean\_absolute\_error: 0.0090  
Epoch 62/100  
 1/126 [..............................] - ETA: 0s - loss: 3.5826e-05 - mean\_absolute\_error: 0.0047 17/126 [===>..........................] - ETA: 0s - loss: 3.7459e-05 - mean\_absolute\_error: 0.0045 33/126 [======>.......................] - ETA: 0s - loss: 3.6921e-05 - mean\_absolute\_error: 0.0045 49/126 [==========>...................] - ETA: 0s - loss: 3.6657e-05 - mean\_absolute\_error: 0.0045 65/126 [==============>...............] - ETA: 0s - loss: 3.6712e-05 - mean\_absolute\_error: 0.0045 81/126 [==================>...........] - ETA: 0s - loss: 3.7671e-05 - mean\_absolute\_error: 0.0046 97/126 [======================>.......] - ETA: 0s - loss: 4.1719e-05 - mean\_absolute\_error: 0.0049113/126 [=========================>....] - ETA: 0s - loss: 4.2507e-05 - mean\_absolute\_error: 0.0049126/126 [==============================] - 0s 4ms/step - loss: 4.2694e-05 - mean\_absolute\_error: 0.0049 - val\_loss: 6.5145e-05 - val\_mean\_absolute\_error: 0.0057  
Epoch 63/100  
 1/126 [..............................] - ETA: 0s - loss: 3.9500e-05 - mean\_absolute\_error: 0.0051 18/126 [===>..........................] - ETA: 0s - loss: 4.0738e-05 - mean\_absolute\_error: 0.0050 34/126 [=======>......................] - ETA: 0s - loss: 3.8355e-05 - mean\_absolute\_error: 0.0047 51/126 [===========>..................] - ETA: 0s - loss: 3.9216e-05 - mean\_absolute\_error: 0.0048 68/126 [===============>..............] - ETA: 0s - loss: 4.0950e-05 - mean\_absolute\_error: 0.0049 84/126 [===================>..........] - ETA: 0s - loss: 4.0175e-05 - mean\_absolute\_error: 0.0049100/126 [======================>.......] - ETA: 0s - loss: 4.1002e-05 - mean\_absolute\_error: 0.0049115/126 [==========================>...] - ETA: 0s - loss: 4.2137e-05 - mean\_absolute\_error: 0.0050126/126 [==============================] - 0s 4ms/step - loss: 4.2300e-05 - mean\_absolute\_error: 0.0050 - val\_loss: 6.5600e-05 - val\_mean\_absolute\_error: 0.0058  
Epoch 64/100  
 1/126 [..............................] - ETA: 0s - loss: 3.6746e-05 - mean\_absolute\_error: 0.0045 17/126 [===>..........................] - ETA: 0s - loss: 3.6366e-05 - mean\_absolute\_error: 0.0045 33/126 [======>.......................] - ETA: 0s - loss: 4.1345e-05 - mean\_absolute\_error: 0.0049 49/126 [==========>...................] - ETA: 0s - loss: 5.0296e-05 - mean\_absolute\_error: 0.0055 65/126 [==============>...............] - ETA: 0s - loss: 5.0371e-05 - mean\_absolute\_error: 0.0056 81/126 [==================>...........] - ETA: 0s - loss: 4.7938e-05 - mean\_absolute\_error: 0.0055 97/126 [======================>.......] - ETA: 0s - loss: 4.7813e-05 - mean\_absolute\_error: 0.0055114/126 [==========================>...] - ETA: 0s - loss: 4.6110e-05 - mean\_absolute\_error: 0.0053126/126 [==============================] - 0s 4ms/step - loss: 4.6106e-05 - mean\_absolute\_error: 0.0053 - val\_loss: 6.2701e-05 - val\_mean\_absolute\_error: 0.0055  
Epoch 65/100  
 1/126 [..............................] - ETA: 0s - loss: 1.9792e-05 - mean\_absolute\_error: 0.0033 17/126 [===>..........................] - ETA: 0s - loss: 4.6089e-05 - mean\_absolute\_error: 0.0051 33/126 [======>.......................] - ETA: 0s - loss: 4.5188e-05 - mean\_absolute\_error: 0.0052 49/126 [==========>...................] - ETA: 0s - loss: 4.6363e-05 - mean\_absolute\_error: 0.0053 65/126 [==============>...............] - ETA: 0s - loss: 4.6064e-05 - mean\_absolute\_error: 0.0053 81/126 [==================>...........] - ETA: 0s - loss: 4.4054e-05 - mean\_absolute\_error: 0.0051 97/126 [======================>.......] - ETA: 0s - loss: 4.6670e-05 - mean\_absolute\_error: 0.0053113/126 [=========================>....] - ETA: 0s - loss: 4.9095e-05 - mean\_absolute\_error: 0.0054126/126 [==============================] - 0s 4ms/step - loss: 4.8320e-05 - mean\_absolute\_error: 0.0054 - val\_loss: 8.9217e-05 - val\_mean\_absolute\_error: 0.0072  
Epoch 66/100  
 1/126 [..............................] - ETA: 0s - loss: 2.9903e-05 - mean\_absolute\_error: 0.0040 17/126 [===>..........................] - ETA: 0s - loss: 3.5984e-05 - mean\_absolute\_error: 0.0045 34/126 [=======>......................] - ETA: 0s - loss: 3.7295e-05 - mean\_absolute\_error: 0.0048 50/126 [==========>...................] - ETA: 0s - loss: 4.1921e-05 - mean\_absolute\_error: 0.0050 66/126 [==============>...............] - ETA: 0s - loss: 4.0157e-05 - mean\_absolute\_error: 0.0048 83/126 [==================>...........] - ETA: 0s - loss: 4.0540e-05 - mean\_absolute\_error: 0.0047 99/126 [======================>.......] - ETA: 0s - loss: 4.0078e-05 - mean\_absolute\_error: 0.0047115/126 [==========================>...] - ETA: 0s - loss: 3.9778e-05 - mean\_absolute\_error: 0.0047126/126 [==============================] - 0s 4ms/step - loss: 3.9243e-05 - mean\_absolute\_error: 0.0047 - val\_loss: 9.8480e-05 - val\_mean\_absolute\_error: 0.0077  
Epoch 67/100  
 1/126 [..............................] - ETA: 0s - loss: 3.1795e-05 - mean\_absolute\_error: 0.0046 17/126 [===>..........................] - ETA: 0s - loss: 2.9562e-05 - mean\_absolute\_error: 0.0040 33/126 [======>.......................] - ETA: 0s - loss: 3.3484e-05 - mean\_absolute\_error: 0.0043 49/126 [==========>...................] - ETA: 0s - loss: 3.4747e-05 - mean\_absolute\_error: 0.0043 65/126 [==============>...............] - ETA: 0s - loss: 3.4079e-05 - mean\_absolute\_error: 0.0042 81/126 [==================>...........] - ETA: 0s - loss: 3.5786e-05 - mean\_absolute\_error: 0.0043 98/126 [======================>.......] - ETA: 0s - loss: 3.7103e-05 - mean\_absolute\_error: 0.0045114/126 [==========================>...] - ETA: 0s - loss: 3.7725e-05 - mean\_absolute\_error: 0.0046126/126 [==============================] - 0s 4ms/step - loss: 3.7716e-05 - mean\_absolute\_error: 0.0046 - val\_loss: 9.4524e-05 - val\_mean\_absolute\_error: 0.0075  
Epoch 68/100  
 1/126 [..............................] - ETA: 0s - loss: 3.8750e-05 - mean\_absolute\_error: 0.0044 16/126 [==>...........................] - ETA: 0s - loss: 3.6966e-05 - mean\_absolute\_error: 0.0044 31/126 [======>.......................] - ETA: 0s - loss: 3.6567e-05 - mean\_absolute\_error: 0.0045 47/126 [==========>...................] - ETA: 0s - loss: 4.0072e-05 - mean\_absolute\_error: 0.0048 63/126 [==============>...............] - ETA: 0s - loss: 4.1276e-05 - mean\_absolute\_error: 0.0048 79/126 [=================>............] - ETA: 0s - loss: 3.9917e-05 - mean\_absolute\_error: 0.0047 95/126 [=====================>........] - ETA: 0s - loss: 3.9467e-05 - mean\_absolute\_error: 0.0047111/126 [=========================>....] - ETA: 0s - loss: 3.8580e-05 - mean\_absolute\_error: 0.0047126/126 [==============================] - 0s 4ms/step - loss: 3.8915e-05 - mean\_absolute\_error: 0.0047 - val\_loss: 6.3968e-05 - val\_mean\_absolute\_error: 0.0057  
Epoch 69/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0293e-04 - mean\_absolute\_error: 0.0053 17/126 [===>..........................] - ETA: 0s - loss: 4.0967e-05 - mean\_absolute\_error: 0.0045 34/126 [=======>......................] - ETA: 0s - loss: 4.0922e-05 - mean\_absolute\_error: 0.0047 50/126 [==========>...................] - ETA: 0s - loss: 4.0745e-05 - mean\_absolute\_error: 0.0048 66/126 [==============>...............] - ETA: 0s - loss: 4.1614e-05 - mean\_absolute\_error: 0.0049 82/126 [==================>...........] - ETA: 0s - loss: 4.2846e-05 - mean\_absolute\_error: 0.0051 98/126 [======================>.......] - ETA: 0s - loss: 4.1576e-05 - mean\_absolute\_error: 0.0050114/126 [==========================>...] - ETA: 0s - loss: 4.1142e-05 - mean\_absolute\_error: 0.0050126/126 [==============================] - 0s 4ms/step - loss: 4.1306e-05 - mean\_absolute\_error: 0.0049 - val\_loss: 9.4464e-05 - val\_mean\_absolute\_error: 0.0075  
Epoch 70/100  
 1/126 [..............................] - ETA: 0s - loss: 2.9081e-05 - mean\_absolute\_error: 0.0040 17/126 [===>..........................] - ETA: 0s - loss: 3.2185e-05 - mean\_absolute\_error: 0.0043 33/126 [======>.......................] - ETA: 0s - loss: 3.6795e-05 - mean\_absolute\_error: 0.0047 49/126 [==========>...................] - ETA: 0s - loss: 4.0181e-05 - mean\_absolute\_error: 0.0049 65/126 [==============>...............] - ETA: 0s - loss: 4.2819e-05 - mean\_absolute\_error: 0.0051 81/126 [==================>...........] - ETA: 0s - loss: 4.4196e-05 - mean\_absolute\_error: 0.0052 97/126 [======================>.......] - ETA: 0s - loss: 4.3174e-05 - mean\_absolute\_error: 0.0051112/126 [=========================>....] - ETA: 0s - loss: 4.2526e-05 - mean\_absolute\_error: 0.0050126/126 [==============================] - 0s 4ms/step - loss: 4.1448e-05 - mean\_absolute\_error: 0.0049 - val\_loss: 8.2464e-05 - val\_mean\_absolute\_error: 0.0068  
Epoch 71/100  
 1/126 [..............................] - ETA: 0s - loss: 2.7647e-05 - mean\_absolute\_error: 0.0033 17/126 [===>..........................] - ETA: 0s - loss: 3.4421e-05 - mean\_absolute\_error: 0.0042 33/126 [======>.......................] - ETA: 0s - loss: 3.3639e-05 - mean\_absolute\_error: 0.0041 49/126 [==========>...................] - ETA: 0s - loss: 3.4768e-05 - mean\_absolute\_error: 0.0042 65/126 [==============>...............] - ETA: 0s - loss: 3.6981e-05 - mean\_absolute\_error: 0.0044 81/126 [==================>...........] - ETA: 0s - loss: 3.6254e-05 - mean\_absolute\_error: 0.0044 97/126 [======================>.......] - ETA: 0s - loss: 3.6247e-05 - mean\_absolute\_error: 0.0044113/126 [=========================>....] - ETA: 0s - loss: 3.5888e-05 - mean\_absolute\_error: 0.0044126/126 [==============================] - 0s 4ms/step - loss: 3.5845e-05 - mean\_absolute\_error: 0.0044 - val\_loss: 7.3197e-05 - val\_mean\_absolute\_error: 0.0063  
Epoch 72/100  
 1/126 [..............................] - ETA: 0s - loss: 2.5928e-05 - mean\_absolute\_error: 0.0037 17/126 [===>..........................] - ETA: 0s - loss: 3.5225e-05 - mean\_absolute\_error: 0.0042 33/126 [======>.......................] - ETA: 0s - loss: 3.7855e-05 - mean\_absolute\_error: 0.0044 49/126 [==========>...................] - ETA: 0s - loss: 3.9367e-05 - mean\_absolute\_error: 0.0046 65/126 [==============>...............] - ETA: 0s - loss: 4.0708e-05 - mean\_absolute\_error: 0.0047 81/126 [==================>...........] - ETA: 0s - loss: 4.1155e-05 - mean\_absolute\_error: 0.0048 97/126 [======================>.......] - ETA: 0s - loss: 4.0921e-05 - mean\_absolute\_error: 0.0048113/126 [=========================>....] - ETA: 0s - loss: 3.9849e-05 - mean\_absolute\_error: 0.0048126/126 [==============================] - 0s 4ms/step - loss: 4.0238e-05 - mean\_absolute\_error: 0.0048 - val\_loss: 1.1267e-04 - val\_mean\_absolute\_error: 0.0084  
Epoch 73/100  
 1/126 [..............................] - ETA: 0s - loss: 2.2517e-05 - mean\_absolute\_error: 0.0035 17/126 [===>..........................] - ETA: 0s - loss: 3.8751e-05 - mean\_absolute\_error: 0.0049 33/126 [======>.......................] - ETA: 0s - loss: 3.6988e-05 - mean\_absolute\_error: 0.0047 49/126 [==========>...................] - ETA: 0s - loss: 3.5586e-05 - mean\_absolute\_error: 0.0044 65/126 [==============>...............] - ETA: 0s - loss: 3.5876e-05 - mean\_absolute\_error: 0.0045 81/126 [==================>...........] - ETA: 0s - loss: 3.5642e-05 - mean\_absolute\_error: 0.0045 97/126 [======================>.......] - ETA: 0s - loss: 3.5855e-05 - mean\_absolute\_error: 0.0044113/126 [=========================>....] - ETA: 0s - loss: 3.6358e-05 - mean\_absolute\_error: 0.0045126/126 [==============================] - 0s 4ms/step - loss: 3.7032e-05 - mean\_absolute\_error: 0.0045 - val\_loss: 6.8216e-05 - val\_mean\_absolute\_error: 0.0060  
Epoch 74/100  
 1/126 [..............................] - ETA: 0s - loss: 3.5455e-05 - mean\_absolute\_error: 0.0049 17/126 [===>..........................] - ETA: 0s - loss: 3.5578e-05 - mean\_absolute\_error: 0.0045 33/126 [======>.......................] - ETA: 0s - loss: 3.9659e-05 - mean\_absolute\_error: 0.0049 48/126 [==========>...................] - ETA: 0s - loss: 4.0612e-05 - mean\_absolute\_error: 0.0049 64/126 [==============>...............] - ETA: 0s - loss: 4.4160e-05 - mean\_absolute\_error: 0.0051 80/126 [==================>...........] - ETA: 0s - loss: 4.3229e-05 - mean\_absolute\_error: 0.0051 95/126 [=====================>........] - ETA: 0s - loss: 4.1798e-05 - mean\_absolute\_error: 0.0050111/126 [=========================>....] - ETA: 0s - loss: 4.1053e-05 - mean\_absolute\_error: 0.0049126/126 [==============================] - 0s 4ms/step - loss: 4.0571e-05 - mean\_absolute\_error: 0.0049 - val\_loss: 6.3018e-05 - val\_mean\_absolute\_error: 0.0056  
Epoch 75/100  
 1/126 [..............................] - ETA: 0s - loss: 4.6429e-05 - mean\_absolute\_error: 0.0058 17/126 [===>..........................] - ETA: 0s - loss: 3.7197e-05 - mean\_absolute\_error: 0.0046 33/126 [======>.......................] - ETA: 0s - loss: 4.0217e-05 - mean\_absolute\_error: 0.0049 49/126 [==========>...................] - ETA: 0s - loss: 4.4727e-05 - mean\_absolute\_error: 0.0052 65/126 [==============>...............] - ETA: 0s - loss: 4.1866e-05 - mean\_absolute\_error: 0.0050 81/126 [==================>...........] - ETA: 0s - loss: 4.0626e-05 - mean\_absolute\_error: 0.0048 96/126 [=====================>........] - ETA: 0s - loss: 4.3462e-05 - mean\_absolute\_error: 0.0050112/126 [=========================>....] - ETA: 0s - loss: 4.4066e-05 - mean\_absolute\_error: 0.0051126/126 [==============================] - 0s 4ms/step - loss: 4.3813e-05 - mean\_absolute\_error: 0.0051 - val\_loss: 6.2113e-05 - val\_mean\_absolute\_error: 0.0055  
Epoch 76/100  
 1/126 [..............................] - ETA: 0s - loss: 2.7229e-05 - mean\_absolute\_error: 0.0042 16/126 [==>...........................] - ETA: 0s - loss: 3.2085e-05 - mean\_absolute\_error: 0.0043 32/126 [======>.......................] - ETA: 0s - loss: 3.8311e-05 - mean\_absolute\_error: 0.0048 48/126 [==========>...................] - ETA: 0s - loss: 4.3056e-05 - mean\_absolute\_error: 0.0051 64/126 [==============>...............] - ETA: 0s - loss: 4.2703e-05 - mean\_absolute\_error: 0.0050 80/126 [==================>...........] - ETA: 0s - loss: 4.1064e-05 - mean\_absolute\_error: 0.0049 96/126 [=====================>........] - ETA: 0s - loss: 4.1283e-05 - mean\_absolute\_error: 0.0049112/126 [=========================>....] - ETA: 0s - loss: 4.0227e-05 - mean\_absolute\_error: 0.0048126/126 [==============================] - ETA: 0s - loss: 4.0074e-05 - mean\_absolute\_error: 0.0048126/126 [==============================] - 0s 4ms/step - loss: 4.0074e-05 - mean\_absolute\_error: 0.0048 - val\_loss: 1.3418e-04 - val\_mean\_absolute\_error: 0.0094  
Epoch 77/100  
 1/126 [..............................] - ETA: 0s - loss: 3.9872e-05 - mean\_absolute\_error: 0.0052 17/126 [===>..........................] - ETA: 0s - loss: 4.9713e-05 - mean\_absolute\_error: 0.0055 33/126 [======>.......................] - ETA: 0s - loss: 4.6238e-05 - mean\_absolute\_error: 0.0052 49/126 [==========>...................] - ETA: 0s - loss: 4.1731e-05 - mean\_absolute\_error: 0.0049 65/126 [==============>...............] - ETA: 0s - loss: 4.4218e-05 - mean\_absolute\_error: 0.0051 81/126 [==================>...........] - ETA: 0s - loss: 4.4394e-05 - mean\_absolute\_error: 0.0051 97/126 [======================>.......] - ETA: 0s - loss: 4.3251e-05 - mean\_absolute\_error: 0.0051113/126 [=========================>....] - ETA: 0s - loss: 4.1839e-05 - mean\_absolute\_error: 0.0049126/126 [==============================] - 0s 4ms/step - loss: 4.1321e-05 - mean\_absolute\_error: 0.0049 - val\_loss: 7.2850e-05 - val\_mean\_absolute\_error: 0.0063  
Epoch 78/100  
 1/126 [..............................] - ETA: 0s - loss: 3.9968e-05 - mean\_absolute\_error: 0.0047 17/126 [===>..........................] - ETA: 0s - loss: 3.3396e-05 - mean\_absolute\_error: 0.0043 33/126 [======>.......................] - ETA: 0s - loss: 3.7522e-05 - mean\_absolute\_error: 0.0046 49/126 [==========>...................] - ETA: 0s - loss: 3.7713e-05 - mean\_absolute\_error: 0.0046 65/126 [==============>...............] - ETA: 0s - loss: 3.5963e-05 - mean\_absolute\_error: 0.0045 82/126 [==================>...........] - ETA: 0s - loss: 3.5458e-05 - mean\_absolute\_error: 0.0045 98/126 [======================>.......] - ETA: 0s - loss: 3.9153e-05 - mean\_absolute\_error: 0.0047114/126 [==========================>...] - ETA: 0s - loss: 3.9131e-05 - mean\_absolute\_error: 0.0047126/126 [==============================] - 0s 4ms/step - loss: 3.9020e-05 - mean\_absolute\_error: 0.0047 - val\_loss: 1.3650e-04 - val\_mean\_absolute\_error: 0.0095  
Epoch 79/100  
 1/126 [..............................] - ETA: 0s - loss: 5.9709e-05 - mean\_absolute\_error: 0.0063 17/126 [===>..........................] - ETA: 0s - loss: 5.4048e-05 - mean\_absolute\_error: 0.0058 32/126 [======>.......................] - ETA: 0s - loss: 4.5498e-05 - mean\_absolute\_error: 0.0052 48/126 [==========>...................] - ETA: 0s - loss: 4.4218e-05 - mean\_absolute\_error: 0.0051 64/126 [==============>...............] - ETA: 0s - loss: 4.2857e-05 - mean\_absolute\_error: 0.0050 80/126 [==================>...........] - ETA: 0s - loss: 4.2587e-05 - mean\_absolute\_error: 0.0050 96/126 [=====================>........] - ETA: 0s - loss: 4.1514e-05 - mean\_absolute\_error: 0.0049112/126 [=========================>....] - ETA: 0s - loss: 4.2188e-05 - mean\_absolute\_error: 0.0049126/126 [==============================] - 0s 4ms/step - loss: 4.2833e-05 - mean\_absolute\_error: 0.0050 - val\_loss: 1.4183e-04 - val\_mean\_absolute\_error: 0.0097  
Epoch 80/100  
 1/126 [..............................] - ETA: 0s - loss: 3.7589e-05 - mean\_absolute\_error: 0.0053 17/126 [===>..........................] - ETA: 0s - loss: 5.4906e-05 - mean\_absolute\_error: 0.0058 33/126 [======>.......................] - ETA: 0s - loss: 5.3496e-05 - mean\_absolute\_error: 0.0058 49/126 [==========>...................] - ETA: 0s - loss: 5.3799e-05 - mean\_absolute\_error: 0.0058 65/126 [==============>...............] - ETA: 0s - loss: 5.1553e-05 - mean\_absolute\_error: 0.0057 81/126 [==================>...........] - ETA: 0s - loss: 4.9296e-05 - mean\_absolute\_error: 0.0054 97/126 [======================>.......] - ETA: 0s - loss: 4.6701e-05 - mean\_absolute\_error: 0.0053113/126 [=========================>....] - ETA: 0s - loss: 4.5086e-05 - mean\_absolute\_error: 0.0051126/126 [==============================] - 0s 4ms/step - loss: 4.4525e-05 - mean\_absolute\_error: 0.0051 - val\_loss: 7.5104e-05 - val\_mean\_absolute\_error: 0.0066  
Epoch 81/100  
 1/126 [..............................] - ETA: 0s - loss: 7.9028e-05 - mean\_absolute\_error: 0.0076 17/126 [===>..........................] - ETA: 0s - loss: 3.7716e-05 - mean\_absolute\_error: 0.0046 33/126 [======>.......................] - ETA: 0s - loss: 3.6335e-05 - mean\_absolute\_error: 0.0043 48/126 [==========>...................] - ETA: 0s - loss: 3.6866e-05 - mean\_absolute\_error: 0.0044 64/126 [==============>...............] - ETA: 0s - loss: 3.9710e-05 - mean\_absolute\_error: 0.0046 80/126 [==================>...........] - ETA: 0s - loss: 4.2478e-05 - mean\_absolute\_error: 0.0049 96/126 [=====================>........] - ETA: 0s - loss: 4.2193e-05 - mean\_absolute\_error: 0.0048112/126 [=========================>....] - ETA: 0s - loss: 4.0804e-05 - mean\_absolute\_error: 0.0048126/126 [==============================] - 0s 4ms/step - loss: 4.0827e-05 - mean\_absolute\_error: 0.0048 - val\_loss: 6.0321e-05 - val\_mean\_absolute\_error: 0.0054  
Epoch 82/100  
 1/126 [..............................] - ETA: 0s - loss: 1.6704e-05 - mean\_absolute\_error: 0.0033 17/126 [===>..........................] - ETA: 0s - loss: 5.0501e-05 - mean\_absolute\_error: 0.0054 33/126 [======>.......................] - ETA: 0s - loss: 4.2725e-05 - mean\_absolute\_error: 0.0050 47/126 [==========>...................] - ETA: 0s - loss: 3.9748e-05 - mean\_absolute\_error: 0.0048 63/126 [==============>...............] - ETA: 0s - loss: 3.8195e-05 - mean\_absolute\_error: 0.0047 79/126 [=================>............] - ETA: 0s - loss: 3.7825e-05 - mean\_absolute\_error: 0.0046 95/126 [=====================>........] - ETA: 0s - loss: 3.8900e-05 - mean\_absolute\_error: 0.0047112/126 [=========================>....] - ETA: 0s - loss: 4.0141e-05 - mean\_absolute\_error: 0.0048126/126 [==============================] - 0s 4ms/step - loss: 3.9262e-05 - mean\_absolute\_error: 0.0047 - val\_loss: 1.1353e-04 - val\_mean\_absolute\_error: 0.0085  
Epoch 83/100  
 1/126 [..............................] - ETA: 0s - loss: 5.2915e-05 - mean\_absolute\_error: 0.0056 17/126 [===>..........................] - ETA: 0s - loss: 4.7334e-05 - mean\_absolute\_error: 0.0053 33/126 [======>.......................] - ETA: 0s - loss: 4.6372e-05 - mean\_absolute\_error: 0.0053 49/126 [==========>...................] - ETA: 0s - loss: 4.3439e-05 - mean\_absolute\_error: 0.0051 65/126 [==============>...............] - ETA: 0s - loss: 4.1346e-05 - mean\_absolute\_error: 0.0049 81/126 [==================>...........] - ETA: 0s - loss: 4.0257e-05 - mean\_absolute\_error: 0.0049 97/126 [======================>.......] - ETA: 0s - loss: 3.9415e-05 - mean\_absolute\_error: 0.0048113/126 [=========================>....] - ETA: 0s - loss: 3.9215e-05 - mean\_absolute\_error: 0.0048126/126 [==============================] - 0s 4ms/step - loss: 3.9496e-05 - mean\_absolute\_error: 0.0048 - val\_loss: 6.7236e-05 - val\_mean\_absolute\_error: 0.0059  
Epoch 84/100  
 1/126 [..............................] - ETA: 0s - loss: 3.5204e-05 - mean\_absolute\_error: 0.0044 17/126 [===>..........................] - ETA: 0s - loss: 3.8412e-05 - mean\_absolute\_error: 0.0046 33/126 [======>.......................] - ETA: 0s - loss: 4.2026e-05 - mean\_absolute\_error: 0.0049 50/126 [==========>...................] - ETA: 0s - loss: 4.0079e-05 - mean\_absolute\_error: 0.0048 66/126 [==============>...............] - ETA: 0s - loss: 3.8067e-05 - mean\_absolute\_error: 0.0047 83/126 [==================>...........] - ETA: 0s - loss: 3.6456e-05 - mean\_absolute\_error: 0.0045 99/126 [======================>.......] - ETA: 0s - loss: 3.6473e-05 - mean\_absolute\_error: 0.0045115/126 [==========================>...] - ETA: 0s - loss: 3.7519e-05 - mean\_absolute\_error: 0.0046126/126 [==============================] - 0s 4ms/step - loss: 3.8534e-05 - mean\_absolute\_error: 0.0047 - val\_loss: 1.7355e-04 - val\_mean\_absolute\_error: 0.0111  
Epoch 85/100  
 1/126 [..............................] - ETA: 0s - loss: 5.2666e-05 - mean\_absolute\_error: 0.0062 17/126 [===>..........................] - ETA: 0s - loss: 3.5188e-05 - mean\_absolute\_error: 0.0045 33/126 [======>.......................] - ETA: 0s - loss: 3.4933e-05 - mean\_absolute\_error: 0.0044 48/126 [==========>...................] - ETA: 0s - loss: 3.3614e-05 - mean\_absolute\_error: 0.0043 64/126 [==============>...............] - ETA: 0s - loss: 3.5368e-05 - mean\_absolute\_error: 0.0044 80/126 [==================>...........] - ETA: 0s - loss: 3.7929e-05 - mean\_absolute\_error: 0.0046 96/126 [=====================>........] - ETA: 0s - loss: 3.9947e-05 - mean\_absolute\_error: 0.0048112/126 [=========================>....] - ETA: 0s - loss: 3.9986e-05 - mean\_absolute\_error: 0.0048126/126 [==============================] - 0s 4ms/step - loss: 4.1278e-05 - mean\_absolute\_error: 0.0049 - val\_loss: 1.4679e-04 - val\_mean\_absolute\_error: 0.0099  
Epoch 86/100  
 1/126 [..............................] - ETA: 0s - loss: 6.6933e-05 - mean\_absolute\_error: 0.0070 17/126 [===>..........................] - ETA: 0s - loss: 4.8335e-05 - mean\_absolute\_error: 0.0056 32/126 [======>.......................] - ETA: 0s - loss: 4.9807e-05 - mean\_absolute\_error: 0.0055 47/126 [==========>...................] - ETA: 0s - loss: 4.5411e-05 - mean\_absolute\_error: 0.0053 63/126 [==============>...............] - ETA: 0s - loss: 4.6331e-05 - mean\_absolute\_error: 0.0052 80/126 [==================>...........] - ETA: 0s - loss: 4.3376e-05 - mean\_absolute\_error: 0.0050 97/126 [======================>.......] - ETA: 0s - loss: 4.1834e-05 - mean\_absolute\_error: 0.0049113/126 [=========================>....] - ETA: 0s - loss: 4.0868e-05 - mean\_absolute\_error: 0.0048126/126 [==============================] - 0s 4ms/step - loss: 4.0861e-05 - mean\_absolute\_error: 0.0048 - val\_loss: 6.1351e-05 - val\_mean\_absolute\_error: 0.0055  
Epoch 87/100  
 1/126 [..............................] - ETA: 0s - loss: 4.1705e-05 - mean\_absolute\_error: 0.0052 17/126 [===>..........................] - ETA: 0s - loss: 4.6488e-05 - mean\_absolute\_error: 0.0053 33/126 [======>.......................] - ETA: 0s - loss: 4.3793e-05 - mean\_absolute\_error: 0.0051 49/126 [==========>...................] - ETA: 0s - loss: 4.6234e-05 - mean\_absolute\_error: 0.0053 65/126 [==============>...............] - ETA: 0s - loss: 4.2836e-05 - mean\_absolute\_error: 0.0051 81/126 [==================>...........] - ETA: 0s - loss: 4.1247e-05 - mean\_absolute\_error: 0.0049 97/126 [======================>.......] - ETA: 0s - loss: 4.0626e-05 - mean\_absolute\_error: 0.0048113/126 [=========================>....] - ETA: 0s - loss: 3.9940e-05 - mean\_absolute\_error: 0.0048126/126 [==============================] - 0s 4ms/step - loss: 4.0243e-05 - mean\_absolute\_error: 0.0048 - val\_loss: 6.1669e-05 - val\_mean\_absolute\_error: 0.0056  
Epoch 88/100  
 1/126 [..............................] - ETA: 0s - loss: 4.7932e-05 - mean\_absolute\_error: 0.0056 17/126 [===>..........................] - ETA: 0s - loss: 3.1891e-05 - mean\_absolute\_error: 0.0042 33/126 [======>.......................] - ETA: 0s - loss: 3.4386e-05 - mean\_absolute\_error: 0.0044 49/126 [==========>...................] - ETA: 0s - loss: 3.5575e-05 - mean\_absolute\_error: 0.0045 64/126 [==============>...............] - ETA: 0s - loss: 3.4596e-05 - mean\_absolute\_error: 0.0044 80/126 [==================>...........] - ETA: 0s - loss: 3.3875e-05 - mean\_absolute\_error: 0.0043 95/126 [=====================>........] - ETA: 0s - loss: 3.3730e-05 - mean\_absolute\_error: 0.0043110/126 [=========================>....] - ETA: 0s - loss: 3.4267e-05 - mean\_absolute\_error: 0.0043126/126 [==============================] - ETA: 0s - loss: 3.4829e-05 - mean\_absolute\_error: 0.0043126/126 [==============================] - 0s 4ms/step - loss: 3.4829e-05 - mean\_absolute\_error: 0.0043 - val\_loss: 6.4645e-05 - val\_mean\_absolute\_error: 0.0058  
Epoch 89/100  
 1/126 [..............................] - ETA: 0s - loss: 7.5682e-05 - mean\_absolute\_error: 0.0073 17/126 [===>..........................] - ETA: 0s - loss: 3.3753e-05 - mean\_absolute\_error: 0.0043 33/126 [======>.......................] - ETA: 0s - loss: 3.3520e-05 - mean\_absolute\_error: 0.0042 49/126 [==========>...................] - ETA: 0s - loss: 3.4049e-05 - mean\_absolute\_error: 0.0042 65/126 [==============>...............] - ETA: 0s - loss: 3.5676e-05 - mean\_absolute\_error: 0.0044 81/126 [==================>...........] - ETA: 0s - loss: 3.5281e-05 - mean\_absolute\_error: 0.0044 97/126 [======================>.......] - ETA: 0s - loss: 3.7622e-05 - mean\_absolute\_error: 0.0046113/126 [=========================>....] - ETA: 0s - loss: 3.8296e-05 - mean\_absolute\_error: 0.0047126/126 [==============================] - 0s 4ms/step - loss: 3.8492e-05 - mean\_absolute\_error: 0.0047 - val\_loss: 6.0281e-05 - val\_mean\_absolute\_error: 0.0054  
Epoch 90/100  
 1/126 [..............................] - ETA: 0s - loss: 4.7890e-05 - mean\_absolute\_error: 0.0059 17/126 [===>..........................] - ETA: 0s - loss: 3.7997e-05 - mean\_absolute\_error: 0.0048 33/126 [======>.......................] - ETA: 0s - loss: 3.8412e-05 - mean\_absolute\_error: 0.0048 50/126 [==========>...................] - ETA: 0s - loss: 3.7686e-05 - mean\_absolute\_error: 0.0047 66/126 [==============>...............] - ETA: 0s - loss: 3.6889e-05 - mean\_absolute\_error: 0.0046 83/126 [==================>...........] - ETA: 0s - loss: 3.8019e-05 - mean\_absolute\_error: 0.0047 99/126 [======================>.......] - ETA: 0s - loss: 3.6637e-05 - mean\_absolute\_error: 0.0045114/126 [==========================>...] - ETA: 0s - loss: 3.5502e-05 - mean\_absolute\_error: 0.0044126/126 [==============================] - 0s 4ms/step - loss: 3.5858e-05 - mean\_absolute\_error: 0.0045 - val\_loss: 1.2126e-04 - val\_mean\_absolute\_error: 0.0088  
Epoch 91/100  
 1/126 [..............................] - ETA: 0s - loss: 1.4426e-05 - mean\_absolute\_error: 0.0028 16/126 [==>...........................] - ETA: 0s - loss: 3.2957e-05 - mean\_absolute\_error: 0.0040 32/126 [======>.......................] - ETA: 0s - loss: 3.5790e-05 - mean\_absolute\_error: 0.0043 48/126 [==========>...................] - ETA: 0s - loss: 3.4199e-05 - mean\_absolute\_error: 0.0043 63/126 [==============>...............] - ETA: 0s - loss: 3.4213e-05 - mean\_absolute\_error: 0.0043 79/126 [=================>............] - ETA: 0s - loss: 3.7315e-05 - mean\_absolute\_error: 0.0046 95/126 [=====================>........] - ETA: 0s - loss: 4.0826e-05 - mean\_absolute\_error: 0.0049111/126 [=========================>....] - ETA: 0s - loss: 4.0876e-05 - mean\_absolute\_error: 0.0049126/126 [==============================] - 0s 4ms/step - loss: 3.9994e-05 - mean\_absolute\_error: 0.0048 - val\_loss: 5.8912e-05 - val\_mean\_absolute\_error: 0.0053  
Epoch 92/100  
 1/126 [..............................] - ETA: 0s - loss: 2.7383e-05 - mean\_absolute\_error: 0.0039 17/126 [===>..........................] - ETA: 0s - loss: 3.8151e-05 - mean\_absolute\_error: 0.0047 33/126 [======>.......................] - ETA: 0s - loss: 3.6942e-05 - mean\_absolute\_error: 0.0045 49/126 [==========>...................] - ETA: 0s - loss: 3.5919e-05 - mean\_absolute\_error: 0.0046 66/126 [==============>...............] - ETA: 0s - loss: 3.6537e-05 - mean\_absolute\_error: 0.0046 82/126 [==================>...........] - ETA: 0s - loss: 3.6393e-05 - mean\_absolute\_error: 0.0046 99/126 [======================>.......] - ETA: 0s - loss: 3.7920e-05 - mean\_absolute\_error: 0.0047115/126 [==========================>...] - ETA: 0s - loss: 3.7359e-05 - mean\_absolute\_error: 0.0046126/126 [==============================] - 0s 4ms/step - loss: 3.7153e-05 - mean\_absolute\_error: 0.0046 - val\_loss: 7.9242e-05 - val\_mean\_absolute\_error: 0.0069  
Epoch 93/100  
 1/126 [..............................] - ETA: 0s - loss: 7.8989e-05 - mean\_absolute\_error: 0.0077 17/126 [===>..........................] - ETA: 0s - loss: 4.5105e-05 - mean\_absolute\_error: 0.0054 33/126 [======>.......................] - ETA: 0s - loss: 4.0300e-05 - mean\_absolute\_error: 0.0050 49/126 [==========>...................] - ETA: 0s - loss: 4.0080e-05 - mean\_absolute\_error: 0.0048 65/126 [==============>...............] - ETA: 0s - loss: 3.8389e-05 - mean\_absolute\_error: 0.0047 81/126 [==================>...........] - ETA: 0s - loss: 3.7314e-05 - mean\_absolute\_error: 0.0046 96/126 [=====================>........] - ETA: 0s - loss: 3.7069e-05 - mean\_absolute\_error: 0.0045112/126 [=========================>....] - ETA: 0s - loss: 3.7560e-05 - mean\_absolute\_error: 0.0046126/126 [==============================] - 0s 4ms/step - loss: 3.6847e-05 - mean\_absolute\_error: 0.0045 - val\_loss: 5.9781e-05 - val\_mean\_absolute\_error: 0.0054  
Epoch 94/100  
 1/126 [..............................] - ETA: 0s - loss: 7.5145e-05 - mean\_absolute\_error: 0.0073 17/126 [===>..........................] - ETA: 0s - loss: 3.9544e-05 - mean\_absolute\_error: 0.0049 33/126 [======>.......................] - ETA: 0s - loss: 4.0400e-05 - mean\_absolute\_error: 0.0051 48/126 [==========>...................] - ETA: 0s - loss: 3.9064e-05 - mean\_absolute\_error: 0.0049 64/126 [==============>...............] - ETA: 0s - loss: 3.7859e-05 - mean\_absolute\_error: 0.0047 80/126 [==================>...........] - ETA: 0s - loss: 4.0004e-05 - mean\_absolute\_error: 0.0048 97/126 [======================>.......] - ETA: 0s - loss: 3.9485e-05 - mean\_absolute\_error: 0.0047113/126 [=========================>....] - ETA: 0s - loss: 3.8070e-05 - mean\_absolute\_error: 0.0046126/126 [==============================] - 0s 4ms/step - loss: 3.7613e-05 - mean\_absolute\_error: 0.0046 - val\_loss: 7.6109e-05 - val\_mean\_absolute\_error: 0.0066  
Epoch 95/100  
 1/126 [..............................] - ETA: 0s - loss: 1.3229e-05 - mean\_absolute\_error: 0.0027 17/126 [===>..........................] - ETA: 0s - loss: 3.2290e-05 - mean\_absolute\_error: 0.0040 33/126 [======>.......................] - ETA: 0s - loss: 3.7066e-05 - mean\_absolute\_error: 0.0044 49/126 [==========>...................] - ETA: 0s - loss: 3.6870e-05 - mean\_absolute\_error: 0.0045 64/126 [==============>...............] - ETA: 0s - loss: 3.9732e-05 - mean\_absolute\_error: 0.0047 80/126 [==================>...........] - ETA: 0s - loss: 3.8128e-05 - mean\_absolute\_error: 0.0046 96/126 [=====================>........] - ETA: 0s - loss: 3.7336e-05 - mean\_absolute\_error: 0.0045111/126 [=========================>....] - ETA: 0s - loss: 3.7272e-05 - mean\_absolute\_error: 0.0045122/126 [============================>.] - ETA: 0s - loss: 3.6824e-05 - mean\_absolute\_error: 0.0044126/126 [==============================] - 1s 4ms/step - loss: 3.6588e-05 - mean\_absolute\_error: 0.0044 - val\_loss: 6.8768e-05 - val\_mean\_absolute\_error: 0.0061  
Epoch 96/100  
 1/126 [..............................] - ETA: 0s - loss: 3.5431e-05 - mean\_absolute\_error: 0.0044 12/126 [=>............................] - ETA: 0s - loss: 2.5786e-05 - mean\_absolute\_error: 0.0036 23/126 [====>.........................] - ETA: 0s - loss: 2.6595e-05 - mean\_absolute\_error: 0.0037 34/126 [=======>......................] - ETA: 0s - loss: 2.9470e-05 - mean\_absolute\_error: 0.0040 45/126 [=========>....................] - ETA: 0s - loss: 3.0302e-05 - mean\_absolute\_error: 0.0041 56/126 [============>.................] - ETA: 0s - loss: 3.4239e-05 - mean\_absolute\_error: 0.0043 69/126 [===============>..............] - ETA: 0s - loss: 3.7028e-05 - mean\_absolute\_error: 0.0046 85/126 [===================>..........] - ETA: 0s - loss: 3.9194e-05 - mean\_absolute\_error: 0.0047101/126 [=======================>......] - ETA: 0s - loss: 3.8558e-05 - mean\_absolute\_error: 0.0047117/126 [==========================>...] - ETA: 0s - loss: 3.8184e-05 - mean\_absolute\_error: 0.0046126/126 [==============================] - 1s 4ms/step - loss: 3.8282e-05 - mean\_absolute\_error: 0.0046 - val\_loss: 1.3001e-04 - val\_mean\_absolute\_error: 0.0093  
Epoch 97/100  
 1/126 [..............................] - ETA: 0s - loss: 6.0933e-05 - mean\_absolute\_error: 0.0065 17/126 [===>..........................] - ETA: 0s - loss: 3.9636e-05 - mean\_absolute\_error: 0.0049 33/126 [======>.......................] - ETA: 0s - loss: 3.9976e-05 - mean\_absolute\_error: 0.0050 48/126 [==========>...................] - ETA: 0s - loss: 4.1744e-05 - mean\_absolute\_error: 0.0050 64/126 [==============>...............] - ETA: 0s - loss: 4.0580e-05 - mean\_absolute\_error: 0.0049 80/126 [==================>...........] - ETA: 0s - loss: 3.9110e-05 - mean\_absolute\_error: 0.0048 96/126 [=====================>........] - ETA: 0s - loss: 3.8314e-05 - mean\_absolute\_error: 0.0047112/126 [=========================>....] - ETA: 0s - loss: 3.7585e-05 - mean\_absolute\_error: 0.0046126/126 [==============================] - 0s 4ms/step - loss: 3.6776e-05 - mean\_absolute\_error: 0.0045 - val\_loss: 6.2586e-05 - val\_mean\_absolute\_error: 0.0056  
Epoch 98/100  
 1/126 [..............................] - ETA: 0s - loss: 3.0424e-05 - mean\_absolute\_error: 0.0037 17/126 [===>..........................] - ETA: 0s - loss: 3.2150e-05 - mean\_absolute\_error: 0.0041 34/126 [=======>......................] - ETA: 0s - loss: 3.2951e-05 - mean\_absolute\_error: 0.0042 50/126 [==========>...................] - ETA: 0s - loss: 3.6526e-05 - mean\_absolute\_error: 0.0044 66/126 [==============>...............] - ETA: 0s - loss: 3.5420e-05 - mean\_absolute\_error: 0.0044 81/126 [==================>...........] - ETA: 0s - loss: 3.4722e-05 - mean\_absolute\_error: 0.0044 97/126 [======================>.......] - ETA: 0s - loss: 3.4665e-05 - mean\_absolute\_error: 0.0044114/126 [==========================>...] - ETA: 0s - loss: 3.4960e-05 - mean\_absolute\_error: 0.0044126/126 [==============================] - 0s 4ms/step - loss: 3.4558e-05 - mean\_absolute\_error: 0.0043 - val\_loss: 5.9545e-05 - val\_mean\_absolute\_error: 0.0055  
Epoch 99/100  
 1/126 [..............................] - ETA: 0s - loss: 4.5305e-05 - mean\_absolute\_error: 0.0045 17/126 [===>..........................] - ETA: 0s - loss: 3.4048e-05 - mean\_absolute\_error: 0.0043 33/126 [======>.......................] - ETA: 0s - loss: 3.2571e-05 - mean\_absolute\_error: 0.0043 49/126 [==========>...................] - ETA: 0s - loss: 3.2452e-05 - mean\_absolute\_error: 0.0042 65/126 [==============>...............] - ETA: 0s - loss: 3.5576e-05 - mean\_absolute\_error: 0.0044 80/126 [==================>...........] - ETA: 0s - loss: 3.6706e-05 - mean\_absolute\_error: 0.0045 96/126 [=====================>........] - ETA: 0s - loss: 3.7517e-05 - mean\_absolute\_error: 0.0046112/126 [=========================>....] - ETA: 0s - loss: 3.7861e-05 - mean\_absolute\_error: 0.0047126/126 [==============================] - 0s 4ms/step - loss: 3.8188e-05 - mean\_absolute\_error: 0.0047 - val\_loss: 5.7720e-05 - val\_mean\_absolute\_error: 0.0053  
Epoch 100/100  
 1/126 [..............................] - ETA: 0s - loss: 2.7031e-05 - mean\_absolute\_error: 0.0046 17/126 [===>..........................] - ETA: 0s - loss: 3.8630e-05 - mean\_absolute\_error: 0.0046 33/126 [======>.......................] - ETA: 0s - loss: 3.9456e-05 - mean\_absolute\_error: 0.0047 49/126 [==========>...................] - ETA: 0s - loss: 3.8137e-05 - mean\_absolute\_error: 0.0047 65/126 [==============>...............] - ETA: 0s - loss: 3.6185e-05 - mean\_absolute\_error: 0.0045 81/126 [==================>...........] - ETA: 0s - loss: 3.6479e-05 - mean\_absolute\_error: 0.0046 97/126 [======================>.......] - ETA: 0s - loss: 3.5268e-05 - mean\_absolute\_error: 0.0045112/126 [=========================>....] - ETA: 0s - loss: 3.5711e-05 - mean\_absolute\_error: 0.0045126/126 [==============================] - 0s 4ms/step - loss: 3.6236e-05 - mean\_absolute\_error: 0.0045 - val\_loss: 1.3324e-04 - val\_mean\_absolute\_error: 0.0094

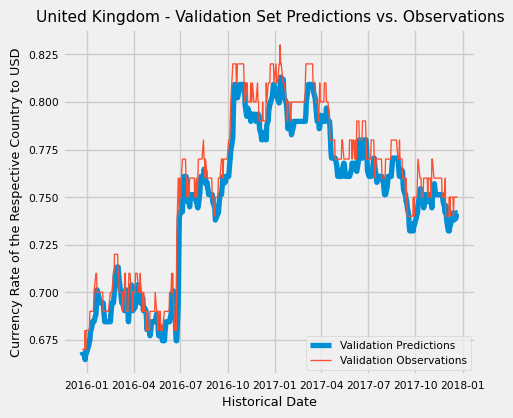
<keras.src.callbacks.History at 0x28eef6a31d0>

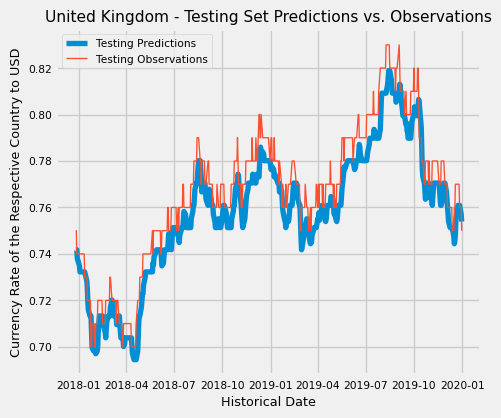
After the training and fitting of the Machine Learning model for the United Kingdom, I tried to create visualizations comparing the model against the country’s training dataset, validation dataset, but most importantly the testing dataset (as shown below in the line graphs). Note that the darker and thicker blue lines represent the prediction model’s projections and the thinner red lines is the observed/gathered data.

```{python}  
# Testing the Machine Learning Model prediction for United Kingdom with the train,   
# validation, and test sets  
# Most important is the test set prediction as this tests the effectiveness  
# of the Machine Learning model on data it has not seen before   
united\_kingdom\_train\_pred = united\_kingdom\_model.predict(X\_united\_kingdom\_train).flatten()  
  
plt.plot(dates\_united\_kingdom\_train, united\_kingdom\_train\_pred, linewidth=4)  
plt.plot(dates\_united\_kingdom\_train, y\_united\_kingdom\_train, linewidth=1)  
plt.legend(["Training Predictions", "Training Observations"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("United Kingdom - Training Set Predictions vs. Observations")  
plt.show()  
  
united\_kingdom\_val\_pred = united\_kingdom\_model.predict(X\_united\_kingdom\_val).flatten()  
  
plt.plot(dates\_united\_kingdom\_val, united\_kingdom\_val\_pred, linewidth=4)  
plt.plot(dates\_united\_kingdom\_val, y\_united\_kingdom\_val, linewidth=1)  
plt.legend(["Validation Predictions", "Validation Observations"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("United Kingdom - Validation Set Predictions vs. Observations")  
plt.show()  
  
united\_kingdom\_test\_pred = united\_kingdom\_model.predict(X\_united\_kingdom\_test).flatten()  
  
plt.plot(dates\_united\_kingdom\_test, united\_kingdom\_test\_pred, linewidth=4)  
plt.plot(dates\_united\_kingdom\_test, y\_united\_kingdom\_test, linewidth=1)  
plt.legend(["Testing Predictions", "Testing Observations"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("United Kingdom - Testing Set Predictions vs. Observations")  
plt.show()  
```

1/126 [..............................] - ETA: 39s 28/126 [=====>........................] - ETA: 0s 58/126 [============>.................] - ETA: 0s 88/126 [===================>..........] - ETA: 0s119/126 [===========================>..] - ETA: 0s126/126 [==============================] - 1s 2ms/step  
 1/16 [>.............................] - ETA: 0s16/16 [==============================] - 0s 2ms/step  
 1/16 [>.............................] - ETA: 0s16/16 [==============================] - 0s 2ms/step

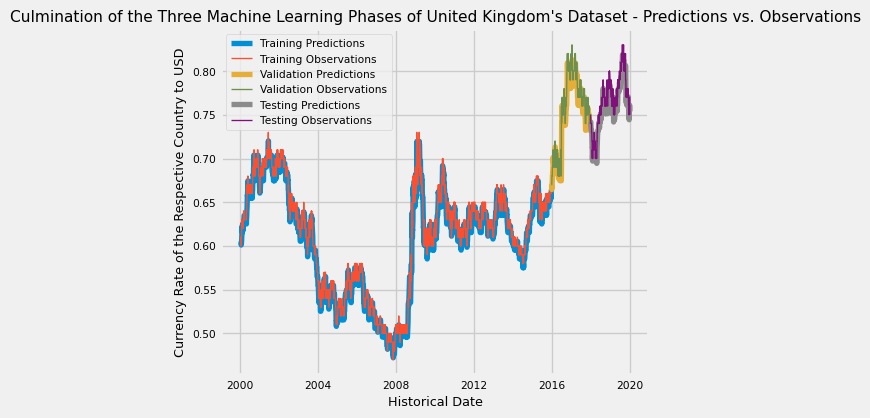






Through careful consideration of all of the prediction-based vs. observation-based contrast visualizations together, I consolidated all of graphics into one singular visualization for you to see below to get a more general perspective of the effectiveness of the Machine Learning model at training and fitting towards predicting the United Kingdom’s international currency rate with the United States.

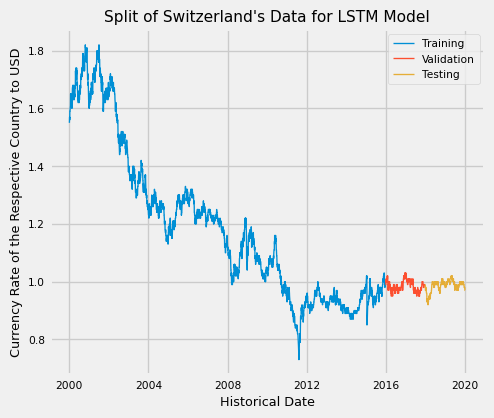
```{python}  
# Plotting United Kingdom's observational (reference) data with the predictions   
# of its Machine Learning Model (as a way to visually inspect the effectiveness   
# of the model)   
plt.plot(dates\_united\_kingdom\_train, united\_kingdom\_train\_pred, linewidth=4)  
plt.plot(dates\_united\_kingdom\_train, y\_united\_kingdom\_train, linewidth=1)  
plt.plot(dates\_united\_kingdom\_val, united\_kingdom\_val\_pred, linewidth=4)  
plt.plot(dates\_united\_kingdom\_val, y\_united\_kingdom\_val, linewidth=1)  
plt.plot(dates\_united\_kingdom\_test, united\_kingdom\_test\_pred, linewidth=4)  
plt.plot(dates\_united\_kingdom\_test, y\_united\_kingdom\_test, linewidth=1)  
  
plt.legend(["Training Predictions",  
 "Training Observations",  
 "Validation Predictions",  
 "Validation Observations",  
 "Testing Predictions",  
 "Testing Observations"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Culmination of the Three Machine Learning Phases of United Kingdom's Dataset - Predictions vs. Observations")  
plt.show()  
```



Lastly, I worked on Switzerland’s data (as shown below):

Since the data (date, X, and y) is split into three np.arrays and to be more efficient, I will manually split Switzerland’s data into train, test, and validation datasets for the Machine Learning model with 80% going to the training dataset, the next 10% going to the validation dataset, and the last 10% going to the test dataset for each np.array respectively.

```{python}  
# Splitting Switzerland's data into train, test, and validation sets on 3   
# mediums: the X-axis, the y-axis, and the indices (represented by dates)  
dates\_switzerland\_train, X\_switzerland\_train, y\_switzerland\_train = dates\_switzerland[:percentile\_80], X\_switzerland[:percentile\_80], y\_switzerland[:percentile\_80]  
dates\_switzerland\_val, X\_switzerland\_val, y\_switzerland\_val = dates\_switzerland[percentile\_80:percentile\_90], X\_switzerland[percentile\_80:percentile\_90], y\_switzerland[percentile\_80:percentile\_90]  
dates\_switzerland\_test, X\_switzerland\_test, y\_switzerland\_test = dates\_switzerland[percentile\_90:], X\_switzerland[percentile\_90:], y\_switzerland[percentile\_90:]  
  
plt.plot(dates\_switzerland\_train, y\_switzerland\_train, linewidth=1)  
plt.plot(dates\_switzerland\_val, y\_switzerland\_val, linewidth=1)  
plt.plot(dates\_switzerland\_test, y\_switzerland\_test, linewidth=1)  
  
plt.legend(["Training", "Validation", "Testing"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Split of Switzerland's Data for LSTM Model")  
plt.show()  
```



Now, I began to configure the Machine Learning model. We added Sequential layers: an Input layer 3 by 1 because we will have 3 np.arrays of Input and 1 np.array as output, utilize a LSTM (Long Short-Term Memory) layer of 64 neurons, apply 2 levels of dense layers with 32 neurons and folliowing recommendations online to use the RELU (Rectified Linear Unit) Activiation Function, and I followed up with one last dense layer of 1 neuron as our output layer since we are just trying to linearly-predict the next currency-rate on a near-future date. Once I configured the Sequential layers, we are ready to compile the model, utilzing the mean\_square\_error as our minimizing loss function, using the Adam optimizer, and comparing our trained model against our data with the mean\_absolute\_error metric. Lastly, I fitted our model, utilzing our X\_train and Y\_train datasets for fitting with validation from our X\_valid and Y\_valid datasets at 100 epochs.

```{python}  
# Configuring the Machine Learning Tensorflow Model for Switzerland  
switzerland\_model = Sequential([layers.Input((3, 1)),  
 layers.LSTM(64),  
 layers.Dense(32, activation="relu"),  
 layers.Dense(32, activation="relu"),  
 layers.Dense(1)])  
  
switzerland\_model.compile(loss="mse",  
 optimizer=Adam(learning\_rate=0.001),  
 metrics=["mean\_absolute\_error"])  
  
switzerland\_model.fit(X\_switzerland\_train, y\_switzerland\_train, validation\_data=(X\_switzerland\_val, y\_switzerland\_val), epochs=100)  
```

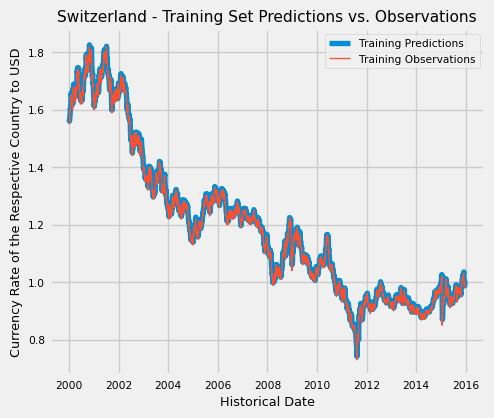
Epoch 1/100  
 1/126 [..............................] - ETA: 4:04 - loss: 1.4247 - mean\_absolute\_error: 1.1709 17/126 [===>..........................] - ETA: 0s - loss: 0.5830 - mean\_absolute\_error: 0.6890 33/126 [======>.......................] - ETA: 0s - loss: 0.3179 - mean\_absolute\_error: 0.4387 48/126 [==========>...................] - ETA: 0s - loss: 0.2218 - mean\_absolute\_error: 0.3250 64/126 [==============>...............] - ETA: 0s - loss: 0.1675 - mean\_absolute\_error: 0.2579 80/126 [==================>...........] - ETA: 0s - loss: 0.1346 - mean\_absolute\_error: 0.2159 96/126 [=====================>........] - ETA: 0s - loss: 0.1127 - mean\_absolute\_error: 0.1874112/126 [=========================>....] - ETA: 0s - loss: 0.0969 - mean\_absolute\_error: 0.1665126/126 [==============================] - 3s 7ms/step - loss: 0.0868 - mean\_absolute\_error: 0.1525 - val\_loss: 0.0016 - val\_mean\_absolute\_error: 0.0394  
Epoch 2/100  
 1/126 [..............................] - ETA: 0s - loss: 0.0020 - mean\_absolute\_error: 0.0385 17/126 [===>..........................] - ETA: 0s - loss: 0.0017 - mean\_absolute\_error: 0.0342 33/126 [======>.......................] - ETA: 0s - loss: 0.0015 - mean\_absolute\_error: 0.0317 49/126 [==========>...................] - ETA: 0s - loss: 0.0014 - mean\_absolute\_error: 0.0303 65/126 [==============>...............] - ETA: 0s - loss: 0.0012 - mean\_absolute\_error: 0.0285 81/126 [==================>...........] - ETA: 0s - loss: 0.0011 - mean\_absolute\_error: 0.0270 97/126 [======================>.......] - ETA: 0s - loss: 0.0010 - mean\_absolute\_error: 0.0256113/126 [=========================>....] - ETA: 0s - loss: 9.2665e-04 - mean\_absolute\_error: 0.0244126/126 [==============================] - 0s 4ms/step - loss: 8.7364e-04 - mean\_absolute\_error: 0.0235 - val\_loss: 2.8992e-04 - val\_mean\_absolute\_error: 0.0156  
Epoch 3/100  
 1/126 [..............................] - ETA: 0s - loss: 2.6143e-04 - mean\_absolute\_error: 0.0139 17/126 [===>..........................] - ETA: 0s - loss: 2.3551e-04 - mean\_absolute\_error: 0.0126 33/126 [======>.......................] - ETA: 0s - loss: 2.2385e-04 - mean\_absolute\_error: 0.0123 49/126 [==========>...................] - ETA: 0s - loss: 2.2130e-04 - mean\_absolute\_error: 0.0118 65/126 [==============>...............] - ETA: 0s - loss: 2.1423e-04 - mean\_absolute\_error: 0.0114 81/126 [==================>...........] - ETA: 0s - loss: 1.9905e-04 - mean\_absolute\_error: 0.0110 97/126 [======================>.......] - ETA: 0s - loss: 1.9404e-04 - mean\_absolute\_error: 0.0108113/126 [=========================>....] - ETA: 0s - loss: 1.8703e-04 - mean\_absolute\_error: 0.0106126/126 [==============================] - 0s 4ms/step - loss: 1.8057e-04 - mean\_absolute\_error: 0.0104 - val\_loss: 6.5529e-05 - val\_mean\_absolute\_error: 0.0066  
Epoch 4/100  
 1/126 [..............................] - ETA: 0s - loss: 4.2117e-05 - mean\_absolute\_error: 0.0054 18/126 [===>..........................] - ETA: 0s - loss: 1.6459e-04 - mean\_absolute\_error: 0.0092 34/126 [=======>......................] - ETA: 0s - loss: 1.4440e-04 - mean\_absolute\_error: 0.0090 51/126 [===========>..................] - ETA: 0s - loss: 1.4059e-04 - mean\_absolute\_error: 0.0088 67/126 [==============>...............] - ETA: 0s - loss: 1.3644e-04 - mean\_absolute\_error: 0.0088 83/126 [==================>...........] - ETA: 0s - loss: 1.3359e-04 - mean\_absolute\_error: 0.0087100/126 [======================>.......] - ETA: 0s - loss: 1.3320e-04 - mean\_absolute\_error: 0.0087117/126 [==========================>...] - ETA: 0s - loss: 1.3438e-04 - mean\_absolute\_error: 0.0086126/126 [==============================] - 0s 4ms/step - loss: 1.3400e-04 - mean\_absolute\_error: 0.0086 - val\_loss: 4.8211e-05 - val\_mean\_absolute\_error: 0.0054  
Epoch 5/100  
 1/126 [..............................] - ETA: 0s - loss: 6.4642e-05 - mean\_absolute\_error: 0.0064 17/126 [===>..........................] - ETA: 0s - loss: 1.0786e-04 - mean\_absolute\_error: 0.0081 33/126 [======>.......................] - ETA: 0s - loss: 1.2196e-04 - mean\_absolute\_error: 0.0084 49/126 [==========>...................] - ETA: 0s - loss: 1.2987e-04 - mean\_absolute\_error: 0.0084 66/126 [==============>...............] - ETA: 0s - loss: 1.3027e-04 - mean\_absolute\_error: 0.0085 83/126 [==================>...........] - ETA: 0s - loss: 1.3621e-04 - mean\_absolute\_error: 0.0085 99/126 [======================>.......] - ETA: 0s - loss: 1.3489e-04 - mean\_absolute\_error: 0.0086115/126 [==========================>...] - ETA: 0s - loss: 1.3504e-04 - mean\_absolute\_error: 0.0086126/126 [==============================] - 0s 4ms/step - loss: 1.3348e-04 - mean\_absolute\_error: 0.0086 - val\_loss: 4.8421e-05 - val\_mean\_absolute\_error: 0.0055  
Epoch 6/100  
 1/126 [..............................] - ETA: 0s - loss: 1.8306e-04 - mean\_absolute\_error: 0.0108 18/126 [===>..........................] - ETA: 0s - loss: 1.3809e-04 - mean\_absolute\_error: 0.0082 34/126 [=======>......................] - ETA: 0s - loss: 1.3884e-04 - mean\_absolute\_error: 0.0086 50/126 [==========>...................] - ETA: 0s - loss: 1.3292e-04 - mean\_absolute\_error: 0.0085 65/126 [==============>...............] - ETA: 0s - loss: 1.3150e-04 - mean\_absolute\_error: 0.0085 81/126 [==================>...........] - ETA: 0s - loss: 1.2955e-04 - mean\_absolute\_error: 0.0085 97/126 [======================>.......] - ETA: 0s - loss: 1.3261e-04 - mean\_absolute\_error: 0.0085113/126 [=========================>....] - ETA: 0s - loss: 1.3108e-04 - mean\_absolute\_error: 0.0085126/126 [==============================] - 0s 4ms/step - loss: 1.3252e-04 - mean\_absolute\_error: 0.0086 - val\_loss: 6.0704e-05 - val\_mean\_absolute\_error: 0.0063  
Epoch 7/100  
 1/126 [..............................] - ETA: 0s - loss: 9.4556e-05 - mean\_absolute\_error: 0.0076 17/126 [===>..........................] - ETA: 0s - loss: 1.3304e-04 - mean\_absolute\_error: 0.0089 33/126 [======>.......................] - ETA: 0s - loss: 1.4895e-04 - mean\_absolute\_error: 0.0090 49/126 [==========>...................] - ETA: 0s - loss: 1.4494e-04 - mean\_absolute\_error: 0.0089 65/126 [==============>...............] - ETA: 0s - loss: 1.4260e-04 - mean\_absolute\_error: 0.0089 81/126 [==================>...........] - ETA: 0s - loss: 1.4577e-04 - mean\_absolute\_error: 0.0089 97/126 [======================>.......] - ETA: 0s - loss: 1.4145e-04 - mean\_absolute\_error: 0.0088114/126 [==========================>...] - ETA: 0s - loss: 1.3794e-04 - mean\_absolute\_error: 0.0087126/126 [==============================] - 0s 4ms/step - loss: 1.3667e-04 - mean\_absolute\_error: 0.0087 - val\_loss: 5.3463e-05 - val\_mean\_absolute\_error: 0.0058  
Epoch 8/100  
 1/126 [..............................] - ETA: 0s - loss: 8.9788e-05 - mean\_absolute\_error: 0.0074 17/126 [===>..........................] - ETA: 0s - loss: 1.1469e-04 - mean\_absolute\_error: 0.0081 33/126 [======>.......................] - ETA: 0s - loss: 1.3120e-04 - mean\_absolute\_error: 0.0083 49/126 [==========>...................] - ETA: 0s - loss: 1.3820e-04 - mean\_absolute\_error: 0.0084 66/126 [==============>...............] - ETA: 0s - loss: 1.3766e-04 - mean\_absolute\_error: 0.0085 82/126 [==================>...........] - ETA: 0s - loss: 1.3919e-04 - mean\_absolute\_error: 0.0087 98/126 [======================>.......] - ETA: 0s - loss: 1.4011e-04 - mean\_absolute\_error: 0.0087114/126 [==========================>...] - ETA: 0s - loss: 1.3861e-04 - mean\_absolute\_error: 0.0087126/126 [==============================] - 0s 4ms/step - loss: 1.3758e-04 - mean\_absolute\_error: 0.0087 - val\_loss: 4.9415e-05 - val\_mean\_absolute\_error: 0.0056  
Epoch 9/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0575e-04 - mean\_absolute\_error: 0.0076 18/126 [===>..........................] - ETA: 0s - loss: 1.0415e-04 - mean\_absolute\_error: 0.0079 35/126 [=======>......................] - ETA: 0s - loss: 1.2321e-04 - mean\_absolute\_error: 0.0085 52/126 [===========>..................] - ETA: 0s - loss: 1.2894e-04 - mean\_absolute\_error: 0.0087 69/126 [===============>..............] - ETA: 0s - loss: 1.3870e-04 - mean\_absolute\_error: 0.0088 85/126 [===================>..........] - ETA: 0s - loss: 1.4320e-04 - mean\_absolute\_error: 0.0088101/126 [=======================>......] - ETA: 0s - loss: 1.3941e-04 - mean\_absolute\_error: 0.0087117/126 [==========================>...] - ETA: 0s - loss: 1.3859e-04 - mean\_absolute\_error: 0.0087126/126 [==============================] - 0s 4ms/step - loss: 1.3777e-04 - mean\_absolute\_error: 0.0087 - val\_loss: 4.7080e-05 - val\_mean\_absolute\_error: 0.0052  
Epoch 10/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1898e-04 - mean\_absolute\_error: 0.0083 17/126 [===>..........................] - ETA: 0s - loss: 1.5179e-04 - mean\_absolute\_error: 0.0086 34/126 [=======>......................] - ETA: 0s - loss: 1.5395e-04 - mean\_absolute\_error: 0.0086 50/126 [==========>...................] - ETA: 0s - loss: 1.5092e-04 - mean\_absolute\_error: 0.0087 67/126 [==============>...............] - ETA: 0s - loss: 1.4348e-04 - mean\_absolute\_error: 0.0087 83/126 [==================>...........] - ETA: 0s - loss: 1.4165e-04 - mean\_absolute\_error: 0.0087 99/126 [======================>.......] - ETA: 0s - loss: 1.3912e-04 - mean\_absolute\_error: 0.0087116/126 [==========================>...] - ETA: 0s - loss: 1.3628e-04 - mean\_absolute\_error: 0.0086126/126 [==============================] - 0s 4ms/step - loss: 1.3441e-04 - mean\_absolute\_error: 0.0086 - val\_loss: 4.7100e-05 - val\_mean\_absolute\_error: 0.0052  
Epoch 11/100  
 1/126 [..............................] - ETA: 0s - loss: 1.7061e-04 - mean\_absolute\_error: 0.0109 18/126 [===>..........................] - ETA: 0s - loss: 1.1015e-04 - mean\_absolute\_error: 0.0081 35/126 [=======>......................] - ETA: 0s - loss: 1.2965e-04 - mean\_absolute\_error: 0.0083 51/126 [===========>..................] - ETA: 0s - loss: 1.4274e-04 - mean\_absolute\_error: 0.0086 67/126 [==============>...............] - ETA: 0s - loss: 1.4151e-04 - mean\_absolute\_error: 0.0087 83/126 [==================>...........] - ETA: 0s - loss: 1.3555e-04 - mean\_absolute\_error: 0.0086 99/126 [======================>.......] - ETA: 0s - loss: 1.3485e-04 - mean\_absolute\_error: 0.0086115/126 [==========================>...] - ETA: 0s - loss: 1.3491e-04 - mean\_absolute\_error: 0.0086126/126 [==============================] - 0s 4ms/step - loss: 1.3384e-04 - mean\_absolute\_error: 0.0086 - val\_loss: 5.7603e-05 - val\_mean\_absolute\_error: 0.0061  
Epoch 12/100  
 1/126 [..............................] - ETA: 0s - loss: 1.3412e-04 - mean\_absolute\_error: 0.0098 18/126 [===>..........................] - ETA: 0s - loss: 1.4970e-04 - mean\_absolute\_error: 0.0086 34/126 [=======>......................] - ETA: 0s - loss: 1.4592e-04 - mean\_absolute\_error: 0.0087 50/126 [==========>...................] - ETA: 0s - loss: 1.4022e-04 - mean\_absolute\_error: 0.0087 66/126 [==============>...............] - ETA: 0s - loss: 1.4314e-04 - mean\_absolute\_error: 0.0087 83/126 [==================>...........] - ETA: 0s - loss: 1.3502e-04 - mean\_absolute\_error: 0.0085 99/126 [======================>.......] - ETA: 0s - loss: 1.3181e-04 - mean\_absolute\_error: 0.0085115/126 [==========================>...] - ETA: 0s - loss: 1.3395e-04 - mean\_absolute\_error: 0.0086126/126 [==============================] - 0s 4ms/step - loss: 1.3344e-04 - mean\_absolute\_error: 0.0086 - val\_loss: 5.7065e-05 - val\_mean\_absolute\_error: 0.0060  
Epoch 13/100  
 1/126 [..............................] - ETA: 0s - loss: 1.5878e-04 - mean\_absolute\_error: 0.0096 17/126 [===>..........................] - ETA: 0s - loss: 1.1715e-04 - mean\_absolute\_error: 0.0082 33/126 [======>.......................] - ETA: 0s - loss: 1.2078e-04 - mean\_absolute\_error: 0.0082 48/126 [==========>...................] - ETA: 0s - loss: 1.3195e-04 - mean\_absolute\_error: 0.0084 65/126 [==============>...............] - ETA: 0s - loss: 1.2921e-04 - mean\_absolute\_error: 0.0084 80/126 [==================>...........] - ETA: 0s - loss: 1.2775e-04 - mean\_absolute\_error: 0.0084 96/126 [=====================>........] - ETA: 0s - loss: 1.3042e-04 - mean\_absolute\_error: 0.0085111/126 [=========================>....] - ETA: 0s - loss: 1.3502e-04 - mean\_absolute\_error: 0.0086126/126 [==============================] - 0s 4ms/step - loss: 1.3514e-04 - mean\_absolute\_error: 0.0086 - val\_loss: 6.6547e-05 - val\_mean\_absolute\_error: 0.0066  
Epoch 14/100  
 1/126 [..............................] - ETA: 0s - loss: 2.2541e-04 - mean\_absolute\_error: 0.0108 17/126 [===>..........................] - ETA: 0s - loss: 1.8143e-04 - mean\_absolute\_error: 0.0095 33/126 [======>.......................] - ETA: 0s - loss: 1.5432e-04 - mean\_absolute\_error: 0.0091 49/126 [==========>...................] - ETA: 0s - loss: 1.4915e-04 - mean\_absolute\_error: 0.0091 65/126 [==============>...............] - ETA: 0s - loss: 1.4418e-04 - mean\_absolute\_error: 0.0090 82/126 [==================>...........] - ETA: 0s - loss: 1.4011e-04 - mean\_absolute\_error: 0.0089 98/126 [======================>.......] - ETA: 0s - loss: 1.4343e-04 - mean\_absolute\_error: 0.0089114/126 [==========================>...] - ETA: 0s - loss: 1.4104e-04 - mean\_absolute\_error: 0.0089126/126 [==============================] - 0s 4ms/step - loss: 1.3923e-04 - mean\_absolute\_error: 0.0088 - val\_loss: 5.7391e-05 - val\_mean\_absolute\_error: 0.0061  
Epoch 15/100  
 1/126 [..............................] - ETA: 0s - loss: 1.2051e-04 - mean\_absolute\_error: 0.0090 17/126 [===>..........................] - ETA: 0s - loss: 1.0903e-04 - mean\_absolute\_error: 0.0081 34/126 [=======>......................] - ETA: 0s - loss: 1.0873e-04 - mean\_absolute\_error: 0.0080 49/126 [==========>...................] - ETA: 0s - loss: 1.1098e-04 - mean\_absolute\_error: 0.0081 65/126 [==============>...............] - ETA: 0s - loss: 1.2101e-04 - mean\_absolute\_error: 0.0082 80/126 [==================>...........] - ETA: 0s - loss: 1.2520e-04 - mean\_absolute\_error: 0.0084 95/126 [=====================>........] - ETA: 0s - loss: 1.3487e-04 - mean\_absolute\_error: 0.0086111/126 [=========================>....] - ETA: 0s - loss: 1.3487e-04 - mean\_absolute\_error: 0.0086126/126 [==============================] - 0s 4ms/step - loss: 1.3640e-04 - mean\_absolute\_error: 0.0087 - val\_loss: 5.0299e-05 - val\_mean\_absolute\_error: 0.0056  
Epoch 16/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1756e-04 - mean\_absolute\_error: 0.0080 18/126 [===>..........................] - ETA: 0s - loss: 1.3851e-04 - mean\_absolute\_error: 0.0089 34/126 [=======>......................] - ETA: 0s - loss: 1.3369e-04 - mean\_absolute\_error: 0.0088 51/126 [===========>..................] - ETA: 0s - loss: 1.3219e-04 - mean\_absolute\_error: 0.0087 67/126 [==============>...............] - ETA: 0s - loss: 1.3103e-04 - mean\_absolute\_error: 0.0087 83/126 [==================>...........] - ETA: 0s - loss: 1.3082e-04 - mean\_absolute\_error: 0.0087 99/126 [======================>.......] - ETA: 0s - loss: 1.4292e-04 - mean\_absolute\_error: 0.0089115/126 [==========================>...] - ETA: 0s - loss: 1.3915e-04 - mean\_absolute\_error: 0.0088126/126 [==============================] - 0s 4ms/step - loss: 1.4053e-04 - mean\_absolute\_error: 0.0088 - val\_loss: 7.0178e-05 - val\_mean\_absolute\_error: 0.0068  
Epoch 17/100  
 1/126 [..............................] - ETA: 0s - loss: 1.6927e-04 - mean\_absolute\_error: 0.0104 17/126 [===>..........................] - ETA: 0s - loss: 1.5898e-04 - mean\_absolute\_error: 0.0097 33/126 [======>.......................] - ETA: 0s - loss: 1.3687e-04 - mean\_absolute\_error: 0.0091 49/126 [==========>...................] - ETA: 0s - loss: 1.3166e-04 - mean\_absolute\_error: 0.0088 65/126 [==============>...............] - ETA: 0s - loss: 1.3616e-04 - mean\_absolute\_error: 0.0090 81/126 [==================>...........] - ETA: 0s - loss: 1.4408e-04 - mean\_absolute\_error: 0.0090 97/126 [======================>.......] - ETA: 0s - loss: 1.4266e-04 - mean\_absolute\_error: 0.0090113/126 [=========================>....] - ETA: 0s - loss: 1.4552e-04 - mean\_absolute\_error: 0.0090126/126 [==============================] - 0s 4ms/step - loss: 1.4147e-04 - mean\_absolute\_error: 0.0089 - val\_loss: 4.6976e-05 - val\_mean\_absolute\_error: 0.0052  
Epoch 18/100  
 1/126 [..............................] - ETA: 0s - loss: 9.8533e-05 - mean\_absolute\_error: 0.0082 17/126 [===>..........................] - ETA: 0s - loss: 1.1883e-04 - mean\_absolute\_error: 0.0081 33/126 [======>.......................] - ETA: 0s - loss: 1.3336e-04 - mean\_absolute\_error: 0.0082 49/126 [==========>...................] - ETA: 0s - loss: 1.2682e-04 - mean\_absolute\_error: 0.0082 65/126 [==============>...............] - ETA: 0s - loss: 1.2498e-04 - mean\_absolute\_error: 0.0083 81/126 [==================>...........] - ETA: 0s - loss: 1.3512e-04 - mean\_absolute\_error: 0.0085 97/126 [======================>.......] - ETA: 0s - loss: 1.3497e-04 - mean\_absolute\_error: 0.0085113/126 [=========================>....] - ETA: 0s - loss: 1.3520e-04 - mean\_absolute\_error: 0.0086126/126 [==============================] - 0s 4ms/step - loss: 1.3216e-04 - mean\_absolute\_error: 0.0086 - val\_loss: 8.6919e-05 - val\_mean\_absolute\_error: 0.0077  
Epoch 19/100  
 1/126 [..............................] - ETA: 0s - loss: 2.2592e-04 - mean\_absolute\_error: 0.0122 17/126 [===>..........................] - ETA: 0s - loss: 2.5252e-04 - mean\_absolute\_error: 0.0123 33/126 [======>.......................] - ETA: 0s - loss: 2.0953e-04 - mean\_absolute\_error: 0.0107 49/126 [==========>...................] - ETA: 0s - loss: 1.8045e-04 - mean\_absolute\_error: 0.0101 65/126 [==============>...............] - ETA: 0s - loss: 1.7244e-04 - mean\_absolute\_error: 0.0098 81/126 [==================>...........] - ETA: 0s - loss: 1.6051e-04 - mean\_absolute\_error: 0.0095 97/126 [======================>.......] - ETA: 0s - loss: 1.5401e-04 - mean\_absolute\_error: 0.0094114/126 [==========================>...] - ETA: 0s - loss: 1.5353e-04 - mean\_absolute\_error: 0.0093126/126 [==============================] - 0s 4ms/step - loss: 1.4993e-04 - mean\_absolute\_error: 0.0092 - val\_loss: 4.8798e-05 - val\_mean\_absolute\_error: 0.0055  
Epoch 20/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1605e-04 - mean\_absolute\_error: 0.0085 17/126 [===>..........................] - ETA: 0s - loss: 1.2139e-04 - mean\_absolute\_error: 0.0084 33/126 [======>.......................] - ETA: 0s - loss: 1.3491e-04 - mean\_absolute\_error: 0.0085 49/126 [==========>...................] - ETA: 0s - loss: 1.3539e-04 - mean\_absolute\_error: 0.0086 65/126 [==============>...............] - ETA: 0s - loss: 1.4234e-04 - mean\_absolute\_error: 0.0087 81/126 [==================>...........] - ETA: 0s - loss: 1.4555e-04 - mean\_absolute\_error: 0.0090 97/126 [======================>.......] - ETA: 0s - loss: 1.5679e-04 - mean\_absolute\_error: 0.0094113/126 [=========================>....] - ETA: 0s - loss: 1.5528e-04 - mean\_absolute\_error: 0.0094126/126 [==============================] - 0s 4ms/step - loss: 1.5271e-04 - mean\_absolute\_error: 0.0093 - val\_loss: 4.8093e-05 - val\_mean\_absolute\_error: 0.0054  
Epoch 21/100  
 1/126 [..............................] - ETA: 0s - loss: 5.0788e-05 - mean\_absolute\_error: 0.0051 17/126 [===>..........................] - ETA: 0s - loss: 1.5391e-04 - mean\_absolute\_error: 0.0088 33/126 [======>.......................] - ETA: 0s - loss: 1.5556e-04 - mean\_absolute\_error: 0.0091 49/126 [==========>...................] - ETA: 0s - loss: 1.6581e-04 - mean\_absolute\_error: 0.0097 65/126 [==============>...............] - ETA: 0s - loss: 1.6518e-04 - mean\_absolute\_error: 0.0097 81/126 [==================>...........] - ETA: 0s - loss: 1.5563e-04 - mean\_absolute\_error: 0.0095 97/126 [======================>.......] - ETA: 0s - loss: 1.5113e-04 - mean\_absolute\_error: 0.0093112/126 [=========================>....] - ETA: 0s - loss: 1.5520e-04 - mean\_absolute\_error: 0.0093126/126 [==============================] - 0s 4ms/step - loss: 1.5175e-04 - mean\_absolute\_error: 0.0092 - val\_loss: 4.9924e-05 - val\_mean\_absolute\_error: 0.0056  
Epoch 22/100  
 1/126 [..............................] - ETA: 0s - loss: 1.3577e-04 - mean\_absolute\_error: 0.0086 18/126 [===>..........................] - ETA: 0s - loss: 1.3058e-04 - mean\_absolute\_error: 0.0086 34/126 [=======>......................] - ETA: 0s - loss: 1.5430e-04 - mean\_absolute\_error: 0.0091 50/126 [==========>...................] - ETA: 0s - loss: 1.5414e-04 - mean\_absolute\_error: 0.0092 67/126 [==============>...............] - ETA: 0s - loss: 1.5489e-04 - mean\_absolute\_error: 0.0094 83/126 [==================>...........] - ETA: 0s - loss: 1.5738e-04 - mean\_absolute\_error: 0.0095 99/126 [======================>.......] - ETA: 0s - loss: 1.5488e-04 - mean\_absolute\_error: 0.0094111/126 [=========================>....] - ETA: 0s - loss: 1.5810e-04 - mean\_absolute\_error: 0.0094126/126 [==============================] - ETA: 0s - loss: 1.5468e-04 - mean\_absolute\_error: 0.0093126/126 [==============================] - 0s 4ms/step - loss: 1.5468e-04 - mean\_absolute\_error: 0.0093 - val\_loss: 4.7577e-05 - val\_mean\_absolute\_error: 0.0054  
Epoch 23/100  
 1/126 [..............................] - ETA: 0s - loss: 8.0677e-05 - mean\_absolute\_error: 0.0078 17/126 [===>..........................] - ETA: 0s - loss: 1.4014e-04 - mean\_absolute\_error: 0.0089 33/126 [======>.......................] - ETA: 0s - loss: 1.3890e-04 - mean\_absolute\_error: 0.0089 49/126 [==========>...................] - ETA: 0s - loss: 1.3269e-04 - mean\_absolute\_error: 0.0087 65/126 [==============>...............] - ETA: 0s - loss: 1.3550e-04 - mean\_absolute\_error: 0.0089 81/126 [==================>...........] - ETA: 0s - loss: 1.3162e-04 - mean\_absolute\_error: 0.0088 97/126 [======================>.......] - ETA: 0s - loss: 1.3359e-04 - mean\_absolute\_error: 0.0088113/126 [=========================>....] - ETA: 0s - loss: 1.4518e-04 - mean\_absolute\_error: 0.0090126/126 [==============================] - 0s 4ms/step - loss: 1.4554e-04 - mean\_absolute\_error: 0.0090 - val\_loss: 5.1571e-05 - val\_mean\_absolute\_error: 0.0057  
Epoch 24/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0200e-04 - mean\_absolute\_error: 0.0080 17/126 [===>..........................] - ETA: 0s - loss: 1.2784e-04 - mean\_absolute\_error: 0.0087 33/126 [======>.......................] - ETA: 0s - loss: 1.6054e-04 - mean\_absolute\_error: 0.0094 49/126 [==========>...................] - ETA: 0s - loss: 1.4262e-04 - mean\_absolute\_error: 0.0089 66/126 [==============>...............] - ETA: 0s - loss: 1.5508e-04 - mean\_absolute\_error: 0.0091 82/126 [==================>...........] - ETA: 0s - loss: 1.5054e-04 - mean\_absolute\_error: 0.0090 98/126 [======================>.......] - ETA: 0s - loss: 1.4974e-04 - mean\_absolute\_error: 0.0090114/126 [==========================>...] - ETA: 0s - loss: 1.4656e-04 - mean\_absolute\_error: 0.0090126/126 [==============================] - 0s 4ms/step - loss: 1.4498e-04 - mean\_absolute\_error: 0.0090 - val\_loss: 9.2570e-05 - val\_mean\_absolute\_error: 0.0080  
Epoch 25/100  
 1/126 [..............................] - ETA: 0s - loss: 1.2156e-04 - mean\_absolute\_error: 0.0093 17/126 [===>..........................] - ETA: 0s - loss: 1.3707e-04 - mean\_absolute\_error: 0.0092 33/126 [======>.......................] - ETA: 0s - loss: 1.2775e-04 - mean\_absolute\_error: 0.0089 49/126 [==========>...................] - ETA: 0s - loss: 1.4265e-04 - mean\_absolute\_error: 0.0089 66/126 [==============>...............] - ETA: 0s - loss: 1.4648e-04 - mean\_absolute\_error: 0.0091 82/126 [==================>...........] - ETA: 0s - loss: 1.4554e-04 - mean\_absolute\_error: 0.0091 98/126 [======================>.......] - ETA: 0s - loss: 1.4686e-04 - mean\_absolute\_error: 0.0092115/126 [==========================>...] - ETA: 0s - loss: 1.5611e-04 - mean\_absolute\_error: 0.0096126/126 [==============================] - 0s 4ms/step - loss: 1.6558e-04 - mean\_absolute\_error: 0.0098 - val\_loss: 1.1039e-04 - val\_mean\_absolute\_error: 0.0089  
Epoch 26/100  
 1/126 [..............................] - ETA: 0s - loss: 1.7162e-04 - mean\_absolute\_error: 0.0101 16/126 [==>...........................] - ETA: 0s - loss: 1.5952e-04 - mean\_absolute\_error: 0.0100 33/126 [======>.......................] - ETA: 0s - loss: 1.6294e-04 - mean\_absolute\_error: 0.0101 49/126 [==========>...................] - ETA: 0s - loss: 1.4629e-04 - mean\_absolute\_error: 0.0094 64/126 [==============>...............] - ETA: 0s - loss: 1.4419e-04 - mean\_absolute\_error: 0.0093 81/126 [==================>...........] - ETA: 0s - loss: 1.4865e-04 - mean\_absolute\_error: 0.0093 97/126 [======================>.......] - ETA: 0s - loss: 1.4663e-04 - mean\_absolute\_error: 0.0093112/126 [=========================>....] - ETA: 0s - loss: 1.5321e-04 - mean\_absolute\_error: 0.0093126/126 [==============================] - 0s 4ms/step - loss: 1.5269e-04 - mean\_absolute\_error: 0.0094 - val\_loss: 6.2294e-05 - val\_mean\_absolute\_error: 0.0064  
Epoch 27/100  
 1/126 [..............................] - ETA: 0s - loss: 1.3823e-04 - mean\_absolute\_error: 0.0091 18/126 [===>..........................] - ETA: 0s - loss: 1.3351e-04 - mean\_absolute\_error: 0.0086 34/126 [=======>......................] - ETA: 0s - loss: 1.2241e-04 - mean\_absolute\_error: 0.0084 50/126 [==========>...................] - ETA: 0s - loss: 1.3152e-04 - mean\_absolute\_error: 0.0088 66/126 [==============>...............] - ETA: 0s - loss: 1.4030e-04 - mean\_absolute\_error: 0.0089 82/126 [==================>...........] - ETA: 0s - loss: 1.4703e-04 - mean\_absolute\_error: 0.0091 98/126 [======================>.......] - ETA: 0s - loss: 1.4747e-04 - mean\_absolute\_error: 0.0090114/126 [==========================>...] - ETA: 0s - loss: 1.4846e-04 - mean\_absolute\_error: 0.0091126/126 [==============================] - 0s 4ms/step - loss: 1.4697e-04 - mean\_absolute\_error: 0.0091 - val\_loss: 6.9959e-05 - val\_mean\_absolute\_error: 0.0068  
Epoch 28/100  
 1/126 [..............................] - ETA: 0s - loss: 2.0374e-04 - mean\_absolute\_error: 0.0113 17/126 [===>..........................] - ETA: 0s - loss: 1.3174e-04 - mean\_absolute\_error: 0.0088 34/126 [=======>......................] - ETA: 0s - loss: 1.4962e-04 - mean\_absolute\_error: 0.0096 50/126 [==========>...................] - ETA: 0s - loss: 1.5173e-04 - mean\_absolute\_error: 0.0096 66/126 [==============>...............] - ETA: 0s - loss: 1.5765e-04 - mean\_absolute\_error: 0.0096 81/126 [==================>...........] - ETA: 0s - loss: 1.5752e-04 - mean\_absolute\_error: 0.0096 97/126 [======================>.......] - ETA: 0s - loss: 1.5688e-04 - mean\_absolute\_error: 0.0096111/126 [=========================>....] - ETA: 0s - loss: 1.6082e-04 - mean\_absolute\_error: 0.0096126/126 [==============================] - 0s 4ms/step - loss: 1.5757e-04 - mean\_absolute\_error: 0.0095 - val\_loss: 5.2450e-05 - val\_mean\_absolute\_error: 0.0058  
Epoch 29/100  
 1/126 [..............................] - ETA: 0s - loss: 1.4132e-04 - mean\_absolute\_error: 0.0092 17/126 [===>..........................] - ETA: 0s - loss: 1.4954e-04 - mean\_absolute\_error: 0.0098 33/126 [======>.......................] - ETA: 0s - loss: 1.4891e-04 - mean\_absolute\_error: 0.0095 49/126 [==========>...................] - ETA: 0s - loss: 1.5452e-04 - mean\_absolute\_error: 0.0094 66/126 [==============>...............] - ETA: 0s - loss: 1.4413e-04 - mean\_absolute\_error: 0.0092 83/126 [==================>...........] - ETA: 0s - loss: 1.4095e-04 - mean\_absolute\_error: 0.0091 98/126 [======================>.......] - ETA: 0s - loss: 1.4376e-04 - mean\_absolute\_error: 0.0090114/126 [==========================>...] - ETA: 0s - loss: 1.3905e-04 - mean\_absolute\_error: 0.0089126/126 [==============================] - 0s 4ms/step - loss: 1.3920e-04 - mean\_absolute\_error: 0.0088 - val\_loss: 4.6664e-05 - val\_mean\_absolute\_error: 0.0052  
Epoch 30/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1724e-04 - mean\_absolute\_error: 0.0094 17/126 [===>..........................] - ETA: 0s - loss: 1.3908e-04 - mean\_absolute\_error: 0.0089 33/126 [======>.......................] - ETA: 0s - loss: 1.2891e-04 - mean\_absolute\_error: 0.0086 49/126 [==========>...................] - ETA: 0s - loss: 1.3478e-04 - mean\_absolute\_error: 0.0087 66/126 [==============>...............] - ETA: 0s - loss: 1.5036e-04 - mean\_absolute\_error: 0.0091 82/126 [==================>...........] - ETA: 0s - loss: 1.5919e-04 - mean\_absolute\_error: 0.0093 98/126 [======================>.......] - ETA: 0s - loss: 1.5934e-04 - mean\_absolute\_error: 0.0094114/126 [==========================>...] - ETA: 0s - loss: 1.5266e-04 - mean\_absolute\_error: 0.0092126/126 [==============================] - 0s 4ms/step - loss: 1.5141e-04 - mean\_absolute\_error: 0.0092 - val\_loss: 5.0450e-05 - val\_mean\_absolute\_error: 0.0057  
Epoch 31/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0112e-04 - mean\_absolute\_error: 0.0087 17/126 [===>..........................] - ETA: 0s - loss: 1.0156e-04 - mean\_absolute\_error: 0.0080 33/126 [======>.......................] - ETA: 0s - loss: 1.4107e-04 - mean\_absolute\_error: 0.0091 49/126 [==========>...................] - ETA: 0s - loss: 1.5724e-04 - mean\_absolute\_error: 0.0096 65/126 [==============>...............] - ETA: 0s - loss: 1.7197e-04 - mean\_absolute\_error: 0.0099 81/126 [==================>...........] - ETA: 0s - loss: 1.6886e-04 - mean\_absolute\_error: 0.0097 97/126 [======================>.......] - ETA: 0s - loss: 1.6331e-04 - mean\_absolute\_error: 0.0096113/126 [=========================>....] - ETA: 0s - loss: 1.5833e-04 - mean\_absolute\_error: 0.0094126/126 [==============================] - 0s 4ms/step - loss: 1.5487e-04 - mean\_absolute\_error: 0.0093 - val\_loss: 5.2763e-05 - val\_mean\_absolute\_error: 0.0058  
Epoch 32/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1622e-04 - mean\_absolute\_error: 0.0077 16/126 [==>...........................] - ETA: 0s - loss: 1.3147e-04 - mean\_absolute\_error: 0.0087 31/126 [======>.......................] - ETA: 0s - loss: 1.5971e-04 - mean\_absolute\_error: 0.0088 48/126 [==========>...................] - ETA: 0s - loss: 1.5030e-04 - mean\_absolute\_error: 0.0088 65/126 [==============>...............] - ETA: 0s - loss: 1.4254e-04 - mean\_absolute\_error: 0.0087 81/126 [==================>...........] - ETA: 0s - loss: 1.4425e-04 - mean\_absolute\_error: 0.0088 97/126 [======================>.......] - ETA: 0s - loss: 1.5219e-04 - mean\_absolute\_error: 0.0091113/126 [=========================>....] - ETA: 0s - loss: 1.6139e-04 - mean\_absolute\_error: 0.0094126/126 [==============================] - 0s 4ms/step - loss: 1.5857e-04 - mean\_absolute\_error: 0.0094 - val\_loss: 5.2369e-05 - val\_mean\_absolute\_error: 0.0058  
Epoch 33/100  
 1/126 [..............................] - ETA: 0s - loss: 1.3224e-04 - mean\_absolute\_error: 0.0095 16/126 [==>...........................] - ETA: 0s - loss: 1.2273e-04 - mean\_absolute\_error: 0.0083 31/126 [======>.......................] - ETA: 0s - loss: 1.2790e-04 - mean\_absolute\_error: 0.0085 46/126 [=========>....................] - ETA: 0s - loss: 1.2744e-04 - mean\_absolute\_error: 0.0086 62/126 [=============>................] - ETA: 0s - loss: 1.2948e-04 - mean\_absolute\_error: 0.0087 78/126 [=================>............] - ETA: 0s - loss: 1.2497e-04 - mean\_absolute\_error: 0.0085 94/126 [=====================>........] - ETA: 0s - loss: 1.2689e-04 - mean\_absolute\_error: 0.0086110/126 [=========================>....] - ETA: 0s - loss: 1.3513e-04 - mean\_absolute\_error: 0.0087126/126 [==============================] - ETA: 0s - loss: 1.3939e-04 - mean\_absolute\_error: 0.0088126/126 [==============================] - 0s 4ms/step - loss: 1.3939e-04 - mean\_absolute\_error: 0.0088 - val\_loss: 1.8398e-04 - val\_mean\_absolute\_error: 0.0119  
Epoch 34/100  
 1/126 [..............................] - ETA: 0s - loss: 3.9550e-04 - mean\_absolute\_error: 0.0167 17/126 [===>..........................] - ETA: 0s - loss: 1.7776e-04 - mean\_absolute\_error: 0.0099 33/126 [======>.......................] - ETA: 0s - loss: 1.5418e-04 - mean\_absolute\_error: 0.0092 49/126 [==========>...................] - ETA: 0s - loss: 1.5025e-04 - mean\_absolute\_error: 0.0091 66/126 [==============>...............] - ETA: 0s - loss: 1.4200e-04 - mean\_absolute\_error: 0.0090 82/126 [==================>...........] - ETA: 0s - loss: 1.4172e-04 - mean\_absolute\_error: 0.0090 98/126 [======================>.......] - ETA: 0s - loss: 1.4436e-04 - mean\_absolute\_error: 0.0091115/126 [==========================>...] - ETA: 0s - loss: 1.4896e-04 - mean\_absolute\_error: 0.0092126/126 [==============================] - 0s 4ms/step - loss: 1.4820e-04 - mean\_absolute\_error: 0.0092 - val\_loss: 4.9862e-05 - val\_mean\_absolute\_error: 0.0056  
Epoch 35/100  
 1/126 [..............................] - ETA: 0s - loss: 7.4921e-05 - mean\_absolute\_error: 0.0072 17/126 [===>..........................] - ETA: 0s - loss: 1.4458e-04 - mean\_absolute\_error: 0.0095 33/126 [======>.......................] - ETA: 0s - loss: 1.8596e-04 - mean\_absolute\_error: 0.0107 49/126 [==========>...................] - ETA: 0s - loss: 1.7467e-04 - mean\_absolute\_error: 0.0102 65/126 [==============>...............] - ETA: 0s - loss: 1.5955e-04 - mean\_absolute\_error: 0.0097 82/126 [==================>...........] - ETA: 0s - loss: 1.5300e-04 - mean\_absolute\_error: 0.0095 98/126 [======================>.......] - ETA: 0s - loss: 1.6366e-04 - mean\_absolute\_error: 0.0098114/126 [==========================>...] - ETA: 0s - loss: 1.6789e-04 - mean\_absolute\_error: 0.0098126/126 [==============================] - 0s 4ms/step - loss: 1.6613e-04 - mean\_absolute\_error: 0.0098 - val\_loss: 4.7573e-05 - val\_mean\_absolute\_error: 0.0054  
Epoch 36/100  
 1/126 [..............................] - ETA: 0s - loss: 8.2308e-05 - mean\_absolute\_error: 0.0070 17/126 [===>..........................] - ETA: 0s - loss: 1.5626e-04 - mean\_absolute\_error: 0.0096 33/126 [======>.......................] - ETA: 0s - loss: 1.3917e-04 - mean\_absolute\_error: 0.0091 49/126 [==========>...................] - ETA: 0s - loss: 1.5719e-04 - mean\_absolute\_error: 0.0097 65/126 [==============>...............] - ETA: 0s - loss: 1.5105e-04 - mean\_absolute\_error: 0.0095 79/126 [=================>............] - ETA: 0s - loss: 1.4459e-04 - mean\_absolute\_error: 0.0093 89/126 [====================>.........] - ETA: 0s - loss: 1.4888e-04 - mean\_absolute\_error: 0.0092 99/126 [======================>.......] - ETA: 0s - loss: 1.5372e-04 - mean\_absolute\_error: 0.0093109/126 [========================>.....] - ETA: 0s - loss: 1.5313e-04 - mean\_absolute\_error: 0.0093119/126 [===========================>..] - ETA: 0s - loss: 1.5002e-04 - mean\_absolute\_error: 0.0092126/126 [==============================] - 1s 5ms/step - loss: 1.4974e-04 - mean\_absolute\_error: 0.0092 - val\_loss: 9.2248e-05 - val\_mean\_absolute\_error: 0.0080  
Epoch 37/100  
 1/126 [..............................] - ETA: 0s - loss: 2.6858e-04 - mean\_absolute\_error: 0.0146 10/126 [=>............................] - ETA: 0s - loss: 1.3236e-04 - mean\_absolute\_error: 0.0089 20/126 [===>..........................] - ETA: 0s - loss: 1.3012e-04 - mean\_absolute\_error: 0.0089 30/126 [======>.......................] - ETA: 0s - loss: 1.2865e-04 - mean\_absolute\_error: 0.0088 40/126 [========>.....................] - ETA: 0s - loss: 1.4582e-04 - mean\_absolute\_error: 0.0093 47/126 [==========>...................] - ETA: 0s - loss: 1.4817e-04 - mean\_absolute\_error: 0.0094 54/126 [===========>..................] - ETA: 0s - loss: 1.5486e-04 - mean\_absolute\_error: 0.0094 63/126 [==============>...............] - ETA: 0s - loss: 1.5462e-04 - mean\_absolute\_error: 0.0094 73/126 [================>.............] - ETA: 0s - loss: 1.5229e-04 - mean\_absolute\_error: 0.0094 81/126 [==================>...........] - ETA: 0s - loss: 1.5220e-04 - mean\_absolute\_error: 0.0094 88/126 [===================>..........] - ETA: 0s - loss: 1.5122e-04 - mean\_absolute\_error: 0.0094 95/126 [=====================>........] - ETA: 0s - loss: 1.4675e-04 - mean\_absolute\_error: 0.0092102/126 [=======================>......] - ETA: 0s - loss: 1.4193e-04 - mean\_absolute\_error: 0.0090109/126 [========================>.....] - ETA: 0s - loss: 1.4082e-04 - mean\_absolute\_error: 0.0090115/126 [==========================>...] - ETA: 0s - loss: 1.4176e-04 - mean\_absolute\_error: 0.0090122/126 [============================>.] - ETA: 0s - loss: 1.4200e-04 - mean\_absolute\_error: 0.0090126/126 [==============================] - 1s 8ms/step - loss: 1.4706e-04 - mean\_absolute\_error: 0.0091 - val\_loss: 1.2601e-04 - val\_mean\_absolute\_error: 0.0095  
Epoch 38/100  
 1/126 [..............................] - ETA: 0s - loss: 1.2644e-04 - mean\_absolute\_error: 0.0093 10/126 [=>............................] - ETA: 0s - loss: 1.4919e-04 - mean\_absolute\_error: 0.0097 19/126 [===>..........................] - ETA: 0s - loss: 1.4174e-04 - mean\_absolute\_error: 0.0092 28/126 [=====>........................] - ETA: 0s - loss: 1.2990e-04 - mean\_absolute\_error: 0.0088 41/126 [========>.....................] - ETA: 0s - loss: 1.3122e-04 - mean\_absolute\_error: 0.0089 56/126 [============>.................] - ETA: 0s - loss: 1.3265e-04 - mean\_absolute\_error: 0.0088 72/126 [================>.............] - ETA: 0s - loss: 1.3325e-04 - mean\_absolute\_error: 0.0088 88/126 [===================>..........] - ETA: 0s - loss: 1.3366e-04 - mean\_absolute\_error: 0.0088104/126 [=======================>......] - ETA: 0s - loss: 1.3710e-04 - mean\_absolute\_error: 0.0088120/126 [===========================>..] - ETA: 0s - loss: 1.4002e-04 - mean\_absolute\_error: 0.0088126/126 [==============================] - 1s 4ms/step - loss: 1.3887e-04 - mean\_absolute\_error: 0.0088 - val\_loss: 6.1075e-05 - val\_mean\_absolute\_error: 0.0063  
Epoch 39/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0219e-04 - mean\_absolute\_error: 0.0086 17/126 [===>..........................] - ETA: 0s - loss: 1.3394e-04 - mean\_absolute\_error: 0.0091 33/126 [======>.......................] - ETA: 0s - loss: 1.4538e-04 - mean\_absolute\_error: 0.0093 49/126 [==========>...................] - ETA: 0s - loss: 1.6522e-04 - mean\_absolute\_error: 0.0095 66/126 [==============>...............] - ETA: 0s - loss: 1.5676e-04 - mean\_absolute\_error: 0.0093 82/126 [==================>...........] - ETA: 0s - loss: 1.5725e-04 - mean\_absolute\_error: 0.0094 98/126 [======================>.......] - ETA: 0s - loss: 1.5096e-04 - mean\_absolute\_error: 0.0093114/126 [==========================>...] - ETA: 0s - loss: 1.4635e-04 - mean\_absolute\_error: 0.0091126/126 [==============================] - 0s 4ms/step - loss: 1.4700e-04 - mean\_absolute\_error: 0.0092 - val\_loss: 8.3905e-05 - val\_mean\_absolute\_error: 0.0075  
Epoch 40/100  
 1/126 [..............................] - ETA: 0s - loss: 1.2295e-04 - mean\_absolute\_error: 0.0089 17/126 [===>..........................] - ETA: 0s - loss: 1.2880e-04 - mean\_absolute\_error: 0.0087 33/126 [======>.......................] - ETA: 0s - loss: 1.4269e-04 - mean\_absolute\_error: 0.0092 49/126 [==========>...................] - ETA: 0s - loss: 1.4090e-04 - mean\_absolute\_error: 0.0091 65/126 [==============>...............] - ETA: 0s - loss: 1.6477e-04 - mean\_absolute\_error: 0.0098 82/126 [==================>...........] - ETA: 0s - loss: 2.0258e-04 - mean\_absolute\_error: 0.0109 98/126 [======================>.......] - ETA: 0s - loss: 2.0811e-04 - mean\_absolute\_error: 0.0110114/126 [==========================>...] - ETA: 0s - loss: 2.0103e-04 - mean\_absolute\_error: 0.0108126/126 [==============================] - 0s 4ms/step - loss: 1.9534e-04 - mean\_absolute\_error: 0.0107 - val\_loss: 8.9244e-05 - val\_mean\_absolute\_error: 0.0078  
Epoch 41/100  
 1/126 [..............................] - ETA: 0s - loss: 1.7821e-04 - mean\_absolute\_error: 0.0108 17/126 [===>..........................] - ETA: 0s - loss: 1.3897e-04 - mean\_absolute\_error: 0.0089 34/126 [=======>......................] - ETA: 0s - loss: 1.4457e-04 - mean\_absolute\_error: 0.0092 51/126 [===========>..................] - ETA: 0s - loss: 1.5558e-04 - mean\_absolute\_error: 0.0097 68/126 [===============>..............] - ETA: 0s - loss: 1.5240e-04 - mean\_absolute\_error: 0.0095 84/126 [===================>..........] - ETA: 0s - loss: 1.4478e-04 - mean\_absolute\_error: 0.0093100/126 [======================>.......] - ETA: 0s - loss: 1.5008e-04 - mean\_absolute\_error: 0.0093116/126 [==========================>...] - ETA: 0s - loss: 1.5404e-04 - mean\_absolute\_error: 0.0094126/126 [==============================] - 0s 4ms/step - loss: 1.5693e-04 - mean\_absolute\_error: 0.0095 - val\_loss: 8.3532e-05 - val\_mean\_absolute\_error: 0.0075  
Epoch 42/100  
 1/126 [..............................] - ETA: 0s - loss: 1.5983e-04 - mean\_absolute\_error: 0.0102 17/126 [===>..........................] - ETA: 0s - loss: 1.5455e-04 - mean\_absolute\_error: 0.0097 33/126 [======>.......................] - ETA: 0s - loss: 1.4968e-04 - mean\_absolute\_error: 0.0095 49/126 [==========>...................] - ETA: 0s - loss: 1.4981e-04 - mean\_absolute\_error: 0.0094 65/126 [==============>...............] - ETA: 0s - loss: 1.5664e-04 - mean\_absolute\_error: 0.0095 81/126 [==================>...........] - ETA: 0s - loss: 1.5228e-04 - mean\_absolute\_error: 0.0093 98/126 [======================>.......] - ETA: 0s - loss: 1.4659e-04 - mean\_absolute\_error: 0.0091114/126 [==========================>...] - ETA: 0s - loss: 1.4558e-04 - mean\_absolute\_error: 0.0090126/126 [==============================] - 0s 4ms/step - loss: 1.4280e-04 - mean\_absolute\_error: 0.0089 - val\_loss: 4.7485e-05 - val\_mean\_absolute\_error: 0.0054  
Epoch 43/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0326e-04 - mean\_absolute\_error: 0.0084 17/126 [===>..........................] - ETA: 0s - loss: 1.5707e-04 - mean\_absolute\_error: 0.0091 34/126 [=======>......................] - ETA: 0s - loss: 1.9294e-04 - mean\_absolute\_error: 0.0102 50/126 [==========>...................] - ETA: 0s - loss: 1.7983e-04 - mean\_absolute\_error: 0.0100 66/126 [==============>...............] - ETA: 0s - loss: 1.6442e-04 - mean\_absolute\_error: 0.0096 82/126 [==================>...........] - ETA: 0s - loss: 1.6269e-04 - mean\_absolute\_error: 0.0096 98/126 [======================>.......] - ETA: 0s - loss: 1.6570e-04 - mean\_absolute\_error: 0.0097114/126 [==========================>...] - ETA: 0s - loss: 1.6009e-04 - mean\_absolute\_error: 0.0095126/126 [==============================] - 0s 4ms/step - loss: 1.5572e-04 - mean\_absolute\_error: 0.0094 - val\_loss: 6.0389e-05 - val\_mean\_absolute\_error: 0.0063  
Epoch 44/100  
 1/126 [..............................] - ETA: 0s - loss: 1.7609e-04 - mean\_absolute\_error: 0.0108 16/126 [==>...........................] - ETA: 0s - loss: 2.8391e-04 - mean\_absolute\_error: 0.0135 33/126 [======>.......................] - ETA: 0s - loss: 2.2364e-04 - mean\_absolute\_error: 0.0115 49/126 [==========>...................] - ETA: 0s - loss: 1.8877e-04 - mean\_absolute\_error: 0.0105 65/126 [==============>...............] - ETA: 0s - loss: 1.7808e-04 - mean\_absolute\_error: 0.0102 81/126 [==================>...........] - ETA: 0s - loss: 1.6577e-04 - mean\_absolute\_error: 0.0098 97/126 [======================>.......] - ETA: 0s - loss: 1.6486e-04 - mean\_absolute\_error: 0.0097113/126 [=========================>....] - ETA: 0s - loss: 1.6744e-04 - mean\_absolute\_error: 0.0097126/126 [==============================] - 0s 4ms/step - loss: 1.6563e-04 - mean\_absolute\_error: 0.0096 - val\_loss: 4.6496e-05 - val\_mean\_absolute\_error: 0.0053  
Epoch 45/100  
 1/126 [..............................] - ETA: 0s - loss: 1.6161e-04 - mean\_absolute\_error: 0.0100 17/126 [===>..........................] - ETA: 0s - loss: 1.3544e-04 - mean\_absolute\_error: 0.0089 33/126 [======>.......................] - ETA: 0s - loss: 1.4646e-04 - mean\_absolute\_error: 0.0094 49/126 [==========>...................] - ETA: 0s - loss: 1.5698e-04 - mean\_absolute\_error: 0.0094 65/126 [==============>...............] - ETA: 0s - loss: 1.4761e-04 - mean\_absolute\_error: 0.0091 81/126 [==================>...........] - ETA: 0s - loss: 1.5348e-04 - mean\_absolute\_error: 0.0093 97/126 [======================>.......] - ETA: 0s - loss: 1.5087e-04 - mean\_absolute\_error: 0.0093113/126 [=========================>....] - ETA: 0s - loss: 1.4792e-04 - mean\_absolute\_error: 0.0092126/126 [==============================] - 0s 4ms/step - loss: 1.5379e-04 - mean\_absolute\_error: 0.0093 - val\_loss: 4.5281e-05 - val\_mean\_absolute\_error: 0.0051  
Epoch 46/100  
 1/126 [..............................] - ETA: 0s - loss: 6.3311e-05 - mean\_absolute\_error: 0.0068 17/126 [===>..........................] - ETA: 0s - loss: 2.0985e-04 - mean\_absolute\_error: 0.0106 33/126 [======>.......................] - ETA: 0s - loss: 1.6578e-04 - mean\_absolute\_error: 0.0096 49/126 [==========>...................] - ETA: 0s - loss: 1.5903e-04 - mean\_absolute\_error: 0.0095 65/126 [==============>...............] - ETA: 0s - loss: 1.6939e-04 - mean\_absolute\_error: 0.0097 81/126 [==================>...........] - ETA: 0s - loss: 1.6184e-04 - mean\_absolute\_error: 0.0096 97/126 [======================>.......] - ETA: 0s - loss: 1.6018e-04 - mean\_absolute\_error: 0.0096113/126 [=========================>....] - ETA: 0s - loss: 1.5693e-04 - mean\_absolute\_error: 0.0095126/126 [==============================] - 0s 4ms/step - loss: 1.5961e-04 - mean\_absolute\_error: 0.0096 - val\_loss: 1.0906e-04 - val\_mean\_absolute\_error: 0.0088  
Epoch 47/100  
 1/126 [..............................] - ETA: 0s - loss: 2.1295e-04 - mean\_absolute\_error: 0.0117 17/126 [===>..........................] - ETA: 0s - loss: 1.7914e-04 - mean\_absolute\_error: 0.0106 33/126 [======>.......................] - ETA: 0s - loss: 1.6210e-04 - mean\_absolute\_error: 0.0099 49/126 [==========>...................] - ETA: 0s - loss: 1.5393e-04 - mean\_absolute\_error: 0.0096 64/126 [==============>...............] - ETA: 0s - loss: 1.4659e-04 - mean\_absolute\_error: 0.0093 80/126 [==================>...........] - ETA: 0s - loss: 1.4784e-04 - mean\_absolute\_error: 0.0094 96/126 [=====================>........] - ETA: 0s - loss: 1.4933e-04 - mean\_absolute\_error: 0.0094113/126 [=========================>....] - ETA: 0s - loss: 1.5601e-04 - mean\_absolute\_error: 0.0096126/126 [==============================] - 0s 4ms/step - loss: 1.6755e-04 - mean\_absolute\_error: 0.0098 - val\_loss: 1.9999e-04 - val\_mean\_absolute\_error: 0.0126  
Epoch 48/100  
 1/126 [..............................] - ETA: 0s - loss: 4.0913e-04 - mean\_absolute\_error: 0.0174 17/126 [===>..........................] - ETA: 0s - loss: 2.0991e-04 - mean\_absolute\_error: 0.0114 33/126 [======>.......................] - ETA: 0s - loss: 1.9040e-04 - mean\_absolute\_error: 0.0102 49/126 [==========>...................] - ETA: 0s - loss: 1.8168e-04 - mean\_absolute\_error: 0.0101 64/126 [==============>...............] - ETA: 0s - loss: 1.6865e-04 - mean\_absolute\_error: 0.0097 80/126 [==================>...........] - ETA: 0s - loss: 1.5823e-04 - mean\_absolute\_error: 0.0094 96/126 [=====================>........] - ETA: 0s - loss: 1.5771e-04 - mean\_absolute\_error: 0.0094112/126 [=========================>....] - ETA: 0s - loss: 1.5691e-04 - mean\_absolute\_error: 0.0094126/126 [==============================] - 0s 4ms/step - loss: 1.5714e-04 - mean\_absolute\_error: 0.0095 - val\_loss: 4.4922e-05 - val\_mean\_absolute\_error: 0.0051  
Epoch 49/100  
 1/126 [..............................] - ETA: 0s - loss: 9.3562e-05 - mean\_absolute\_error: 0.0071 17/126 [===>..........................] - ETA: 0s - loss: 1.9511e-04 - mean\_absolute\_error: 0.0102 33/126 [======>.......................] - ETA: 0s - loss: 1.8027e-04 - mean\_absolute\_error: 0.0102 49/126 [==========>...................] - ETA: 0s - loss: 1.7798e-04 - mean\_absolute\_error: 0.0103 65/126 [==============>...............] - ETA: 0s - loss: 1.7155e-04 - mean\_absolute\_error: 0.0100 80/126 [==================>...........] - ETA: 0s - loss: 1.6202e-04 - mean\_absolute\_error: 0.0097 94/126 [=====================>........] - ETA: 0s - loss: 1.6852e-04 - mean\_absolute\_error: 0.0098108/126 [========================>.....] - ETA: 0s - loss: 1.6574e-04 - mean\_absolute\_error: 0.0098122/126 [============================>.] - ETA: 0s - loss: 1.6136e-04 - mean\_absolute\_error: 0.0096126/126 [==============================] - 0s 4ms/step - loss: 1.6108e-04 - mean\_absolute\_error: 0.0096 - val\_loss: 1.5222e-04 - val\_mean\_absolute\_error: 0.0106  
Epoch 50/100  
 1/126 [..............................] - ETA: 0s - loss: 2.3610e-04 - mean\_absolute\_error: 0.0128 16/126 [==>...........................] - ETA: 0s - loss: 1.4585e-04 - mean\_absolute\_error: 0.0094 31/126 [======>.......................] - ETA: 0s - loss: 1.5067e-04 - mean\_absolute\_error: 0.0093 47/126 [==========>...................] - ETA: 0s - loss: 1.4029e-04 - mean\_absolute\_error: 0.0090 63/126 [==============>...............] - ETA: 0s - loss: 1.4241e-04 - mean\_absolute\_error: 0.0088 80/126 [==================>...........] - ETA: 0s - loss: 1.3794e-04 - mean\_absolute\_error: 0.0088 97/126 [======================>.......] - ETA: 0s - loss: 1.3971e-04 - mean\_absolute\_error: 0.0089113/126 [=========================>....] - ETA: 0s - loss: 1.4253e-04 - mean\_absolute\_error: 0.0090126/126 [==============================] - 0s 4ms/step - loss: 1.4421e-04 - mean\_absolute\_error: 0.0091 - val\_loss: 4.8618e-05 - val\_mean\_absolute\_error: 0.0055  
Epoch 51/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0779e-04 - mean\_absolute\_error: 0.0090 18/126 [===>..........................] - ETA: 0s - loss: 1.4293e-04 - mean\_absolute\_error: 0.0094 34/126 [=======>......................] - ETA: 0s - loss: 1.4433e-04 - mean\_absolute\_error: 0.0093 50/126 [==========>...................] - ETA: 0s - loss: 1.6978e-04 - mean\_absolute\_error: 0.0101 66/126 [==============>...............] - ETA: 0s - loss: 1.8611e-04 - mean\_absolute\_error: 0.0104 82/126 [==================>...........] - ETA: 0s - loss: 1.7848e-04 - mean\_absolute\_error: 0.0101 97/126 [======================>.......] - ETA: 0s - loss: 1.6976e-04 - mean\_absolute\_error: 0.0099113/126 [=========================>....] - ETA: 0s - loss: 1.6797e-04 - mean\_absolute\_error: 0.0099126/126 [==============================] - 0s 4ms/step - loss: 1.7066e-04 - mean\_absolute\_error: 0.0100 - val\_loss: 7.0450e-05 - val\_mean\_absolute\_error: 0.0069  
Epoch 52/100  
 1/126 [..............................] - ETA: 0s - loss: 2.1709e-04 - mean\_absolute\_error: 0.0111 17/126 [===>..........................] - ETA: 0s - loss: 1.3920e-04 - mean\_absolute\_error: 0.0087 34/126 [=======>......................] - ETA: 0s - loss: 1.4503e-04 - mean\_absolute\_error: 0.0090 51/126 [===========>..................] - ETA: 0s - loss: 1.4260e-04 - mean\_absolute\_error: 0.0088 67/126 [==============>...............] - ETA: 0s - loss: 1.4267e-04 - mean\_absolute\_error: 0.0087 83/126 [==================>...........] - ETA: 0s - loss: 1.3787e-04 - mean\_absolute\_error: 0.0087 99/126 [======================>.......] - ETA: 0s - loss: 1.4084e-04 - mean\_absolute\_error: 0.0088115/126 [==========================>...] - ETA: 0s - loss: 1.3848e-04 - mean\_absolute\_error: 0.0088126/126 [==============================] - 0s 4ms/step - loss: 1.3722e-04 - mean\_absolute\_error: 0.0087 - val\_loss: 4.5618e-05 - val\_mean\_absolute\_error: 0.0053  
Epoch 53/100  
 1/126 [..............................] - ETA: 0s - loss: 1.2079e-04 - mean\_absolute\_error: 0.0084 17/126 [===>..........................] - ETA: 0s - loss: 1.7354e-04 - mean\_absolute\_error: 0.0102 33/126 [======>.......................] - ETA: 0s - loss: 1.7108e-04 - mean\_absolute\_error: 0.0097 49/126 [==========>...................] - ETA: 0s - loss: 1.4803e-04 - mean\_absolute\_error: 0.0090 65/126 [==============>...............] - ETA: 0s - loss: 1.4534e-04 - mean\_absolute\_error: 0.0090 81/126 [==================>...........] - ETA: 0s - loss: 1.4052e-04 - mean\_absolute\_error: 0.0089 97/126 [======================>.......] - ETA: 0s - loss: 1.5148e-04 - mean\_absolute\_error: 0.0092113/126 [=========================>....] - ETA: 0s - loss: 1.5368e-04 - mean\_absolute\_error: 0.0093126/126 [==============================] - 0s 4ms/step - loss: 1.5051e-04 - mean\_absolute\_error: 0.0093 - val\_loss: 9.8391e-05 - val\_mean\_absolute\_error: 0.0083  
Epoch 54/100  
 1/126 [..............................] - ETA: 0s - loss: 1.8487e-04 - mean\_absolute\_error: 0.0100 16/126 [==>...........................] - ETA: 0s - loss: 1.5215e-04 - mean\_absolute\_error: 0.0097 32/126 [======>.......................] - ETA: 0s - loss: 1.7401e-04 - mean\_absolute\_error: 0.0104 48/126 [==========>...................] - ETA: 0s - loss: 1.8087e-04 - mean\_absolute\_error: 0.0103 64/126 [==============>...............] - ETA: 0s - loss: 1.7000e-04 - mean\_absolute\_error: 0.0100 80/126 [==================>...........] - ETA: 0s - loss: 1.7033e-04 - mean\_absolute\_error: 0.0101 97/126 [======================>.......] - ETA: 0s - loss: 1.6990e-04 - mean\_absolute\_error: 0.0100113/126 [=========================>....] - ETA: 0s - loss: 1.6593e-04 - mean\_absolute\_error: 0.0098126/126 [==============================] - 0s 4ms/step - loss: 1.7169e-04 - mean\_absolute\_error: 0.0100 - val\_loss: 2.3058e-04 - val\_mean\_absolute\_error: 0.0138  
Epoch 55/100  
 1/126 [..............................] - ETA: 0s - loss: 4.0805e-04 - mean\_absolute\_error: 0.0168 17/126 [===>..........................] - ETA: 0s - loss: 1.7188e-04 - mean\_absolute\_error: 0.0103 33/126 [======>.......................] - ETA: 0s - loss: 1.3737e-04 - mean\_absolute\_error: 0.0091 49/126 [==========>...................] - ETA: 0s - loss: 1.2902e-04 - mean\_absolute\_error: 0.0087 66/126 [==============>...............] - ETA: 0s - loss: 1.3314e-04 - mean\_absolute\_error: 0.0090 82/126 [==================>...........] - ETA: 0s - loss: 1.3057e-04 - mean\_absolute\_error: 0.0088 98/126 [======================>.......] - ETA: 0s - loss: 1.3935e-04 - mean\_absolute\_error: 0.0089115/126 [==========================>...] - ETA: 0s - loss: 1.3765e-04 - mean\_absolute\_error: 0.0088126/126 [==============================] - 0s 4ms/step - loss: 1.4124e-04 - mean\_absolute\_error: 0.0089 - val\_loss: 4.4096e-05 - val\_mean\_absolute\_error: 0.0050  
Epoch 56/100  
 1/126 [..............................] - ETA: 0s - loss: 5.3685e-05 - mean\_absolute\_error: 0.0053 18/126 [===>..........................] - ETA: 0s - loss: 1.3636e-04 - mean\_absolute\_error: 0.0092 34/126 [=======>......................] - ETA: 0s - loss: 1.6519e-04 - mean\_absolute\_error: 0.0098 50/126 [==========>...................] - ETA: 0s - loss: 1.7398e-04 - mean\_absolute\_error: 0.0102 67/126 [==============>...............] - ETA: 0s - loss: 1.7531e-04 - mean\_absolute\_error: 0.0102 83/126 [==================>...........] - ETA: 0s - loss: 1.9621e-04 - mean\_absolute\_error: 0.0109100/126 [======================>.......] - ETA: 0s - loss: 2.0326e-04 - mean\_absolute\_error: 0.0110117/126 [==========================>...] - ETA: 0s - loss: 2.0096e-04 - mean\_absolute\_error: 0.0110126/126 [==============================] - 0s 4ms/step - loss: 1.9685e-04 - mean\_absolute\_error: 0.0109 - val\_loss: 1.5566e-04 - val\_mean\_absolute\_error: 0.0108  
Epoch 57/100  
 1/126 [..............................] - ETA: 0s - loss: 2.3774e-04 - mean\_absolute\_error: 0.0135 17/126 [===>..........................] - ETA: 0s - loss: 1.4947e-04 - mean\_absolute\_error: 0.0094 34/126 [=======>......................] - ETA: 0s - loss: 1.4422e-04 - mean\_absolute\_error: 0.0093 50/126 [==========>...................] - ETA: 0s - loss: 1.4437e-04 - mean\_absolute\_error: 0.0090 66/126 [==============>...............] - ETA: 0s - loss: 1.3450e-04 - mean\_absolute\_error: 0.0088 81/126 [==================>...........] - ETA: 0s - loss: 1.3376e-04 - mean\_absolute\_error: 0.0088 96/126 [=====================>........] - ETA: 0s - loss: 1.3487e-04 - mean\_absolute\_error: 0.0087112/126 [=========================>....] - ETA: 0s - loss: 1.3406e-04 - mean\_absolute\_error: 0.0086126/126 [==============================] - 0s 4ms/step - loss: 1.3178e-04 - mean\_absolute\_error: 0.0086 - val\_loss: 1.1181e-04 - val\_mean\_absolute\_error: 0.0089  
Epoch 58/100  
 1/126 [..............................] - ETA: 0s - loss: 1.8960e-04 - mean\_absolute\_error: 0.0112 17/126 [===>..........................] - ETA: 0s - loss: 1.2087e-04 - mean\_absolute\_error: 0.0086 33/126 [======>.......................] - ETA: 0s - loss: 1.3550e-04 - mean\_absolute\_error: 0.0087 49/126 [==========>...................] - ETA: 0s - loss: 1.5318e-04 - mean\_absolute\_error: 0.0094 65/126 [==============>...............] - ETA: 0s - loss: 1.5511e-04 - mean\_absolute\_error: 0.0095 77/126 [=================>............] - ETA: 0s - loss: 1.5541e-04 - mean\_absolute\_error: 0.0096 85/126 [===================>..........] - ETA: 0s - loss: 1.5349e-04 - mean\_absolute\_error: 0.0095 93/126 [=====================>........] - ETA: 0s - loss: 1.5772e-04 - mean\_absolute\_error: 0.0097101/126 [=======================>......] - ETA: 0s - loss: 1.6402e-04 - mean\_absolute\_error: 0.0098110/126 [=========================>....] - ETA: 0s - loss: 1.6521e-04 - mean\_absolute\_error: 0.0099118/126 [===========================>..] - ETA: 0s - loss: 1.6267e-04 - mean\_absolute\_error: 0.0097126/126 [==============================] - ETA: 0s - loss: 1.5960e-04 - mean\_absolute\_error: 0.0096126/126 [==============================] - 1s 5ms/step - loss: 1.5960e-04 - mean\_absolute\_error: 0.0096 - val\_loss: 5.6478e-05 - val\_mean\_absolute\_error: 0.0061  
Epoch 59/100  
 1/126 [..............................] - ETA: 1s - loss: 8.9456e-05 - mean\_absolute\_error: 0.0081 9/126 [=>............................] - ETA: 0s - loss: 1.1190e-04 - mean\_absolute\_error: 0.0083 17/126 [===>..........................] - ETA: 0s - loss: 1.2432e-04 - mean\_absolute\_error: 0.0087 25/126 [====>.........................] - ETA: 0s - loss: 1.3567e-04 - mean\_absolute\_error: 0.0090 33/126 [======>.......................] - ETA: 0s - loss: 1.3357e-04 - mean\_absolute\_error: 0.0089 41/126 [========>.....................] - ETA: 0s - loss: 1.3543e-04 - mean\_absolute\_error: 0.0089 49/126 [==========>...................] - ETA: 0s - loss: 1.3460e-04 - mean\_absolute\_error: 0.0089 57/126 [============>.................] - ETA: 0s - loss: 1.2951e-04 - mean\_absolute\_error: 0.0088 65/126 [==============>...............] - ETA: 0s - loss: 1.3109e-04 - mean\_absolute\_error: 0.0089 73/126 [================>.............] - ETA: 0s - loss: 1.3704e-04 - mean\_absolute\_error: 0.0090 81/126 [==================>...........] - ETA: 0s - loss: 1.3810e-04 - mean\_absolute\_error: 0.0091 89/126 [====================>.........] - ETA: 0s - loss: 1.4198e-04 - mean\_absolute\_error: 0.0092 97/126 [======================>.......] - ETA: 0s - loss: 1.4942e-04 - mean\_absolute\_error: 0.0093105/126 [========================>.....] - ETA: 0s - loss: 1.4831e-04 - mean\_absolute\_error: 0.0093113/126 [=========================>....] - ETA: 0s - loss: 1.5146e-04 - mean\_absolute\_error: 0.0093121/126 [===========================>..] - ETA: 0s - loss: 1.4958e-04 - mean\_absolute\_error: 0.0092126/126 [==============================] - 1s 7ms/step - loss: 1.4747e-04 - mean\_absolute\_error: 0.0092 - val\_loss: 7.2296e-05 - val\_mean\_absolute\_error: 0.0070  
Epoch 60/100  
 1/126 [..............................] - ETA: 0s - loss: 1.5329e-04 - mean\_absolute\_error: 0.0100 11/126 [=>............................] - ETA: 0s - loss: 1.3091e-04 - mean\_absolute\_error: 0.0090 21/126 [====>.........................] - ETA: 0s - loss: 1.4419e-04 - mean\_absolute\_error: 0.0094 31/126 [======>.......................] - ETA: 0s - loss: 1.3743e-04 - mean\_absolute\_error: 0.0091 41/126 [========>.....................] - ETA: 0s - loss: 1.3989e-04 - mean\_absolute\_error: 0.0092 52/126 [===========>..................] - ETA: 0s - loss: 1.3541e-04 - mean\_absolute\_error: 0.0090 62/126 [=============>................] - ETA: 0s - loss: 1.3255e-04 - mean\_absolute\_error: 0.0088 72/126 [================>.............] - ETA: 0s - loss: 1.3694e-04 - mean\_absolute\_error: 0.0088 82/126 [==================>...........] - ETA: 0s - loss: 1.3954e-04 - mean\_absolute\_error: 0.0089 92/126 [====================>.........] - ETA: 0s - loss: 1.3962e-04 - mean\_absolute\_error: 0.0090102/126 [=======================>......] - ETA: 0s - loss: 1.3714e-04 - mean\_absolute\_error: 0.0089116/126 [==========================>...] - ETA: 0s - loss: 1.4149e-04 - mean\_absolute\_error: 0.0089126/126 [==============================] - 1s 5ms/step - loss: 1.4333e-04 - mean\_absolute\_error: 0.0090 - val\_loss: 4.3693e-05 - val\_mean\_absolute\_error: 0.0050  
Epoch 61/100  
 1/126 [..............................] - ETA: 0s - loss: 7.8148e-05 - mean\_absolute\_error: 0.0068 17/126 [===>..........................] - ETA: 0s - loss: 1.5423e-04 - mean\_absolute\_error: 0.0088 33/126 [======>.......................] - ETA: 0s - loss: 1.5083e-04 - mean\_absolute\_error: 0.0091 49/126 [==========>...................] - ETA: 0s - loss: 1.3921e-04 - mean\_absolute\_error: 0.0088 65/126 [==============>...............] - ETA: 0s - loss: 1.4322e-04 - mean\_absolute\_error: 0.0089 82/126 [==================>...........] - ETA: 0s - loss: 1.4298e-04 - mean\_absolute\_error: 0.0090 99/126 [======================>.......] - ETA: 0s - loss: 1.4208e-04 - mean\_absolute\_error: 0.0090115/126 [==========================>...] - ETA: 0s - loss: 1.4338e-04 - mean\_absolute\_error: 0.0090126/126 [==============================] - 0s 4ms/step - loss: 1.4218e-04 - mean\_absolute\_error: 0.0089 - val\_loss: 5.8779e-05 - val\_mean\_absolute\_error: 0.0062  
Epoch 62/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0609e-04 - mean\_absolute\_error: 0.0080 17/126 [===>..........................] - ETA: 0s - loss: 1.8337e-04 - mean\_absolute\_error: 0.0107 33/126 [======>.......................] - ETA: 0s - loss: 1.5829e-04 - mean\_absolute\_error: 0.0098 49/126 [==========>...................] - ETA: 0s - loss: 1.4686e-04 - mean\_absolute\_error: 0.0094 65/126 [==============>...............] - ETA: 0s - loss: 1.3966e-04 - mean\_absolute\_error: 0.0092 81/126 [==================>...........] - ETA: 0s - loss: 1.3998e-04 - mean\_absolute\_error: 0.0091 97/126 [======================>.......] - ETA: 0s - loss: 1.4593e-04 - mean\_absolute\_error: 0.0093113/126 [=========================>....] - ETA: 0s - loss: 1.4655e-04 - mean\_absolute\_error: 0.0092126/126 [==============================] - 0s 4ms/step - loss: 1.5116e-04 - mean\_absolute\_error: 0.0094 - val\_loss: 1.4453e-04 - val\_mean\_absolute\_error: 0.0104  
Epoch 63/100  
 1/126 [..............................] - ETA: 0s - loss: 1.4646e-04 - mean\_absolute\_error: 0.0104 17/126 [===>..........................] - ETA: 0s - loss: 1.2621e-04 - mean\_absolute\_error: 0.0085 33/126 [======>.......................] - ETA: 0s - loss: 1.5229e-04 - mean\_absolute\_error: 0.0090 49/126 [==========>...................] - ETA: 0s - loss: 1.5162e-04 - mean\_absolute\_error: 0.0092 66/126 [==============>...............] - ETA: 0s - loss: 1.4983e-04 - mean\_absolute\_error: 0.0092 82/126 [==================>...........] - ETA: 0s - loss: 1.5817e-04 - mean\_absolute\_error: 0.0094 98/126 [======================>.......] - ETA: 0s - loss: 1.5398e-04 - mean\_absolute\_error: 0.0093114/126 [==========================>...] - ETA: 0s - loss: 1.4841e-04 - mean\_absolute\_error: 0.0091126/126 [==============================] - 0s 4ms/step - loss: 1.4543e-04 - mean\_absolute\_error: 0.0090 - val\_loss: 1.0550e-04 - val\_mean\_absolute\_error: 0.0087  
Epoch 64/100  
 1/126 [..............................] - ETA: 0s - loss: 2.0021e-04 - mean\_absolute\_error: 0.0114 17/126 [===>..........................] - ETA: 0s - loss: 1.5464e-04 - mean\_absolute\_error: 0.0094 33/126 [======>.......................] - ETA: 0s - loss: 1.4624e-04 - mean\_absolute\_error: 0.0093 49/126 [==========>...................] - ETA: 0s - loss: 1.6455e-04 - mean\_absolute\_error: 0.0100 64/126 [==============>...............] - ETA: 0s - loss: 1.6204e-04 - mean\_absolute\_error: 0.0097 80/126 [==================>...........] - ETA: 0s - loss: 1.5352e-04 - mean\_absolute\_error: 0.0094 96/126 [=====================>........] - ETA: 0s - loss: 1.4808e-04 - mean\_absolute\_error: 0.0092112/126 [=========================>....] - ETA: 0s - loss: 1.4843e-04 - mean\_absolute\_error: 0.0092126/126 [==============================] - 0s 4ms/step - loss: 1.4309e-04 - mean\_absolute\_error: 0.0090 - val\_loss: 4.4627e-05 - val\_mean\_absolute\_error: 0.0052  
Epoch 65/100  
 1/126 [..............................] - ETA: 0s - loss: 9.8304e-05 - mean\_absolute\_error: 0.0081 18/126 [===>..........................] - ETA: 0s - loss: 1.4047e-04 - mean\_absolute\_error: 0.0091 34/126 [=======>......................] - ETA: 0s - loss: 1.3408e-04 - mean\_absolute\_error: 0.0090 50/126 [==========>...................] - ETA: 0s - loss: 1.5529e-04 - mean\_absolute\_error: 0.0095 66/126 [==============>...............] - ETA: 0s - loss: 1.5555e-04 - mean\_absolute\_error: 0.0095 82/126 [==================>...........] - ETA: 0s - loss: 1.6458e-04 - mean\_absolute\_error: 0.0097 97/126 [======================>.......] - ETA: 0s - loss: 1.6634e-04 - mean\_absolute\_error: 0.0098112/126 [=========================>....] - ETA: 0s - loss: 1.6192e-04 - mean\_absolute\_error: 0.0097126/126 [==============================] - 0s 4ms/step - loss: 1.6090e-04 - mean\_absolute\_error: 0.0097 - val\_loss: 5.6524e-05 - val\_mean\_absolute\_error: 0.0060  
Epoch 66/100  
 1/126 [..............................] - ETA: 0s - loss: 1.4150e-04 - mean\_absolute\_error: 0.0090 17/126 [===>..........................] - ETA: 0s - loss: 1.2836e-04 - mean\_absolute\_error: 0.0088 33/126 [======>.......................] - ETA: 0s - loss: 1.3911e-04 - mean\_absolute\_error: 0.0092 49/126 [==========>...................] - ETA: 0s - loss: 2.0987e-04 - mean\_absolute\_error: 0.0110 66/126 [==============>...............] - ETA: 0s - loss: 2.2057e-04 - mean\_absolute\_error: 0.0115 82/126 [==================>...........] - ETA: 0s - loss: 2.1540e-04 - mean\_absolute\_error: 0.0114 98/126 [======================>.......] - ETA: 0s - loss: 2.0184e-04 - mean\_absolute\_error: 0.0108113/126 [=========================>....] - ETA: 0s - loss: 1.9363e-04 - mean\_absolute\_error: 0.0106126/126 [==============================] - 0s 4ms/step - loss: 1.8842e-04 - mean\_absolute\_error: 0.0105 - val\_loss: 4.3011e-05 - val\_mean\_absolute\_error: 0.0049  
Epoch 67/100  
 1/126 [..............................] - ETA: 0s - loss: 9.1031e-05 - mean\_absolute\_error: 0.0074 15/126 [==>...........................] - ETA: 0s - loss: 1.1045e-04 - mean\_absolute\_error: 0.0079 30/126 [======>.......................] - ETA: 0s - loss: 1.2292e-04 - mean\_absolute\_error: 0.0084 46/126 [=========>....................] - ETA: 0s - loss: 1.5502e-04 - mean\_absolute\_error: 0.0093 62/126 [=============>................] - ETA: 0s - loss: 1.4818e-04 - mean\_absolute\_error: 0.0091 78/126 [=================>............] - ETA: 0s - loss: 1.4409e-04 - mean\_absolute\_error: 0.0090 94/126 [=====================>........] - ETA: 0s - loss: 1.4050e-04 - mean\_absolute\_error: 0.0090110/126 [=========================>....] - ETA: 0s - loss: 1.3928e-04 - mean\_absolute\_error: 0.0089126/126 [==============================] - ETA: 0s - loss: 1.3557e-04 - mean\_absolute\_error: 0.0088126/126 [==============================] - 0s 4ms/step - loss: 1.3557e-04 - mean\_absolute\_error: 0.0088 - val\_loss: 6.0195e-05 - val\_mean\_absolute\_error: 0.0063  
Epoch 68/100  
 1/126 [..............................] - ETA: 0s - loss: 9.7612e-05 - mean\_absolute\_error: 0.0084 18/126 [===>..........................] - ETA: 0s - loss: 1.1803e-04 - mean\_absolute\_error: 0.0086 34/126 [=======>......................] - ETA: 0s - loss: 1.3848e-04 - mean\_absolute\_error: 0.0089 50/126 [==========>...................] - ETA: 0s - loss: 1.2987e-04 - mean\_absolute\_error: 0.0086 66/126 [==============>...............] - ETA: 0s - loss: 1.3925e-04 - mean\_absolute\_error: 0.0090 82/126 [==================>...........] - ETA: 0s - loss: 1.3403e-04 - mean\_absolute\_error: 0.0089 98/126 [======================>.......] - ETA: 0s - loss: 1.3379e-04 - mean\_absolute\_error: 0.0088113/126 [=========================>....] - ETA: 0s - loss: 1.3961e-04 - mean\_absolute\_error: 0.0089125/126 [============================>.] - ETA: 0s - loss: 1.4164e-04 - mean\_absolute\_error: 0.0090126/126 [==============================] - 0s 4ms/step - loss: 1.4195e-04 - mean\_absolute\_error: 0.0090 - val\_loss: 4.2935e-05 - val\_mean\_absolute\_error: 0.0049  
Epoch 69/100  
 1/126 [..............................] - ETA: 0s - loss: 1.2054e-04 - mean\_absolute\_error: 0.0082 13/126 [==>...........................] - ETA: 0s - loss: 1.1568e-04 - mean\_absolute\_error: 0.0082 25/126 [====>.........................] - ETA: 0s - loss: 1.4022e-04 - mean\_absolute\_error: 0.0084 37/126 [=======>......................] - ETA: 0s - loss: 1.4176e-04 - mean\_absolute\_error: 0.0085 53/126 [===========>..................] - ETA: 0s - loss: 1.4719e-04 - mean\_absolute\_error: 0.0089 69/126 [===============>..............] - ETA: 0s - loss: 1.7297e-04 - mean\_absolute\_error: 0.0098 85/126 [===================>..........] - ETA: 0s - loss: 1.8580e-04 - mean\_absolute\_error: 0.0103101/126 [=======================>......] - ETA: 0s - loss: 1.8249e-04 - mean\_absolute\_error: 0.0103117/126 [==========================>...] - ETA: 0s - loss: 1.8256e-04 - mean\_absolute\_error: 0.0103126/126 [==============================] - 1s 4ms/step - loss: 1.7917e-04 - mean\_absolute\_error: 0.0102 - val\_loss: 4.7908e-05 - val\_mean\_absolute\_error: 0.0055  
Epoch 70/100  
 1/126 [..............................] - ETA: 0s - loss: 7.4009e-05 - mean\_absolute\_error: 0.0071 11/126 [=>............................] - ETA: 0s - loss: 1.2750e-04 - mean\_absolute\_error: 0.0085 21/126 [====>.........................] - ETA: 0s - loss: 1.3164e-04 - mean\_absolute\_error: 0.0087 31/126 [======>.......................] - ETA: 0s - loss: 1.2940e-04 - mean\_absolute\_error: 0.0086 41/126 [========>.....................] - ETA: 0s - loss: 1.3201e-04 - mean\_absolute\_error: 0.0085 51/126 [===========>..................] - ETA: 0s - loss: 1.3074e-04 - mean\_absolute\_error: 0.0085 62/126 [=============>................] - ETA: 0s - loss: 1.2840e-04 - mean\_absolute\_error: 0.0085 78/126 [=================>............] - ETA: 0s - loss: 1.2590e-04 - mean\_absolute\_error: 0.0085 94/126 [=====================>........] - ETA: 0s - loss: 1.2926e-04 - mean\_absolute\_error: 0.0086110/126 [=========================>....] - ETA: 0s - loss: 1.2551e-04 - mean\_absolute\_error: 0.0085126/126 [==============================] - ETA: 0s - loss: 1.2626e-04 - mean\_absolute\_error: 0.0084126/126 [==============================] - 1s 4ms/step - loss: 1.2626e-04 - mean\_absolute\_error: 0.0084 - val\_loss: 5.8445e-05 - val\_mean\_absolute\_error: 0.0062  
Epoch 71/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0623e-04 - mean\_absolute\_error: 0.0085 17/126 [===>..........................] - ETA: 0s - loss: 1.0858e-04 - mean\_absolute\_error: 0.0080 33/126 [======>.......................] - ETA: 0s - loss: 1.1619e-04 - mean\_absolute\_error: 0.0079 49/126 [==========>...................] - ETA: 0s - loss: 1.1404e-04 - mean\_absolute\_error: 0.0080 65/126 [==============>...............] - ETA: 0s - loss: 1.2318e-04 - mean\_absolute\_error: 0.0083 81/126 [==================>...........] - ETA: 0s - loss: 1.2603e-04 - mean\_absolute\_error: 0.0085 97/126 [======================>.......] - ETA: 0s - loss: 1.2579e-04 - mean\_absolute\_error: 0.0085113/126 [=========================>....] - ETA: 0s - loss: 1.4510e-04 - mean\_absolute\_error: 0.0090126/126 [==============================] - 0s 4ms/step - loss: 1.5248e-04 - mean\_absolute\_error: 0.0093 - val\_loss: 1.3706e-04 - val\_mean\_absolute\_error: 0.0101  
Epoch 72/100  
 1/126 [..............................] - ETA: 0s - loss: 3.1094e-04 - mean\_absolute\_error: 0.0152 17/126 [===>..........................] - ETA: 0s - loss: 1.8796e-04 - mean\_absolute\_error: 0.0107 32/126 [======>.......................] - ETA: 0s - loss: 1.5321e-04 - mean\_absolute\_error: 0.0095 48/126 [==========>...................] - ETA: 0s - loss: 1.5703e-04 - mean\_absolute\_error: 0.0093 64/126 [==============>...............] - ETA: 0s - loss: 1.4349e-04 - mean\_absolute\_error: 0.0089 80/126 [==================>...........] - ETA: 0s - loss: 1.4567e-04 - mean\_absolute\_error: 0.0091 96/126 [=====================>........] - ETA: 0s - loss: 1.4950e-04 - mean\_absolute\_error: 0.0091112/126 [=========================>....] - ETA: 0s - loss: 1.4481e-04 - mean\_absolute\_error: 0.0090126/126 [==============================] - 0s 4ms/step - loss: 1.4403e-04 - mean\_absolute\_error: 0.0090 - val\_loss: 4.5940e-05 - val\_mean\_absolute\_error: 0.0053  
Epoch 73/100  
 1/126 [..............................] - ETA: 0s - loss: 1.3551e-04 - mean\_absolute\_error: 0.0088 17/126 [===>..........................] - ETA: 0s - loss: 1.5000e-04 - mean\_absolute\_error: 0.0087 33/126 [======>.......................] - ETA: 0s - loss: 1.4296e-04 - mean\_absolute\_error: 0.0087 49/126 [==========>...................] - ETA: 0s - loss: 1.4449e-04 - mean\_absolute\_error: 0.0089 65/126 [==============>...............] - ETA: 0s - loss: 1.3649e-04 - mean\_absolute\_error: 0.0087 81/126 [==================>...........] - ETA: 0s - loss: 1.3815e-04 - mean\_absolute\_error: 0.0087 97/126 [======================>.......] - ETA: 0s - loss: 1.5147e-04 - mean\_absolute\_error: 0.0092113/126 [=========================>....] - ETA: 0s - loss: 1.5027e-04 - mean\_absolute\_error: 0.0092126/126 [==============================] - 0s 4ms/step - loss: 1.4658e-04 - mean\_absolute\_error: 0.0091 - val\_loss: 7.1277e-05 - val\_mean\_absolute\_error: 0.0069  
Epoch 74/100  
 1/126 [..............................] - ETA: 0s - loss: 1.5148e-04 - mean\_absolute\_error: 0.0102 17/126 [===>..........................] - ETA: 0s - loss: 1.5113e-04 - mean\_absolute\_error: 0.0097 32/126 [======>.......................] - ETA: 0s - loss: 1.5250e-04 - mean\_absolute\_error: 0.0092 48/126 [==========>...................] - ETA: 0s - loss: 1.4102e-04 - mean\_absolute\_error: 0.0089 65/126 [==============>...............] - ETA: 0s - loss: 1.3508e-04 - mean\_absolute\_error: 0.0088 81/126 [==================>...........] - ETA: 0s - loss: 1.3291e-04 - mean\_absolute\_error: 0.0087 97/126 [======================>.......] - ETA: 0s - loss: 1.2794e-04 - mean\_absolute\_error: 0.0085113/126 [=========================>....] - ETA: 0s - loss: 1.3992e-04 - mean\_absolute\_error: 0.0089126/126 [==============================] - 0s 4ms/step - loss: 1.5061e-04 - mean\_absolute\_error: 0.0092 - val\_loss: 4.2808e-05 - val\_mean\_absolute\_error: 0.0050  
Epoch 75/100  
 1/126 [..............................] - ETA: 0s - loss: 7.7629e-05 - mean\_absolute\_error: 0.0071 18/126 [===>..........................] - ETA: 0s - loss: 1.0527e-04 - mean\_absolute\_error: 0.0080 34/126 [=======>......................] - ETA: 0s - loss: 9.9938e-05 - mean\_absolute\_error: 0.0078 50/126 [==========>...................] - ETA: 0s - loss: 1.1449e-04 - mean\_absolute\_error: 0.0083 66/126 [==============>...............] - ETA: 0s - loss: 1.1646e-04 - mean\_absolute\_error: 0.0083 82/126 [==================>...........] - ETA: 0s - loss: 1.3561e-04 - mean\_absolute\_error: 0.0088 99/126 [======================>.......] - ETA: 0s - loss: 1.3903e-04 - mean\_absolute\_error: 0.0090114/126 [==========================>...] - ETA: 0s - loss: 1.4901e-04 - mean\_absolute\_error: 0.0092126/126 [==============================] - 0s 4ms/step - loss: 1.4689e-04 - mean\_absolute\_error: 0.0091 - val\_loss: 6.2451e-05 - val\_mean\_absolute\_error: 0.0064  
Epoch 76/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1635e-04 - mean\_absolute\_error: 0.0087 17/126 [===>..........................] - ETA: 0s - loss: 1.1614e-04 - mean\_absolute\_error: 0.0083 33/126 [======>.......................] - ETA: 0s - loss: 1.3298e-04 - mean\_absolute\_error: 0.0085 49/126 [==========>...................] - ETA: 0s - loss: 1.4236e-04 - mean\_absolute\_error: 0.0089 65/126 [==============>...............] - ETA: 0s - loss: 1.3285e-04 - mean\_absolute\_error: 0.0087 82/126 [==================>...........] - ETA: 0s - loss: 1.4547e-04 - mean\_absolute\_error: 0.0092 98/126 [======================>.......] - ETA: 0s - loss: 1.4225e-04 - mean\_absolute\_error: 0.0091114/126 [==========================>...] - ETA: 0s - loss: 1.3697e-04 - mean\_absolute\_error: 0.0089126/126 [==============================] - 0s 4ms/step - loss: 1.4181e-04 - mean\_absolute\_error: 0.0090 - val\_loss: 1.5371e-04 - val\_mean\_absolute\_error: 0.0109  
Epoch 77/100  
 1/126 [..............................] - ETA: 0s - loss: 1.5366e-04 - mean\_absolute\_error: 0.0107 17/126 [===>..........................] - ETA: 0s - loss: 1.4712e-04 - mean\_absolute\_error: 0.0089 32/126 [======>.......................] - ETA: 0s - loss: 1.3600e-04 - mean\_absolute\_error: 0.0088 47/126 [==========>...................] - ETA: 0s - loss: 1.3064e-04 - mean\_absolute\_error: 0.0086 63/126 [==============>...............] - ETA: 0s - loss: 1.3358e-04 - mean\_absolute\_error: 0.0087 79/126 [=================>............] - ETA: 0s - loss: 1.3180e-04 - mean\_absolute\_error: 0.0087 96/126 [=====================>........] - ETA: 0s - loss: 1.3411e-04 - mean\_absolute\_error: 0.0086112/126 [=========================>....] - ETA: 0s - loss: 1.3509e-04 - mean\_absolute\_error: 0.0087126/126 [==============================] - 0s 4ms/step - loss: 1.3748e-04 - mean\_absolute\_error: 0.0088 - val\_loss: 6.2202e-05 - val\_mean\_absolute\_error: 0.0064  
Epoch 78/100  
 1/126 [..............................] - ETA: 0s - loss: 5.4876e-05 - mean\_absolute\_error: 0.0063 17/126 [===>..........................] - ETA: 0s - loss: 2.5629e-04 - mean\_absolute\_error: 0.0131 34/126 [=======>......................] - ETA: 0s - loss: 2.2761e-04 - mean\_absolute\_error: 0.0122 51/126 [===========>..................] - ETA: 0s - loss: 1.9844e-04 - mean\_absolute\_error: 0.0112 68/126 [===============>..............] - ETA: 0s - loss: 1.8805e-04 - mean\_absolute\_error: 0.0108 85/126 [===================>..........] - ETA: 0s - loss: 1.7091e-04 - mean\_absolute\_error: 0.0102101/126 [=======================>......] - ETA: 0s - loss: 1.6897e-04 - mean\_absolute\_error: 0.0100117/126 [==========================>...] - ETA: 0s - loss: 1.6240e-04 - mean\_absolute\_error: 0.0097126/126 [==============================] - 0s 4ms/step - loss: 1.5940e-04 - mean\_absolute\_error: 0.0096 - val\_loss: 7.2779e-05 - val\_mean\_absolute\_error: 0.0070  
Epoch 79/100  
 1/126 [..............................] - ETA: 0s - loss: 1.3592e-04 - mean\_absolute\_error: 0.0095 17/126 [===>..........................] - ETA: 0s - loss: 1.4536e-04 - mean\_absolute\_error: 0.0093 33/126 [======>.......................] - ETA: 0s - loss: 1.3100e-04 - mean\_absolute\_error: 0.0088 49/126 [==========>...................] - ETA: 0s - loss: 1.3165e-04 - mean\_absolute\_error: 0.0088 65/126 [==============>...............] - ETA: 0s - loss: 1.2308e-04 - mean\_absolute\_error: 0.0085 81/126 [==================>...........] - ETA: 0s - loss: 1.2687e-04 - mean\_absolute\_error: 0.0086 97/126 [======================>.......] - ETA: 0s - loss: 1.3049e-04 - mean\_absolute\_error: 0.0086111/126 [=========================>....] - ETA: 0s - loss: 1.3740e-04 - mean\_absolute\_error: 0.0088126/126 [==============================] - ETA: 0s - loss: 1.4166e-04 - mean\_absolute\_error: 0.0089126/126 [==============================] - 0s 4ms/step - loss: 1.4166e-04 - mean\_absolute\_error: 0.0089 - val\_loss: 5.5937e-05 - val\_mean\_absolute\_error: 0.0061  
Epoch 80/100  
 1/126 [..............................] - ETA: 0s - loss: 1.2177e-04 - mean\_absolute\_error: 0.0093 17/126 [===>..........................] - ETA: 0s - loss: 1.4909e-04 - mean\_absolute\_error: 0.0085 33/126 [======>.......................] - ETA: 0s - loss: 1.4311e-04 - mean\_absolute\_error: 0.0084 49/126 [==========>...................] - ETA: 0s - loss: 1.3091e-04 - mean\_absolute\_error: 0.0082 65/126 [==============>...............] - ETA: 0s - loss: 1.2946e-04 - mean\_absolute\_error: 0.0084 81/126 [==================>...........] - ETA: 0s - loss: 1.3111e-04 - mean\_absolute\_error: 0.0085 97/126 [======================>.......] - ETA: 0s - loss: 1.2730e-04 - mean\_absolute\_error: 0.0085113/126 [=========================>....] - ETA: 0s - loss: 1.2660e-04 - mean\_absolute\_error: 0.0085126/126 [==============================] - 0s 4ms/step - loss: 1.2598e-04 - mean\_absolute\_error: 0.0084 - val\_loss: 1.3402e-04 - val\_mean\_absolute\_error: 0.0100  
Epoch 81/100  
 1/126 [..............................] - ETA: 0s - loss: 3.3862e-04 - mean\_absolute\_error: 0.0151 17/126 [===>..........................] - ETA: 0s - loss: 2.3959e-04 - mean\_absolute\_error: 0.0123 33/126 [======>.......................] - ETA: 0s - loss: 2.0177e-04 - mean\_absolute\_error: 0.0111 48/126 [==========>...................] - ETA: 0s - loss: 1.8666e-04 - mean\_absolute\_error: 0.0104 64/126 [==============>...............] - ETA: 0s - loss: 1.6537e-04 - mean\_absolute\_error: 0.0097 80/126 [==================>...........] - ETA: 0s - loss: 1.6201e-04 - mean\_absolute\_error: 0.0096 96/126 [=====================>........] - ETA: 0s - loss: 1.5411e-04 - mean\_absolute\_error: 0.0093109/126 [========================>.....] - ETA: 0s - loss: 1.5004e-04 - mean\_absolute\_error: 0.0092119/126 [===========================>..] - ETA: 0s - loss: 1.5104e-04 - mean\_absolute\_error: 0.0093126/126 [==============================] - 1s 4ms/step - loss: 1.5670e-04 - mean\_absolute\_error: 0.0095 - val\_loss: 1.7572e-04 - val\_mean\_absolute\_error: 0.0117  
Epoch 82/100  
 1/126 [..............................] - ETA: 0s - loss: 2.7571e-04 - mean\_absolute\_error: 0.0139 11/126 [=>............................] - ETA: 0s - loss: 3.2596e-04 - mean\_absolute\_error: 0.0134 21/126 [====>.........................] - ETA: 0s - loss: 2.5802e-04 - mean\_absolute\_error: 0.0122 31/126 [======>.......................] - ETA: 0s - loss: 2.1886e-04 - mean\_absolute\_error: 0.0113 41/126 [========>.....................] - ETA: 0s - loss: 1.9856e-04 - mean\_absolute\_error: 0.0107 51/126 [===========>..................] - ETA: 0s - loss: 1.8793e-04 - mean\_absolute\_error: 0.0105 61/126 [=============>................] - ETA: 0s - loss: 1.8973e-04 - mean\_absolute\_error: 0.0106 71/126 [===============>..............] - ETA: 0s - loss: 1.8192e-04 - mean\_absolute\_error: 0.0104 81/126 [==================>...........] - ETA: 0s - loss: 1.7228e-04 - mean\_absolute\_error: 0.0101 91/126 [====================>.........] - ETA: 0s - loss: 1.6652e-04 - mean\_absolute\_error: 0.0099101/126 [=======================>......] - ETA: 0s - loss: 1.6028e-04 - mean\_absolute\_error: 0.0097111/126 [=========================>....] - ETA: 0s - loss: 1.5672e-04 - mean\_absolute\_error: 0.0095121/126 [===========================>..] - ETA: 0s - loss: 1.6180e-04 - mean\_absolute\_error: 0.0096126/126 [==============================] - 1s 6ms/step - loss: 1.6378e-04 - mean\_absolute\_error: 0.0097 - val\_loss: 4.1908e-05 - val\_mean\_absolute\_error: 0.0049  
Epoch 83/100  
 1/126 [..............................] - ETA: 0s - loss: 5.7066e-05 - mean\_absolute\_error: 0.0054 11/126 [=>............................] - ETA: 0s - loss: 1.3829e-04 - mean\_absolute\_error: 0.0090 21/126 [====>.........................] - ETA: 0s - loss: 1.2270e-04 - mean\_absolute\_error: 0.0083 31/126 [======>.......................] - ETA: 0s - loss: 1.1602e-04 - mean\_absolute\_error: 0.0081 40/126 [========>.....................] - ETA: 0s - loss: 1.1234e-04 - mean\_absolute\_error: 0.0081 50/126 [==========>...................] - ETA: 0s - loss: 1.1298e-04 - mean\_absolute\_error: 0.0081 60/126 [=============>................] - ETA: 0s - loss: 1.1817e-04 - mean\_absolute\_error: 0.0082 70/126 [===============>..............] - ETA: 0s - loss: 1.1924e-04 - mean\_absolute\_error: 0.0082 80/126 [==================>...........] - ETA: 0s - loss: 1.1791e-04 - mean\_absolute\_error: 0.0082 90/126 [====================>.........] - ETA: 0s - loss: 1.3063e-04 - mean\_absolute\_error: 0.0084100/126 [======================>.......] - ETA: 0s - loss: 1.4193e-04 - mean\_absolute\_error: 0.0088110/126 [=========================>....] - ETA: 0s - loss: 1.4355e-04 - mean\_absolute\_error: 0.0089119/126 [===========================>..] - ETA: 0s - loss: 1.4620e-04 - mean\_absolute\_error: 0.0090126/126 [==============================] - 1s 6ms/step - loss: 1.4729e-04 - mean\_absolute\_error: 0.0091 - val\_loss: 4.1982e-05 - val\_mean\_absolute\_error: 0.0049  
Epoch 84/100  
 1/126 [..............................] - ETA: 1s - loss: 1.5504e-04 - mean\_absolute\_error: 0.0078 9/126 [=>............................] - ETA: 0s - loss: 1.6843e-04 - mean\_absolute\_error: 0.0102 17/126 [===>..........................] - ETA: 0s - loss: 1.4434e-04 - mean\_absolute\_error: 0.0094 25/126 [====>.........................] - ETA: 0s - loss: 1.3218e-04 - mean\_absolute\_error: 0.0090 34/126 [=======>......................] - ETA: 0s - loss: 1.4092e-04 - mean\_absolute\_error: 0.0092 43/126 [=========>....................] - ETA: 0s - loss: 1.3858e-04 - mean\_absolute\_error: 0.0091 53/126 [===========>..................] - ETA: 0s - loss: 1.4826e-04 - mean\_absolute\_error: 0.0095 68/126 [===============>..............] - ETA: 0s - loss: 1.6904e-04 - mean\_absolute\_error: 0.0102 83/126 [==================>...........] - ETA: 0s - loss: 1.6497e-04 - mean\_absolute\_error: 0.0101 98/126 [======================>.......] - ETA: 0s - loss: 1.6120e-04 - mean\_absolute\_error: 0.0098111/126 [=========================>....] - ETA: 0s - loss: 1.5845e-04 - mean\_absolute\_error: 0.0097125/126 [============================>.] - ETA: 0s - loss: 1.7350e-04 - mean\_absolute\_error: 0.0101126/126 [==============================] - 1s 5ms/step - loss: 1.7418e-04 - mean\_absolute\_error: 0.0101 - val\_loss: 5.9448e-05 - val\_mean\_absolute\_error: 0.0063  
Epoch 85/100  
 1/126 [..............................] - ETA: 0s - loss: 7.5755e-05 - mean\_absolute\_error: 0.0069 16/126 [==>...........................] - ETA: 0s - loss: 2.4354e-04 - mean\_absolute\_error: 0.0127 31/126 [======>.......................] - ETA: 0s - loss: 2.0538e-04 - mean\_absolute\_error: 0.0113 46/126 [=========>....................] - ETA: 0s - loss: 1.7130e-04 - mean\_absolute\_error: 0.0101 57/126 [============>.................] - ETA: 0s - loss: 1.5653e-04 - mean\_absolute\_error: 0.0096 69/126 [===============>..............] - ETA: 0s - loss: 1.5555e-04 - mean\_absolute\_error: 0.0095 81/126 [==================>...........] - ETA: 0s - loss: 1.5339e-04 - mean\_absolute\_error: 0.0094 94/126 [=====================>........] - ETA: 0s - loss: 1.5301e-04 - mean\_absolute\_error: 0.0092106/126 [========================>.....] - ETA: 0s - loss: 1.4996e-04 - mean\_absolute\_error: 0.0092118/126 [===========================>..] - ETA: 0s - loss: 1.5059e-04 - mean\_absolute\_error: 0.0092126/126 [==============================] - 1s 5ms/step - loss: 1.4991e-04 - mean\_absolute\_error: 0.0092 - val\_loss: 4.4374e-05 - val\_mean\_absolute\_error: 0.0052  
Epoch 86/100  
 1/126 [..............................] - ETA: 0s - loss: 1.2979e-04 - mean\_absolute\_error: 0.0100 12/126 [=>............................] - ETA: 0s - loss: 1.1509e-04 - mean\_absolute\_error: 0.0084 24/126 [====>.........................] - ETA: 0s - loss: 1.2230e-04 - mean\_absolute\_error: 0.0084 36/126 [=======>......................] - ETA: 0s - loss: 1.2327e-04 - mean\_absolute\_error: 0.0085 48/126 [==========>...................] - ETA: 0s - loss: 1.1786e-04 - mean\_absolute\_error: 0.0083 58/126 [============>.................] - ETA: 0s - loss: 1.1562e-04 - mean\_absolute\_error: 0.0081 69/126 [===============>..............] - ETA: 0s - loss: 1.1872e-04 - mean\_absolute\_error: 0.0082 79/126 [=================>............] - ETA: 0s - loss: 1.1983e-04 - mean\_absolute\_error: 0.0083 90/126 [====================>.........] - ETA: 0s - loss: 1.1740e-04 - mean\_absolute\_error: 0.0082102/126 [=======================>......] - ETA: 0s - loss: 1.1667e-04 - mean\_absolute\_error: 0.0082115/126 [==========================>...] - ETA: 0s - loss: 1.2605e-04 - mean\_absolute\_error: 0.0084126/126 [==============================] - 1s 5ms/step - loss: 1.2688e-04 - mean\_absolute\_error: 0.0084 - val\_loss: 4.5059e-05 - val\_mean\_absolute\_error: 0.0052  
Epoch 87/100  
 1/126 [..............................] - ETA: 0s - loss: 9.0177e-05 - mean\_absolute\_error: 0.0076 15/126 [==>...........................] - ETA: 0s - loss: 9.7666e-05 - mean\_absolute\_error: 0.0077 30/126 [======>.......................] - ETA: 0s - loss: 1.5367e-04 - mean\_absolute\_error: 0.0092 45/126 [=========>....................] - ETA: 0s - loss: 1.3134e-04 - mean\_absolute\_error: 0.0085 59/126 [=============>................] - ETA: 0s - loss: 1.3903e-04 - mean\_absolute\_error: 0.0086 73/126 [================>.............] - ETA: 0s - loss: 1.3343e-04 - mean\_absolute\_error: 0.0085 87/126 [===================>..........] - ETA: 0s - loss: 1.3087e-04 - mean\_absolute\_error: 0.0085101/126 [=======================>......] - ETA: 0s - loss: 1.2731e-04 - mean\_absolute\_error: 0.0084115/126 [==========================>...] - ETA: 0s - loss: 1.2673e-04 - mean\_absolute\_error: 0.0084126/126 [==============================] - 1s 4ms/step - loss: 1.2544e-04 - mean\_absolute\_error: 0.0083 - val\_loss: 4.0898e-05 - val\_mean\_absolute\_error: 0.0047  
Epoch 88/100  
 1/126 [..............................] - ETA: 0s - loss: 2.1230e-04 - mean\_absolute\_error: 0.0113 14/126 [==>...........................] - ETA: 0s - loss: 1.4080e-04 - mean\_absolute\_error: 0.0090 29/126 [=====>........................] - ETA: 0s - loss: 1.3537e-04 - mean\_absolute\_error: 0.0089 43/126 [=========>....................] - ETA: 0s - loss: 1.2863e-04 - mean\_absolute\_error: 0.0086 57/126 [============>.................] - ETA: 0s - loss: 1.2621e-04 - mean\_absolute\_error: 0.0086 71/126 [===============>..............] - ETA: 0s - loss: 1.2306e-04 - mean\_absolute\_error: 0.0085 85/126 [===================>..........] - ETA: 0s - loss: 1.2155e-04 - mean\_absolute\_error: 0.0085100/126 [======================>.......] - ETA: 0s - loss: 1.1616e-04 - mean\_absolute\_error: 0.0083114/126 [==========================>...] - ETA: 0s - loss: 1.1827e-04 - mean\_absolute\_error: 0.0083126/126 [==============================] - 1s 4ms/step - loss: 1.2192e-04 - mean\_absolute\_error: 0.0083 - val\_loss: 4.1059e-05 - val\_mean\_absolute\_error: 0.0048  
Epoch 89/100  
 1/126 [..............................] - ETA: 0s - loss: 8.4639e-05 - mean\_absolute\_error: 0.0074 16/126 [==>...........................] - ETA: 0s - loss: 1.2172e-04 - mean\_absolute\_error: 0.0083 30/126 [======>.......................] - ETA: 0s - loss: 1.1102e-04 - mean\_absolute\_error: 0.0080 43/126 [=========>....................] - ETA: 0s - loss: 1.1000e-04 - mean\_absolute\_error: 0.0079 58/126 [============>.................] - ETA: 0s - loss: 1.1361e-04 - mean\_absolute\_error: 0.0081 71/126 [===============>..............] - ETA: 0s - loss: 1.2215e-04 - mean\_absolute\_error: 0.0085 85/126 [===================>..........] - ETA: 0s - loss: 1.2556e-04 - mean\_absolute\_error: 0.0086 99/126 [======================>.......] - ETA: 0s - loss: 1.2441e-04 - mean\_absolute\_error: 0.0086114/126 [==========================>...] - ETA: 0s - loss: 1.2889e-04 - mean\_absolute\_error: 0.0086126/126 [==============================] - 1s 4ms/step - loss: 1.3172e-04 - mean\_absolute\_error: 0.0087 - val\_loss: 8.0980e-05 - val\_mean\_absolute\_error: 0.0075  
Epoch 90/100  
 1/126 [..............................] - ETA: 0s - loss: 1.8835e-04 - mean\_absolute\_error: 0.0120 15/126 [==>...........................] - ETA: 0s - loss: 1.2912e-04 - mean\_absolute\_error: 0.0089 29/126 [=====>........................] - ETA: 0s - loss: 1.2167e-04 - mean\_absolute\_error: 0.0085 44/126 [=========>....................] - ETA: 0s - loss: 1.1728e-04 - mean\_absolute\_error: 0.0083 57/126 [============>.................] - ETA: 0s - loss: 1.2352e-04 - mean\_absolute\_error: 0.0081 71/126 [===============>..............] - ETA: 0s - loss: 1.2487e-04 - mean\_absolute\_error: 0.0083 86/126 [===================>..........] - ETA: 0s - loss: 1.3313e-04 - mean\_absolute\_error: 0.0086100/126 [======================>.......] - ETA: 0s - loss: 1.3470e-04 - mean\_absolute\_error: 0.0088114/126 [==========================>...] - ETA: 0s - loss: 1.3230e-04 - mean\_absolute\_error: 0.0087126/126 [==============================] - 1s 4ms/step - loss: 1.3015e-04 - mean\_absolute\_error: 0.0086 - val\_loss: 4.3909e-05 - val\_mean\_absolute\_error: 0.0051  
Epoch 91/100  
 1/126 [..............................] - ETA: 0s - loss: 1.0168e-04 - mean\_absolute\_error: 0.0078 15/126 [==>...........................] - ETA: 0s - loss: 1.2386e-04 - mean\_absolute\_error: 0.0079 27/126 [=====>........................] - ETA: 0s - loss: 1.1997e-04 - mean\_absolute\_error: 0.0080 38/126 [========>.....................] - ETA: 0s - loss: 1.1341e-04 - mean\_absolute\_error: 0.0078 49/126 [==========>...................] - ETA: 0s - loss: 1.1234e-04 - mean\_absolute\_error: 0.0078 60/126 [=============>................] - ETA: 0s - loss: 1.0970e-04 - mean\_absolute\_error: 0.0077 71/126 [===============>..............] - ETA: 0s - loss: 1.1180e-04 - mean\_absolute\_error: 0.0079 82/126 [==================>...........] - ETA: 0s - loss: 1.1709e-04 - mean\_absolute\_error: 0.0082 94/126 [=====================>........] - ETA: 0s - loss: 1.2279e-04 - mean\_absolute\_error: 0.0084108/126 [========================>.....] - ETA: 0s - loss: 1.2490e-04 - mean\_absolute\_error: 0.0084122/126 [============================>.] - ETA: 0s - loss: 1.2832e-04 - mean\_absolute\_error: 0.0085126/126 [==============================] - 1s 5ms/step - loss: 1.2738e-04 - mean\_absolute\_error: 0.0085 - val\_loss: 5.9703e-05 - val\_mean\_absolute\_error: 0.0063  
Epoch 92/100  
 1/126 [..............................] - ETA: 0s - loss: 1.5555e-04 - mean\_absolute\_error: 0.0102 16/126 [==>...........................] - ETA: 0s - loss: 1.3073e-04 - mean\_absolute\_error: 0.0084 30/126 [======>.......................] - ETA: 0s - loss: 1.2376e-04 - mean\_absolute\_error: 0.0084 44/126 [=========>....................] - ETA: 0s - loss: 1.1737e-04 - mean\_absolute\_error: 0.0081 57/126 [============>.................] - ETA: 0s - loss: 1.1853e-04 - mean\_absolute\_error: 0.0082 70/126 [===============>..............] - ETA: 0s - loss: 1.2335e-04 - mean\_absolute\_error: 0.0084 84/126 [===================>..........] - ETA: 0s - loss: 1.2166e-04 - mean\_absolute\_error: 0.0084 98/126 [======================>.......] - ETA: 0s - loss: 1.2525e-04 - mean\_absolute\_error: 0.0083113/126 [=========================>....] - ETA: 0s - loss: 1.2429e-04 - mean\_absolute\_error: 0.0083126/126 [==============================] - ETA: 0s - loss: 1.2588e-04 - mean\_absolute\_error: 0.0084126/126 [==============================] - 1s 4ms/step - loss: 1.2588e-04 - mean\_absolute\_error: 0.0084 - val\_loss: 6.7759e-05 - val\_mean\_absolute\_error: 0.0068  
Epoch 93/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1071e-04 - mean\_absolute\_error: 0.0090 14/126 [==>...........................] - ETA: 0s - loss: 1.1136e-04 - mean\_absolute\_error: 0.0082 29/126 [=====>........................] - ETA: 0s - loss: 1.1082e-04 - mean\_absolute\_error: 0.0081 45/126 [=========>....................] - ETA: 0s - loss: 1.1334e-04 - mean\_absolute\_error: 0.0082 60/126 [=============>................] - ETA: 0s - loss: 1.1427e-04 - mean\_absolute\_error: 0.0083 75/126 [================>.............] - ETA: 0s - loss: 1.1590e-04 - mean\_absolute\_error: 0.0083 90/126 [====================>.........] - ETA: 0s - loss: 1.1670e-04 - mean\_absolute\_error: 0.0083104/126 [=======================>......] - ETA: 0s - loss: 1.2306e-04 - mean\_absolute\_error: 0.0085119/126 [===========================>..] - ETA: 0s - loss: 1.3032e-04 - mean\_absolute\_error: 0.0086126/126 [==============================] - 1s 4ms/step - loss: 1.2989e-04 - mean\_absolute\_error: 0.0087 - val\_loss: 4.0786e-05 - val\_mean\_absolute\_error: 0.0048  
Epoch 94/100  
 1/126 [..............................] - ETA: 0s - loss: 7.3154e-05 - mean\_absolute\_error: 0.0068 16/126 [==>...........................] - ETA: 0s - loss: 1.6731e-04 - mean\_absolute\_error: 0.0101 31/126 [======>.......................] - ETA: 0s - loss: 1.4218e-04 - mean\_absolute\_error: 0.0093 46/126 [=========>....................] - ETA: 0s - loss: 1.3697e-04 - mean\_absolute\_error: 0.0091 61/126 [=============>................] - ETA: 0s - loss: 1.2956e-04 - mean\_absolute\_error: 0.0087 76/126 [=================>............] - ETA: 0s - loss: 1.3785e-04 - mean\_absolute\_error: 0.0088 91/126 [====================>.........] - ETA: 0s - loss: 1.3835e-04 - mean\_absolute\_error: 0.0088106/126 [========================>.....] - ETA: 0s - loss: 1.3808e-04 - mean\_absolute\_error: 0.0089121/126 [===========================>..] - ETA: 0s - loss: 1.3219e-04 - mean\_absolute\_error: 0.0087126/126 [==============================] - 0s 4ms/step - loss: 1.3218e-04 - mean\_absolute\_error: 0.0087 - val\_loss: 7.6229e-05 - val\_mean\_absolute\_error: 0.0073  
Epoch 95/100  
 1/126 [..............................] - ETA: 0s - loss: 8.6671e-05 - mean\_absolute\_error: 0.0077 16/126 [==>...........................] - ETA: 0s - loss: 1.4664e-04 - mean\_absolute\_error: 0.0094 30/126 [======>.......................] - ETA: 0s - loss: 1.2772e-04 - mean\_absolute\_error: 0.0088 43/126 [=========>....................] - ETA: 0s - loss: 1.2054e-04 - mean\_absolute\_error: 0.0084 58/126 [============>.................] - ETA: 0s - loss: 1.1826e-04 - mean\_absolute\_error: 0.0083 73/126 [================>.............] - ETA: 0s - loss: 1.3786e-04 - mean\_absolute\_error: 0.0087 87/126 [===================>..........] - ETA: 0s - loss: 1.3107e-04 - mean\_absolute\_error: 0.0085102/126 [=======================>......] - ETA: 0s - loss: 1.2743e-04 - mean\_absolute\_error: 0.0084116/126 [==========================>...] - ETA: 0s - loss: 1.2758e-04 - mean\_absolute\_error: 0.0085126/126 [==============================] - 1s 4ms/step - loss: 1.2854e-04 - mean\_absolute\_error: 0.0085 - val\_loss: 4.0304e-05 - val\_mean\_absolute\_error: 0.0047  
Epoch 96/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1127e-04 - mean\_absolute\_error: 0.0081 14/126 [==>...........................] - ETA: 0s - loss: 1.2461e-04 - mean\_absolute\_error: 0.0090 28/126 [=====>........................] - ETA: 0s - loss: 1.1392e-04 - mean\_absolute\_error: 0.0083 42/126 [=========>....................] - ETA: 0s - loss: 1.0645e-04 - mean\_absolute\_error: 0.0079 56/126 [============>.................] - ETA: 0s - loss: 1.0697e-04 - mean\_absolute\_error: 0.0079 70/126 [===============>..............] - ETA: 0s - loss: 1.1165e-04 - mean\_absolute\_error: 0.0081 84/126 [===================>..........] - ETA: 0s - loss: 1.1394e-04 - mean\_absolute\_error: 0.0081 98/126 [======================>.......] - ETA: 0s - loss: 1.2407e-04 - mean\_absolute\_error: 0.0083113/126 [=========================>....] - ETA: 0s - loss: 1.2278e-04 - mean\_absolute\_error: 0.0083126/126 [==============================] - 1s 4ms/step - loss: 1.1947e-04 - mean\_absolute\_error: 0.0082 - val\_loss: 4.8445e-05 - val\_mean\_absolute\_error: 0.0055  
Epoch 97/100  
 1/126 [..............................] - ETA: 0s - loss: 1.1554e-04 - mean\_absolute\_error: 0.0089 14/126 [==>...........................] - ETA: 0s - loss: 1.2629e-04 - mean\_absolute\_error: 0.0085 27/126 [=====>........................] - ETA: 0s - loss: 1.0960e-04 - mean\_absolute\_error: 0.0080 41/126 [========>.....................] - ETA: 0s - loss: 1.0846e-04 - mean\_absolute\_error: 0.0080 56/126 [============>.................] - ETA: 0s - loss: 1.2311e-04 - mean\_absolute\_error: 0.0085 70/126 [===============>..............] - ETA: 0s - loss: 1.3719e-04 - mean\_absolute\_error: 0.0090 85/126 [===================>..........] - ETA: 0s - loss: 1.3783e-04 - mean\_absolute\_error: 0.0089100/126 [======================>.......] - ETA: 0s - loss: 1.4174e-04 - mean\_absolute\_error: 0.0090115/126 [==========================>...] - ETA: 0s - loss: 1.5648e-04 - mean\_absolute\_error: 0.0095126/126 [==============================] - 1s 4ms/step - loss: 1.5448e-04 - mean\_absolute\_error: 0.0094 - val\_loss: 4.8837e-05 - val\_mean\_absolute\_error: 0.0056  
Epoch 98/100  
 1/126 [..............................] - ETA: 0s - loss: 1.2095e-04 - mean\_absolute\_error: 0.0090 15/126 [==>...........................] - ETA: 0s - loss: 1.8045e-04 - mean\_absolute\_error: 0.0095 30/126 [======>.......................] - ETA: 0s - loss: 1.3633e-04 - mean\_absolute\_error: 0.0085 44/126 [=========>....................] - ETA: 0s - loss: 1.2451e-04 - mean\_absolute\_error: 0.0082 59/126 [=============>................] - ETA: 0s - loss: 1.2909e-04 - mean\_absolute\_error: 0.0083 74/126 [================>.............] - ETA: 0s - loss: 1.2868e-04 - mean\_absolute\_error: 0.0084 89/126 [====================>.........] - ETA: 0s - loss: 1.3646e-04 - mean\_absolute\_error: 0.0087104/126 [=======================>......] - ETA: 0s - loss: 1.4338e-04 - mean\_absolute\_error: 0.0090119/126 [===========================>..] - ETA: 0s - loss: 1.4723e-04 - mean\_absolute\_error: 0.0092126/126 [==============================] - 0s 4ms/step - loss: 1.4906e-04 - mean\_absolute\_error: 0.0093 - val\_loss: 8.2023e-05 - val\_mean\_absolute\_error: 0.0076  
Epoch 99/100  
 1/126 [..............................] - ETA: 0s - loss: 9.9188e-05 - mean\_absolute\_error: 0.0080 15/126 [==>...........................] - ETA: 0s - loss: 1.1517e-04 - mean\_absolute\_error: 0.0082 29/126 [=====>........................] - ETA: 0s - loss: 1.1841e-04 - mean\_absolute\_error: 0.0081 43/126 [=========>....................] - ETA: 0s - loss: 1.1347e-04 - mean\_absolute\_error: 0.0080 56/126 [============>.................] - ETA: 0s - loss: 1.2072e-04 - mean\_absolute\_error: 0.0083 70/126 [===============>..............] - ETA: 0s - loss: 1.1650e-04 - mean\_absolute\_error: 0.0081 85/126 [===================>..........] - ETA: 0s - loss: 1.1409e-04 - mean\_absolute\_error: 0.0081 99/126 [======================>.......] - ETA: 0s - loss: 1.1232e-04 - mean\_absolute\_error: 0.0080113/126 [=========================>....] - ETA: 0s - loss: 1.1589e-04 - mean\_absolute\_error: 0.0080126/126 [==============================] - 1s 4ms/step - loss: 1.1344e-04 - mean\_absolute\_error: 0.0080 - val\_loss: 4.1929e-05 - val\_mean\_absolute\_error: 0.0049  
Epoch 100/100  
 1/126 [..............................] - ETA: 0s - loss: 2.2065e-04 - mean\_absolute\_error: 0.0095 16/126 [==>...........................] - ETA: 0s - loss: 1.3675e-04 - mean\_absolute\_error: 0.0084 30/126 [======>.......................] - ETA: 0s - loss: 1.3889e-04 - mean\_absolute\_error: 0.0083 44/126 [=========>....................] - ETA: 0s - loss: 1.3888e-04 - mean\_absolute\_error: 0.0085 58/126 [============>.................] - ETA: 0s - loss: 1.3459e-04 - mean\_absolute\_error: 0.0085 72/126 [================>.............] - ETA: 0s - loss: 1.2993e-04 - mean\_absolute\_error: 0.0084 86/126 [===================>..........] - ETA: 0s - loss: 1.4446e-04 - mean\_absolute\_error: 0.0090100/126 [======================>.......] - ETA: 0s - loss: 1.4451e-04 - mean\_absolute\_error: 0.0090114/126 [==========================>...] - ETA: 0s - loss: 1.4084e-04 - mean\_absolute\_error: 0.0089126/126 [==============================] - 1s 4ms/step - loss: 1.4164e-04 - mean\_absolute\_error: 0.0090 - val\_loss: 6.9528e-05 - val\_mean\_absolute\_error: 0.0069

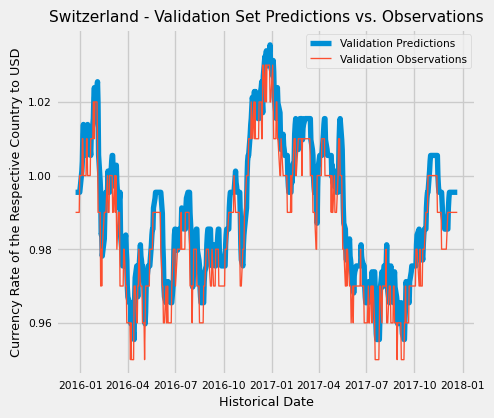
<keras.src.callbacks.History at 0x28f02e0f6d0>

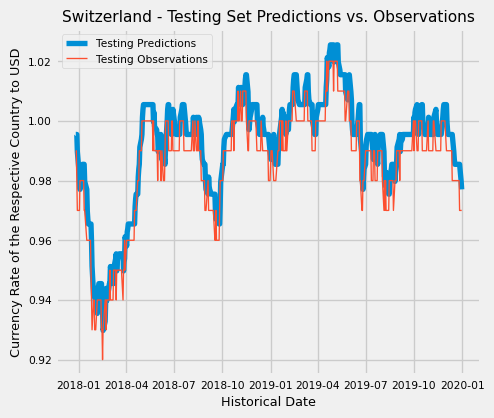
After the training and fitting of the Machine Learning model for Switzerland, I tried to create visualizations comparing the model against the country’s training dataset, validation dataset, but most importantly the testing dataset (as shown below in the line graphs). Note that the darker and thicker blue lines represent the prediction model’s projections and the thinner red lines is the observed/gathered data.

```{python}  
# Testing the Machine Learning Model prediction for Switzerland with the train,   
# validation, and test sets  
# Most important is the test set prediction as this tests the effectiveness  
# of the Machine Learning model on data it has not seen before   
switzerland\_train\_pred = switzerland\_model.predict(X\_switzerland\_train).flatten()  
  
plt.plot(dates\_switzerland\_train, switzerland\_train\_pred, linewidth=4)  
plt.plot(dates\_switzerland\_train, y\_switzerland\_train, linewidth=1)  
plt.legend(["Training Predictions", "Training Observations"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Switzerland - Training Set Predictions vs. Observations")  
plt.show()  
  
switzerland\_val\_pred = switzerland\_model.predict(X\_switzerland\_val).flatten()  
  
plt.plot(dates\_switzerland\_val, switzerland\_val\_pred, linewidth=4)  
plt.plot(dates\_switzerland\_val, y\_switzerland\_val, linewidth=1)  
plt.legend(["Validation Predictions", "Validation Observations"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Switzerland - Validation Set Predictions vs. Observations")  
plt.show()  
  
switzerland\_test\_pred = switzerland\_model.predict(X\_switzerland\_test).flatten()  
  
plt.plot(dates\_switzerland\_test, switzerland\_test\_pred, linewidth=4)  
plt.plot(dates\_switzerland\_test, y\_switzerland\_test, linewidth=1)  
plt.legend(["Testing Predictions", "Testing Observations"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Switzerland - Testing Set Predictions vs. Observations")  
plt.show()  
```

1/126 [..............................] - ETA: 41s 30/126 [======>.......................] - ETA: 0s 61/126 [=============>................] - ETA: 0s 90/126 [====================>.........] - ETA: 0s120/126 [===========================>..] - ETA: 0s126/126 [==============================] - 1s 2ms/step  
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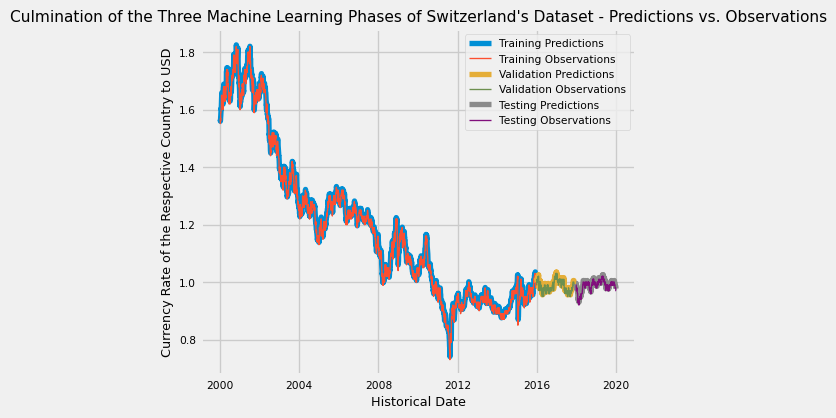






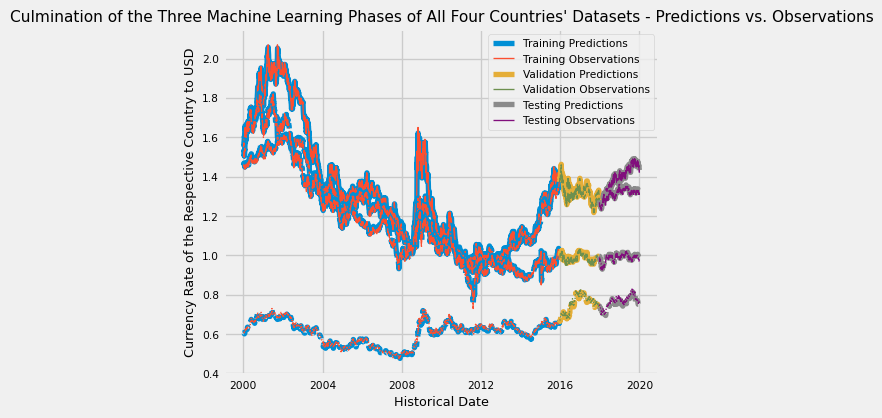
Through careful consideration of all of the prediction-based vs. observation-based contrast visualizations together, I consolidated all of graphics into one singular visualization for you to see below to get a more general perspective of the effectiveness of the Machine Learning model at training and fitting towards predicting Switzerland’s international currency rate with the United States.

```{python}  
# Plotting Switzerland's observational (reference) data with the predictions   
# of its Machine Learning Model (as a way to visually inspect the effectiveness   
# of the model)   
plt.plot(dates\_switzerland\_train, switzerland\_train\_pred, linewidth=4)  
plt.plot(dates\_switzerland\_train, y\_switzerland\_train, linewidth=1)  
plt.plot(dates\_switzerland\_val, switzerland\_val\_pred, linewidth=4)  
plt.plot(dates\_switzerland\_val, y\_switzerland\_val, linewidth=1)  
plt.plot(dates\_switzerland\_test, switzerland\_test\_pred, linewidth=4)  
plt.plot(dates\_switzerland\_test, y\_switzerland\_test, linewidth=1)  
  
plt.legend(["Training Predictions",  
 "Training Observations",  
 "Validation Predictions",  
 "Validation Observations",  
 "Testing Predictions",  
 "Testing Observations"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Culmination of the Three Machine Learning Phases of Switzerland's Dataset - Predictions vs. Observations")  
plt.show()  
```



To put it all together, I made one large visualization to encompass all 4 countries’ Machine Learning model prediction-based vs. observation-based visualizations - Austrailia, Canada, the United Kingdom, and Switzerland as shown below.

```{python}  
# Plotting all countries' observational (reference) data with the predictions   
# of its Machine Learning Model (as a way to visually inspect the effectiveness   
# of the model in an overall sense)   
plt.plot(dates\_austrailia\_train, austrailia\_train\_pred, linewidth=4, linestyle="solid")  
plt.plot(dates\_austrailia\_train, y\_austrailia\_train, linewidth=1, linestyle="solid")  
plt.plot(dates\_austrailia\_val, austrailia\_val\_pred, linewidth=4, linestyle="solid")  
plt.plot(dates\_austrailia\_val, y\_austrailia\_val, linewidth=1, linestyle="solid")  
plt.plot(dates\_austrailia\_test, austrailia\_test\_pred, linewidth=4, linestyle="solid")  
plt.plot(dates\_austrailia\_test, y\_austrailia\_test, linewidth=1, linestyle="solid")  
  
plt.plot(dates\_canada\_train, canada\_train\_pred, linewidth=4, linestyle="dashed")  
plt.plot(dates\_canada\_train, y\_canada\_train, linewidth=1, linestyle="dashed")  
plt.plot(dates\_canada\_val, canada\_val\_pred, linewidth=4, linestyle="dashed")  
plt.plot(dates\_canada\_val, y\_canada\_val, linewidth=1, linestyle="dashed")  
plt.plot(dates\_canada\_test, canada\_test\_pred, linewidth=4, linestyle="dashed")  
plt.plot(dates\_canada\_test, y\_canada\_test, linewidth=1, linestyle="dashed")  
  
plt.plot(dates\_united\_kingdom\_train, united\_kingdom\_train\_pred, linewidth=4, linestyle="dotted")  
plt.plot(dates\_united\_kingdom\_train, y\_united\_kingdom\_train, linewidth=1, linestyle="dotted")  
plt.plot(dates\_united\_kingdom\_val, united\_kingdom\_val\_pred, linewidth=4, linestyle="dotted")  
plt.plot(dates\_united\_kingdom\_val, y\_united\_kingdom\_val, linewidth=1, linestyle="dotted")  
plt.plot(dates\_united\_kingdom\_test, united\_kingdom\_test\_pred, linewidth=4, linestyle="dotted")  
plt.plot(dates\_united\_kingdom\_test, y\_united\_kingdom\_test, linewidth=1, linestyle="dotted")  
  
plt.plot(dates\_switzerland\_train, switzerland\_train\_pred, linewidth=4, linestyle="dashdot")  
plt.plot(dates\_switzerland\_train, y\_switzerland\_train, linewidth=1, linestyle="dashdot")  
plt.plot(dates\_switzerland\_val, switzerland\_val\_pred, linewidth=4, linestyle="dashdot")  
plt.plot(dates\_switzerland\_val, y\_switzerland\_val, linewidth=1, linestyle="dashdot")  
plt.plot(dates\_switzerland\_test, switzerland\_test\_pred, linewidth=4, linestyle="dashdot")  
plt.plot(dates\_switzerland\_test, y\_switzerland\_test, linewidth=1, linestyle="dashdot")  
  
plt.legend(["Training Predictions",  
 "Training Observations",  
 "Validation Predictions",  
 "Validation Observations",  
 "Testing Predictions",  
 "Testing Observations"])  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Culmination of the Three Machine Learning Phases of All Four Countries' Datasets - Predictions vs. Observations")  
plt.show()  
```



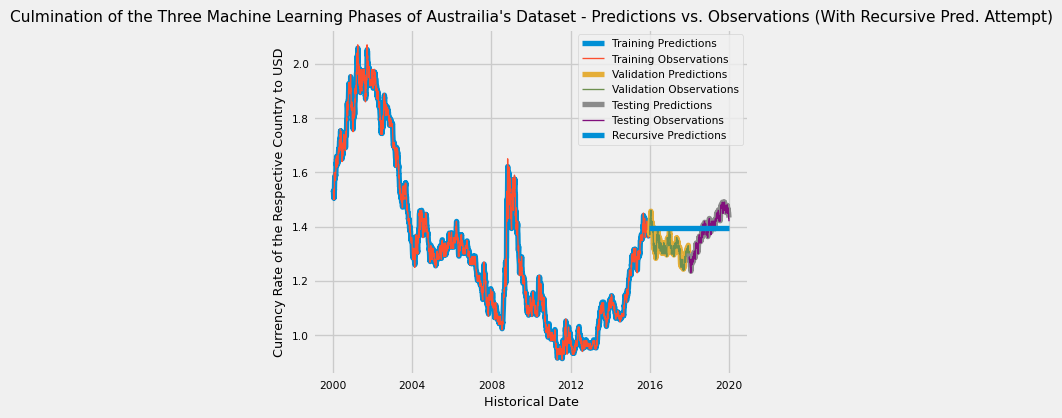
Ultimately, here is the moment of truth: I tried to recursively predict Austrailia’s future expected projection on its international currency rate between the United States through using my LSTM prediction model as shown below. By using the data from the training dataset for Austrailia, I tried to contrast the effectiveness of the model by constrasting its projection to the actual validation and testing data results. However, unfortunately, it did not predict as well as I hoped, but this was a good experiment, nonetheless.

```{python}  
# Attempt at using the model to predict into the future for Austrailia's currency   
# rate  
recursive\_pred: list = []  
recursive\_dates = np.concatenate([dates\_austrailia\_val, dates\_austrailia\_test])  
  
for target\_date in recursive\_dates:  
 last\_window = deepcopy(X\_austrailia\_train[-1])  
 next\_pred = austrailia\_model.predict(np.array([last\_window])).flatten()  
 recursive\_pred.append(next\_pred)  
 last\_window[-1] = next\_pred  
```

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To visualize the results of my recursive prediction that I completed, I added these results to the previous large visualization that encompassed all 4 countries’ Machine Learning model prediction-based vs. observation-based visualizations - Austrailia, Canada, the United Kingdom, and Switzerland as shown below.

```{python}  
# Plotting all countries' observational (reference) data with the predictions   
# of its Machine Learning Model (as a way to visually inspect the effectiveness   
# of the model in an overall sense) along with the new recursive prediction  
# results  
plt.plot(dates\_austrailia\_train, austrailia\_train\_pred, linewidth=4, linestyle="solid")  
plt.plot(dates\_austrailia\_train, y\_austrailia\_train, linewidth=1, linestyle="solid")  
plt.plot(dates\_austrailia\_val, austrailia\_val\_pred, linewidth=4, linestyle="solid")  
plt.plot(dates\_austrailia\_val, y\_austrailia\_val, linewidth=1, linestyle="solid")  
plt.plot(dates\_austrailia\_test, austrailia\_test\_pred, linewidth=4, linestyle="solid")  
plt.plot(dates\_austrailia\_test, y\_austrailia\_test, linewidth=1, linestyle="solid")  
plt.plot(recursive\_dates, recursive\_pred, linewidth=4, linestyle="solid")  
  
plt.legend(["Training Predictions",  
 "Training Observations",  
 "Validation Predictions",  
 "Validation Observations",  
 "Testing Predictions",  
 "Testing Observations",  
 "Recursive Predictions"], loc="upper right")  
plt.rcParams["font.size"] = 8  
plt.tight\_layout()  
plt.xlabel("Historical Date")  
plt.ylabel("Currency Rate of the Respective Country to USD")  
plt.title("Culmination of the Three Machine Learning Phases of Austrailia's Dataset - Predictions vs. Observations (With Recursive Pred. Attempt)")  
plt.show()  
```



## Conclusions

* Returning to my attempt to test the ability for my Machine Learning model to predict the International Currency rates for Austrailia from just the range of my training dataset as shown above, I felt that its prediction was acceptable in my opinion giving the averaging across the currency rate values in my validation and testing datasets would have proven to be considerably close in its precision.
* Thus, I reached the conclusion that my International Currency Predictor would not be a viable Machine Learning model for any real-life applications. This Machine Learning model raised a valuable point - financial market prediction is a difficult endeavor to accurately predict. From a more general point of view, this International Currency Maching Learning prediction model is not totally inaccurate or untrustworthy but rather it is only on the micro-scale. These financial predictions do not always account for current events in that respective country such as changing domestic or international relations or constantly changing socioeconomic trends which could significantly sway market confidence and impact currency rate fluctuation. Consequently, economists often have to look at larger economic trends across several decades in order to make more educated predictions.
* Ultimately, I learned a great deal about the complexities of financial prediction and usage of Machine Learning models as an attempt to solve this issue. Even though my model was not as successful at predicting as I would have hoped, I am interested to see the future of Machine Learning as it soon dominates these economic sub-field and continues to rise in its relevance by being a pivotal talking point for the future and applied soon enough to other sectors of our society.

## Reference Sources and Citations (IEEE Format)

To complete this blog post, I used the following online sources as references for developing this:

[1] US International Exchange Rates Dataset:

B. Ferreira, “Foreign Exchange Rates 2000-2019”, 2019. [Online]. Available: https://www.kaggle.com/datasets/brunotly/foreign-exchange-rates-per-dollar-20002019. [Accessed: 04-Sep.-2023].

[2] Tutorial on Basics of LSTM and Prediction & Forecasting in Machine Learning:

Greg Hogg, “Stock Price Prediction & Forecasting with LSTM Neural Networks in Python”, *YouTube*, 26-Mar.-2022. [Online.] Available: https://www.youtube.com/watch?v=CbTU92pbDKw. [Accessed: 06-Sep.-2023].