Model Definition and Model Training (Deep Neural Network)

This Notebook is for Non-Normalised Dataset

Data Description

Field	Description
Date	Date of incident
Province/State	If there is a breakdown in states
Lat	Latitude
Lon	Longitude
Confirmed	Confirmed cases
Recovered	Recovered cases
Deaths	Death cases
Active	Active cases

Summary and Results

Algorithm	MSE	RMSE	R2
Deep Neural Network	2.423	1.556	0.191

Import Libraries

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import sklearn


%matplotlib inline
sns.set_style('darkgrid')
sns.set(font_scale=1.2)
#sets the default autosave frequency in seconds
%autosave 60

# from sklearn.neural_network import MLPClassifier, MLPRegressor
# from sklearn.utils import shuffle

from sklearn.model_selection import cross_val_score, train_test_split, GridSearchCV, RandomizedSearchCV,Stra
from sklearn.preprocessing import LabelEncoder, StandardScaler, MinMaxScaler, OneHotEncoder
from sklearn.metrics import confusion_matrix, classification_report, mean_absolute_error, mean_squared_error
from sklearn.metrics import plot_confusion_matrix, plot_precision_recall_curve, plot_roc_curve, accuracy_sco
from sklearn.metrics import auc, f1_score, precision_score, recall_score, roc_auc_score

import tensorflow as tf
# from tensorflow import keras
# from tensorflow.keras.models import Sequential, save_model
# from tensorflow.keras.layers import Dense, Dropout, BatchNormalization, Activation
# from tensorflow.keras.wrappers.scikit_learn import KerasRegressor, KerasClassifier
# from tensorflow.keras.optimizers import Adam

#For ANN and DNN
import keras
from keras.models import save_model, load_model, Sequential
from keras.layers import Activation, BatchNormalization, Dense, Dropout, Flatten
from keras.optimizers import Adam, Adagrad, RMSprop, SGD
from keras.wrappers.scikit_learn import KerasRegressor, KerasClassifier
from keras.regularizers import l1,l2,l1_l2

#For Tuning
from keras.callbacks import EarlyStopping, LearningRateScheduler, ModelCheckpoint, ReduceLROnPlateau, Tensor


import warnings
warnings.filterwarnings('ignore')

import pickle
from pickle import dump, load

pd.set_option('display.max_columns',None)
#pd.set_option('display.max_rows',None)
pd.set_option('display.width', 1000)

np.random.seed(0)
np.set_printoptions(suppress=True)
tf.random.set_seed(0)
```

```
Autosaving every 60 seconds
```

Data Exploration

In [2]:
```
df = pd.read_csv("traincovid.csv")
```

In [3]:
```
df
```

Out[3]:

	Month	Day	ConfirmDiff	RecoverDiff	DeathsDiff
0	1	22	0.0	0.0	0.0
1	1	23	0.0	0.0	0.0
2	1	24	0.0	0.0	0.0
3	1	25	3.0	0.0	0.0
4	1	26	1.0	0.0	0.0
...	...	...	...	...	...
304	11	21	1041.0	1405.0	3.0
305	11	22	1096.0	1104.0	3.0
306	11	23	1884.0	883.0	2.0
307	11	24	2188.0	1673.0	4.0
308	11	25	970.0	2348.0	4.0

309 rows × 5 columns

In [4]:
```
df.isnull().sum()
```

Out[4]:
```
Month          0
Day            0
ConfirmDiff    0
RecoverDiff    0
DeathsDiff     0
dtype: int64
```

In [5]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 309 entries, 0 to 308
Data columns (total 5 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   Month        309 non-null    int64
 1   Day          309 non-null    int64
 2   ConfirmDiff  309 non-null    float64
 3   RecoverDiff  309 non-null    float64
 4   DeathsDiff   309 non-null    float64
dtypes: float64(3), int64(2)
memory usage: 12.2 KB
```

In [6]:
```
df.describe(include='all')
```

Out[6]:

	Month	Day	ConfirmDiff	RecoverDiff	DeathsDiff
count	309.000000	309.000000	309.000000	309.000000	309.000000
mean	6.265372	15.857605	193.582524	150.488673	1.116505
std	2.943317	8.814048	359.375952	306.753450	1.988445
min	1.000000	1.000000	0.000000	0.000000	0.000000
25%	4.000000	8.000000	7.000000	6.000000	0.000000
50%	6.000000	16.000000	33.000000	28.000000	0.000000
75%	9.000000	23.000000	150.000000	96.000000	1.000000
max	11.000000	31.000000	2188.000000	2348.000000	12.000000

In [7]:
```
df.shape
```

Out[7]:
```
(309, 5)
```

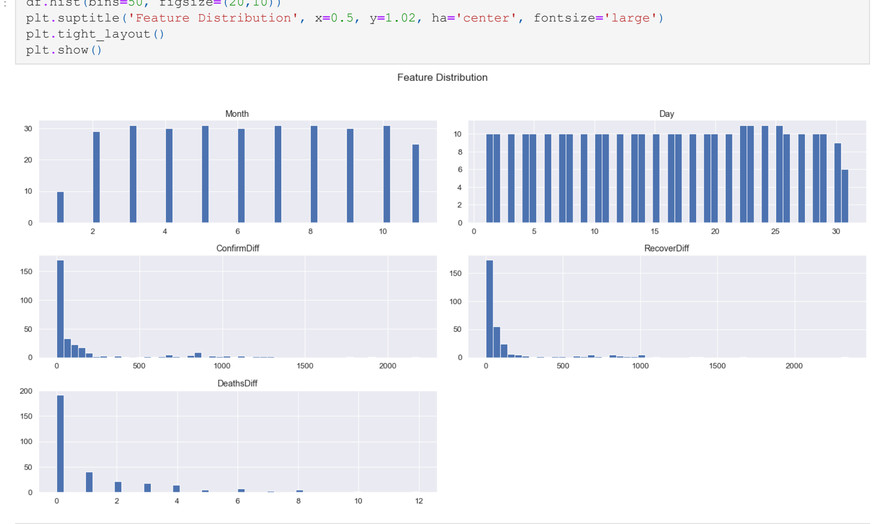
In [8]:
```
df.columns
```

Out[8]:
```
Index(['Month', 'Day', 'ConfirmDiff', 'RecoverDiff', 'DeathsDiff'], dtype='object')
```

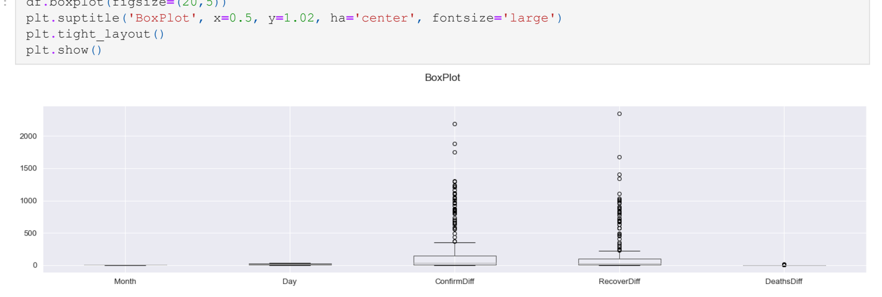
Data Visualization

Univariate Data Exploration

In [9]:
```
df.hist(bins=50, figsize=(20,10))
plt.suptitle('Feature Distribution', x=0.5, y=1.02, ha='center', fontsize='large')
plt.tight_layout()
plt.show()
```



In [10]:
```
df.boxplot(figsize=(20,5))
plt.suptitle('BoxPlot', x=0.5, y=1.02, ha='center', fontsize='large')
plt.tight_layout()
plt.show()
```



Pairplots

In [11]:
```
plt.figure(figsize=(20,20))
sns.pairplot(df.sample(150))
plt.suptitle('Pairplots of features', x=0.5, y=1.02, ha='center', fontsize='large')
plt.show()
```

```
<Figure size 1440x1440 with 0 Axes>
```

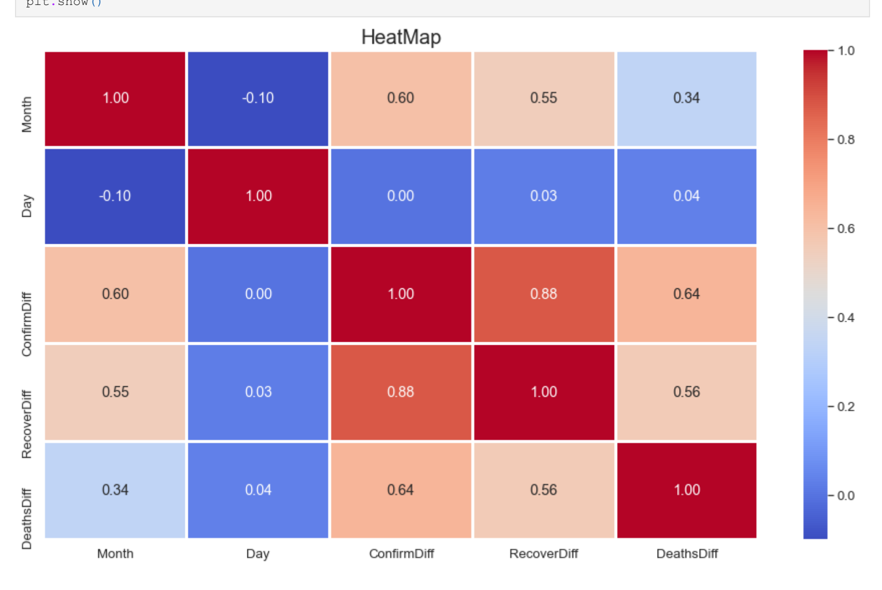
Correlation

In [12]:
```
df.corr()
```

Out[12]:

	Month	Day	ConfirmDiff	RecoverDiff	DeathsDiff
Month	1.000000	-0.098535	0.604269	0.545945	0.341420
Day	-0.098535	1.000000	0.002108	0.027499	0.035592
ConfirmDiff	0.604269	0.002108	1.000000	0.875959	0.641523
RecoverDiff	0.545945	0.027499	0.875959	1.000000	0.561145
DeathsDiff	0.341420	0.035592	0.641523	0.561145	1.000000

In [13]:
```
plt.figure(figsize=(16,9))
sns.heatmap(df.corr(),cmap="coolwarm",annot=True,fmt='.2f',linewidths=2)
plt.title("HeatMap", fontsize=20)
plt.show()
```



Treat Duplicate Values

In [14]:
```
df.duplicated(keep='first').sum()
```

Out[14]:
```
0
```

Train Test Split

In [15]:
```
df2 = pd.read_csv("traincovid2.csv")
```

In [16]:
```
df2.head()
```

Out[16]:

	Month_2	Month_3	Month_4	Month_5	Month_6	Month_7	Month_8	Month_9	Month_10	Month_11	Day_2	Day_3	Day_4	Day_5	Da
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

In [17]:
```
df2.shape
```

Out[17]:
```
(309, 43)
```

In [18]:
```
X = df2.iloc[:,0:42]
y = df2.iloc[:,42]
```

In [19]:
```
X.values, y.values
```

Out[19]:
```
(array([[   0.,    0.,    0., ...,    0.,    0.,    0.],
        [   0.,    0.,    0., ...,    0.,    0.,    0.],
        [   0.,    0.,    0., ...,    0.,    0.,    0.],
        ...,
        [   0.,    0.,    0., ...,    0., 1884.,  883.],
        [   0.,    0.,    0., ...,    0., 2188., 1673.],
        [   0.,    0.,    0., ...,    0.,  970., 2348.]]),
 array([ 0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,
         0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,
         0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,
         0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,
         0.,  0.,  0.,  2.,  0.,  0.,  1.,  1.,  6.,  4.,  2.,  4.,  3.,
         3.,  1.,  8.,  2.,  6.,  2.,  5.,  3.,  4.,  4.,  1.,  1.,  2.,
         2.,  3.,  3.,  3.,  1.,  5.,  1.,  1.,  2.,  2.,  1.,  0.,  3.,
         1.,  2.,  1.,  2.,  0.,  1.,  1.,  0.,  2.,  1.,  0.,  2.,  0.,
         1.,  1.,  0.,  0.,  1.,  0.,  1.,  0.,  2.,  1.,  0.,  1.,  0.,
         0.,  1.,  0.,  0.,  1.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,
         0.,  0.,  0.,  0.,  0.,  1.,  1.,  0.,  0.,  0.,  1.,  0.,  1.,
         1.,  1.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,
         0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,
         0.,  0.,  1.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  1.,  0.,  0.,
         0.,  0.,  0.,  0.,  1.,  0.,  0.,  0.,  0.,  1.,  0.,  0.,  0.,
         0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,
         0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,
         1.,  1.,  1.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,
         0.,  0.,  0.,  0.,  0.,  0.,  1.,  1.,  0.,  0.,  0.,  3.,  0.,
         0.,  0.,  1.,  0.,  0.,  2.,  0.,  0.,  1.,  0.,  0.,  4.,  0.,
         5.,  6.,  3.,  2.,  2.,  4.,  4.,  3.,  6.,  4.,  7.,  3.,  3.,
         6.,  5., 10.,  7.,  8.,  7.,  2.,  8.,  0.,  3.,  0.,  0.,  2.,
        12.,  8.,  6.,  2.,  3.,  4.,  8.,  6.,  2.,  1.,  1.,  2.,  3.,
         4.,  5.,  4.,  4.,  3.,  3.,  3.,  2.,  4.,  4.]))
```

In [20]:
```
X_train, X_test, y_train, y_test = train_test_split(X.values, y.values, test_size=0.25, random_state=0)
```

In [21]:
```
X_train.shape, X_test.shape, y_train.shape, y_test.shape
```

Out[21]:
```
((231, 42), (78, 42), (231,), (78,))
```

Feature Scaling (If not using Batch Normalization)

In [22]:
```
#X_train
```

In [23]:
```
#scaler = StandardScaler()
```

In [24]:
```
#X_train_scaled = scaler.fit_transform(X_train)
```

In [25]:
```
#X_test_scaled = scaler.transform(X_test)
```

In [26]:
```
#X_train_scaled
```

In [27]:
```
#X_test_scaled
```

Model Training

Using DNN

In [28]:
```
model = Sequential()
model.add(Dense(units=100,activation='relu',input_dim=42))
#model.add(BatchNormalization())
#model.add(Dropout(0.2))
model.add(Dense(units=100,activation='relu',kernel_regularizer='l2'))
#model.add(BatchNormalization())
#model.add(Dropout(0.2))
model.add(Dense(units=1,activation='linear'))
```

In [29]:
```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense (Dense)                (None, 100)               4300
_________________________________________________________________
dense_1 (Dense)              (None, 100)               10100
_________________________________________________________________
dense_2 (Dense)              (None, 1)                 101
=================================================================
Total params: 14,501
Trainable params: 14,501
Non-trainable params: 0
_________________________________________________________________
```

In [30]:
```
checkpointcb = keras.callbacks.ModelCheckpoint("BestModelPartA.h5",save_best_only=True)
```

In [31]:
```
earlystoppingcb = keras.callbacks.EarlyStopping(patience=10, verbose=1)
```

In [32]:
```
optimizer = Adam(learning_rate=0.00001)
```

In [33]:
```
model.compile(optimizer=optimizer, loss='mean_squared_error', metrics=["mse"])
```

In [34]:
```
model_history = model.fit(X_train, y_train,epochs=800,
                          validation_split=0.2, verbose=2, callbacks=[checkpointcb,earlystoppingcb])
```

```
Epoch 1/800
6/6 - 0s - loss: 4119.8086 - mse: 4118.7930 - val_loss: 3451.2778 - val_mse: 3450.2622
Epoch 2/800
6/6 - 0s - loss: 3962.5627 - mse: 3961.5471 - val_loss: 3323.4192 - val_mse: 3322.4043
Epoch 3/800
6/6 - 0s - loss: 3806.2603 - mse: 3805.2449 - val_loss: 3202.3857 - val_mse: 3201.3711
Epoch 4/800
6/6 - 0s - loss: 3700.4407 - mse: 3699.4263 - val_loss: 3075.8352 - val_mse: 3074.8208
Epoch 5/800
6/6 - 0s - loss: 3551.0132 - mse: 3549.9985 - val_loss: 2962.4080 - val_mse: 2961.3943
Epoch 6/800
6/6 - 0s - loss: 3432.7051 - mse: 3431.6917 - val_loss: 2849.3926 - val_mse: 2848.3794
Epoch 7/800
6/6 - 0s - loss: 3305.7241 - mse: 3304.7112 - val_loss: 2742.2307 - val_mse: 2741.2178
Epoch 8/800
6/6 - 0s - loss: 3188.9211 - mse: 3187.9087 - val_loss: 2636.8179 - val_mse: 2635.8054
Epoch 9/800
6/6 - 0s - loss: 3069.7297 - mse: 3068.7170 - val_loss: 2535.2654 - val_mse: 2534.2534
Epoch 10/800
6/6 - 0s - loss: 2963.7168 - mse: 2962.7051 - val_loss: 2435.5625 - val_mse: 2434.5508
Epoch 11/800
6/6 - 0s - loss: 2840.6140 - mse: 2839.6030 - val_loss: 2346.0664 - val_mse: 2345.0554
Epoch 12/800
6/6 - 0s - loss: 2735.9507 - mse: 2734.9399 - val_loss: 2259.0222 - val_mse: 2258.0117
Epoch 13/800
6/6 - 0s - loss: 2642.1633 - mse: 2641.1528 - val_loss: 2168.6541 - val_mse: 2167.6440
Epoch 14/800
6/6 - 0s - loss: 2539.3796 - mse: 2538.3699 - val_loss: 2082.8970 - val_mse: 2081.8875
Epoch 15/800
6/6 - 0s - loss: 2451.1516 - mse: 2450.1421 - val_loss: 1995.5027 - val_mse: 1994.4937
Epoch 16/800
6/6 - 0s - loss: 2356.8875 - mse: 2355.8787 - val_loss: 1913.9418 - val_mse: 1912.9332
Epoch 17/800
6/6 - 0s - loss: 2261.3093 - mse: 2260.3008 - val_loss: 1837.3323 - val_mse: 1836.3243
Epoch 18/800
6/6 - 0s - loss: 2184.1353 - mse: 2183.1274 - val_loss: 1758.4362 - val_mse: 1757.4285
Epoch 19/800
6/6 - 0s - loss: 2093.6375 - mse: 2092.6301 - val_loss: 1686.3329 - val_mse: 1685.3257
Epoch 20/800
6/6 - 0s - loss: 2016.6976 - mse: 2015.6906 - val_loss: 1615.3184 - val_mse: 1614.3115
Epoch 21/800
6/6 - 0s - loss: 1935.5194 - mse: 1934.5131 - val_loss: 1548.7103 - val_mse: 1547.7041
Epoch 22/800
6/6 - 0s - loss: 1860.6340 - mse: 1859.6281 - val_loss: 1484.4509 - val_mse: 1483.4452
Epoch 23/800
6/6 - 0s - loss: 1792.7004 - mse: 1791.6948 - val_loss: 1421.1223 - val_mse: 1420.1171
Epoch 24/800
6/6 - 0s - loss: 1715.9379 - mse: 1714.9324 - val_loss: 1363.6907 - val_mse: 1362.6858
Epoch 25/800
6/6 - 0s - loss: 1658.8048 - mse: 1657.8003 - val_loss: 1304.1907 - val_mse: 1303.1863
Epoch 26/800
6/6 - 0s - loss: 1589.8047 - mse: 1588.8007 - val_loss: 1249.4680 - val_mse: 1248.4640
Epoch 27/800
6/6 - 0s - loss: 1522.9521 - mse: 1521.9484 - val_loss: 1198.7352 - val_mse: 1197.7318
Epoch 28/800
6/6 - 0s - loss: 1467.2262 - mse: 1466.2228 - val_loss: 1146.2091 - val_mse: 1145.2061
Epoch 29/800
6/6 - 0s - loss: 1412.1688 - mse: 1411.1659 - val_loss: 1095.4847 - val_mse: 1094.4822
Epoch 30/800
6/6 - 0s - loss: 1353.0044 - mse: 1352.0021 - val_loss: 1047.6288 - val_mse: 1046.6266
Epoch 31/800
6/6 - 0s - loss: 1298.1154 - mse: 1297.1134 - val_loss: 1003.0953 - val_mse: 1002.0935
Epoch 32/800
6/6 - 0s - loss: 1246.2258 - mse: 1245.2242 - val_loss: 960.6699 - val_mse: 959.6686
Epoch 33/800
6/6 - 0s - loss: 1200.5178 - mse: 1199.5167 - val_loss: 918.1075 - val_mse: 917.1067
Epoch 34/800
6/6 - 0s - loss: 1149.6580 - mse: 1148.6573 - val_loss: 878.4232 - val_mse: 877.4229
Epoch 35/800
6/6 - 0s - loss: 1104.1530 - mse: 1103.1527 - val_loss: 838.9037 - val_mse: 837.9037
Epoch 36/800
6/6 - 0s - loss: 1057.7988 - mse: 1056.7992 - val_loss: 800.9469 - val_mse: 799.9474
Epoch 37/800
6/6 - 0s - loss: 1016.7379 - mse: 1015.7386 - val_loss: 764.4780 - val_mse: 763.4791
Epoch 38/800
6/6 - 0s - loss: 974.6820 - mse: 973.6832 - val_loss: 730.3939 - val_mse: 729.3953
Epoch 39/800
6/6 - 0s - loss: 935.0486 - mse: 934.0503 - val_loss: 697.7463 - val_mse: 696.7482
Epoch 40/800
6/6 - 0s - loss: 899.5615 - mse: 898.5635 - val_loss: 665.5546 - val_mse: 664.5569
Epoch 41/800
6/6 - 0s - loss: 857.3395 - mse: 856.3420 - val_loss: 637.3246 - val_mse: 636.3274
Epoch 42/800
6/6 - 0s - loss: 824.4473 - mse: 823.4504 - val_loss: 608.8398 - val_mse: 607.8430
Epoch 43/800
6/6 - 0s - loss: 792.8397 - mse: 791.8431 - val_loss: 580.9192 - val_mse: 579.9229
Epoch 44/800
6/6 - 0s - loss: 759.1879 - mse: 758.1918 - val_loss: 555.0393 - val_mse: 554.0436
Epoch 45/800
6/6 - 0s - loss: 732.6757 - mse: 731.6801 - val_loss: 528.5053 - val_mse: 527.5099
Epoch 46/800
6/6 - 0s - loss: 697.9213 - mse: 696.9261 - val_loss: 505.6784 - val_mse: 504.6835
Epoch 47/800
6/6 - 0s - loss: 673.3491 - mse: 672.3543 - val_loss: 482.3673 - val_mse: 481.3729
Epoch 48/800
6/6 - 0s - loss: 644.1419 - mse: 643.1476 - val_loss: 461.3287 - val_mse: 460.3347
Epoch 49/800
6/6 - 0s - loss: 617.4054 - mse: 616.4116 - val_loss: 440.8979 - val_mse: 439.9044
Epoch 50/800
6/6 - 0s - loss: 592.1478 - mse: 591.1544 - val_loss: 421.1556 - val_mse: 420.1625
Epoch 51/800
6/6 - 0s - loss: 571.4907 - mse: 570.4977 - val_loss: 401.4300 - val_mse: 400.4373
Epoch 52/800
6/6 - 0s - loss: 547.3714 - mse: 546.3790 - val_loss: 383.2385 - val_mse: 382.2462
Epoch 53/800
6/6 - 0s - loss: 522.7885 - mse: 521.7964 - val_loss: 367.3575 - val_mse: 366.3657
Epoch 54/800
6/6 - 0s - loss: 503.2022 - mse: 502.2105 - val_loss: 351.3534 - val_mse: 350.3621
Epoch 55/800
6/6 - 0s - loss: 484.6496 - mse: 483.6584 - val_loss: 335.3739 - val_mse: 334.3830
Epoch 56/800
6/6 - 0s - loss: 463.7102 - mse: 462.7195 - val_loss: 321.1374 - val_mse: 320.1469
Epoch 57/800
6/6 - 0s - loss: 444.8333 - mse: 443.8430 - val_loss: 307.8176 - val_mse: 306.8276
Epoch 58/800
6/6 - 0s - loss: 427.4717 - mse: 426.4818 - val_loss: 294.8246 - val_mse: 293.8350
Epoch 59/800
6/6 - 0s - loss: 412.0145 - mse: 411.0251 - val_loss: 281.6160 - val_mse: 280.6269
Epoch 60/800
6/6 - 0s - loss: 394.1441 - mse: 393.1552 - val_loss: 269.9255 - val_mse: 268.9368
Epoch 61/800
6/6 - 0s - loss: 379.9728 - mse: 378.9843 - val_loss: 258.3640 - val_mse: 257.3757
Epoch 62/800
6/6 - 0s - loss: 364.7440 - mse: 363.7559 - val_loss: 247.5744 - val_mse: 246.5866
Epoch 63/800
6/6 - 0s - loss: 349.7683 - mse: 348.7807 - val_loss: 237.6848 - val_mse: 236.6974
Epoch 64/800
6/6 - 0s - loss: 336.5641 - mse: 335.5768 - val_loss: 228.1099 - val_mse: 227.1230
Epoch 65/800
6/6 - 0s - loss: 322.8783 - mse: 321.8915 - val_loss: 219.4305 - val_mse: 218.4440
Epoch 66/800
6/6 - 0s - loss: 310.5466 - mse: 309.5602 - val_loss: 211.0475 - val_mse: 210.0614
Epoch 67/800
6/6 - 0s - loss: 300.1915 - mse: 299.2055 - val_loss: 202.2740 - val_mse: 201.2884
Epoch 68/800
6/6 - 0s - loss: 287.5768 - mse: 286.5913 - val_loss: 194.3154 - val_mse: 193.3302
Epoch 69/800
6/6 - 0s - loss: 276.2669 - mse: 275.2819 - val_loss: 186.9205 - val_mse: 185.9357
Epoch 70/800
6/6 - 0s - loss: 267.0224 - mse: 266.0378 - val_loss: 179.6001 - val_mse: 178.6157
Epoch 71/800
6/6 - 0s - loss: 256.1535 - mse: 255.1694 - val_loss: 173.2291 - val_mse: 172.2452
Epoch 72/800
6/6 - 0s - loss: 246.9903 - mse: 246.0066 - val_loss: 167.1782 - val_mse: 166.1947
Epoch 73/800
6/6 - 0s - loss: 238.2130 - mse: 237.2298 - val_loss: 161.3684 - val_mse: 160.3854
Epoch 74/800
6/6 - 0s - loss: 230.2455 - mse: 229.2627 - val_loss: 155.5615 - val_mse: 154.5789
Epoch 75/800
6/6 - 0s - loss: 220.9439 - mse: 219.9615 - val_loss: 150.2892 - val_mse: 149.3070
Epoch 76/800
6/6 - 0s - loss: 212.9159 - mse: 211.9339 - val_loss: 145.0660 - val_mse: 144.0843
Epoch 77/800
6/6 - 0s - loss: 205.2188 - mse: 204.2372 - val_loss: 139.9930 - val_mse: 139.0117
Epoch 78/800
6/6 - 0s - loss: 197.0080 - mse: 196.0269 - val_loss: 135.1017 - val_mse: 134.1208
Epoch 79/800
6/6 - 0s - loss: 189.6281 - mse: 188.6474 - val_loss: 130.2577 - val_mse: 129.2773
Epoch 80/800
6/6 - 0s - loss: 182.8339 - mse: 181.8536 - val_loss: 125.4615 - val_mse: 124.4815
Epoch 81/800
6/6 - 0s - loss: 175.0450 - mse: 174.0652 - val_loss: 120.9480 - val_mse: 119.9684
Epoch 82/800
6/6 - 0s - loss: 167.9779 - mse: 166.9985 - val_loss: 116.5317 - val_mse: 115.5526
Epoch 83/800
6/6 - 0s - loss: 161.4220 - mse: 160.4431 - val_loss: 111.8018 - val_mse: 110.8230
Epoch 84/800
6/6 - 0s - loss: 153.9776 - mse: 152.9991 - val_loss: 107.6183 - val_mse: 106.6400
Epoch 85/800
6/6 - 0s - loss: 147.4668 - mse: 146.4887 - val_loss: 103.8943 - val_mse: 102.9164
Epoch 86/800
6/6 - 0s - loss: 141.6649 - mse: 140.6872 - val_loss: 100.3266 - val_mse: 99.3491
Epoch 87/800
6/6 - 0s - loss: 135.3113 - mse: 134.3340 - val_loss: 97.2705 - val_mse: 96.2935
Epoch 88/800
6/6 - 0s - loss: 130.9016 - mse: 129.9247 - val_loss: 94.0389 - val_mse: 93.0623
Epoch 89/800
6/6 - 0s - loss: 125.8565 - mse: 124.8800 - val_loss: 91.1534 - val_mse: 90.1772
Epoch 90/800
6/6 - 0s - loss: 121.5391 - mse: 120.5631 - val_loss: 88.3310 - val_mse: 87.3553
Epoch 91/800
6/6 - 0s - loss: 116.4799 - mse: 115.5043 - val_loss: 85.8837 - val_mse: 84.9083
Epoch 92/800
6/6 - 0s - loss: 112.3725 - mse: 111.3973 - val_loss: 83.5742 - val_mse: 82.5993
Epoch 93/800
6/6 - 0s - loss: 107.8143 - mse: 106.8395 - val_loss: 81.5858 - val_mse: 80.6113
Epoch 94/800
6/6 - 0s - loss: 104.5672 - mse: 103.5929 - val_loss: 79.6035 - val_mse: 78.6294
Epoch 95/800
6/6 - 0s - loss: 101.3370 - mse: 100.3632 - val_loss: 77.6384 - val_mse: 76.6648
Epoch 96/800
6/6 - 0s - loss: 98.0394 - mse: 97.0660 - val_loss: 75.8261 - val_mse: 74.8529
Epoch 97/800
6/6 - 0s - loss: 94.7589 - mse: 93.7859 - val_loss: 74.1808 - val_mse: 73.2081
Epoch 98/800
6/6 - 0s - loss: 91.7915 - mse: 90.8189 - val_loss: 72.5923 - val_mse: 71.6200
Epoch 99/800
6/6 - 0s - loss: 88.8281 - mse: 87.8559 - val_loss: 71.1529 - val_mse: 70.1810
Epoch 100/800
6/6 - 0s - loss: 86.4568 - mse: 85.4850 - val_loss: 69.6996 - val_mse: 68.7281
Epoch 101/800
6/6 - 0s - loss: 83.7284 - mse: 82.7571 - val_loss: 68.3789 - val_mse: 67.4078
Epoch 102/800
6/6 - 0s - loss: 80.8608 - mse: 79.8899 - val_loss: 67.1932 - val_mse: 66.2226
Epoch 103/800
6/6 - 0s - loss: 78.8974 - mse: 77.9268 - val_loss: 65.8796 - val_mse: 64.9094
Epoch 104/800
6/6 - 0s - loss: 76.6142 - mse: 75.6441 - val_loss: 64.6359 - val_mse: 63.6661
Epoch 105/800
6/6 - 0s - loss: 74.1158 - mse: 73.1461 - val_loss: 63.5471 - val_mse: 62.5777
Epoch 106/800
6/6 - 0s - loss: 72.0423 - mse: 71.0731 - val_loss: 62.4628 - val_mse: 61.4938
Epoch 107/800
6/6 - 0s - loss: 70.0924 - mse: 69.1236 - val_loss: 61.3946 - val_mse: 60.4261
Epoch 108/800
6/6 - 0s - loss: 68.0202 - mse: 67.0518 - val_loss: 60.4364 - val_mse: 59.4682
Epoch 109/800
6/6 - 0s - loss: 66.4009 - mse: 65.4330 - val_loss: 59.4171 - val_mse: 58.4494
Epoch 110/800
6/6 - 0s - loss: 64.5971 - mse: 63.6295 - val_loss: 58.4239 - val_mse: 57.4566
Epoch 111/800
6/6 - 0s - loss: 62.6265 - mse: 61.6593 - val_loss: 57.5902 - val_mse: 56.6233
Epoch 112/800
6/6 - 0s - loss: 61.1232 - mse: 60.1565 - val_loss: 56.6283 - val_mse: 55.6618
Epoch 113/800
6/6 - 0s - loss: 59.3181 - mse: 58.3518 - val_loss: 55.7975 - val_mse: 54.8314
Epoch 114/800
6/6 - 0s - loss: 58.1157 - mse: 57.1498 - val_loss: 54.7899 - val_mse: 53.8242
Epoch 115/800
6/6 - 0s - loss: 56.4006 - mse: 55.4352 - val_loss: 53.9143 - val_mse: 52.9490
Epoch 116/800
6/6 - 0s - loss: 55.0138 - mse: 54.0488 - val_loss: 53.0281 - val_mse: 52.0633
Epoch 117/800
6/6 - 0s - loss: 53.5744 - mse: 52.6097 - val_loss: 52.2082 - val_mse: 51.2438
Epoch 118/800
6/6 - 0s - loss: 52.1893 - mse: 51.2251 - val_loss: 51.4996 - val_mse: 50.5356
Epoch 119/800
6/6 - 0s - loss: 50.9202 - mse: 49.9563 - val_loss: 50.6840 - val_mse: 49.7204
Epoch 120/800
6/6 - 0s - loss: 49.6402 - mse: 48.6768 - val_loss: 49.9313 - val_mse: 48.9682
Epoch 121/800
6/6 - 0s - loss: 48.3923 - mse: 47.4293 - val_loss: 49.2072 - val_mse: 48.2445
Epoch 122/800
6/6 - 0s - loss: 47.2712 - mse: 46.3086 - val_loss: 48.5166 - val_mse: 47.5543
Epoch 123/800
6/6 - 0s - loss: 46.1821 - mse: 45.2200 - val_loss: 47.8347 - val_mse: 46.8728
Epoch 124/800
6/6 - 0s - loss: 44.9135 - mse: 43.9517 - val_loss: 47.2846 - val_mse: 46.3231
Epoch 125/800
6/6 - 0s - loss: 44.1715 - mse: 43.2102 - val_loss: 46.5583 - val_mse: 45.5972
Epoch 126/800
6/6 - 0s - loss: 43.1048 - mse: 42.1439 - val_loss: 45.8572 - val_mse: 44.8965
Epoch 127/800
6/6 - 0s - loss: 41.9369 - mse: 40.9764 - val_loss: 45.2940 - val_mse: 44.3337
Epoch 128/800
6/6 - 0s - loss: 41.0282 - mse: 40.0681 - val_loss: 44.6475 - val_mse: 43.6877
Epoch 129/800
6/6 - 0s - loss: 39.9711 - mse: 39.0114 - val_loss: 44.0638 - val_mse: 43.1043
Epoch 130/800
6/6 - 0s - loss: 39.1624 - mse: 38.2032 - val_loss: 43.4703 - val_mse: 42.5113
Epoch 131/800
6/6 - 0s - loss: 38.2860 - mse: 37.3272 - val_loss: 42.8085 - val_mse: 41.8499
Epoch 132/800
6/6 - 0s - loss: 37.4822 - mse: 36.5237 - val_loss: 42.1268 - val_mse: 41.1686
Epoch 133/800
6/6 - 0s - loss: 36.5565 - mse: 35.5985 - val_loss: 41.4998 - val_mse: 40.5420
Epoch 134/800
6/6 - 0s - loss: 35.7209 - mse: 34.7633 - val_loss: 40.8837 - val_mse: 39.9263
Epoch 135/800
6/6 - 0s - loss: 34.9126 - mse: 33.9554 - val_loss: 40.3454 - val_mse: 39.3884
Epoch 136/800
6/6 - 0s - loss: 34.0772 - mse: 33.1205 - val_loss: 39.7996 - val_mse: 38.8431
Epoch 137/800
6/6 - 0s - loss: 33.5030 - mse: 32.5466 - val_loss: 39.2348 - val_mse: 38.2787
Epoch 138/800
6/6 - 0s - loss: 32.6345 - mse: 31.6786 - val_loss: 38.7335 - val_mse: 37.7778
Epoch 139/800
6/6 - 0s - loss: 31.9689 - mse: 31.0133 - val_loss: 38.1787 - val_mse: 37.2234
Epoch 140/800
6/6 - 0s - loss: 31.2509 - mse: 30.2957 - val_loss: 37.6612 - val_mse: 36.7063
Epoch 141/800
6/6 - 0s - loss: 30.7048 - mse: 29.7501 - val_loss: 37.1055 - val_mse: 36.1510
Epoch 142/800
6/6 - 0s - loss: 29.9468 - mse: 28.9924 - val_loss: 36.6220 - val_mse: 35.6679
Epoch 143/800
6/6 - 0s - loss: 29.3492 - mse: 28.3953 - val_loss: 36.1585 - val_mse: 35.2048
Epoch 144/800
6/6 - 0s - loss: 28.8090 - mse: 27.8555 - val_loss: 35.6321 - val_mse: 34.6788
Epoch 145/800
6/6 - 0s - loss: 28.2086 - mse: 27.2554 - val_loss: 35.1481 - val_mse: 34.1953
Epoch 146/800
6/6 - 0s - loss: 27.5100 - mse: 26.5573 - val_loss: 34.7325 - val_mse: 33.7801
Epoch 147/800
6/6 - 0s - loss: 27.0424 - mse: 26.0901 - val_loss: 34.3088 - val_mse: 33.3568
Epoch 148/800
6/6 - 0s - loss: 26.4729 - mse: 25.5210 - val_loss: 33.8348 - val_mse: 32.8832
Epoch 149/800
6/6 - 0s - loss: 25.8855 - mse: 24.9340 - val_loss: 33.4508 - val_mse: 32.4996
Epoch 150/800
6/6 - 0s - loss: 25.4385 - mse: 24.4874 - val_loss: 32.9649 - val_mse: 32.0140
Epoch 151/800
6/6 - 0s - loss: 24.8557 - mse: 23.9051 - val_loss: 32.5548 - val_mse: 31.6043
Epoch 152/800
6/6 - 0s - loss: 24.4314 - mse: 23.4811 - val_loss: 32.0866 - val_mse: 31.1365
Epoch 153/800
6/6 - 0s - loss: 23.8874 - mse: 22.9375 - val_loss: 31.6650 - val_mse: 30.7154
Epoch 154/800
6/6 - 0s - loss: 23.4213 - mse: 22.4719 - val_loss: 31.2558 - val_mse: 30.3065
Epoch 155/800
6/6 - 0s - loss: 23.0754 - mse: 22.1264 - val_loss: 30.7949 - val_mse: 29.8461
Epoch 156/800
6/6 - 0s - loss: 22.5052 - mse: 21.5565 - val_loss: 30.4063 - val_mse: 29.4579
Epoch 157/800
6/6 - 0s - loss: 22.1376 - mse: 21.1893 - val_loss: 29.9958 - val_mse: 29.0478
Epoch 158/800
6/6 - 0s - loss: 21.6969 - mse: 20.7490 - val_loss: 29.5964 - val_mse: 28.6488
Epoch 159/800
6/6 - 0s - loss: 21.3349 - mse: 20.3874 - val_loss: 29.2429 - val_mse: 28.2957
Epoch 160/800
6/6 - 0s - loss: 20.9073 - mse: 19.9603 - val_loss: 28.8797 - val_mse: 27.9329
Epoch 161/800
6/6 - 0s - loss: 20.5437 - mse: 19.5970 - val_loss: 28.5432 - val_mse: 27.5968
Epoch 162/800
6/6 - 0s - loss: 20.1651 - mse: 19.2188 - val_loss: 28.2032 - val_mse: 27.2572
Epoch 163/800
6/6 - 0s - loss: 19.8797 - mse: 18.9339 - val_loss: 27.8737 - val_mse: 26.9281
Epoch 164/800
6/6 - 0s - loss: 19.5314 - mse: 18.5860 - val_loss: 27.4844 - val_mse: 26.5392
Epoch 165/800
6/6 - 0s - loss: 19.1219 - mse: 18.1768 - val_loss: 27.1381 - val_mse: 26.1933
Epoch 166/800
6/6 - 0s - loss: 18.8347 - mse: 17.8901 - val_loss: 26.7972 - val_mse: 25.8528
Epoch 167/800
6/6 - 0s - loss: 18.4699 - mse: 17.5257 - val_loss: 26.4859 - val_mse: 25.5419
Epoch 168/800
6/6 - 0s - loss: 18.2398 - mse: 17.2960 - val_loss: 26.1150 - val_mse: 25.1714
Epoch 169/800
6/6 - 0s - loss: 17.9005 - mse: 16.9570 - val_loss: 25.8012 - val_mse: 24.8580
Epoch 170/800
6/6 - 0s - loss: 17.6108 - mse: 16.6677 - val_loss: 25.4832 - val_mse: 24.5403
Epoch 171/800
6/6 - 0s - loss: 17.3020 - mse: 16.3594 - val_loss: 25.2067 - val_mse: 24.2643
Epoch 172/800
6/6 - 0s - loss: 17.0535 - mse: 16.1113 - val_loss: 24.9141 - val_mse: 23.9720
Epoch 173/800
6/6 - 0s - loss: 16.7815 - mse: 15.8397 - val_loss: 24.6110 - val_mse: 23.6693
Epoch 174/800
6/6 - 0s - loss: 16.5176 - mse: 15.5761 - val_loss: 24.3182 - val_mse: 23.3770
Epoch 175/800
6/6 - 0s - loss: 16.2481 - mse: 15.3071 - val_loss: 24.0360 - val_mse: 23.0952
Epoch 176/800
6/6 - 0s - loss: 15.9864 - mse: 15.0458 - val_loss: 23.7409 - val_mse: 22.8004
Epoch 177/800
6/6 - 0s - loss: 15.7396 - mse: 14.7993 - val_loss: 23.4646 - val_mse: 22.5246
Epoch 178/800
6/6 - 0s - loss: 15.4865 - mse: 14.5466 - val_loss: 23.2440 - val_mse: 22.3043
Epoch 179/800
6/6 - 0s - loss: 15.2705 - mse: 14.3310 - val_loss: 22.9735 - val_mse: 22.0342
Epoch 180/800
6/6 - 0s - loss: 15.0056 - mse: 14.0665 - val_loss: 22.7504 - val_mse: 21.8116
Epoch 181/800
6/6 - 0s - loss: 14.7988 - mse: 13.8601 - val_loss: 22.4807 - val_mse: 21.5423
Epoch 182/800
6/6 - 0s - loss: 14.6133 - mse: 13.6750 - val_loss: 22.1834 - val_mse: 21.2453
Epoch 183/800
6/6 - 0s - loss: 14.3510 - mse: 13.4131 - val_loss: 21.9153 - val_mse: 20.9776
Epoch 184/800
6/6 - 0s - loss: 14.1589 - mse: 13.2214 - val_loss: 21.6767 - val_mse: 20.7394
Epoch 185/800
6/6 - 0s - loss: 13.9375 - mse: 13.0004 - val_loss: 21.4566 - val_mse: 20.5197
Epoch 186/800
6/6 - 0s - loss: 13.7315 - mse: 12.7948 - val_loss: 21.2205 - val_mse: 20.2840
Epoch 187/800
6/6 - 0s - loss: 13.5580 - mse: 12.6216 - val_loss: 20.9835 - val_mse: 20.0474
Epoch 188/800
6/6 - 0s - loss: 13.3503 - mse: 12.4144 - val_loss: 20.7819 - val_mse: 19.8462
Epoch 189/800
6/6 - 0s - loss: 13.1673 - mse: 12.2317 - val_loss: 20.5829 - val_mse: 19.6476
Epoch 190/800
6/6 - 0s - loss: 13.0059 - mse: 12.0707 - val_loss: 20.3599 - val_mse: 19.4250
Epoch 191/800
6/6 - 0s - loss: 12.8220 - mse: 11.8872 - val_loss: 20.1712 - val_mse: 19.2367
Epoch 192/800
6/6 - 0s - loss: 12.6683 - mse: 11.7339 - val_loss: 19.9605 - val_mse: 19.0264
Epoch 193/800
6/6 - 0s - loss: 12.4895 - mse: 11.5555 - val_loss: 19.7575 - val_mse: 18.8238
Epoch 194/800
6/6 - 0s - loss: 12.3394 - mse: 11.4058 - val_loss: 19.5809 - val_mse: 18.6476
Epoch 195/800
6/6 - 0s - loss: 12.2219 - mse: 11.2887 - val_loss: 19.3296 - val_mse: 18.3966
Epoch 196/800
6/6 - 0s - loss: 12.0360 - mse: 11.1032 - val_loss: 19.1312 - val_mse: 18.1986
Epoch 197/800
6/6 - 0s - loss: 11.8924 - mse: 10.9599 - val_loss: 18.9372 - val_mse: 18.0050
Epoch 198/800
6/6 - 0s - loss: 11.7483 - mse: 10.8163 - val_loss: 18.7660 - val_mse: 17.8342
Epoch 199/800
6/6 - 0s - loss: 11.5988 - mse: 10.6672 - val_loss: 18.6005 - val_mse: 17.6691
Epoch 200/800
6/6 - 0s - loss: 11.4735 - mse: 10.5423 - val_loss: 18.4610 - val_mse: 17.5300
Epoch 201/800
6/6 - 0s - loss: 11.3386 - mse: 10.4078 - val_loss: 18.2969 - val_mse: 17.3662
Epoch 202/800
6/6 - 0s - loss: 11.2287 - mse: 10.2983 - val_loss: 18.1197 - val_mse: 17.1895
Epoch 203/800
6/6 - 0s - loss: 11.0959 - mse: 10.1658 - val_loss: 17.9551 - val_mse: 17.0253
Epoch 204/800
6/6 - 0s - loss: 10.9707 - mse: 10.0410 - val_loss: 17.8031 - val_mse: 16.8736
Epoch 205/800
6/6 - 0s - loss: 10.8705 - mse: 9.9411 - val_loss: 17.6229 - val_mse: 16.6938
Epoch 206/800
6/6 - 0s - loss: 10.7487 - mse: 9.8198 - val_loss: 17.4873 - val_mse: 16.5586
Epoch 207/800
6/6 - 0s - loss: 10.6202 - mse: 9.6917 - val_loss: 17.3558 - val_mse: 16.4275
Epoch 208/800
6/6 - 0s - loss: 10.5311 - mse: 9.6030 - val_loss: 17.2162 - val_mse: 16.2883
Epoch 209/800
6/6 - 0s - loss: 10.4288 - mse: 9.5010 - val_loss: 17.0578 - val_mse: 16.1302
Epoch 210/800
6/6 - 0s - loss: 10.3197 - mse: 9.3923 - val_loss: 16.9013 - val_mse: 15.9742
Epoch 211/800
6/6 - 0s - loss: 10.2236 - mse: 9.2966 - val_loss: 16.7538 - val_mse: 15.8270
Epoch 212/800
6/6 - 0s - loss: 10.1246 - mse: 9.1980 - val_loss: 16.6016 - val_mse: 15.6752
Epoch 213/800
6/6 - 0s - loss: 10.0181 - mse: 9.0919 - val_loss: 16.5002 - val_mse: 15.5742
Epoch 214/800
6/6 - 0s - loss: 9.9518 - mse: 9.0259 - val_loss: 16.3272 - val_mse: 15.4016
Epoch 215/800
6/6 - 0s - loss: 9.8391 - mse: 8.9137 - val_loss: 16.1994 - val_mse: 15.2742
Epoch 216/800
6/6 - 0s - loss: 9.7531 - mse: 8.8280 - val_loss: 16.0579 - val_mse: 15.1330
Epoch 217/800
6/6 - 0s - loss: 9.6437 - mse: 8.7190 - val_loss: 15.9544 - val_mse: 15.0299
Epoch 218/800
ss: 9.5623 - mse: 8.6380 - val_loss: 15.8272 - val_mse: 14.9032
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Epoch 219/800
6/6 - 0s - loss: 9.4722 - mse: 8.5483 - val_loss: 15.7315 - val_mse: 14.8078
Epoch 220/800
6/6 - 0s - loss: 9.3837 - mse: 8.4601 - val_loss: 15.6182 - val_mse: 14.6948
Epoch 221/800
6/6 - 0s - loss: 9.3226 - mse: 8.3994 - val_loss: 15.4693 - val_mse: 14.5464
Epoch 222/800
6/6 - 0s - loss: 9.2244 - mse: 8.3017 - val_loss: 15.3571 - val_mse: 14.4345
Epoch 223/800
6/6 - 0s - loss: 9.1430 - mse: 8.2206 - val_loss: 15.2461 - val_mse: 14.3239
Epoch 224/800
6/6 - 0s - loss: 9.0576 - mse: 8.1356 - val_loss: 15.1364 - val_mse: 14.2147
Epoch 225/800
6/6 - 0s - loss: 9.0020 - mse: 8.0804 - val_loss: 14.9859 - val_mse: 14.0645
Epoch 226/800
6/6 - 0s - loss: 8.8977 - mse: 7.9765 - val_loss: 14.8870 - val_mse: 13.9660
Epoch 227/800
6/6 - 0s - loss: 8.8371 - mse: 7.9162 - val_loss: 14.7670 - val_mse: 13.8464
Epoch 228/800
6/6 - 0s - loss: 8.7729 - mse: 7.8524 - val_loss: 14.6527 - val_mse: 13.7325
Epoch 229/800
6/6 - 0s - loss: 8.6862 - mse: 7.7661 - val_loss: 14.5543 - val_mse: 13.6344
Epoch 230/800
6/6 - 0s - loss: 8.6294 - mse: 7.7097 - val_loss: 14.4428 - val_mse: 13.5233
Epoch 231/800
6/6 - 0s - loss: 8.5674 - mse: 7.6480 - val_loss: 14.3455 - val_mse: 13.4264
Epoch 232/800
6/6 - 0s - loss: 8.4957 - mse: 7.5767 - val_loss: 14.2573 - val_mse: 13.3386
Epoch 233/800
6/6 - 0s - loss: 8.4391 - mse: 7.5205 - val_loss: 14.1599 - val_mse: 13.2416
Epoch 234/800
6/6 - 0s - loss: 8.3761 - mse: 7.4579 - val_loss: 14.0619 - val_mse: 13.1440
Epoch 235/800
6/6 - 0s - loss: 8.3156 - mse: 7.3977 - val_loss: 13.9650 - val_mse: 13.0474
Epoch 236/800
6/6 - 0s - loss: 8.2541 - mse: 7.3366 - val_loss: 13.8738 - val_mse: 12.9566
Epoch 237/800
6/6 - 0s - loss: 8.1991 - mse: 7.2821 - val_loss: 13.7738 - val_mse: 12.8569
Epoch 238/800
6/6 - 0s - loss: 8.1439 - mse: 7.2272 - val_loss: 13.6893 - val_mse: 12.7728
Epoch 239/800
6/6 - 0s - loss: 8.0962 - mse: 7.1799 - val_loss: 13.5923 - val_mse: 12.6762
Epoch 240/800
6/6 - 0s - loss: 8.0418 - mse: 7.1258 - val_loss: 13.4937 - val_mse: 12.5780
Epoch 241/800
6/6 - 0s - loss: 7.9777 - mse: 7.0621 - val_loss: 13.4131 - val_mse: 12.4978
Epoch 242/800
6/6 - 0s - loss: 7.9309 - mse: 7.0157 - val_loss: 13.3309 - val_mse: 12.4160
Epoch 243/800
6/6 - 0s - loss: 7.8762 - mse: 6.9614 - val_loss: 13.2484 - val_mse: 12.3338
Epoch 244/800
6/6 - 0s - loss: 7.8223 - mse: 6.9078 - val_loss: 13.1810 - val_mse: 12.2668
Epoch 245/800
6/6 - 0s - loss: 7.7770 - mse: 6.8630 - val_loss: 13.0921 - val_mse: 12.1782
Epoch 246/800
6/6 - 0s - loss: 7.7301 - mse: 6.8164 - val_loss: 12.9883 - val_mse: 12.0748
Epoch 247/800
6/6 - 0s - loss: 7.6761 - mse: 6.7627 - val_loss: 12.9153 - val_mse: 12.0022
Epoch 248/800
6/6 - 0s - loss: 7.6316 - mse: 6.7186 - val_loss: 12.8064 - val_mse: 11.8936
Epoch 249/800
6/6 - 0s - loss: 7.5752 - mse: 6.6627 - val_loss: 12.7167 - val_mse: 11.8043
Epoch 250/800
6/6 - 0s - loss: 7.5270 - mse: 6.6148 - val_loss: 12.6349 - val_mse: 11.7230
Epoch 251/800
6/6 - 0s - loss: 7.4841 - mse: 6.5723 - val_loss: 12.5533 - val_mse: 11.6417
Epoch 252/800
6/6 - 0s - loss: 7.4360 - mse: 6.5246 - val_loss: 12.4648 - val_mse: 11.5536
Epoch 253/800
6/6 - 0s - loss: 7.3885 - mse: 6.4775 - val_loss: 12.3896 - val_mse: 11.4788
Epoch 254/800
6/6 - 0s - loss: 7.3381 - mse: 6.4274 - val_loss: 12.3198 - val_mse: 11.4094
Epoch 255/800
6/6 - 0s - loss: 7.3017 - mse: 6.3914 - val_loss: 12.2287 - val_mse: 11.3186
Epoch 256/800
6/6 - 0s - loss: 7.2556 - mse: 6.3456 - val_loss: 12.1439 - val_mse: 11.2342
Epoch 257/800
6/6 - 0s - loss: 7.2075 - mse: 6.2979 - val_loss: 12.0902 - val_mse: 11.1808
Epoch 258/800
6/6 - 0s - loss: 7.1621 - mse: 6.2529 - val_loss: 12.0103 - val_mse: 11.1013
Epoch 259/800
6/6 - 0s - loss: 7.1123 - mse: 6.2035 - val_loss: 11.9325 - val_mse: 11.0239
Epoch 260/800
6/6 - 0s - loss: 7.0629 - mse: 6.1545 - val_loss: 11.8651 - val_mse: 10.9568
Epoch 261/800
6/6 - 0s - loss: 7.0284 - mse: 6.1203 - val_loss: 11.7989 - val_mse: 10.8910
Epoch 262/800
6/6 - 0s - loss: 6.9843 - mse: 6.0766 - val_loss: 11.7269 - val_mse: 10.8194
Epoch 263/800
6/6 - 0s - loss: 6.9457 - mse: 6.0383 - val_loss: 11.6439 - val_mse: 10.7368
Epoch 264/800
6/6 - 0s - loss: 6.9152 - mse: 6.0083 - val_loss: 11.5565 - val_mse: 10.6498
Epoch 265/800
6/6 - 0s - loss: 6.8576 - mse: 5.9510 - val_loss: 11.4933 - val_mse: 10.5869
Epoch 266/800
6/6 - 0s - loss: 6.8173 - mse: 5.9110 - val_loss: 11.4411 - val_mse: 10.5351
Epoch 267/800
6/6 - 0s - loss: 6.7778 - mse: 5.8719 - val_loss: 11.3838 - val_mse: 10.4781
Epoch 268/800
6/6 - 0s - loss: 6.7460 - mse: 5.8405 - val_loss: 11.3052 - val_mse: 10.3999
Epoch 269/800
6/6 - 0s - loss: 6.7002 - mse: 5.7951 - val_loss: 11.2491 - val_mse: 10.3442
Epoch 270/800
6/6 - 0s - loss: 6.6573 - mse: 5.7525 - val_loss: 11.1928 - val_mse: 10.2883
Epoch 271/800
6/6 - 0s - loss: 6.6364 - mse: 5.7320 - val_loss: 11.1133 - val_mse: 10.2091
Epoch 272/800
6/6 - 0s - loss: 6.5937 - mse: 5.6897 - val_loss: 11.0719 - val_mse: 10.1681
Epoch 273/800
6/6 - 0s - loss: 6.5518 - mse: 5.6481 - val_loss: 11.0132 - val_mse: 10.1098
Epoch 274/800
6/6 - 0s - loss: 6.5158 - mse: 5.6125 - val_loss: 10.9493 - val_mse: 10.0462
Epoch 275/800
6/6 - 0s - loss: 6.4854 - mse: 5.5824 - val_loss: 10.8895 - val_mse: 9.9868
Epoch 276/800
6/6 - 0s - loss: 6.4481 - mse: 5.5455 - val_loss: 10.8409 - val_mse: 9.9385
Epoch 277/800
6/6 - 0s - loss: 6.4122 - mse: 5.5100 - val_loss: 10.7840 - val_mse: 9.8820
Epoch 278/800
6/6 - 0s - loss: 6.3805 - mse: 5.4786 - val_loss: 10.7286 - val_mse: 9.8270
Epoch 279/800
6/6 - 0s - loss: 6.3475 - mse: 5.4460 - val_loss: 10.6749 - val_mse: 9.7737
Epoch 280/800
6/6 - 0s - loss: 6.3174 - mse: 5.4163 - val_loss: 10.6403 - val_mse: 9.7394
Epoch 281/800
6/6 - 0s - loss: 6.2763 - mse: 5.3755 - val_loss: 10.5850 - val_mse: 9.6844
Epoch 282/800
6/6 - 0s - loss: 6.2438 - mse: 5.3434 - val_loss: 10.5465 - val_mse: 9.6464
Epoch 283/800
6/6 - 0s - loss: 6.2146 - mse: 5.3146 - val_loss: 10.4902 - val_mse: 9.5904
Epoch 284/800
6/6 - 0s - loss: 6.1788 - mse: 5.2792 - val_loss: 10.4445 - val_mse: 9.5451
Epoch 285/800
6/6 - 0s - loss: 6.1467 - mse: 5.2474 - val_loss: 10.4063 - val_mse: 9.5072
Epoch 286/800
6/6 - 0s - loss: 6.1203 - mse: 5.2214 - val_loss: 10.3383 - val_mse: 9.4396
Epoch 287/800
6/6 - 0s - loss: 6.0912 - mse: 5.1926 - val_loss: 10.2719 - val_mse: 9.3736
Epoch 288/800
6/6 - 0s - loss: 6.0554 - mse: 5.1572 - val_loss: 10.2286 - val_mse: 9.3306
Epoch 289/800
6/6 - 0s - loss: 6.0312 - mse: 5.1333 - val_loss: 10.1718 - val_mse: 9.2742
Epoch 290/800
6/6 - 0s - loss: 6.0132 - mse: 5.1157 - val_loss: 10.1384 - val_mse: 9.2411
Epoch 291/800
6/6 - 0s - loss: 5.9752 - mse: 5.0781 - val_loss: 10.0830 - val_mse: 9.1861
Epoch 292/800
6/6 - 0s - loss: 5.9412 - mse: 5.0445 - val_loss: 10.0491 - val_mse: 9.1526
Epoch 293/800
6/6 - 0s - loss: 5.9279 - mse: 5.0315 - val_loss: 9.9861 - val_mse: 9.0899
Epoch 294/800
6/6 - 0s - loss: 5.8857 - mse: 4.9897 - val_loss: 9.9448 - val_mse: 9.0490
Epoch 295/800
6/6 - 0s - loss: 5.8575 - mse: 4.9619 - val_loss: 9.8967 - val_mse: 9.0013
Epoch 296/800
6/6 - 0s - loss: 5.8304 - mse: 4.9351 - val_loss: 9.8546 - val_mse: 8.9596
Epoch 297/800
6/6 - 0s - loss: 5.8040 - mse: 4.9091 - val_loss: 9.8106 - val_mse: 8.9159
Epoch 298/800
6/6 - 0s - loss: 5.7811 - mse: 4.8865 - val_loss: 9.7756 - val_mse: 8.8813
Epoch 299/800
6/6 - 0s - loss: 5.7511 - mse: 4.8569 - val_loss: 9.7326 - val_mse: 8.8386
Epoch 300/800
6/6 - 0s - loss: 5.7235 - mse: 4.8296 - val_loss: 9.6824 - val_mse: 8.7887
Epoch 301/800
6/6 - 0s - loss: 5.7011 - mse: 4.8076 - val_loss: 9.6317 - val_mse: 8.7384
Epoch 302/800
6/6 - 0s - loss: 5.6755 - mse: 4.7824 - val_loss: 9.5843 - val_mse: 8.6913
Epoch 303/800
6/6 - 0s - loss: 5.6441 - mse: 4.7513 - val_loss: 9.5478 - val_mse: 8.6552
Epoch 304/800
6/6 - 0s - loss: 5.6223 - mse: 4.7299 - val_loss: 9.5039 - val_mse: 8.6117
Epoch 305/800
6/6 - 0s - loss: 5.6129 - mse: 4.7209 - val_loss: 9.4823 - val_mse: 8.5904
Epoch 306/800
6/6 - 0s - loss: 5.5699 - mse: 4.6782 - val_loss: 9.4375 - val_mse: 8.5460
Epoch 307/800
6/6 - 0s - loss: 5.5460 - mse: 4.6547 - val_loss: 9.3870 - val_mse: 8.4959
Epoch 308/800
6/6 - 0s - loss: 5.5186 - mse: 4.6276 - val_loss: 9.3457 - val_mse: 8.4549
Epoch 309/800
6/6 - 0s - loss: 5.4947 - mse: 4.6041 - val_loss: 9.3132 - val_mse: 8.4228
Epoch 310/800
6/6 - 0s - loss: 5.4733 - mse: 4.5830 - val_loss: 9.2681 - val_mse: 8.3780
Epoch 311/800
6/6 - 0s - loss: 5.4493 - mse: 4.5594 - val_loss: 9.2243 - val_mse: 8.3346
Epoch 312/800
6/6 - 0s - loss: 5.4313 - mse: 4.5417 - val_loss: 9.1874 - val_mse: 8.2981
Epoch 313/800
6/6 - 0s - loss: 5.3978 - mse: 4.5086 - val_loss: 9.1498 - val_mse: 8.2608
Epoch 314/800
6/6 - 0s - loss: 5.3753 - mse: 4.4865 - val_loss: 9.1117 - val_mse: 8.2231
Epoch 315/800
6/6 - 0s - loss: 5.3535 - mse: 4.4650 - val_loss: 9.0742 - val_mse: 8.1860
Epoch 316/800
6/6 - 0s - loss: 5.3284 - mse: 4.4403 - val_loss: 9.0412 - val_mse: 8.1532
Epoch 317/800
6/6 - 0s - loss: 5.3042 - mse: 4.4164 - val_loss: 9.0095 - val_mse: 8.1219
Epoch 318/800
6/6 - 0s - loss: 5.2831 - mse: 4.3957 - val_loss: 8.9693 - val_mse: 8.0821
Epoch 319/800
6/6 - 0s - loss: 5.2612 - mse: 4.3741 - val_loss: 8.9366 - val_mse: 8.0497
Epoch 320/800
6/6 - 0s - loss: 5.2354 - mse: 4.3487 - val_loss: 8.9055 - val_mse: 8.0190
Epoch 321/800
6/6 - 0s - loss: 5.2177 - mse: 4.3313 - val_loss: 8.8744 - val_mse: 7.9882
Epoch 322/800
6/6 - 0s - loss: 5.1960 - mse: 4.3100 - val_loss: 8.8436 - val_mse: 7.9578
Epoch 323/800
6/6 - 0s - loss: 5.1790 - mse: 4.2933 - val_loss: 8.8008 - val_mse: 7.9153
Epoch 324/800
6/6 - 0s - loss: 5.1522 - mse: 4.2669 - val_loss: 8.7741 - val_mse: 7.8890
Epoch 325/800
6/6 - 0s - loss: 5.1276 - mse: 4.2427 - val_loss: 8.7439 - val_mse: 7.8591
Epoch 326/800
6/6 - 0s - loss: 5.1106 - mse: 4.2260 - val_loss: 8.7092 - val_mse: 7.8248
Epoch 327/800
6/6 - 0s - loss: 5.0868 - mse: 4.2025 - val_loss: 8.6816 - val_mse: 7.7976
Epoch 328/800
6/6 - 0s - loss: 5.0654 - mse: 4.1815 - val_loss: 8.6526 - val_mse: 7.7689
Epoch 329/800
6/6 - 0s - loss: 5.0499 - mse: 4.1663 - val_loss: 8.6143 - val_mse: 7.7310
Epoch 330/800
6/6 - 0s - loss: 5.0258 - mse: 4.1426 - val_loss: 8.5857 - val_mse: 7.7027
Epoch 331/800
6/6 - 0s - loss: 5.0061 - mse: 4.1233 - val_loss: 8.5591 - val_mse: 7.6765
Epoch 332/800
6/6 - 0s - loss: 4.9869 - mse: 4.1044 - val_loss: 8.5276 - val_mse: 7.6453
Epoch 333/800
6/6 - 0s - loss: 4.9692 - mse: 4.0870 - val_loss: 8.4998 - val_mse: 7.6179
Epoch 334/800
6/6 - 0s - loss: 4.9485 - mse: 4.0667 - val_loss: 8.4751 - val_mse: 7.5935
Epoch 335/800
6/6 - 0s - loss: 4.9270 - mse: 4.0456 - val_loss: 8.4438 - val_mse: 7.5626
Epoch 336/800
6/6 - 0s - loss: 4.9069 - mse: 4.0258 - val_loss: 8.4214 - val_mse: 7.5405
Epoch 337/800
6/6 - 0s - loss: 4.8871 - mse: 4.0064 - val_loss: 8.3906 - val_mse: 7.5100
Epoch 338/800
6/6 - 0s - loss: 4.8736 - mse: 3.9932 - val_loss: 8.3569 - val_mse: 7.4767
Epoch 339/800
6/6 - 0s - loss: 4.8480 - mse: 3.9679 - val_loss: 8.3324 - val_mse: 7.4526
Epoch 340/800
6/6 - 0s - loss: 4.8321 - mse: 3.9524 - val_loss: 8.3087 - val_mse: 7.4292
Epoch 341/800
6/6 - 0s - loss: 4.8138 - mse: 3.9344 - val_loss: 8.2856 - val_mse: 7.4064
Epoch 342/800
6/6 - 0s - loss: 4.7971 - mse: 3.9181 - val_loss: 8.2513 - val_mse: 7.3725
Epoch 343/800
6/6 - 0s - loss: 4.7781 - mse: 3.8994 - val_loss: 8.2178 - val_mse: 7.3394
Epoch 344/800
6/6 - 0s - loss: 4.7613 - mse: 3.8830 - val_loss: 8.1911 - val_mse: 7.3130
Epoch 345/800
6/6 - 0s - loss: 4.7404 - mse: 3.8624 - val_loss: 8.1608 - val_mse: 7.2830
Epoch 346/800
6/6 - 0s - loss: 4.7218 - mse: 3.8442 - val_loss: 8.1328 - val_mse: 7.2554
Epoch 347/800
6/6 - 0s - loss: 4.7054 - mse: 3.8281 - val_loss: 8.1026 - val_mse: 7.2255
Epoch 348/800
6/6 - 0s - loss: 4.6851 - mse: 3.8081 - val_loss: 8.0764 - val_mse: 7.1997
Epoch 349/800
6/6 - 0s - loss: 4.6739 - mse: 3.7973 - val_loss: 8.0469 - val_mse: 7.1705
Epoch 350/800
6/6 - 0s - loss: 4.6556 - mse: 3.7794 - val_loss: 8.0281 - val_mse: 7.1521
Epoch 351/800
6/6 - 0s - loss: 4.6366 - mse: 3.7607 - val_loss: 8.0019 - val_mse: 7.1262
Epoch 352/800
6/6 - 0s - loss: 4.6244 - mse: 3.7488 - val_loss: 7.9755 - val_mse: 7.1001
Epoch 353/800
6/6 - 0s - loss: 4.6005 - mse: 3.7253 - val_loss: 7.9548 - val_mse: 7.0798
Epoch 354/800
6/6 - 0s - loss: 4.5811 - mse: 3.7063 - val_loss: 7.9272 - val_mse: 7.0526
Epoch 355/800
6/6 - 0s - loss: 4.5647 - mse: 3.6902 - val_loss: 7.9010 - val_mse: 7.0267
Epoch 356/800
6/6 - 0s - loss: 4.5458 - mse: 3.6716 - val_loss: 7.8756 - val_mse: 7.0016
Epoch 357/800
6/6 - 0s - loss: 4.5296 - mse: 3.6558 - val_loss: 7.8495 - val_mse: 6.9759
Epoch 358/800
6/6 - 0s - loss: 4.5120 - mse: 3.6385 - val_loss: 7.8267 - val_mse: 6.9534
Epoch 359/800
6/6 - 0s - loss: 4.4929 - mse: 3.6197 - val_loss: 7.8023 - val_mse: 6.9293
Epoch 360/800
6/6 - 0s - loss: 4.4804 - mse: 3.6076 - val_loss: 7.7735 - val_mse: 6.9009
Epoch 361/800
6/6 - 0s - loss: 4.4736 - mse: 3.6012 - val_loss: 7.7458 - val_mse: 6.8735
Epoch 362/800
6/6 - 0s - loss: 4.4423 - mse: 3.5701 - val_loss: 7.7211 - val_mse: 6.8492
Epoch 363/800
6/6 - 0s - loss: 4.4322 - mse: 3.5605 - val_loss: 7.6983 - val_mse: 6.8268
Epoch 364/800
6/6 - 0s - loss: 4.4110 - mse: 3.5395 - val_loss: 7.6759 - val_mse: 6.8047
Epoch 365/800
6/6 - 0s - loss: 4.3957 - mse: 3.5246 - val_loss: 7.6554 - val_mse: 6.7845
Epoch 366/800
6/6 - 0s - loss: 4.3784 - mse: 3.5077 - val_loss: 7.6325 - val_mse: 6.7620
Epoch 367/800
6/6 - 0s - loss: 4.3634 - mse: 3.4930 - val_loss: 7.6097 - val_mse: 6.7395
Epoch 368/800
6/6 - 0s - loss: 4.3476 - mse: 3.4775 - val_loss: 7.5855 - val_mse: 6.7156
Epoch 369/800
6/6 - 0s - loss: 4.3303 - mse: 3.4606 - val_loss: 7.5627 - val_mse: 6.6932
Epoch 370/800
6/6 - 0s - loss: 4.3149 - mse: 3.4455 - val_loss: 7.5367 - val_mse: 6.6675
Epoch 371/800
6/6 - 0s - loss: 4.2985 - mse: 3.4295 - val_loss: 7.5155 - val_mse: 6.6467
Epoch 372/800
6/6 - 0s - loss: 4.2861 - mse: 3.4174 - val_loss: 7.4897 - val_mse: 6.6212
Epoch 373/800
6/6 - 0s - loss: 4.2667 - mse: 3.3983 - val_loss: 7.4704 - val_mse: 6.6022
Epoch 374/800
6/6 - 0s - loss: 4.2561 - mse: 3.3881 - val_loss: 7.4476 - val_mse: 6.5798
Epoch 375/800
6/6 - 0s - loss: 4.2374 - mse: 3.3697 - val_loss: 7.4252 - val_mse: 6.5577
Epoch 376/800
6/6 - 0s - loss: 4.2207 - mse: 3.3533 - val_loss: 7.4060 - val_mse: 6.5389
Epoch 377/800
6/6 - 0s - loss: 4.2110 - mse: 3.3440 - val_loss: 7.3836 - val_mse: 6.5168
Epoch 378/800
6/6 - 0s - loss: 4.1939 - mse: 3.3272 - val_loss: 7.3604 - val_mse: 6.4939
Epoch 379/800
6/6 - 0s - loss: 4.1793 - mse: 3.3130 - val_loss: 7.3395 - val_mse: 6.4734
Epoch 380/800
6/6 - 0s - loss: 4.1637 - mse: 3.2977 - val_loss: 7.3198 - val_mse: 6.4540
Epoch 381/800
6/6 - 0s - loss: 4.1517 - mse: 3.2860 - val_loss: 7.2976 - val_mse: 6.4321
Epoch 382/800
6/6 - 0s - loss: 4.1375 - mse: 3.2722 - val_loss: 7.2788 - val_mse: 6.4137
Epoch 383/800
6/6 - 0s - loss: 4.1226 - mse: 3.2576 - val_loss: 7.2611 - val_mse: 6.3963
Epoch 384/800
6/6 - 0s - loss: 4.1090 - mse: 3.2444 - val_loss: 7.2465 - val_mse: 6.3821
Epoch 385/800
6/6 - 0s - loss: 4.0985 - mse: 3.2342 - val_loss: 7.2255 - val_mse: 6.3614
Epoch 386/800
6/6 - 0s - loss: 4.0851 - mse: 3.2211 - val_loss: 7.2069 - val_mse: 6.3432
Epoch 387/800
6/6 - 0s - loss: 4.0698 - mse: 3.2061 - val_loss: 7.1894 - val_mse: 6.3259
Epoch 388/800
6/6 - 0s - loss: 4.0620 - mse: 3.1987 - val_loss: 7.1685 - val_mse: 6.3053
Epoch 389/800
6/6 - 0s - loss: 4.0445 - mse: 3.1815 - val_loss: 7.1413 - val_mse: 6.2785
Epoch 390/800
6/6 - 0s - loss: 4.0374 - mse: 3.1748 - val_loss: 7.1166 - val_mse: 6.2541
Epoch 391/800
6/6 - 0s - loss: 4.0226 - mse: 3.1603 - val_loss: 7.0943 - val_mse: 6.2322
Epoch 392/800
6/6 - 0s - loss: 4.0131 - mse: 3.1511 - val_loss: 7.0751 - val_mse: 6.2134
Epoch 393/800
6/6 - 0s - loss: 3.9938 - mse: 3.1322 - val_loss: 7.0555 - val_mse: 6.1941
Epoch 394/800
6/6 - 0s - loss: 3.9850 - mse: 3.1237 - val_loss: 7.0353 - val_mse: 6.1742
Epoch 395/800
6/6 - 0s - loss: 3.9693 - mse: 3.1083 - val_loss: 7.0139 - val_mse: 6.1531
Epoch 396/800
6/6 - 0s - loss: 3.9563 - mse: 3.0956 - val_loss: 6.9939 - val_mse: 6.1335
Epoch 397/800
6/6 - 0s - loss: 3.9472 - mse: 3.0869 - val_loss: 6.9730 - val_mse: 6.1129
Epoch 398/800
6/6 - 0s - loss: 3.9319 - mse: 3.0719 - val_loss: 6.9497 - val_mse: 6.0899
Epoch 399/800
6/6 - 0s - loss: 3.9194 - mse: 3.0597 - val_loss: 6.9292 - val_mse: 6.0697
Epoch 400/800
6/6 - 0s - loss: 3.9090 - mse: 3.0497 - val_loss: 6.9066 - val_mse: 6.0475
Epoch 401/800
6/6 - 0s - loss: 3.8948 - mse: 3.0358 - val_loss: 6.8872 - val_mse: 6.0284
Epoch 402/800
6/6 - 0s - loss: 3.8845 - mse: 3.0258 - val_loss: 6.8669 - val_mse: 6.0085
Epoch 403/800
6/6 - 0s - loss: 3.8737 - mse: 3.0154 - val_loss: 6.8460 - val_mse: 5.9879
Epoch 404/800
6/6 - 0s - loss: 3.8627 - mse: 3.0047 - val_loss: 6.8287 - val_mse: 5.9710
Epoch 405/800
6/6 - 0s - loss: 3.8511 - mse: 2.9935 - val_loss: 6.8077 - val_mse: 5.9502
Epoch 406/800
6/6 - 0s - loss: 3.8409 - mse: 2.9835 - val_loss: 6.7935 - val_mse: 5.9363
Epoch 407/800
6/6 - 0s - loss: 3.8254 - mse: 2.9684 - val_loss: 6.7745 - val_mse: 5.9177
Epoch 408/800
6/6 - 0s - loss: 3.8180 - mse: 2.9614 - val_loss: 6.7522 - val_mse: 5.8958
Epoch 409/800
6/6 - 0s - loss: 3.8044 - mse: 2.9481 - val_loss: 6.7333 - val_mse: 5.8771
Epoch 410/800
6/6 - 0s - loss: 3.7935 - mse: 2.9375 - val_loss: 6.7174 - val_mse: 5.8616
Epoch 411/800
6/6 - 0s - loss: 3.7825 - mse: 2.9268 - val_loss: 6.6981 - val_mse: 5.8426
Epoch 412/800
6/6 - 0s - loss: 3.7724 - mse: 2.9170 - val_loss: 6.6781 - val_mse: 5.8229
Epoch 413/800
6/6 - 0s - loss: 3.7623 - mse: 2.9073 - val_loss: 6.6643 - val_mse: 5.8095
Epoch 414/800
6/6 - 0s - loss: 3.7513 - mse: 2.8966 - val_loss: 6.6469 - val_mse: 5.7924
Epoch 415/800
6/6 - 0s - loss: 3.7431 - mse: 2.8887 - val_loss: 6.6282 - val_mse: 5.7740
Epoch 416/800
6/6 - 0s - loss: 3.7305 - mse: 2.8764 - val_loss: 6.6079 - val_mse: 5.7541
Epoch 417/800
6/6 - 0s - loss: 3.7196 - mse: 2.8659 - val_loss: 6.5905 - val_mse: 5.7370
Epoch 418/800
6/6 - 0s - loss: 3.7103 - mse: 2.8569 - val_loss: 6.5744 - val_mse: 5.7212
Epoch 419/800
6/6 - 0s - loss: 3.6998 - mse: 2.8468 - val_loss: 6.5615 - val_mse: 5.7086
Epoch 420/800
6/6 - 0s - loss: 3.6916 - mse: 2.8389 - val_loss: 6.5414 - val_mse: 5.6889
Epoch 421/800
6/6 - 0s - loss: 3.6851 - mse: 2.8327 - val_loss: 6.5272 - val_mse: 5.6750
Epoch 422/800
6/6 - 0s - loss: 3.6773 - mse: 2.8252 - val_loss: 6.5045 - val_mse: 5.6526
Epoch 423/800
6/6 - 0s - loss: 3.6628 - mse: 2.8111 - val_loss: 6.4922 - val_mse: 5.6407
Epoch 424/800
6/6 - 0s - loss: 3.6543 - mse: 2.8029 - val_loss: 6.4768 - val_mse: 5.6256
Epoch 425/800
6/6 - 0s - loss: 3.6474 - mse: 2.7964 - val_loss: 6.4568 - val_mse: 5.6060
Epoch 426/800
6/6 - 0s - loss: 3.6359 - mse: 2.7851 - val_loss: 6.4457 - val_mse: 5.5951
Epoch 427/800
6/6 - 0s - loss: 3.6259 - mse: 2.7755 - val_loss: 6.4331 - val_mse: 5.5828
Epoch 428/800
6/6 - 0s - loss: 3.6169 - mse: 2.7668 - val_loss: 6.4166 - val_mse: 5.5667
Epoch 429/800
6/6 - 0s - loss: 3.6076 - mse: 2.7578 - val_loss: 6.4047 - val_mse: 5.5551
Epoch 430/800
6/6 - 0s - loss: 3.5998 - mse: 2.7503 - val_loss: 6.3949 - val_mse: 5.5456
Epoch 431/800
6/6 - 0s - loss: 3.5916 - mse: 2.7424 - val_loss: 6.3771 - val_mse: 5.5282
Epoch 432/800
6/6 - 0s - loss: 3.5834 - mse: 2.7346 - val_loss: 6.3631 - val_mse: 5.5145
Epoch 433/800
6/6 - 0s - loss: 3.5751 - mse: 2.7266 - val_loss: 6.3447 - val_mse: 5.4964
Epoch 434/800
6/6 - 0s - loss: 3.5658 - mse: 2.7176 - val_loss: 6.3321 - val_mse: 5.4841
Epoch 435/800
6/6 - 0s - loss: 3.5569 - mse: 2.7090 - val_loss: 6.3197 - val_mse: 5.4720
Epoch 436/800
6/6 - 0s - loss: 3.5500 - mse: 2.7025 - val_loss: 6.3050 - val_mse: 5.4577
Epoch 437/800
6/6 - 0s - loss: 3.5412 - mse: 2.6940 - val_loss: 6.2905 - val_mse: 5.4435
Epoch 438/800
6/6 - 0s - loss: 3.5339 - mse: 2.6870 - val_loss: 6.2770 - val_mse: 5.4304
Epoch 439/800
6/6 - 0s - loss: 3.5250 - mse: 2.6785 - val_loss: 6.2695 - val_mse: 5.4231
Epoch 440/800
6/6 - 0s - loss: 3.5184 - mse: 2.6722 - val_loss: 6.2606 - val_mse: 5.4146
Epoch 441/800
6/6 - 0s - loss: 3.5129 - mse: 2.6670 - val_loss: 6.2503 - val_mse: 5.4046
Epoch 442/800
6/6 - 0s - loss: 3.5054 - mse: 2.6599 - val_loss: 6.2365 - val_mse: 5.3911
Epoch 443/800
6/6 - 0s - loss: 3.4955 - mse: 2.6502 - val_loss: 6.2217 - val_mse: 5.3766
Epoch 444/800
6/6 - 0s - loss: 3.4901 - mse: 2.6452 - val_loss: 6.2025 - val_mse: 5.3577
Epoch 445/800
6/6 - 0s - loss: 3.4820 - mse: 2.6374 - val_loss: 6.1902 - val_mse: 5.3457
Epoch 446/800
6/6 - 0s - loss: 3.4768 - mse: 2.6325 - val_loss: 6.1744 - val_mse: 5.3303
Epoch 447/800
6/6 - 0s - loss: 3.4719 - mse: 2.6279 - val_loss: 6.1560 - val_mse: 5.3123
Epoch 448/800
6/6 - 0s - loss: 3.4664 - mse: 2.6227 - val_loss: 6.1505 - val_mse: 5.3070
Epoch 449/800
6/6 - 0s - loss: 3.4579 - mse: 2.6145 - val_loss: 6.1454 - val_mse: 5.3022
Epoch 450/800
6/6 - 0s - loss: 3.4489 - mse: 2.6058 - val_loss: 6.1358 - val_mse: 5.2930
Epoch 451/800
6/6 - 0s - loss: 3.4457 - mse: 2.6030 - val_loss: 6.1213 - val_mse: 5.2788
Epoch 452/800
6/6 - 0s - loss: 3.4364 - mse: 2.5940 - val_loss: 6.1076 - val_mse: 5.2654
Epoch 453/800
6/6 - 0s - loss: 3.4309 - mse: 2.5888 - val_loss: 6.0950 - val_mse: 5.2532
Epoch 454/800
6/6 - 0s - loss: 3.4237 - mse: 2.5819 - val_loss: 6.0884 - val_mse: 5.2469
Epoch 455/800
6/6 - 0s - loss: 3.4182 - mse: 2.5768 - val_loss: 6.0814 - val_mse: 5.2401
Epoch 456/800
6/6 - 0s - loss: 3.4123 - mse: 2.5712 - val_loss: 6.0711 - val_mse: 5.2302
Epoch 457/800
6/6 - 0s - loss: 3.4052 - mse: 2.5644 - val_loss: 6.0647 - val_mse: 5.2241
Epoch 458/800
6/6 - 0s - loss: 3.4019 - mse: 2.5615 - val_loss: 6.0498 - val_mse: 5.2095
Epoch 459/800
6/6 - 0s - loss: 3.3946 - mse: 2.5544 - val_loss: 6.0402 - val_mse: 5.2002
Epoch 460/800
6/6 - 0s - loss: 3.3888 - mse: 2.5490 - val_loss: 6.0345 - val_mse: 5.1948
Epoch 461/800
6/6 - 0s - loss: 3.3827 - mse: 2.5432 - val_loss: 6.0273 - val_mse: 5.1880
Epoch 462/800
6/6 - 0s - loss: 3.3771 - mse: 2.5379 - val_loss: 6.0181 - val_mse: 5.1791
Epoch 463/800
6/6 - 0s - loss: 3.3720 - mse: 2.5331 - val_loss: 6.0111 - val_mse: 5.1724
Epoch 464/800
6/6 - 0s - loss: 3.3664 - mse: 2.5278 - val_loss: 6.0042 - val_mse: 5.1658
Epoch 465/800
6/6 - 0s - loss: 3.3614 - mse: 2.5231 - val_loss: 5.9900 - val_mse: 5.1520
Epoch 466/800
6/6 - 0s - loss: 3.3559 - mse: 2.5179 - val_loss: 5.9804 - val_mse: 5.1426
Epoch 467/800
6/6 - 0s - loss: 3.3511 - mse: 2.5135 - val_loss: 5.9683 - val_mse: 5.1308
Epoch 468/800
6/6 - 0s - loss: 3.3448 - mse: 2.5075 - val_loss: 5.9599 - val_mse: 5.1227
Epoch 469/800
6/6 - 0s - loss: 3.3386 - mse: 2.5016 - val_loss: 5.9517 - val_mse: 5.1149
Epoch 470/800
6/6 - 0s - loss: 3.3363 - mse: 2.4996 - val_loss: 5.9394 - val_mse: 5.1029
Epoch 471/800
6/6 - 0s - loss: 3.3287 - mse: 2.4923 - val_loss: 5.9326 - val_mse: 5.0964
Epoch 472/800
6/6 - 0s - loss: 3.3244 - mse: 2.4883 - val_loss: 5.9284 - val_mse: 5.0925
Epoch 473/800
6/6 - 0s - loss: 3.3222 - mse: 2.4864 - val_loss: 5.9237 - val_mse: 5.0881
Epoch 474/800
6/6 - 0s - loss: 3.3217 - mse: 2.4863 - val_loss: 5.9033 - val_mse: 5.0681
Epoch 475/800
6/6 - 0s - loss: 3.3079 - mse: 2.4728 - val_loss: 5.8966 - val_mse: 5.0616
Epoch 476/800
6/6 - 0s - loss: 3.3037 - mse: 2.4688 - val_loss: 5.8873 - val_mse: 5.0527
Epoch 477/800
6/6 - 0s - loss: 3.2992 - mse: 2.4647 - val_loss: 5.8827 - val_mse: 5.0484
Epoch 478/800
6/6 - 0s - loss: 3.2942 - mse: 2.4601 - val_loss: 5.8714 - val_mse: 5.0374
Epoch 479/800
6/6 - 0s - loss: 3.2915 - mse: 2.4577 - val_loss: 5.8671 - val_mse: 5.0334
Epoch 480/800
6/6 - 0s - loss: 3.2848 - mse: 2.4512 - val_loss: 5.8590 - val_mse: 5.0256
Epoch 481/800
6/6 - 0s - loss: 3.2804 - mse: 2.4472 - val_loss: 5.8464 - val_mse: 5.0133
Epoch 482/800
6/6 - 0s - loss: 3.2765 - mse: 2.4436 - val_loss: 5.8357 - val_mse: 5.0030
Epoch 483/800
6/6 - 0s - loss: 3.2721 - mse: 2.4394 - val_loss: 5.8304 - val_mse: 4.9979
Epoch 484/800
6/6 - 0s - loss: 3.2657 - mse: 2.4334 - val_loss: 5.8244 - val_mse: 4.9923
Epoch 485/800
6/6 - 0s - loss: 3.2644 - mse: 2.4324 - val_loss: 5.8212 - val_mse: 4.9894
Epoch 486/800
6/6 - 0s - loss: 3.2608 - mse: 2.4291 - val_loss: 5.8082 - val_mse: 4.9767
Epoch 487/800
6/6 - 0s - loss: 3.2536 - mse: 2.4222 - val_loss: 5.8008 - val_mse: 4.9696
Epoch 488/800
6/6 - 0s - loss: 3.2485 - mse: 2.4174 - val_loss: 5.7950 - val_mse: 4.9641
Epoch 489/800
6/6 - 0s - loss: 3.2463 - mse: 2.4155 - val_loss: 5.7891 - val_mse: 4.9585
Epoch 490/800
6/6 - 0s - loss: 3.2405 - mse: 2.4100 - val_loss: 5.7832 - val_mse: 4.9530
Epoch 491/800
6/6 - 0s - loss: 3.2363 - mse: 2.4062 - val_loss: 5.7723 - val_mse: 4.9423
Epoch 492/800
6/6 - 0s - loss: 3.2327 - mse: 2.4028 - val_loss: 5.7660 - val_mse: 4.9363
Epoch 493/800
6/6 - 0s - loss: 3.2304 - mse: 2.4008 - val_loss: 5.7518 - val_mse: 4.9224
Epoch 494/800
6/6 - 0s - loss: 3.2244 - mse: 2.3952 - val_loss: 5.7451 - val_mse: 4.9161
Epoch 495/800
6/6 - 0s - loss: 3.2220 - mse: 2.3931 - val_loss: 5.7334 - val_mse: 4.9047
Epoch 496/800
6/6 - 0s - loss: 3.2169 - mse: 2.3882 - val_loss: 5.7299 - val_mse: 4.9014
Epoch 497/800
6/6 - 0s - loss: 3.2128 - mse: 2.3845 - val_loss: 5.7256 - val_mse: 4.8975
Epoch 498/800
6/6 - 0s - loss: 3.2113 - mse: 2.3833 - val_loss: 5.7213 - val_mse: 4.8935
Epoch 499/800
6/6 - 0s - loss: 3.2086 - mse: 2.3809 - val_loss: 5.7173 - val_mse: 4.8898
Epoch 500/800
6/6 - 0s - loss: 3.2012 - mse: 2.3739 - val_loss: 5.7052 - val_mse: 4.8780
Epoch 501/800
6/6 - 0s - loss: 3.2027 - mse: 2.3756 - val_loss: 5.6873 - val_mse: 4.8604
Epoch 502/800
6/6 - 0s - loss: 3.1950 - mse: 2.3682 - val_loss: 5.6810 - val_mse: 4.8544
Epoch 503/800
6/6 - 0s - loss: 3.1937 - mse: 2.3673 - val_loss: 5.6818 - val_mse: 4.8555
Epoch 504/800
6/6 - 0s - loss: 3.1896 - mse: 2.3634 - val_loss: 5.6784 - val_mse: 4.8524
Epoch 505/800
6/6 - 0s - loss: 3.1859 - mse: 2.3601 - val_loss: 5.6704 - val_mse: 4.8448
Epoch 506/800
6/6 - 0s - loss: 3.1836 - mse: 2.3581 - val_loss: 5.6604 - val_mse: 4.8350
Epoch 507/800
6/6 - 0s - loss: 3.1790 - mse: 2.3538 - val_loss: 5.6526 - val_mse: 4.8275
Epoch 508/800
6/6 - 0s - loss: 3.1765 - mse: 2.3515 - val_loss: 5.6506 - val_mse: 4.8259
Epoch 509/800
6/6 - 0s - loss: 3.1727 - mse: 2.3480 - val_loss: 5.6461 - val_mse: 4.8217
Epoch 510/800
6/6 - 0s - loss: 3.1702 - mse: 2.3459 - val_loss: 5.6447 - val_mse: 4.8206
Epoch 511/800
6/6 - 0s - loss: 3.1684 - mse: 2.3444 - val_loss: 5.6372 - val_mse: 4.8133
Epoch 512/800
6/6 - 0s - loss: 3.1658 - mse: 2.3421 - val_loss: 5.6382 - val_mse: 4.8146
Epoch 513/800
6/6 - 0s - loss: 3.1631 - mse: 2.3397 - val_loss: 5.6293 - val_mse: 4.8061
Epoch 514/800
6/6 - 0s - loss: 3.1605 - mse: 2.3374 - val_loss: 5.6295 - val_mse: 4.8066
Epoch 515/800
6/6 - 0s - loss: 3.1555 - mse: 2.3327 - val_loss: 5.6217 - val_mse: 4.7990
Epoch 516/800
6/6 - 0s - loss: 3.1525 - mse: 2.3300 - val_loss: 5.6179 - val_mse: 4.7956
Epoch 517/800
6/6 - 0s - loss: 3.1512 - mse: 2.3290 - val_loss: 5.6105 - val_mse: 4.7885
Epoch 518/800
6/6 - 0s - loss: 3.1480 - mse: 2.3261 - val_loss: 5.6114 - val_mse: 4.7897
Epoch 519/800
6/6 - 0s - loss: 3.1480 - mse: 2.3264 - val_loss: 5.5990 - val_mse: 4.7776
Epoch 520/800
6/6 - 0s - loss: 3.1420 - mse: 2.3207 - val_loss: 5.5999 - val_mse: 4.7788
Epoch 521/800
6/6 - 0s - loss: 3.1399 - mse: 2.3189 - val_loss: 5.6028 - val_mse: 4.7819
Epoch 522/800
6/6 - 0s - loss: 3.1369 - mse: 2.3162 - val_loss: 5.5982 - val_mse: 4.7777
Epoch 523/800
6/6 - 0s - loss: 3.1343 - mse: 2.3139 - val_loss: 5.5938 - val_mse: 4.7736
Epoch 524/800
6/6 - 0s - loss: 3.1324 - mse: 2.3124 - val_loss: 5.5814 - val_mse: 4.7615
Epoch 525/800
6/6 - 0s - loss: 3.1285 - mse: 2.3087 - val_loss: 5.5777 - val_mse: 4.7581
Epoch 526/800
6/6 - 0s - loss: 3.1269 - mse: 2.3074 - val_loss: 5.5667 - val_mse: 4.7474
Epoch 527/800
6/6 - 0s - loss: 3.1238 - mse: 2.3046 - val_loss: 5.5617 - val_mse: 4.7427
Epoch 528/800
6/6 - 0s - loss: 3.1228 - mse: 2.3039 - val_loss: 5.5590 - val_mse: 4.7403
Epoch 529/800
6/6 - 0s - loss: 3.1192 - mse: 2.3006 - val_loss: 5.5562 - val_mse: 4.7378
Epoch 530/800
6/6 - 0s - loss: 3.1168 - mse: 2.2985 - val_loss: 5.5561 - val_mse: 4.7379
Epoch 531/800
6/6 - 0s - loss: 3.1157 - mse: 2.2977 - val_loss: 5.5529 - val_mse: 4.7351
Epoch 532/800
6/6 - 0s - loss: 3.1136 - mse: 2.2959 - val_loss: 5.5433 - val_mse: 4.7258
Epoch 533/800
6/6 - 0s - loss: 3.1120 - mse: 2.2946 - val_loss: 5.5361 - val_mse: 4.7189
Epoch 534/800
6/6 - 0s - loss: 3.1125 - mse: 2.2954 - val_loss: 5.5419 - val_mse: 4.7250
Epoch 535/800
6/6 - 0s - loss: 3.1064 - mse: 2.2896 - val_loss: 5.5342 - val_mse: 4.7176
Epoch 536/800
6/6 - 0s - loss: 3.1036 - mse: 2.2871 - val_loss: 5.5242 - val_mse: 4.7079
Epoch 537/800
6/6 - 0s - loss: 3.1028 - mse: 2.2866 - val_loss: 5.5138 - val_mse: 4.6978
Epoch 538/800
6/6 - 0s - loss: 3.1002 - mse: 2.2843 - val_loss: 5.5083 - val_mse: 4.6926
Epoch 539/800
6/6 - 0s - loss: 3.0970 - mse: 2.2814 - val_loss: 5.5070 - val_mse: 4.6916
Epoch 540/800
6/6 - 0s - loss: 3.0947 - mse: 2.2794 - val_loss: 5.5102 - val_mse: 4.6951
Epoch 541/800
6/6 - 0s - loss: 3.0935 - mse: 2.2785 - val_loss: 5.5080 - val_mse: 4.6932
Epoch 542/800
6/6 - 0s - loss: 3.0918 - mse: 2.2771 - val_loss: 5.5097 - val_mse: 4.6952
Epoch 543/800
6/6 - 0s - loss: 3.0893 - mse: 2.2749 - val_loss: 5.5109 - val_mse: 4.6967
Epoch 544/800
6/6 - 0s - loss: 3.0871 - mse: 2.2730 - val_loss: 5.5072 - val_mse: 4.6933
Epoch 545/800
6/6 - 0s - loss: 3.0876 - mse: 2.2737 - val_loss: 5.4963 - val_mse: 4.6827
Epoch 546/800
6/6 - 0s - loss: 3.0840 - mse: 2.2705 - val_loss: 5.4914 - val_mse: 4.6780
Epoch 547/800
6/6 - 0s - loss: 3.0943 - mse: 2.2811 - val_loss: 5.5095 - val_mse: 4.6965
Epoch 548/800
6/6 - 0s - loss: 3.0842 - mse: 2.2713 - val_loss: 5.4856 - val_mse: 4.6728
Epoch 549/800
6/6 - 0s - loss: 3.0776 - mse: 2.2650 - val_loss: 5.4745 - val_mse: 4.6621
Epoch 550/800
6/6 - 0s - loss: 3.0747 - mse: 2.2624 - val_loss: 5.4673 - val_mse: 4.6551
Epoch 551/800
6/6 - 0s - loss: 3.0737 - mse: 2.2616 - val_loss: 5.4581 - val_mse: 4.6462
Epoch 552/800
6/6 - 0s - loss: 3.0732 - mse: 2.2615 - val_loss: 5.4612 - val_mse: 4.6496
Epoch 553/800
6/6 - 0s - loss: 3.0697 - mse: 2.2583 - val_loss: 5.4563 - val_mse: 4.6450
Epoch 554/800
6/6 - 0s - loss: 3.0669 - mse: 2.2558 - val_loss: 5.4555 - val_mse: 4.6446
Epoch 555/800
6/6 - 0s - loss: 3.0676 - mse: 2.2568 - val_loss: 5.4436 - val_mse: 4.6329
Epoch 556/800
6/6 - 0s - loss: 3.0673 - mse: 2.2567 - val_loss: 5.4330 - val_mse: 4.6226
Epoch 557/800
6/6 - 0s - loss: 3.0625 - mse: 2.2523 - val_loss: 5.4400 - val_mse: 4.6299
Epoch 558/800
6/6 - 0s - loss: 3.0600 - mse: 2.2500 - val_loss: 5.4345 - val_mse: 4.6247
Epoch 559/800
6/6 - 0s - loss: 3.0611 - mse: 2.2514 - val_loss: 5.4263 - val_mse: 4.6168
Epoch 560/800
6/6 - 0s - loss: 3.0571 - mse: 2.2477 - val_loss: 5.4377 - val_mse: 4.6284
Epoch 561/800
6/6 - 0s - loss: 3.0542 - mse: 2.2451 - val_loss: 5.4376 - val_mse: 4.6287
Epoch 562/800
6/6 - 0s - loss: 3.0527 - mse: 2.2439 - val_loss: 5.4353 - val_mse: 4.6267
Epoch 563/800
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Epoch 565/800
6/6 - 0s - loss: 3.0483 - mse: 2.2404 - val_loss: 5.4183 - val_mse: 4.6105
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6/6 - 0s - loss: 3.0467 - mse: 2.2391 - val_loss: 5.4223 - val_mse: 4.6148
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Epoch 586/800
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Epoch 587/800
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Epoch 00587: early stopping
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In [35]:

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model_history.params
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Out[35]:

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In [36]:

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Out[36]:

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```

In [37]:
```
hist = pd.DataFrame(model_history.history)
hist
```

Out[37]:

	loss	mse	val_loss	val_mse
0	4119.808594	4118.792969	3451.277832	3450.262207
1	3962.562744	3961.547119	3323.419189	3322.404297
2	3806.260254	3805.244873	3202.385742	3201.371094
3	3700.440674	3699.426270	3075.835205	3074.820801
4	3551.013184	3549.998535	2962.407959	2961.394287
...	...	...	...	...
582	3.017624	2.214906	5.372094	4.569550
583	3.017066	2.214636	5.363765	4.561507
584	3.014844	2.212701	5.361718	4.559749
585	3.012782	2.210927	5.367266	4.565584
586	3.013782	2.212214	5.370528	4.569132

587 rows × 4 columns

In [38]:
```
hist['epoch'] = model_history.epoch
```

In [39]:
```
hist
```

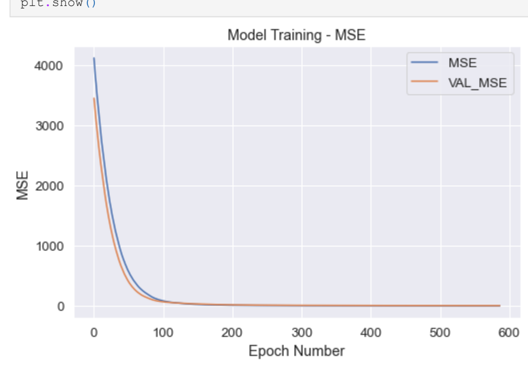
Out[39]:

	loss	mse	val_loss	val_mse	epoch
0	4119.808594	4118.792969	3451.277832	3450.262207	0
1	3962.562744	3961.547119	3323.419189	3322.404297	1
2	3806.260254	3805.244873	3202.385742	3201.371094	2
3	3700.440674	3699.426270	3075.835205	3074.820801	3
4	3551.013184	3549.998535	2962.407959	2961.394287	4
...	...	...	...	...	...
582	3.017624	2.214906	5.372094	4.569550	582
583	3.017066	2.214636	5.363765	4.561507	583
584	3.014844	2.212701	5.361718	4.559749	584
585	3.012782	2.210927	5.367266	4.565584	585
586	3.013782	2.212214	5.370528	4.569132	586

587 rows × 5 columns

In [40]:
```
plt.figure(figsize=(8,5))
plt.plot(model_history.history['loss'])
plt.plot(model_history.history['val_loss'])
plt.title("Model Training")
plt.ylabel("Training and Validation Loss")
plt.xlabel("Epoch Number")
plt.legend(['Training Loss', 'Validation Loss'])
plt.show()
```

In [41]:
```
plt.figure(figsize=(8,5))
plt.plot(model_history.history['mse'])
plt.plot(model_history.history['val_mse'])
plt.title("Model Training - MSE")
plt.ylabel("MSE")
plt.xlabel("Epoch Number")
plt.legend(['MSE','VAL_MSE'])
plt.show()
```



Model Evaluation

In [42]:
```
model.get_weights()
```

Out[42]:
```
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```

In [43]:
```
test_loss, test_mse = model.evaluate(X_test,y_test)
```
```
3/3 [==============================] - 0s 998us/step - loss: 3.1042 - mse: 2.3028
```

In [44]:
```
print("Test MSE: {}".format(test_mse))
```
```
Test MSE: 2.3028433322906494
```

Model Prediction

In [45]:
```
y_pred = model.predict(X_test)
```

In [46]:
```
y_pred[0:5]
```

Out[46]:
```
array([[ 0.7172812 ],
       [ 0.06949318],
       [ 0.1189203 ],
       [-0.02114202],
       [ 0.09577706]], dtype=float32)
```

In [47]:
```
y_pred.round()[0:5]
```

Out[47]:
```
array([[ 1.],
       [ 0.],
       [ 0.],
       [-0.],
       [ 0.]], dtype=float32)
```

In [48]:
```
y_test[0:5]
```

Out[48]:
```
array([4., 0., 0., 0., 0.])
```

In [49]:
```
mse = mean_squared_error(y_test,y_pred.round())
mse
```

Out[49]:
```
2.423076923076923
```

In [50]:
```
rmse = np.sqrt(mse)
rmse
```

Out[50]:
```
1.5566235649883124
```

In [51]:
```
r2 = r2_score(y_test,y_pred.round())
r2
```

Out[51]:
```
0.1907114624505929
```

In [52]:
```
n = len(X_test)
n
```

Out[52]:
```
78
```

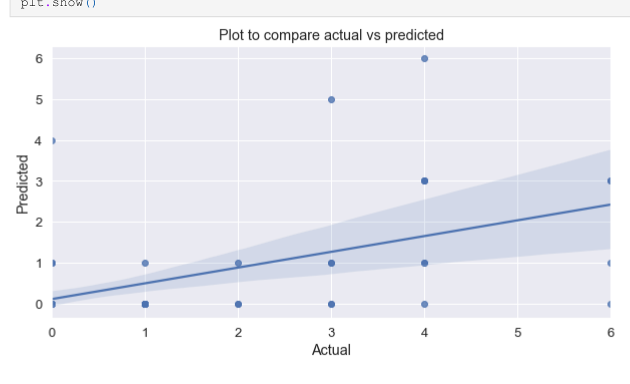
In [53]:
```
p = X_test.shape[1]
p
```

Out[53]:
```
42
```

In [54]:
```
#Adjusted R2 Score
adjr2 = 1-(1-r2)*(n-1)/(n-p-1)
adjr2
```

Out[54]:
```
-0.7804347826086955
```

In [55]:
```
fig, ax = plt.subplots(figsize=(10,5))
sns.regplot(x=y_test, y=y_pred.round(), ax=ax)
plt.title("Plot to compare actual vs predicted")
plt.ylabel("Predicted")
plt.xlabel("Actual")
plt.show()
```



Save the Model

In [56]:
```
model.save("dnnPartA.h5")
```

Cross Validation

Build a model (regression or classfier) first

In [57]:
```
def build_regressor():
    model = Sequential()
    model.add(Dense(units=100,activation='relu',input_dim=42))
    #model.add(BatchNormalization())
    #model.add(Dropout(0.2))
    model.add(Dense(units=100,activation='relu',kernel_regularizer='l2'))
    #model.add(BatchNormalization())
    #model.add(Dropout(0.2))
    model.add(Dense(units=1,activation='linear'))
    optimizer = Adam(learning_rate=0.00001)
    model.compile(optimizer=optimizer, loss='mean_squared_error', metrics=["mse"])
    return model
```

In [58]:
```
model = KerasRegressor(build_fn=build_regressor, epochs=800)
```

In [59]:
```
kfold = StratifiedKFold(n_splits=5,shuffle=True,random_state=0)
```

In [60]:
```
cv = cross_val_score(estimator=model,X=X_train, y=y_train, cv=kfold, n_jobs=-1, verbose=2)
```
```
[Parallel(n_jobs=-1)]: Using backend LokyBackend with 4 concurrent workers.
[Parallel(n_jobs=-1)]: Done   5 out of   5 | elapsed:   32.0s finished
```

In [61]:
```
cv
```

Out[61]:
```
array([-6.45266533, -2.98656297, -3.08224034, -2.71152568, -4.56542969])
```

In [62]:
```
cv.mean()
```

Out[62]:
```
-3.9596848011016847
```

In [63]:
```
cv.std()
```

Out[63]:
```
1.4040409434972103
```

In [64]:
```
mse_mean = abs(cv.mean())
mse_mean
```

Out[64]:
```
3.9596848011016847
```

In [65]:
```
rmse = np.sqrt(mse_mean)
rmse
```

Out[65]:
```
1.9898956759342146
```

Model Hyperparameter Tuning

Create a regressor or classifier function

In [ ]:
```
def build_regressor(optimizer):
    model = Sequential()
    model.add(Dense(units=100,activation='relu',input_dim=42))
    #model.add(BatchNormalization())
    #model.add(Dropout(0.2))
    model.add(Dense(units=100,activation='relu',kernel_regularizer='l2'))
    #model.add(BatchNormalization())
    #model.add(Dropout(0.2))
    model.add(Dense(units=1,activation='linear'))
    optimizer = Adam(learning_rate=0.00001)
    model.compile(optimizer=optimizer, loss='mean_squared_error', metrics=["mse"])
    return model
```

In [ ]:
```
model = KerasRegressor(build_fn=build_regressor)
```

In [ ]:
```
params = {'batch_size':[1,2,5],
          'epochs' : [100,200,300],
          'optimizer' : ['Adam', 'RMSprop', 'SGD']
         }
```

Use RandomSearch CV

In [ ]:
```
randomsearch = RandomizedSearchCV(estimator=model, param_distributions=params,n_iter=10,
                                  scoring='neg_root_mean_squared_error',n_jobs=-1,cv=5,random_state=0)
```

In [ ]:
```
randomsearchcv = randomsearch.fit(X_train, y_train)
```

In [ ]:
```
randomsearchcv.best_params_
```

In [ ]:
```
randomsearchcv.best_score_
```

Final Model

In [ ]:
```
model2 = Sequential()
model2.add(Dense(units=100,activation='relu',input_dim=42))
#model2.add(BatchNormalization())
#model2.add(Dropout(0.2))
model2.add(Dense(units=100,activation='relu',kernel_regularizer='l2'))
#model2.add(BatchNormalization())
#model2.add(Dropout(0.2))
model2.add(Dense(units=1,activation='linear'))
```

In [ ]:
```
model2.summary()
```

In [ ]:
```
checkpointcb = keras.callbacks.ModelCheckpoint("BestModelPartA.h5",save_best_only=True)
```

In [ ]:
```
earlystoppingcb = keras.callbacks.EarlyStopping(patience=10, verbose=1)
```

In [ ]:
```
optimizer = SGD(learning_rate=0.0001)
```

In [ ]:
```
model2.compile(optimizer=optimizer, loss='mean_squared_error', metrics=["mse"])
```

In [ ]:
```
model_history_2 = model2.fit(X_train, y_train,epochs=200,batch_size=2,
                             validation_split=0.2, verbose=2, callbacks=[checkpointcb,earlystoppingcb])
```

In [ ]:
```
model_history_2.params
```