

Sử dụng pandas để chuyển các file excel sang csv

File 1

```
import pandas as pd

df1 = pd.read_excel("./DATA_DIEMTHI/data_pttk_1.xlsx")

# Save to CSV
df1.to_csv("./DATA_DIEMTHI/data_pttk_1.csv", index=False)

df1
```

	mã sv	0.1	0.1.1	Unnamed: 3	0.2	Unnamed: 5	điểm thi	Unnamed: 7
0	b1	9	7	NaN	6.0	NaN	6.00	sáu điểm
1	b2	9	7	NaN	6.0	NaN	6.00	sáu điểm
2	b3	10	9	NaN	7.0	NaN	7.25	bảy hai lăm
3	b4	9	7	NaN	6.0	NaN	6.00	sáu điểm
4	b5	10	8	NaN	7.0	NaN	7.50	bảy rưỡi
5	b6	9	7	NaN	6.5	NaN	6.50	sáu rưỡi
6	b7	0	0	NaN	0.0	NaN	NaN	NaN
7	b8	10	8	NaN	6.0	NaN	7.25	bảy hai lăm
8	b9	10	8	NaN	8.0	NaN	8.00	tám điểm
9	b10	10	8	NaN	7.5	NaN	8.75	tám bảy lăm
10	b11	9	7	NaN	6.0	NaN	5.50	năm rưỡi
11	b12	9	7	NaN	6.0	NaN	6.00	sáu điểm
12	b13	10	8	NaN	7.0	NaN	7.50	bảy rưỡi
13	b14	0	0	NaN	0.0	NaN	NaN	NaN
14	b15	10	8	NaN	7.0	NaN	7.00	bảy điểm
15	b16	10	8	NaN	6.0	NaN	7.50	bảy rưỡi

	mã sv	0.1	0.1.1	Unnamed: 3	0.2	Unnamed: 5	điểm thi	Unnamed: 7
16	b17	10	9	NaN	7.0	NaN	7.25	bảy hai lăm
17	b18	6	5	NaN	5.0	NaN	5.00	năm điểm
18	b19	9	7	NaN	6.0	NaN	6.00	sáu điểm
19	b20	10	9	NaN	7.0	NaN	6.50	sáu rưỡi
20	b21	9	7	NaN	6.0	NaN	6.00	sáu điểm
21	b22	9	7	NaN	6.0	NaN	3.50	ba rưỡi
22	b23	10	8	NaN	7.0	NaN	8.00	tám điểm
23	b24	9	6	NaN	6.0	NaN	6.50	sáu rưỡi
24	b25	10	7	NaN	6.0	NaN	6.00	sáu điểm
25	b26	10	7	NaN	6.0	NaN	7.00	bảy điểm
26	b27	10	6	NaN	6.0	NaN	6.00	sáu điểm
27	b28	10	7	NaN	6.0	NaN	7.00	bảy điểm
28	b29	10	8	NaN	6.5	NaN	7.50	bảy rưỡi
29	b30	9	8	NaN	6.0	NaN	5.50	năm rưỡi
30	b30	9	7	NaN	6.0	NaN	6.50	sáu rưỡi
31	b31	10	7	NaN	6.0	NaN	6.00	sáu điểm
32	b32	9	7	NaN	6.0	NaN	5.50	năm rưỡi
33	b34	9	7	NaN	6.0	NaN	4.50	bốn rưỡi
34	b35	9	7	NaN	6.0	NaN	NaN	NaN
35	b36	0	0	NaN	0.0	NaN	NaN	NaN
36	b37	10	9	NaN	7.0	NaN	7.50	bảy rưỡi
37	b38	10	8	NaN	7.0	NaN	7.00	bảy điểm
38	b39	10	8	NaN	7.5	NaN	7.25	bảy hai lăm
39	b40	0	0	NaN	0.0	NaN	NaN	NaN

	mã sv	0.1	0.1.1	Unnamed: 3	0.2	Unnamed: 5	điểm thi	Unnamed: 7
40	b41	9	7	NaN	6.0	NaN	6.50	sáu rưỡi
41	b42	0	0	NaN	0.0	NaN	NaN	NaN
42	b43	10	8	NaN	7.0	NaN	7.25	bảy hai lăm
43	b44	10	8	NaN	7.0	NaN	7.25	bảy hai lăm
44	b45	10	7	NaN	6.0	NaN	6.00	sáu điểm
45	b46	10	8	NaN	7.5	NaN	7.00	bảy điểm
46	b47	0	0	NaN	0.0	NaN	NaN	NaN
47	b48	10	8	NaN	7.0	NaN	7.00	bảy điểm
48	b49	9	7	NaN	6.0	NaN	6.00	sáu điểm
49	b50	7	6	NaN	5.0	NaN	5.00	năm điểm
50	b51	9	7	NaN	6.0	NaN	6.00	sáu điểm
51	b52	9	7	NaN	6.0	NaN	5.50	năm rưỡi
52	b53	10	8	NaN	7.0	NaN	6.75	sáu bảy lăm
53	b54	10	8	NaN	6.0	NaN	7.00	bảy điểm

File 2

```
import pandas as pd

df2 = pd.read_excel("./DATA_DIEMTHI/data_pttk_2.xlsx")

# Save to CSV
df2.to_csv("./DATA_DIEMTHI/data_pttk_2.csv", index=False)

df2
```

	mã sv	0.1	0.1.1	Unnamed: 3	0.2	Unnamed: 5	điểm thi
0	a1	9	7	NaN	6.0	NaN	6.00
1	a2	9	7	NaN	6.0	NaN	5.50
2	a3	10	8	NaN	7.0	NaN	6.75

	mã sv	0.1	0.1.1	Unnamed: 3	0.2	Unnamed: 5	điểm thi
3	a4	10	8	NaN	6.0	NaN	7.00
4	a5	9	7	NaN	6.0	NaN	6.00
5	a6	10	8	NaN	7.0	NaN	6.50
6	a7	9	7	NaN	6.0	NaN	6.00
7	a8	9	7	NaN	6.0	NaN	5.00
8	a9	10	7	NaN	6.0	NaN	7.00
9	a10	9	7	NaN	6.0	NaN	5.50
10	a11	9	7	NaN	6.0	NaN	6.00
11	a12	9	7	NaN	6.0	NaN	4.50
12	a13	9	7	NaN	6.5	NaN	6.50
13	a14	7	7	NaN	6.0	NaN	6.75
14	a15	9	7	NaN	6.0	NaN	5.00
15	a16	10	8	NaN	7.0	NaN	6.75
16	a17	10	8	NaN	7.0	NaN	5.50
17	a18	10	8	NaN	7.0	NaN	7.50
18	a19	9	7	NaN	6.0	NaN	6.50
19	a20	7	6	NaN	5.0	NaN	4.50
20	a21	9	7	NaN	6.0	NaN	7.75
21	a22	0	0	NaN	0.0	NaN	NaN
22	a23	9	7	NaN	6.0	NaN	6.75
23	a24	9	7	NaN	6.0	NaN	5.50
24	a25	9	7	NaN	6.0	NaN	7.50
25	a26	0	0	NaN	0.0	NaN	NaN
26	a27	10	8	NaN	7.0	NaN	7.50

	mã sv	0.1	0.1.1	Unnamed: 3	0.2	Unnamed: 5	điểm thi
27	a28	10	8	NaN	7.0	NaN	6.00
28	a29	9	7	NaN	6.0	NaN	7.00
29	a30	10	8	NaN	7.0	NaN	6.50
30	a31	9	7	NaN	6.0	NaN	6.00

Gộp lại thành 1 file csv data_pttk.csv

Gộp file 1 và file 2

```
import pandas as pd

string_columns = ["msv",
                  {"header": "10%_1", "value": 0.1},
                  {"header": "10%_2", "value": 0.1},
                  {"header": "20%", "value": 0.2},
                  "score"
                  ]

df1 = pd.read_csv("./DATA_DIEMTHI/data_pttk_1.csv")
df2 = pd.read_csv("./DATA_DIEMTHI/data_pttk_2.csv")

merge_df = pd.concat([df1, df2], ignore_index=True)

# Drop columns with all NaN values
merge_df = merge_df.dropna(axis=1, how='all')

# Drop rows with 0 values
merge_df = merge_df[(merge_df != 0).all(1)]

# Remove the last column
merge_df = merge_df.iloc[:, :-1]

# Use integer indices to access elements in the list
merge_df.columns = [string_columns[0],
                    string_columns[1]['header'],
                    string_columns[2]['header'],
                    string_columns[3]['header'],
                    string_columns[4]]

merge_df.to_csv("./DATA_DIEMTHI/data_pttk_1_2.csv", index=False)

merge_df
```

	msv	10%_1	10%_2	20%	score
0	b1	9	7	6.0	6.00
1	b2	9	7	6.0	6.00
2	b3	10	9	7.0	7.25
3	b4	9	7	6.0	6.00
4	b5	10	8	7.0	7.50
...
80	a27	10	8	7.0	7.50
81	a28	10	8	7.0	6.00
82	a29	9	7	6.0	7.00
83	a30	10	8	7.0	6.50
84	a31	9	7	6.0	6.00

77 rows × 5 columns

Đồng bộ header file 3

```
import pandas as pd

string_columns = ["msv",
                  {"header": "10%_1", "value": 0.1},
                  {"header": "10%_2", "value": 0.1},
                  {"header": "20%", "value": 0.2},
                  "score"
                  ]

df3 = pd.read_csv("./DATA_DIEMTHI/data_pttk_3.csv")

df3.columns = [string_columns[0],
               string_columns[1]['header'],
               string_columns[2]['header'],
               string_columns[3]['header'],
               string_columns[4]]

df3.to_csv("./DATA_DIEMTHI/data_pttk_3_changed.csv", index=False)
df3
```

	msv	10%_1	10%_2	20%	score
0	31_011	8.375	7.25	8.50	9.0
1	31_012	8.250	7.25	8.50	9.0
2	31_013	8.500	7.50	8.50	10.0
3	31_014	4.000	7.25	8.50	9.0
4	31_015	8.750	7.50	8.50	9.5
...
70	31_151	8.250	7.75	8.25	8.0
71	31_152	3.500	3.25	6.00	6.5
72	31_153	7.250	6.50	6.00	6.5
73	31_154	7.750	3.50	7.50	7.5
74	31_155	0.000	0.00	0.00	0.0

75 rows × 5 columns

Merge file 3 changed với file 1 + 2

```

import pandas as pd

string_columns = ["msv",
                  {"header": "10%_1", "value": 0.1},
                  {"header": "10%_2", "value": 0.1},
                  {"header": "20%", "value": 0.2},
                  "score"
                  ]

df = pd.read_csv("./DATA_DIEMTHI/data_pttk_1_2.csv")
df3 = pd.read_csv("./DATA_DIEMTHI/data_pttk_3_changed.csv")

merge_df = pd.concat([df, df3], ignore_index=True)

merge_df.columns = [string_columns[0],
                    string_columns[1]['header'],
                    string_columns[2]['header'],
                    string_columns[3]['header'],
                    string_columns[4]]

merge_df.to_csv("./DATA_DIEMTHI/data_pttk.csv", index=False)
merge_df

```

	msv	10%_1	10%_2	20%	score
0	b1	9.00	7.00	6.00	6.00
1	b2	9.00	7.00	6.00	6.00
2	b3	10.00	9.00	7.00	7.25
3	b4	9.00	7.00	6.00	6.00
4	b5	10.00	8.00	7.00	7.50
...
147	31_151	8.25	7.75	8.25	8.00
148	31_152	3.50	3.25	6.00	6.50
149	31_153	7.25	6.50	6.00	6.50
150	31_154	7.75	3.50	7.50	7.50
151	31_155	0.00	0.00	0.00	0.00

152 rows × 5 columns

Tiền xử lý data

```
import pandas as pd
import numpy as np

df = pd.read_csv("./DATA_DIEMTHI/data_pttk.csv")

df
```

	msv	10%_1	10%_2	20%	score
0	b1	9.00	7.00	6.00	6.00
1	b2	9.00	7.00	6.00	6.00
2	b3	10.00	9.00	7.00	7.25
3	b4	9.00	7.00	6.00	6.00
4	b5	10.00	8.00	7.00	7.50
...
147	31_151	8.25	7.75	8.25	8.00
148	31_152	3.50	3.25	6.00	6.50
149	31_153	7.25	6.50	6.00	6.50
150	31_154	7.75	3.50	7.50	7.50
151	31_155	0.00	0.00	0.00	0.00

152 rows × 5 columns

```
df = df.drop(columns=['msv'])

df.to_csv("./DATA_DIEMTHI/data_pttk.csv", index=False)

df
```

	10%_1	10%_2	20%	score
0	9.00	7.00	6.00	6.00
1	9.00	7.00	6.00	6.00

	10%_1	10%_2	20%	score
2	10.00	9.00	7.00	7.25
3	9.00	7.00	6.00	6.00
4	10.00	8.00	7.00	7.50
...
147	8.25	7.75	8.25	8.00
148	3.50	3.25	6.00	6.50
149	7.25	6.50	6.00	6.50
150	7.75	3.50	7.50	7.50
151	0.00	0.00	0.00	0.00

152 rows × 4 columns

```
print("NULL")
print("====")
display(df.isnull().sum())
```

```
NULL
====
```

```
10%_1    0
10%_2    0
20%      0
score    1
dtype: int64
```

```
df['score'] = df['score'].replace("", np.NaN)
```

```
df.isnull().sum()
```

```
10%_1    0
10%_2    0
20%      0
score    1
dtype: int64
```

```
print("0s")
print("==")
display(df.eq(0).sum())
```

```
0s
==
```

```
10%_1    6
10%_2    6
20%      6
score    6
dtype: int64
```

```
df['10%_1'] = df['10%_1'].replace(0, np.NaN)
df['10%_2'] = df['10%_2'].replace(0, np.NaN)
df['20%'] = df['20%'].replace(0, np.NaN)
df['score'] = df['score'].replace(0, np.NaN)
```

```
df
```

	10%_1	10%_2	20%	score
0	9.00	7.00	6.00	6.00
1	9.00	7.00	6.00	6.00
2	10.00	9.00	7.00	7.25
3	9.00	7.00	6.00	6.00
4	10.00	8.00	7.00	7.50
...
147	8.25	7.75	8.25	8.00
148	3.50	3.25	6.00	6.50
149	7.25	6.50	6.00	6.50
150	7.75	3.50	7.50	7.50
151	NaN	NaN	NaN	NaN

152 rows × 4 columns

```

numeric_columns = ['10%_1', '10%_2', '20%', 'score']
df[numeric_columns] = df[numeric_columns].fillna(df[numeric_columns].mean())

df.eq(0).sum()

10%_1    0
10%_2    0
20%      0
score    0
dtype: int64

corr = df.corr()
corr

```

	10%_1	10%_2	20%	score
10%_1	1.000000	0.509850	-0.014744	-0.118942
10%_2	0.509850	1.000000	0.312920	0.234598
20%	-0.014744	0.312920	1.000000	0.739730
score	-0.118942	0.234598	0.739730	1.000000

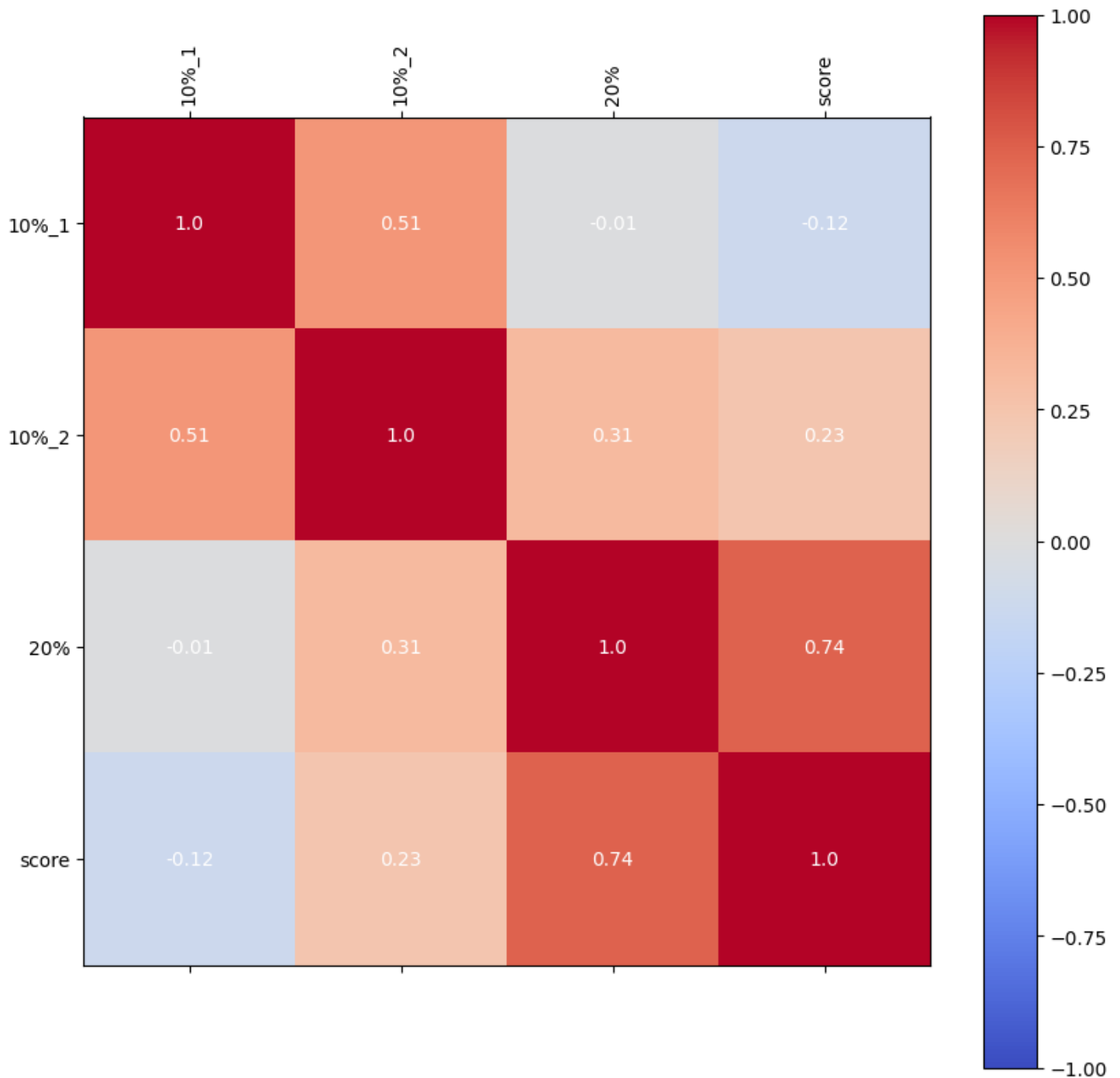
Basic Machine Learning

```

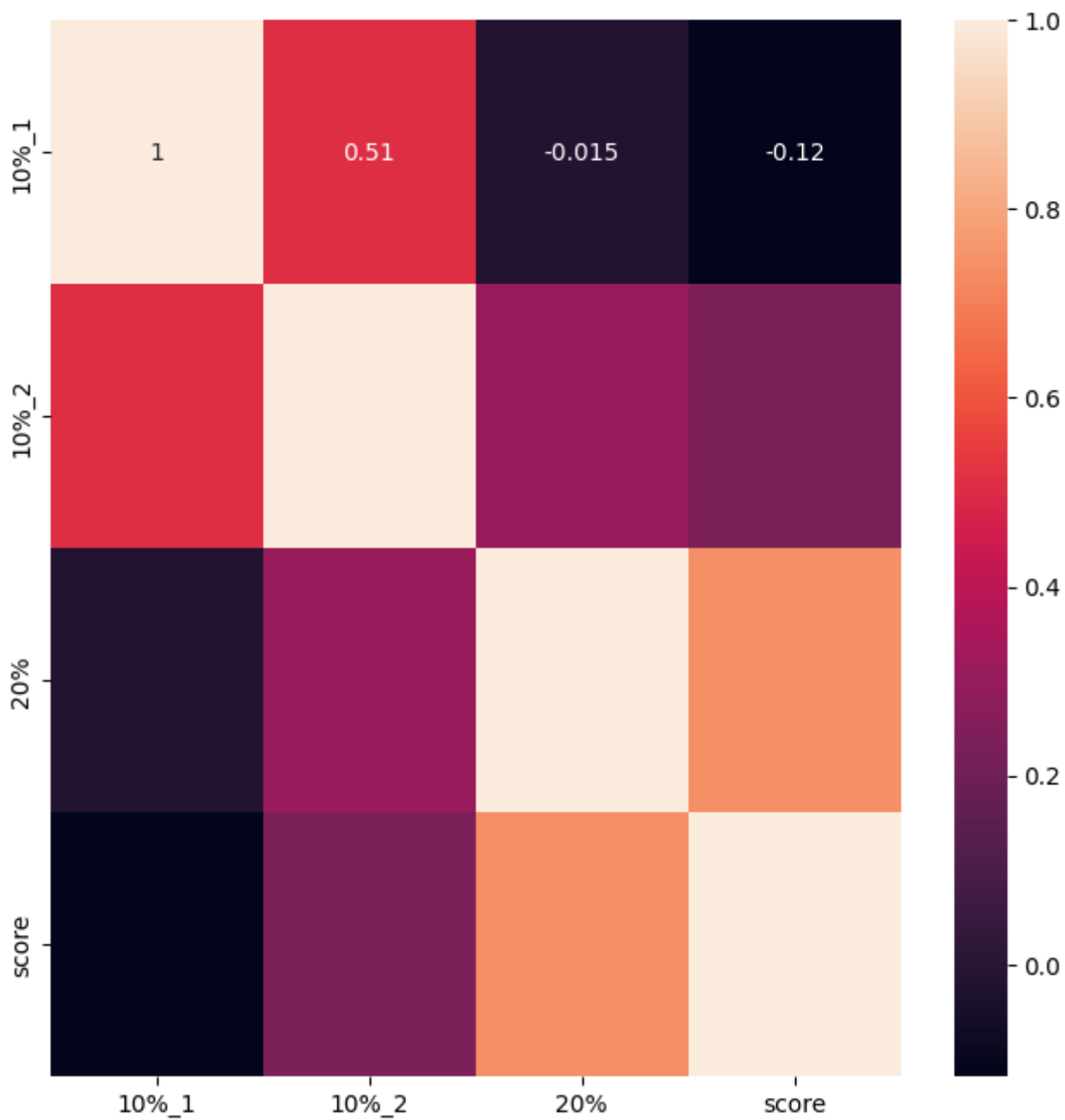
%matplotlib inline
import matplotlib.pyplot as plt
fig, ax = plt.subplots(figsize=(10, 10))
cax = ax.matshow(corr, cmap='coolwarm', vmin=-1, vmax=1)
fig.colorbar(cax)
ticks = np.arange(0, len(df.columns), 1)
ax.set_xticks(ticks)
ax.set_xticklabels(df.columns)
plt.xticks(rotation = 90)
ax.set_yticklabels(df.columns)
ax.set_yticks(ticks)
#---print the correlation factor---
for i in range(df.shape[1]):
    for j in range(4):
        text = ax.text(j, i, round(corr.iloc[i][j], 2),
                        ha="center", va="center", color="w")
plt.show()

```

```
C:\Users\tien2\AppData\Local\Temp\ipykernel_20524\2074297294.py:10: UserWarning: set_ticklabels(
  ax.set_yticklabels(df.columns)
C:\Users\tien2\AppData\Local\Temp\ipykernel_20524\2074297294.py:15: FutureWarning: Series.__geti
  text = ax.text(j, i, round(corr.iloc[i][j],2),
```



```
import seaborn as sns
sns.heatmap(df.corr(),annot=True)
#---get a reference to the current figure and set its size---
fig = plt.gcf()
fig.set_size_inches(8,8)
```



```
print(df.corr().nlargest(4, 'score').values[:,3])
```

```
[ 1.          0.73972991  0.23459822 -0.11894182]
```

```
df
```

	10%_1	10%_2	20%	score
0	9.000000	7.000000	6.000000	6.000000
1	9.000000	7.000000	6.000000	6.000000

	10%_1	10%_2	20%	score
2	10.000000	9.000000	7.000000	7.250000
3	9.000000	7.000000	6.000000	6.000000
4	10.000000	8.000000	7.000000	7.500000
...
147	8.250000	7.750000	8.250000	8.000000
148	3.500000	3.250000	6.000000	6.500000
149	7.250000	6.500000	6.000000	6.500000
150	7.750000	3.500000	7.500000	7.500000
151	8.448801	7.158733	6.760274	6.984483

152 rows × 4 columns

```

from sklearn.linear_model import LinearRegression
from sklearn.model_selection import cross_val_score
from sklearn.metrics import mean_squared_error

# Features
X = df[['10%_1', '10%_2', '20%']]

# Target variable
y = df['score']

# Create a Linear Regression model
linear_reg = LinearRegression()

# Perform cross-validation
scores = cross_val_score(linear_reg, X, y, cv=10, scoring='neg_mean_squared_error')
mse = -scores.mean()

# Print the Mean Squared Error
print("Mean Squared Error:", mse)

```

Mean Squared Error: 0.49066370011708954

```

result = []
result.append(mse)

```

```

from sklearn.neighbors import KNeighborsRegressor

#---number of folds---
folds = 10

# Create a list of odd values for K
ks = list(range(1, int(len(X) * ((folds - 1) / folds)), 2))

# Cross-validate KNeighborsRegressor
cv_scores = []

for k in ks:
    knn_reg = KNeighborsRegressor(n_neighbors=k)
    scores = cross_val_score(knn_reg, X, y, cv=folds, scoring='neg_mean_squared_error')
    mse = -scores.mean()
    cv_scores.append(mse)

# Find the optimal K that gives the lowest MSE
optimal_k_index = cv_scores.index(min(cv_scores))
optimal_k = ks[optimal_k_index]
optimal_mse = min(cv_scores)

print(f"The optimal number of neighbors is {optimal_k}")
print(f"Mean Squared Error with optimal K: {optimal_mse}")

result.append(optimal_mse)

```

The optimal number of neighbors is 3
Mean Squared Error with optimal K: 0.5138031238990178

```

from sklearn.svm import SVR

# Create a Support Vector Regression (SVR) model with a linear kernel
linear_svr = SVR(kernel='linear')

# Cross-validate SVR
scores = cross_val_score(linear_svr, X, y, cv=10, scoring='neg_mean_squared_error')
mse = -scores.mean()

print(f"Mean Squared Error (SVR with linear kernel): {mse}")

result.append(mse)

```

Mean Squared Error (SVR with linear kernel): 0.5142064542495162


```
rbf = SVR(kernel='rbf')
rbf_scores = cross_val_score(rbf, X, y,
                             cv=10, scoring='neg_mean_squared_error').mean()

print(-rbf_scores)
result.append(-rbf_scores)
```

0.5095506145399122

```
knn = KNeighborsRegressor(n_neighbors=optimal_k)
knn.fit(X, y)
```

▼ KNeighborsRegressor

```
KNeighborsRegressor(n_neighbors=3)
```

```
import pickle
#---save the model to disk---
filename = 'scores.sav'
#---write to the file using write and binary mode---
pickle.dump(knn, open(filename, 'wb'))
```

```
#---load the model from disk---
loaded_model = pickle.load(open(filename, 'rb'))
```

```
# s_10_1 = float(input("Nhập điểm 10%_1: "))
# s_10_2 = float(input("Nhập điểm 10%_2: "))
# s_20 = float(input("Nhập điểm 20%: "))
s_10_1 = float(7)
s_10_2 = float(6.5)
s_20 = float(7.5)
```

```
prediction = loaded_model.predict([[s_10_1, s_10_2, s_20]])
print("Điểm dự đoán: ", prediction[0])
print("Đánh giá mô hình: ", optimal_mse)
```

Điểm dự đoán: 8.0

Đánh giá mô hình: 0.5138031238990178

```
c:\Users\tien2\miniconda3\envs\intel\lib\site-packages\sklearn\base.py:464: UserWarning: X does
warnings.warn(
```

Linear regression

```
s_10_1 = float(7)
s_10_2 = float(6.5)
s_20 = float(7.5)

prediction = loaded_model.predict([[s_10_1, s_10_2, s_20]])
print("Điểm dự đoán: ", prediction[0])
```

Điểm dự đoán: 8.0

c:\Users\tien2\miniconda3\envs\intel\lib\site-packages\sklearn\base.py:464: UserWarning: X does
warnings.warn(

```
import pandas as pd
import numpy as np

df = pd.read_csv('./DATA_DIEMTHI/data_pttk.csv')

df['10%_1'] = df['10%_1'].replace(0, np.NaN)
df['10%_2'] = df['10%_2'].replace(0, np.NaN)
df['20%'] = df['20%'].replace(0, np.NaN)
df['score'] = df['score'].replace(0, np.NaN)

numeric_columns = ['10%_1', '10%_2', '20%', 'score']
df[numeric_columns] = df[numeric_columns].fillna(df[numeric_columns].mean())

display(df)

X = df[['10%_1', '10%_2', '20%']]
y = df['score']
```

	10%_1	10%_2	20%	score
0	9.000000	7.000000	6.000000	6.000000
1	9.000000	7.000000	6.000000	6.000000
2	10.000000	9.000000	7.000000	7.250000
3	9.000000	7.000000	6.000000	6.000000
4	10.000000	8.000000	7.000000	7.500000

	10%_1	10%_2	20%	score
...
147	8.250000	7.750000	8.250000	8.000000
148	3.500000	3.250000	6.000000	6.500000
149	7.250000	6.500000	6.000000	6.500000
150	7.750000	3.500000	7.500000	7.500000
151	8.448801	7.158733	6.760274	6.984483

152 rows × 4 columns

```
import pandas as pd
import tensorflow as tf
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import mean_squared_error

# Tách dữ liệu thành features (X) và target (y)
X = df[['10%_1', '10%_2', '20%']]
y = df['score']

# Chia dữ liệu thành tập huấn luyện và tập kiểm tra
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Chuẩn hóa dữ liệu
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)

# Xây dựng mô hình
model = tf.keras.Sequential([
    tf.keras.layers.Input(shape=(3,)), # Số lượng đặc trưng
    tf.keras.layers.Dense(1) # Layer Linear Regression
])

# Biên dịch mô hình
model.compile(optimizer='adam', loss='mean_squared_error')

# Huấn luyện mô hình
model.fit(X_train_scaled, y_train, epochs=2000, batch_size=32, verbose=1)
```

Epoch 1/2000
4/4 [=====] - 0s 4ms/step - loss: 51.1235
Epoch 2/2000
4/4 [=====] - 0s 3ms/step - loss: 51.0552
Epoch 3/2000
4/4 [=====] - 0s 3ms/step - loss: 50.9855
Epoch 4/2000
4/4 [=====] - 0s 2ms/step - loss: 50.9127
Epoch 5/2000
4/4 [=====] - 0s 2ms/step - loss: 50.8447
Epoch 6/2000
4/4 [=====] - 0s 3ms/step - loss: 50.7808
Epoch 7/2000
4/4 [=====] - 0s 3ms/step - loss: 50.7131
Epoch 8/2000
4/4 [=====] - 0s 2ms/step - loss: 50.6450
Epoch 9/2000
4/4 [=====] - 0s 2ms/step - loss: 50.5751
Epoch 10/2000
4/4 [=====] - 0s 2ms/step - loss: 50.5065
Epoch 11/2000
4/4 [=====] - 0s 3ms/step - loss: 50.4402
Epoch 12/2000
4/4 [=====] - 0s 2ms/step - loss: 50.3742
Epoch 13/2000
4/4 [=====] - 0s 2ms/step - loss: 50.3082
Epoch 14/2000
4/4 [=====] - 0s 3ms/step - loss: 50.2425
Epoch 15/2000
4/4 [=====] - 0s 3ms/step - loss: 50.1722
Epoch 16/2000
4/4 [=====] - 0s 2ms/step - loss: 50.1075
Epoch 17/2000
4/4 [=====] - 0s 3ms/step - loss: 50.0431
Epoch 18/2000
4/4 [=====] - 0s 3ms/step - loss: 49.9761
Epoch 19/2000
4/4 [=====] - 0s 3ms/step - loss: 49.9089
Epoch 20/2000
4/4 [=====] - 0s 2ms/step - loss: 49.8419
Epoch 21/2000
4/4 [=====] - 0s 3ms/step - loss: 49.7780
Epoch 22/2000
4/4 [=====] - 0s 2ms/step - loss: 49.7091
Epoch 23/2000
4/4 [=====] - 0s 3ms/step - loss: 49.6467
Epoch 24/2000
4/4 [=====] - 0s 3ms/step - loss: 49.5823
Epoch 25/2000
4/4 [=====] - 0s 2ms/step - loss: 49.5125

Epoch 26/2000
4/4 [=====] - 0s 2ms/step - loss: 49.4490
Epoch 27/2000
4/4 [=====] - 0s 3ms/step - loss: 49.3810
Epoch 28/2000
4/4 [=====] - 0s 3ms/step - loss: 49.3183
Epoch 29/2000
4/4 [=====] - 0s 2ms/step - loss: 49.2509
Epoch 30/2000
4/4 [=====] - 0s 3ms/step - loss: 49.1849
Epoch 31/2000
4/4 [=====] - 0s 3ms/step - loss: 49.1210
Epoch 32/2000
4/4 [=====] - 0s 2ms/step - loss: 49.0557
Epoch 33/2000
4/4 [=====] - 0s 2ms/step - loss: 48.9930
Epoch 34/2000
4/4 [=====] - 0s 3ms/step - loss: 48.9271
Epoch 35/2000
4/4 [=====] - 0s 2ms/step - loss: 48.8622
Epoch 36/2000
4/4 [=====] - 0s 2ms/step - loss: 48.7979
Epoch 37/2000
4/4 [=====] - 0s 2ms/step - loss: 48.7310
Epoch 38/2000
4/4 [=====] - 0s 2ms/step - loss: 48.6731
Epoch 39/2000
4/4 [=====] - 0s 2ms/step - loss: 48.6040
Epoch 40/2000
4/4 [=====] - 0s 2ms/step - loss: 48.5388
Epoch 41/2000
4/4 [=====] - 0s 3ms/step - loss: 48.4769
Epoch 42/2000
4/4 [=====] - 0s 2ms/step - loss: 48.4131
Epoch 43/2000
4/4 [=====] - 0s 2ms/step - loss: 48.3530
Epoch 44/2000
4/4 [=====] - 0s 3ms/step - loss: 48.2889
Epoch 45/2000
4/4 [=====] - 0s 2ms/step - loss: 48.2226
Epoch 46/2000
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Epoch 47/2000
4/4 [=====] - 0s 3ms/step - loss: 48.0970
Epoch 48/2000
4/4 [=====] - 0s 3ms/step - loss: 48.0359
Epoch 49/2000
4/4 [=====] - 0s 2ms/step - loss: 47.9756
Epoch 50/2000
4/4 [=====] - 0s 2ms/step - loss: 47.9116
Epoch 51/2000

4/4 [=====] - 0s 3ms/step - loss: 47.8466
Epoch 52/2000
4/4 [=====] - 0s 2ms/step - loss: 47.7849
Epoch 53/2000
4/4 [=====] - 0s 2ms/step - loss: 47.7234
Epoch 54/2000
4/4 [=====] - 0s 2ms/step - loss: 47.6624
Epoch 55/2000
4/4 [=====] - 0s 2ms/step - loss: 47.5996
Epoch 56/2000
4/4 [=====] - 0s 3ms/step - loss: 47.5373
Epoch 57/2000
4/4 [=====] - 0s 2ms/step - loss: 47.4779
Epoch 58/2000
4/4 [=====] - 0s 2ms/step - loss: 47.4132
Epoch 59/2000
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Epoch 60/2000
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Epoch 61/2000
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Epoch 62/2000
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Epoch 63/2000
4/4 [=====] - 0s 2ms/step - loss: 47.1080
Epoch 64/2000
4/4 [=====] - 0s 2ms/step - loss: 47.0496
Epoch 65/2000
4/4 [=====] - 0s 3ms/step - loss: 46.9873
Epoch 66/2000
4/4 [=====] - 0s 2ms/step - loss: 46.9258
Epoch 67/2000
4/4 [=====] - 0s 2ms/step - loss: 46.8663
Epoch 68/2000
4/4 [=====] - 0s 2ms/step - loss: 46.8040
Epoch 69/2000
4/4 [=====] - 0s 3ms/step - loss: 46.7461
Epoch 70/2000
4/4 [=====] - 0s 2ms/step - loss: 46.6842
Epoch 71/2000
4/4 [=====] - 0s 2ms/step - loss: 46.6268
Epoch 72/2000
4/4 [=====] - 0s 3ms/step - loss: 46.5647
Epoch 73/2000
4/4 [=====] - 0s 2ms/step - loss: 46.5057
Epoch 74/2000
4/4 [=====] - 0s 2ms/step - loss: 46.4444
Epoch 75/2000
4/4 [=====] - 0s 2ms/step - loss: 46.3852
Epoch 76/2000
4/4 [=====] - 0s 2ms/step - loss: 46.3249

Epoch 77/2000
4/4 [=====] - 0s 2ms/step - loss: 46.2648
Epoch 78/2000
4/4 [=====] - 0s 2ms/step - loss: 46.2072
Epoch 79/2000
4/4 [=====] - 0s 2ms/step - loss: 46.1479
Epoch 80/2000
4/4 [=====] - 0s 0s/step - loss: 46.0887
Epoch 81/2000
4/4 [=====] - 0s 0s/step - loss: 46.0267
Epoch 82/2000
4/4 [=====] - 0s 5ms/step - loss: 45.9684
Epoch 83/2000
4/4 [=====] - 0s 0s/step - loss: 45.9117
Epoch 84/2000
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Epoch 85/2000
4/4 [=====] - 0s 5ms/step - loss: 45.7917
Epoch 86/2000
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Epoch 87/2000
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Epoch 88/2000
4/4 [=====] - 0s 0s/step - loss: 45.6158
Epoch 89/2000
4/4 [=====] - 0s 5ms/step - loss: 45.5579
Epoch 90/2000
4/4 [=====] - 0s 0s/step - loss: 45.4980
Epoch 91/2000
4/4 [=====] - 0s 0s/step - loss: 45.4400
Epoch 92/2000
4/4 [=====] - 0s 5ms/step - loss: 45.3850
Epoch 93/2000
4/4 [=====] - 0s 5ms/step - loss: 45.3247
Epoch 94/2000
4/4 [=====] - 0s 0s/step - loss: 45.2664
Epoch 95/2000
4/4 [=====] - 0s 0s/step - loss: 45.2127
Epoch 96/2000
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Epoch 97/2000
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Epoch 98/2000
4/4 [=====] - 0s 0s/step - loss: 45.0374
Epoch 99/2000
4/4 [=====] - 0s 5ms/step - loss: 44.9822
Epoch 100/2000
4/4 [=====] - 0s 0s/step - loss: 44.9244
Epoch 101/2000
4/4 [=====] - 0s 0s/step - loss: 44.8663
Epoch 102/2000

4/4 [=====] - 0s 5ms/step - loss: 44.8094
Epoch 103/2000
4/4 [=====] - 0s 5ms/step - loss: 44.7534
Epoch 104/2000
4/4 [=====] - 0s 0s/step - loss: 44.6949
Epoch 105/2000
4/4 [=====] - 0s 0s/step - loss: 44.6385
Epoch 106/2000
4/4 [=====] - 0s 5ms/step - loss: 44.5814
Epoch 107/2000
4/4 [=====] - 0s 0s/step - loss: 44.5266
Epoch 108/2000
4/4 [=====] - 0s 0s/step - loss: 44.4709
Epoch 109/2000
4/4 [=====] - 0s 5ms/step - loss: 44.4140
Epoch 110/2000
4/4 [=====] - 0s 5ms/step - loss: 44.3553
Epoch 111/2000
4/4 [=====] - 0s 0s/step - loss: 44.3011
Epoch 112/2000
4/4 [=====] - 0s 0s/step - loss: 44.2455
Epoch 113/2000
4/4 [=====] - 0s 5ms/step - loss: 44.1899
Epoch 114/2000
4/4 [=====] - 0s 5ms/step - loss: 44.1318
Epoch 115/2000
4/4 [=====] - 0s 0s/step - loss: 44.0768
Epoch 116/2000
4/4 [=====] - 0s 0s/step - loss: 44.0207
Epoch 117/2000
4/4 [=====] - 0s 5ms/step - loss: 43.9644
Epoch 118/2000
4/4 [=====] - 0s 0s/step - loss: 43.9094
Epoch 119/2000
4/4 [=====] - 0s 0s/step - loss: 43.8542
Epoch 120/2000
4/4 [=====] - 0s 5ms/step - loss: 43.7972
Epoch 121/2000
4/4 [=====] - 0s 0s/step - loss: 43.7457
Epoch 122/2000
4/4 [=====] - 0s 0s/step - loss: 43.6872
Epoch 123/2000
4/4 [=====] - 0s 5ms/step - loss: 43.6331
Epoch 124/2000
4/4 [=====] - 0s 5ms/step - loss: 43.5759
Epoch 125/2000
4/4 [=====] - 0s 0s/step - loss: 43.5217
Epoch 126/2000
4/4 [=====] - 0s 0s/step - loss: 43.4683
Epoch 127/2000
4/4 [=====] - 0s 5ms/step - loss: 43.4122

Epoch 128/2000
4/4 [=====] - 0s 5ms/step - loss: 43.3573
Epoch 129/2000
4/4 [=====] - 0s 16ms/step - loss: 43.3038
Epoch 130/2000
4/4 [=====] - 0s 5ms/step - loss: 43.2468
Epoch 131/2000
4/4 [=====] - 0s 5ms/step - loss: 43.1946
Epoch 132/2000
4/4 [=====] - 0s 0s/step - loss: 43.1373
Epoch 133/2000
4/4 [=====] - 0s 0s/step - loss: 43.0823
Epoch 134/2000
4/4 [=====] - 0s 7ms/step - loss: 43.0299
Epoch 135/2000
4/4 [=====] - 0s 2ms/step - loss: 42.9740
Epoch 136/2000
4/4 [=====] - 0s 2ms/step - loss: 42.9196
Epoch 137/2000
4/4 [=====] - 0s 2ms/step - loss: 42.8655
Epoch 138/2000
4/4 [=====] - 0s 0s/step - loss: 42.8121
Epoch 139/2000
4/4 [=====] - 0s 5ms/step - loss: 42.7585
Epoch 140/2000
4/4 [=====] - 0s 5ms/step - loss: 42.7019
Epoch 141/2000
4/4 [=====] - 0s 0s/step - loss: 42.6490
Epoch 142/2000
4/4 [=====] - 0s 5ms/step - loss: 42.5955
Epoch 143/2000
4/4 [=====] - 0s 5ms/step - loss: 42.5436
Epoch 144/2000
4/4 [=====] - 0s 0s/step - loss: 42.4868
Epoch 145/2000
4/4 [=====] - 0s 0s/step - loss: 42.4356
Epoch 146/2000
4/4 [=====] - 0s 5ms/step - loss: 42.3817
Epoch 147/2000
4/4 [=====] - 0s 0s/step - loss: 42.3289
Epoch 148/2000
4/4 [=====] - 0s 0s/step - loss: 42.2741
Epoch 149/2000
4/4 [=====] - 0s 5ms/step - loss: 42.2245
Epoch 150/2000
4/4 [=====] - 0s 0s/step - loss: 42.1680
Epoch 151/2000
4/4 [=====] - 0s 0s/step - loss: 42.1158
Epoch 152/2000
4/4 [=====] - 0s 5ms/step - loss: 42.0627
Epoch 153/2000

4/4 [=====] - 0s 0s/step - loss: 42.0111
Epoch 154/2000
4/4 [=====] - 0s 0s/step - loss: 41.9571
Epoch 155/2000
4/4 [=====] - 0s 5ms/step - loss: 41.9048
Epoch 156/2000
4/4 [=====] - 0s 5ms/step - loss: 41.8528
Epoch 157/2000
4/4 [=====] - 0s 0s/step - loss: 41.7997
Epoch 158/2000
4/4 [=====] - 0s 0s/step - loss: 41.7471
Epoch 159/2000
4/4 [=====] - 0s 5ms/step - loss: 41.6937
Epoch 160/2000
4/4 [=====] - 0s 5ms/step - loss: 41.6416
Epoch 161/2000
4/4 [=====] - 0s 0s/step - loss: 41.5902
Epoch 162/2000
4/4 [=====] - 0s 0s/step - loss: 41.5372
Epoch 163/2000
4/4 [=====] - 0s 5ms/step - loss: 41.4846
Epoch 164/2000
4/4 [=====] - 0s 0s/step - loss: 41.4333
Epoch 165/2000
4/4 [=====] - 0s 0s/step - loss: 41.3797
Epoch 166/2000
4/4 [=====] - 0s 2ms/step - loss: 41.3283
Epoch 167/2000
4/4 [=====] - 0s 2ms/step - loss: 41.2765
Epoch 168/2000
4/4 [=====] - 0s 2ms/step - loss: 41.2234
Epoch 169/2000
4/4 [=====] - 0s 5ms/step - loss: 41.1730
Epoch 170/2000
4/4 [=====] - 0s 2ms/step - loss: 41.1215
Epoch 171/2000
4/4 [=====] - 0s 2ms/step - loss: 41.0695
Epoch 172/2000
4/4 [=====] - 0s 2ms/step - loss: 41.0176
Epoch 173/2000
4/4 [=====] - 0s 3ms/step - loss: 40.9669
Epoch 174/2000
4/4 [=====] - 0s 3ms/step - loss: 40.9142
Epoch 175/2000
4/4 [=====] - 0s 3ms/step - loss: 40.8631
Epoch 176/2000
4/4 [=====] - 0s 3ms/step - loss: 40.8117
Epoch 177/2000
4/4 [=====] - 0s 1ms/step - loss: 40.7607
Epoch 178/2000
4/4 [=====] - 0s 0s/step - loss: 40.7123

Epoch 179/2000
4/4 [=====] - 0s 0s/step - loss: 40.6573
Epoch 180/2000
4/4 [=====] - 0s 3ms/step - loss: 40.6073
Epoch 181/2000
4/4 [=====] - 0s 1ms/step - loss: 40.5562
Epoch 182/2000
4/4 [=====] - 0s 7ms/step - loss: 40.5066
Epoch 183/2000
4/4 [=====] - 0s 5ms/step - loss: 40.4544
Epoch 184/2000
4/4 [=====] - 0s 3ms/step - loss: 40.4040
Epoch 185/2000
4/4 [=====] - 0s 5ms/step - loss: 40.3526
Epoch 186/2000
4/4 [=====] - 0s 6ms/step - loss: 40.3047
Epoch 187/2000
4/4 [=====] - 0s 4ms/step - loss: 40.2524
Epoch 188/2000
4/4 [=====] - 0s 9ms/step - loss: 40.2010
Epoch 189/2000
4/4 [=====] - 0s 2ms/step - loss: 40.1506
Epoch 190/2000
4/4 [=====] - 0s 3ms/step - loss: 40.1012
Epoch 191/2000
4/4 [=====] - 0s 6ms/step - loss: 40.0503
Epoch 192/2000
4/4 [=====] - 0s 1ms/step - loss: 40.0001
Epoch 193/2000
4/4 [=====] - 0s 2ms/step - loss: 39.9506
Epoch 194/2000
4/4 [=====] - 0s 5ms/step - loss: 39.9002
Epoch 195/2000
4/4 [=====] - 0s 6ms/step - loss: 39.8517
Epoch 196/2000
4/4 [=====] - 0s 6ms/step - loss: 39.7998
Epoch 197/2000
4/4 [=====] - 0s 6ms/step - loss: 39.7494
Epoch 198/2000
4/4 [=====] - 0s 4ms/step - loss: 39.7011
Epoch 199/2000
4/4 [=====] - 0s 0s/step - loss: 39.6504
Epoch 200/2000
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Epoch 201/2000
4/4 [=====] - 0s 1ms/step - loss: 39.5519
Epoch 202/2000
4/4 [=====] - 0s 5ms/step - loss: 39.5015
Epoch 203/2000
4/4 [=====] - 0s 5ms/step - loss: 39.4522
Epoch 204/2000

4/4 [=====] - 0s 4ms/step - loss: 39.4016
Epoch 205/2000
4/4 [=====] - 0s 460us/step - loss: 39.3530
Epoch 206/2000
4/4 [=====] - 0s 0s/step - loss: 39.3030
Epoch 207/2000
4/4 [=====] - 0s 0s/step - loss: 39.2538
Epoch 208/2000
4/4 [=====] - 0s 6ms/step - loss: 39.2048
Epoch 209/2000
4/4 [=====] - 0s 6ms/step - loss: 39.1560
Epoch 210/2000
4/4 [=====] - 0s 4ms/step - loss: 39.1069
Epoch 211/2000
4/4 [=====] - 0s 0s/step - loss: 39.0564
Epoch 212/2000
4/4 [=====] - 0s 0s/step - loss: 39.0082
Epoch 213/2000
4/4 [=====] - 0s 2ms/step - loss: 38.9588
Epoch 214/2000
4/4 [=====] - 0s 5ms/step - loss: 38.9106
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4/4 [=====] - 0s 6ms/step - loss: 38.8615
Epoch 216/2000
4/4 [=====] - 0s 5ms/step - loss: 38.8132
Epoch 217/2000
4/4 [=====] - 0s 0s/step - loss: 38.7633
Epoch 218/2000
4/4 [=====] - 0s 0s/step - loss: 38.7153
Epoch 219/2000
4/4 [=====] - 0s 0s/step - loss: 38.6657
Epoch 220/2000
4/4 [=====] - 0s 7ms/step - loss: 38.6176
Epoch 221/2000
4/4 [=====] - 0s 5ms/step - loss: 38.5688
Epoch 222/2000
4/4 [=====] - 0s 5ms/step - loss: 38.5232
Epoch 223/2000
4/4 [=====] - 0s 4ms/step - loss: 38.4715
Epoch 224/2000
4/4 [=====] - 0s 3ms/step - loss: 38.4235
Epoch 225/2000
4/4 [=====] - 0s 0s/step - loss: 38.3748
Epoch 226/2000
4/4 [=====] - 0s 1ms/step - loss: 38.3276
Epoch 227/2000
4/4 [=====] - 0s 3ms/step - loss: 38.2787
Epoch 228/2000
4/4 [=====] - 0s 5ms/step - loss: 38.2320
Epoch 229/2000
4/4 [=====] - 0s 5ms/step - loss: 38.1828

Epoch 230/2000
4/4 [=====] - 0s 6ms/step - loss: 38.1347
Epoch 231/2000
4/4 [=====] - 0s 4ms/step - loss: 38.0874
Epoch 232/2000
4/4 [=====] - 0s 6ms/step - loss: 38.0398
Epoch 233/2000
4/4 [=====] - 0s 4ms/step - loss: 37.9904
Epoch 234/2000
4/4 [=====] - 0s 3ms/step - loss: 37.9436
Epoch 235/2000
4/4 [=====] - 0s 0s/step - loss: 37.8953
Epoch 236/2000
4/4 [=====] - 0s 0s/step - loss: 37.8474
Epoch 237/2000
4/4 [=====] - 0s 2ms/step - loss: 37.8036
Epoch 238/2000
4/4 [=====] - 0s 5ms/step - loss: 37.7520
Epoch 239/2000
4/4 [=====] - 0s 4ms/step - loss: 37.7060
Epoch 240/2000
4/4 [=====] - 0s 0s/step - loss: 37.6570
Epoch 241/2000
4/4 [=====] - 0s 0s/step - loss: 37.6098
Epoch 242/2000
4/4 [=====] - 0s 6ms/step - loss: 37.5642
Epoch 243/2000
4/4 [=====] - 0s 15ms/step - loss: 37.5170
Epoch 244/2000
4/4 [=====] - 0s 10ms/step - loss: 37.4683
Epoch 245/2000
4/4 [=====] - 0s 2ms/step - loss: 37.4211
Epoch 246/2000
4/4 [=====] - 0s 5ms/step - loss: 37.3747
Epoch 247/2000
4/4 [=====] - 0s 5ms/step - loss: 37.3265
Epoch 248/2000
4/4 [=====] - 0s 3ms/step - loss: 37.2807
Epoch 249/2000
4/4 [=====] - 0s 3ms/step - loss: 37.2347
Epoch 250/2000
4/4 [=====] - 0s 0s/step - loss: 37.1861
Epoch 251/2000
4/4 [=====] - 0s 914us/step - loss: 37.1389
Epoch 252/2000
4/4 [=====] - 0s 6ms/step - loss: 37.0925
Epoch 253/2000
4/4 [=====] - 0s 0s/step - loss: 37.0459
Epoch 254/2000
4/4 [=====] - 0s 195us/step - loss: 36.9986
Epoch 255/2000

4/4 [=====] - 0s 2ms/step - loss: 36.9527
Epoch 256/2000
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Epoch 257/2000
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Epoch 258/2000
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Epoch 259/2000
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Epoch 260/2000
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Epoch 261/2000
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Epoch 262/2000
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Epoch 263/2000
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Epoch 264/2000
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Epoch 265/2000
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Epoch 266/2000
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Epoch 267/2000
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Epoch 268/2000
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Epoch 269/2000
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Epoch 270/2000
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Epoch 271/2000
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Epoch 272/2000
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Epoch 273/2000
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Epoch 274/2000
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Epoch 275/2000
4/4 [=====] - 0s 3ms/step - loss: 36.0288
Epoch 276/2000
4/4 [=====] - 0s 0s/step - loss: 35.9827
Epoch 277/2000
4/4 [=====] - 0s 0s/step - loss: 35.9373
Epoch 278/2000
4/4 [=====] - 0s 1ms/step - loss: 35.8915
Epoch 279/2000
4/4 [=====] - 0s 7ms/step - loss: 35.8452
Epoch 280/2000
4/4 [=====] - 0s 4ms/step - loss: 35.8010

Epoch 281/2000
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Epoch 282/2000
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Epoch 283/2000
4/4 [=====] - 0s 0s/step - loss: 35.6642
Epoch 284/2000
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Epoch 285/2000
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Epoch 286/2000
4/4 [=====] - 0s 4ms/step - loss: 35.5285
Epoch 287/2000
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Epoch 288/2000
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Epoch 289/2000
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Epoch 290/2000
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Epoch 291/2000
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Epoch 292/2000
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Epoch 293/2000
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Epoch 294/2000
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Epoch 295/2000
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Epoch 296/2000
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Epoch 297/2000
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Epoch 298/2000
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Epoch 299/2000
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Epoch 300/2000
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Epoch 301/2000
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Epoch 302/2000
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Epoch 303/2000
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Epoch 304/2000
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Epoch 305/2000
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Epoch 306/2000

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Epoch 307/2000
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Epoch 308/2000
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Epoch 309/2000
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Epoch 310/2000
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Epoch 311/2000
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Epoch 312/2000
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Epoch 313/2000
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Epoch 314/2000
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Epoch 315/2000
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Epoch 316/2000
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Epoch 317/2000
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Epoch 318/2000
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Epoch 319/2000
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Epoch 325/2000
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Epoch 326/2000
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Epoch 327/2000
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Epoch 328/2000
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Epoch 330/2000
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Epoch 331/2000
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Epoch 332/2000
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Epoch 333/2000
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Epoch 334/2000
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Epoch 335/2000
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Epoch 336/2000
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Epoch 337/2000
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Epoch 338/2000
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Epoch 339/2000
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Epoch 340/2000
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Epoch 341/2000
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Epoch 343/2000
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Epoch 344/2000
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Epoch 345/2000
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Epoch 346/2000
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Epoch 347/2000
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Epoch 350/2000
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Epoch 351/2000
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Epoch 352/2000
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Epoch 353/2000
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Epoch 354/2000
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Epoch 355/2000
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Epoch 356/2000
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Epoch 357/2000

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Epoch 361/2000
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Epoch 362/2000
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Epoch 363/2000
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Epoch 364/2000
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Epoch 365/2000
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Epoch 367/2000
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Epoch 368/2000
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Epoch 369/2000
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Epoch 381/2000
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Epoch 382/2000
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Epoch 387/2000
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Epoch 388/2000
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Epoch 389/2000
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Epoch 390/2000
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Epoch 391/2000
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Epoch 393/2000
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Epoch 394/2000
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Epoch 395/2000
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Epoch 396/2000
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Epoch 397/2000
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Epoch 398/2000
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Epoch 399/2000
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Epoch 400/2000
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Epoch 405/2000
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Epoch 407/2000
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Epoch 408/2000

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Epoch 409/2000
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Epoch 411/2000
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Epoch 412/2000
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Epoch 413/2000
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Epoch 414/2000
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Epoch 415/2000
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Epoch 416/2000
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Epoch 417/2000
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Epoch 420/2000
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Epoch 421/2000
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Epoch 422/2000
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Epoch 423/2000
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Epoch 424/2000
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Epoch 426/2000
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Epoch 427/2000
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Epoch 428/2000
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Epoch 429/2000
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Epoch 431/2000
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Epoch 432/2000
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Epoch 433/2000
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Epoch 434/2000
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Epoch 435/2000
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Epoch 436/2000
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Epoch 437/2000
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Epoch 439/2000
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Epoch 440/2000
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Epoch 444/2000
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Epoch 445/2000
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Epoch 446/2000
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Epoch 450/2000
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Epoch 451/2000
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Epoch 453/2000
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Epoch 455/2000
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Epoch 456/2000
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Epoch 457/2000
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Epoch 459/2000

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Epoch 461/2000
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Epoch 462/2000
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Epoch 463/2000
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Epoch 464/2000
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Epoch 465/2000
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Epoch 467/2000
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Epoch 468/2000
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Epoch 470/2000
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Epoch 471/2000
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Epoch 472/2000
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Epoch 473/2000
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Epoch 477/2000
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Epoch 481/2000
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Epoch 483/2000
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Epoch 484/2000
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Epoch 485/2000
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Epoch 487/2000
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Epoch 488/2000
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Epoch 489/2000
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Epoch 490/2000
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Epoch 491/2000
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Epoch 492/2000
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Epoch 493/2000
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Epoch 496/2000
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Epoch 499/2000
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Epoch 501/2000
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Epoch 502/2000
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Epoch 504/2000
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Epoch 506/2000
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Epoch 507/2000
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Epoch 508/2000
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Epoch 509/2000
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Epoch 510/2000

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Epoch 513/2000
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Epoch 514/2000
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Epoch 515/2000
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Epoch 516/2000
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Epoch 517/2000
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Epoch 518/2000
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Epoch 520/2000
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Epoch 522/2000
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Epoch 527/2000
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Epoch 534/2000
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Epoch 535/2000
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Epoch 536/2000
4/4 [=====] - 0s 1ms/step - loss: 25.5143
Epoch 537/2000
4/4 [=====] - 0s 946us/step - loss: 25.4785
Epoch 538/2000
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Epoch 539/2000
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Epoch 540/2000
4/4 [=====] - 0s 2ms/step - loss: 25.3722
Epoch 541/2000
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Epoch 542/2000
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Epoch 543/2000
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Epoch 544/2000
4/4 [=====] - 0s 5ms/step - loss: 25.2314
Epoch 545/2000
4/4 [=====] - 0s 0s/step - loss: 25.1955
Epoch 546/2000
4/4 [=====] - 0s 8ms/step - loss: 25.1608
Epoch 547/2000
4/4 [=====] - 0s 353us/step - loss: 25.1256
Epoch 548/2000
4/4 [=====] - 0s 5ms/step - loss: 25.0900
Epoch 549/2000
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Epoch 550/2000
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Epoch 551/2000
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Epoch 552/2000
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Epoch 553/2000
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Epoch 554/2000
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Epoch 555/2000
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Epoch 556/2000
4/4 [=====] - 0s 2ms/step - loss: 24.8099
Epoch 557/2000
4/4 [=====] - 0s 2ms/step - loss: 24.7750
Epoch 558/2000
4/4 [=====] - 0s 3ms/step - loss: 24.7399
Epoch 559/2000
4/4 [=====] - 0s 3ms/step - loss: 24.7050
Epoch 560/2000
4/4 [=====] - 0s 0s/step - loss: 24.6703
Epoch 561/2000

4/4 [=====] - 0s 2ms/step - loss: 24.6360
Epoch 562/2000
4/4 [=====] - 0s 2ms/step - loss: 24.6006
Epoch 563/2000
4/4 [=====] - 0s 2ms/step - loss: 24.5667
Epoch 564/2000
4/4 [=====] - 0s 2ms/step - loss: 24.5314
Epoch 565/2000
4/4 [=====] - 0s 0s/step - loss: 24.4969
Epoch 566/2000
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Epoch 567/2000
4/4 [=====] - 0s 5ms/step - loss: 24.4281
Epoch 568/2000
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Epoch 569/2000
4/4 [=====] - 0s 3ms/step - loss: 24.3593
Epoch 570/2000
4/4 [=====] - 0s 4ms/step - loss: 24.3248
Epoch 571/2000
4/4 [=====] - 0s 6ms/step - loss: 24.2899
Epoch 572/2000
4/4 [=====] - 0s 3ms/step - loss: 24.2559
Epoch 573/2000
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Epoch 574/2000
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Epoch 575/2000
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Epoch 576/2000
4/4 [=====] - 0s 0s/step - loss: 24.1191
Epoch 577/2000
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Epoch 578/2000
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Epoch 579/2000
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Epoch 580/2000
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Epoch 582/2000
4/4 [=====] - 0s 5ms/step - loss: 23.9136
Epoch 583/2000
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Epoch 584/2000
4/4 [=====] - 0s 2ms/step - loss: 23.8455
Epoch 585/2000
4/4 [=====] - 0s 1ms/step - loss: 23.8116
Epoch 586/2000
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Epoch 587/2000
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Epoch 588/2000
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Epoch 589/2000
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Epoch 590/2000
4/4 [=====] - 0s 5ms/step - loss: 23.6425
Epoch 591/2000
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Epoch 592/2000
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Epoch 593/2000
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Epoch 594/2000
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Epoch 595/2000
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Epoch 597/2000
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Epoch 598/2000
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Epoch 599/2000
4/4 [=====] - 0s 6ms/step - loss: 23.3397
Epoch 600/2000
4/4 [=====] - 0s 2ms/step - loss: 23.3056
Epoch 601/2000
4/4 [=====] - 0s 2ms/step - loss: 23.2724
Epoch 602/2000
4/4 [=====] - 0s 1ms/step - loss: 23.2386
Epoch 603/2000
4/4 [=====] - 0s 0s/step - loss: 23.2053
Epoch 604/2000
4/4 [=====] - 0s 0s/step - loss: 23.1717
Epoch 605/2000
4/4 [=====] - 0s 2ms/step - loss: 23.1388
Epoch 606/2000
4/4 [=====] - 0s 1ms/step - loss: 23.1052
Epoch 607/2000
4/4 [=====] - 0s 2ms/step - loss: 23.0719
Epoch 608/2000
4/4 [=====] - 0s 4ms/step - loss: 23.0390
Epoch 609/2000
4/4 [=====] - 0s 2ms/step - loss: 23.0062
Epoch 610/2000
4/4 [=====] - 0s 2ms/step - loss: 22.9723
Epoch 611/2000
4/4 [=====] - 0s 2ms/step - loss: 22.9393
Epoch 612/2000

4/4 [=====] - 0s 2ms/step - loss: 22.9063
Epoch 613/2000
4/4 [=====] - 0s 3ms/step - loss: 22.8731
Epoch 614/2000
4/4 [=====] - 0s 4ms/step - loss: 22.8399
Epoch 615/2000
4/4 [=====] - 0s 2ms/step - loss: 22.8068
Epoch 616/2000
4/4 [=====] - 0s 0s/step - loss: 22.7746
Epoch 617/2000
4/4 [=====] - 0s 5ms/step - loss: 22.7409
Epoch 618/2000
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Epoch 619/2000
4/4 [=====] - 0s 2ms/step - loss: 22.6753
Epoch 620/2000
4/4 [=====] - 0s 0s/step - loss: 22.6421
Epoch 621/2000
4/4 [=====] - 0s 0s/step - loss: 22.6097
Epoch 622/2000
4/4 [=====] - 0s 5ms/step - loss: 22.5768
Epoch 623/2000
4/4 [=====] - 0s 0s/step - loss: 22.5440
Epoch 624/2000
4/4 [=====] - 0s 4ms/step - loss: 22.5115
Epoch 625/2000
4/4 [=====] - 0s 2ms/step - loss: 22.4784
Epoch 626/2000
4/4 [=====] - 0s 1ms/step - loss: 22.4457
Epoch 627/2000
4/4 [=====] - 0s 5ms/step - loss: 22.4131
Epoch 628/2000
4/4 [=====] - 0s 0s/step - loss: 22.3805
Epoch 629/2000
4/4 [=====] - 0s 2ms/step - loss: 22.3483
Epoch 630/2000
4/4 [=====] - 0s 6ms/step - loss: 22.3153
Epoch 631/2000
4/4 [=====] - 0s 961us/step - loss: 22.2830
Epoch 632/2000
4/4 [=====] - 0s 5ms/step - loss: 22.2507
Epoch 633/2000
4/4 [=====] - 0s 0s/step - loss: 22.2178
Epoch 634/2000
4/4 [=====] - 0s 5ms/step - loss: 22.1856
Epoch 635/2000
4/4 [=====] - 0s 0s/step - loss: 22.1530
Epoch 636/2000
4/4 [=====] - 0s 0s/step - loss: 22.1209
Epoch 637/2000
4/4 [=====] - 0s 2ms/step - loss: 22.0882

Epoch 638/2000
4/4 [=====] - 0s 2ms/step - loss: 22.0562
Epoch 639/2000
4/4 [=====] - 0s 4ms/step - loss: 22.0244
Epoch 640/2000
4/4 [=====] - 0s 0s/step - loss: 21.9921
Epoch 641/2000
4/4 [=====] - 0s 2ms/step - loss: 21.9595
Epoch 642/2000
4/4 [=====] - 0s 2ms/step - loss: 21.9272
Epoch 643/2000
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Epoch 644/2000
4/4 [=====] - 0s 0s/step - loss: 21.8629
Epoch 645/2000
4/4 [=====] - 0s 5ms/step - loss: 21.8308
Epoch 646/2000
4/4 [=====] - 0s 0s/step - loss: 21.7989
Epoch 647/2000
4/4 [=====] - 0s 5ms/step - loss: 21.7665
Epoch 648/2000
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Epoch 649/2000
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Epoch 650/2000
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Epoch 651/2000
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Epoch 652/2000
4/4 [=====] - 0s 0s/step - loss: 21.6068
Epoch 653/2000
4/4 [=====] - 0s 5ms/step - loss: 21.5748
Epoch 654/2000
4/4 [=====] - 0s 0s/step - loss: 21.5429
Epoch 655/2000
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Epoch 656/2000
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Epoch 657/2000
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Epoch 658/2000
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Epoch 659/2000
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Epoch 660/2000
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Epoch 661/2000
4/4 [=====] - 0s 0s/step - loss: 21.3211
Epoch 662/2000
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Epoch 663/2000

4/4 [=====] - 0s 0s/step - loss: 21.2580
Epoch 664/2000
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Epoch 665/2000
4/4 [=====] - 0s 983us/step - loss: 21.1945
Epoch 666/2000
4/4 [=====] - 0s 7ms/step - loss: 21.1632
Epoch 667/2000
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Epoch 668/2000
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Epoch 669/2000
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Epoch 670/2000
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Epoch 671/2000
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Epoch 673/2000
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Epoch 674/2000
4/4 [=====] - 0s 0s/step - loss: 20.9127
Epoch 675/2000
4/4 [=====] - 0s 3ms/step - loss: 20.8814
Epoch 676/2000
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Epoch 677/2000
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Epoch 678/2000
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Epoch 679/2000
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Epoch 680/2000
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Epoch 681/2000
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Epoch 682/2000
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Epoch 683/2000
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Epoch 684/2000
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Epoch 685/2000
4/4 [=====] - 0s 0s/step - loss: 20.5709
Epoch 686/2000
4/4 [=====] - 0s 2ms/step - loss: 20.5403
Epoch 687/2000
4/4 [=====] - 0s 3ms/step - loss: 20.5094
Epoch 688/2000
4/4 [=====] - 0s 2ms/step - loss: 20.4791

Epoch 689/2000
4/4 [=====] - 0s 0s/step - loss: 20.4478
Epoch 690/2000
4/4 [=====] - 0s 5ms/step - loss: 20.4174
Epoch 691/2000
4/4 [=====] - 0s 0s/step - loss: 20.3863
Epoch 692/2000
4/4 [=====] - 0s 0s/step - loss: 20.3554
Epoch 693/2000
4/4 [=====] - 0s 5ms/step - loss: 20.3247
Epoch 694/2000
4/4 [=====] - 0s 0s/step - loss: 20.2941
Epoch 695/2000
4/4 [=====] - 0s 0s/step - loss: 20.2639
Epoch 696/2000
4/4 [=====] - 0s 5ms/step - loss: 20.2333
Epoch 697/2000
4/4 [=====] - 0s 1ms/step - loss: 20.2025
Epoch 698/2000
4/4 [=====] - 0s 4ms/step - loss: 20.1722
Epoch 699/2000
4/4 [=====] - 0s 2ms/step - loss: 20.1416
Epoch 700/2000
4/4 [=====] - 0s 2ms/step - loss: 20.1110
Epoch 701/2000
4/4 [=====] - 0s 1ms/step - loss: 20.0807
Epoch 702/2000
4/4 [=====] - 0s 0s/step - loss: 20.0501
Epoch 703/2000
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Epoch 704/2000
4/4 [=====] - 0s 5ms/step - loss: 19.9895
Epoch 705/2000
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Epoch 706/2000
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Epoch 707/2000
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Epoch 708/2000
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Epoch 709/2000
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Epoch 710/2000
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Epoch 711/2000
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Epoch 712/2000
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Epoch 713/2000
4/4 [=====] - 0s 5ms/step - loss: 19.7178
Epoch 714/2000

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Epoch 715/2000
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Epoch 716/2000
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Epoch 717/2000
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Epoch 718/2000
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Epoch 719/2000
4/4 [=====] - 0s 948us/step - loss: 19.5383
Epoch 720/2000
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Epoch 721/2000
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Epoch 722/2000
4/4 [=====] - 0s 2ms/step - loss: 19.4487
Epoch 723/2000
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Epoch 724/2000
4/4 [=====] - 0s 6ms/step - loss: 19.3891
Epoch 725/2000
4/4 [=====] - 0s 14ms/step - loss: 19.3596
Epoch 726/2000
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Epoch 727/2000
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Epoch 728/2000
4/4 [=====] - 0s 2ms/step - loss: 19.2708
Epoch 729/2000
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Epoch 730/2000
4/4 [=====] - 0s 0s/step - loss: 19.2113
Epoch 731/2000
4/4 [=====] - 0s 2ms/step - loss: 19.1819
Epoch 732/2000
4/4 [=====] - 0s 1ms/step - loss: 19.1523
Epoch 733/2000
4/4 [=====] - 0s 0s/step - loss: 19.1228
Epoch 734/2000
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Epoch 735/2000
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Epoch 736/2000
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Epoch 737/2000
4/4 [=====] - 0s 5ms/step - loss: 19.0051
Epoch 738/2000
4/4 [=====] - 0s 0s/step - loss: 18.9762
Epoch 739/2000
4/4 [=====] - 0s 0s/step - loss: 18.9465

Epoch 740/2000
4/4 [=====] - 0s 5ms/step - loss: 18.9173
Epoch 741/2000
4/4 [=====] - 0s 415us/step - loss: 18.8882
Epoch 742/2000
4/4 [=====] - 0s 0s/step - loss: 18.8588
Epoch 743/2000
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Epoch 744/2000
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Epoch 745/2000
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Epoch 746/2000
4/4 [=====] - 0s 0s/step - loss: 18.7422
Epoch 747/2000
4/4 [=====] - 0s 5ms/step - loss: 18.7131
Epoch 748/2000
4/4 [=====] - 0s 0s/step - loss: 18.6841
Epoch 749/2000
4/4 [=====] - 0s 0s/step - loss: 18.6550
Epoch 750/2000
4/4 [=====] - 0s 6ms/step - loss: 18.6261
Epoch 751/2000
4/4 [=====] - 0s 1ms/step - loss: 18.5968
Epoch 752/2000
4/4 [=====] - 0s 5ms/step - loss: 18.5683
Epoch 753/2000
4/4 [=====] - 0s 0s/step - loss: 18.5393
Epoch 754/2000
4/4 [=====] - 0s 6ms/step - loss: 18.5110
Epoch 755/2000
4/4 [=====] - 0s 4ms/step - loss: 18.4816
Epoch 756/2000
4/4 [=====] - 0s 3ms/step - loss: 18.4527
Epoch 757/2000
4/4 [=====] - 0s 6ms/step - loss: 18.4236
Epoch 758/2000
4/4 [=====] - 0s 3ms/step - loss: 18.3950
Epoch 759/2000
4/4 [=====] - 0s 2ms/step - loss: 18.3664
Epoch 760/2000
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Epoch 761/2000
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Epoch 762/2000
4/4 [=====] - 0s 0s/step - loss: 18.2804
Epoch 763/2000
4/4 [=====] - 0s 5ms/step - loss: 18.2517
Epoch 764/2000
4/4 [=====] - 0s 0s/step - loss: 18.2229
Epoch 765/2000

4/4 [=====] - 0s 8ms/step - loss: 18.1946
Epoch 766/2000
4/4 [=====] - 0s 0s/step - loss: 18.1662
Epoch 767/2000
4/4 [=====] - 0s 5ms/step - loss: 18.1374
Epoch 768/2000
4/4 [=====] - 0s 0s/step - loss: 18.1091
Epoch 769/2000
4/4 [=====] - 0s 0s/step - loss: 18.0805
Epoch 770/2000
4/4 [=====] - 0s 5ms/step - loss: 18.0521
Epoch 771/2000
4/4 [=====] - 0s 0s/step - loss: 18.0238
Epoch 772/2000
4/4 [=====] - 0s 5ms/step - loss: 17.9958
Epoch 773/2000
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Epoch 774/2000
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Epoch 775/2000
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Epoch 776/2000
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Epoch 777/2000
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Epoch 778/2000
4/4 [=====] - 0s 0s/step - loss: 17.8256
Epoch 779/2000
4/4 [=====] - 0s 0s/step - loss: 17.7974
Epoch 780/2000
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Epoch 781/2000
4/4 [=====] - 0s 0s/step - loss: 17.7410
Epoch 782/2000
4/4 [=====] - 0s 0s/step - loss: 17.7131
Epoch 783/2000
4/4 [=====] - 0s 5ms/step - loss: 17.6850
Epoch 784/2000
4/4 [=====] - 0s 2ms/step - loss: 17.6571
Epoch 785/2000
4/4 [=====] - 0s 0s/step - loss: 17.6295
Epoch 786/2000
4/4 [=====] - 0s 5ms/step - loss: 17.6014
Epoch 787/2000
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Epoch 788/2000
4/4 [=====] - 0s 0s/step - loss: 17.5455
Epoch 789/2000
4/4 [=====] - 0s 0s/step - loss: 17.5174
Epoch 790/2000
4/4 [=====] - 0s 5ms/step - loss: 17.4896

Epoch 791/2000
4/4 [=====] - 0s 5ms/step - loss: 17.4619
Epoch 792/2000
4/4 [=====] - 0s 0s/step - loss: 17.4341
Epoch 793/2000
4/4 [=====] - 0s 1ms/step - loss: 17.4064
Epoch 794/2000
4/4 [=====] - 0s 0s/step - loss: 17.3785
Epoch 795/2000
4/4 [=====] - 0s 0s/step - loss: 17.3508
Epoch 796/2000
4/4 [=====] - 0s 5ms/step - loss: 17.3229
Epoch 797/2000
4/4 [=====] - 0s 7ms/step - loss: 17.2957
Epoch 798/2000
4/4 [=====] - 0s 3ms/step - loss: 17.2684
Epoch 799/2000
4/4 [=====] - 0s 3ms/step - loss: 17.2403
Epoch 800/2000
4/4 [=====] - 0s 3ms/step - loss: 17.2127
Epoch 801/2000
4/4 [=====] - 0s 3ms/step - loss: 17.1855
Epoch 802/2000
4/4 [=====] - 0s 2ms/step - loss: 17.1581
Epoch 803/2000
4/4 [=====] - 0s 751us/step - loss: 17.1302
Epoch 804/2000
4/4 [=====] - 0s 7ms/step - loss: 17.1030
Epoch 805/2000
4/4 [=====] - 0s 4ms/step - loss: 17.0752
Epoch 806/2000
4/4 [=====] - 0s 3ms/step - loss: 17.0480
Epoch 807/2000
4/4 [=====] - 0s 2ms/step - loss: 17.0206
Epoch 808/2000
4/4 [=====] - 0s 9ms/step - loss: 16.9933
Epoch 809/2000
4/4 [=====] - 0s 4ms/step - loss: 16.9662
Epoch 810/2000
4/4 [=====] - 0s 3ms/step - loss: 16.9385
Epoch 811/2000
4/4 [=====] - 0s 5ms/step - loss: 16.9117
Epoch 812/2000
4/4 [=====] - 0s 0s/step - loss: 16.8845
Epoch 813/2000
4/4 [=====] - 0s 0s/step - loss: 16.8572
Epoch 814/2000
4/4 [=====] - 0s 6ms/step - loss: 16.8299
Epoch 815/2000
4/4 [=====] - 0s 0s/step - loss: 16.8027
Epoch 816/2000

4/4 [=====] - 0s 5ms/step - loss: 16.7755
Epoch 817/2000
4/4 [=====] - 0s 0s/step - loss: 16.7487
Epoch 818/2000
4/4 [=====] - 0s 5ms/step - loss: 16.7213
Epoch 819/2000
4/4 [=====] - 0s 5ms/step - loss: 16.6943
Epoch 820/2000
4/4 [=====] - 0s 0s/step - loss: 16.6675
Epoch 821/2000
4/4 [=====] - 0s 0s/step - loss: 16.6411
Epoch 822/2000
4/4 [=====] - 0s 5ms/step - loss: 16.6133
Epoch 823/2000
4/4 [=====] - 0s 0s/step - loss: 16.5868
Epoch 824/2000
4/4 [=====] - 0s 5ms/step - loss: 16.5596
Epoch 825/2000
4/4 [=====] - 0s 6ms/step - loss: 16.5324
Epoch 826/2000
4/4 [=====] - 0s 877us/step - loss: 16.5057
Epoch 827/2000
4/4 [=====] - 0s 5ms/step - loss: 16.4792
Epoch 828/2000
4/4 [=====] - 0s 5ms/step - loss: 16.4525
Epoch 829/2000
4/4 [=====] - 0s 5ms/step - loss: 16.4255
Epoch 830/2000
4/4 [=====] - 0s 0s/step - loss: 16.3989
Epoch 831/2000
4/4 [=====] - 0s 0s/step - loss: 16.3720
Epoch 832/2000
4/4 [=====] - 0s 0s/step - loss: 16.3453
Epoch 833/2000
4/4 [=====] - 0s 5ms/step - loss: 16.3188
Epoch 834/2000
4/4 [=====] - 0s 5ms/step - loss: 16.2920
Epoch 835/2000
4/4 [=====] - 0s 3ms/step - loss: 16.2654
Epoch 836/2000
4/4 [=====] - 0s 5ms/step - loss: 16.2389
Epoch 837/2000
4/4 [=====] - 0s 5ms/step - loss: 16.2128
Epoch 838/2000
4/4 [=====] - 0s 4ms/step - loss: 16.1862
Epoch 839/2000
4/4 [=====] - 0s 2ms/step - loss: 16.1598
Epoch 840/2000
4/4 [=====] - 0s 5ms/step - loss: 16.1336
Epoch 841/2000
4/4 [=====] - 0s 5ms/step - loss: 16.1070

Epoch 842/2000
4/4 [=====] - 0s 0s/step - loss: 16.0807
Epoch 843/2000
4/4 [=====] - 0s 0s/step - loss: 16.0540
Epoch 844/2000
4/4 [=====] - 0s 7ms/step - loss: 16.0280
Epoch 845/2000
4/4 [=====] - 0s 0s/step - loss: 16.0014
Epoch 846/2000
4/4 [=====] - 0s 2ms/step - loss: 15.9750
Epoch 847/2000
4/4 [=====] - 0s 2ms/step - loss: 15.9490
Epoch 848/2000
4/4 [=====] - 0s 0s/step - loss: 15.9228
Epoch 849/2000
4/4 [=====] - 0s 5ms/step - loss: 15.8967
Epoch 850/2000
4/4 [=====] - 0s 0s/step - loss: 15.8703
Epoch 851/2000
4/4 [=====] - 0s 0s/step - loss: 15.8441
Epoch 852/2000
4/4 [=====] - 0s 5ms/step - loss: 15.8182
Epoch 853/2000
4/4 [=====] - 0s 0s/step - loss: 15.7927
Epoch 854/2000
4/4 [=====] - 0s 0s/step - loss: 15.7659
Epoch 855/2000
4/4 [=====] - 0s 7ms/step - loss: 15.7400
Epoch 856/2000
4/4 [=====] - 0s 0s/step - loss: 15.7142
Epoch 857/2000
4/4 [=====] - 0s 5ms/step - loss: 15.6881
Epoch 858/2000
4/4 [=====] - 0s 0s/step - loss: 15.6621
Epoch 859/2000
4/4 [=====] - 0s 5ms/step - loss: 15.6359
Epoch 860/2000
4/4 [=====] - 0s 0s/step - loss: 15.6102
Epoch 861/2000
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Epoch 862/2000
4/4 [=====] - 0s 5ms/step - loss: 15.5586
Epoch 863/2000
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Epoch 864/2000
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Epoch 865/2000
4/4 [=====] - 0s 5ms/step - loss: 15.4811
Epoch 866/2000
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Epoch 867/2000

4/4 [=====] - 0s 3ms/step - loss: 15.4295
Epoch 868/2000
4/4 [=====] - 0s 0s/step - loss: 15.4037
Epoch 869/2000
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Epoch 870/2000
4/4 [=====] - 0s 5ms/step - loss: 15.3525
Epoch 871/2000
4/4 [=====] - 0s 0s/step - loss: 15.3270
Epoch 872/2000
4/4 [=====] - 0s 391us/step - loss: 15.3014
Epoch 873/2000
4/4 [=====] - 0s 0s/step - loss: 15.2759
Epoch 874/2000
4/4 [=====] - 0s 0s/step - loss: 15.2503
Epoch 875/2000
4/4 [=====] - 0s 5ms/step - loss: 15.2248
Epoch 876/2000
4/4 [=====] - 0s 0s/step - loss: 15.1991
Epoch 877/2000
4/4 [=====] - 0s 1ms/step - loss: 15.1739
Epoch 878/2000
4/4 [=====] - 0s 0s/step - loss: 15.1485
Epoch 879/2000
4/4 [=====] - 0s 0s/step - loss: 15.1230
Epoch 880/2000
4/4 [=====] - 0s 5ms/step - loss: 15.0977
Epoch 881/2000
4/4 [=====] - 0s 0s/step - loss: 15.0721
Epoch 882/2000
4/4 [=====] - 0s 0s/step - loss: 15.0469
Epoch 883/2000
4/4 [=====] - 0s 5ms/step - loss: 15.0218
Epoch 884/2000
4/4 [=====] - 0s 0s/step - loss: 14.9966
Epoch 885/2000
4/4 [=====] - 0s 0s/step - loss: 14.9713
Epoch 886/2000
4/4 [=====] - 0s 5ms/step - loss: 14.9459
Epoch 887/2000
4/4 [=====] - 0s 0s/step - loss: 14.9207
Epoch 888/2000
4/4 [=====] - 0s 3ms/step - loss: 14.8959
Epoch 889/2000
4/4 [=====] - 0s 0s/step - loss: 14.8707
Epoch 890/2000
4/4 [=====] - 0s 3ms/step - loss: 14.8456
Epoch 891/2000
4/4 [=====] - 0s 0s/step - loss: 14.8204
Epoch 892/2000
4/4 [=====] - 0s 7ms/step - loss: 14.7950

Epoch 893/2000
4/4 [=====] - 0s 4ms/step - loss: 14.7703
Epoch 894/2000
4/4 [=====] - 0s 2ms/step - loss: 14.7454
Epoch 895/2000
4/4 [=====] - 0s 1ms/step - loss: 14.7202
Epoch 896/2000
4/4 [=====] - 0s 5ms/step - loss: 14.6954
Epoch 897/2000
4/4 [=====] - 0s 2ms/step - loss: 14.6703
Epoch 898/2000
4/4 [=====] - 0s 0s/step - loss: 14.6456
Epoch 899/2000
4/4 [=====] - 0s 10ms/step - loss: 14.6206
Epoch 900/2000
4/4 [=====] - 0s 5ms/step - loss: 14.5960
Epoch 901/2000
4/4 [=====] - 0s 5ms/step - loss: 14.5711
Epoch 902/2000
4/4 [=====] - 0s 0s/step - loss: 14.5464
Epoch 903/2000
4/4 [=====] - 0s 4ms/step - loss: 14.5216
Epoch 904/2000
4/4 [=====] - 0s 4ms/step - loss: 14.4966
Epoch 905/2000
4/4 [=====] - 0s 2ms/step - loss: 14.4718
Epoch 906/2000
4/4 [=====] - 0s 0s/step - loss: 14.4476
Epoch 907/2000
4/4 [=====] - 0s 0s/step - loss: 14.4227
Epoch 908/2000
4/4 [=====] - 0s 0s/step - loss: 14.3980
Epoch 909/2000
4/4 [=====] - 0s 5ms/step - loss: 14.3736
Epoch 910/2000
4/4 [=====] - 0s 0s/step - loss: 14.3492
Epoch 911/2000
4/4 [=====] - 0s 0s/step - loss: 14.3242
Epoch 912/2000
4/4 [=====] - 0s 7ms/step - loss: 14.3000
Epoch 913/2000
4/4 [=====] - 0s 0s/step - loss: 14.2753
Epoch 914/2000
4/4 [=====] - 0s 5ms/step - loss: 14.2509
Epoch 915/2000
4/4 [=====] - 0s 0s/step - loss: 14.2268
Epoch 916/2000
4/4 [=====] - 0s 780us/step - loss: 14.2021
Epoch 917/2000
4/4 [=====] - 0s 0s/step - loss: 14.1777
Epoch 918/2000

4/4 [=====] - 0s 0s/step - loss: 14.1534
Epoch 919/2000
4/4 [=====] - 0s 5ms/step - loss: 14.1290
Epoch 920/2000
4/4 [=====] - 0s 0s/step - loss: 14.1046
Epoch 921/2000
4/4 [=====] - 0s 0s/step - loss: 14.0804
Epoch 922/2000
4/4 [=====] - 0s 5ms/step - loss: 14.0561
Epoch 923/2000
4/4 [=====] - 0s 0s/step - loss: 14.0323
Epoch 924/2000
4/4 [=====] - 0s 0s/step - loss: 14.0078
Epoch 925/2000
4/4 [=====] - 0s 6ms/step - loss: 13.9838
Epoch 926/2000
4/4 [=====] - 0s 0s/step - loss: 13.9596
Epoch 927/2000
4/4 [=====] - 0s 5ms/step - loss: 13.9356
Epoch 928/2000
4/4 [=====] - 0s 0s/step - loss: 13.9112
Epoch 929/2000
4/4 [=====] - 0s 0s/step - loss: 13.8871
Epoch 930/2000
4/4 [=====] - 0s 5ms/step - loss: 13.8633
Epoch 931/2000
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Epoch 932/2000
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Epoch 933/2000
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Epoch 934/2000
4/4 [=====] - 0s 5ms/step - loss: 13.7674
Epoch 935/2000
4/4 [=====] - 0s 0s/step - loss: 13.7434
Epoch 936/2000
4/4 [=====] - 0s 7ms/step - loss: 13.7198
Epoch 937/2000
4/4 [=====] - 0s 0s/step - loss: 13.6958
Epoch 938/2000
4/4 [=====] - 0s 5ms/step - loss: 13.6719
Epoch 939/2000
4/4 [=====] - 0s 0s/step - loss: 13.6480
Epoch 940/2000
4/4 [=====] - 0s 0s/step - loss: 13.6246
Epoch 941/2000
4/4 [=====] - 0s 5ms/step - loss: 13.6006
Epoch 942/2000
4/4 [=====] - 0s 0s/step - loss: 13.5769
Epoch 943/2000
4/4 [=====] - 0s 0s/step - loss: 13.5534

Epoch 944/2000
4/4 [=====] - 0s 5ms/step - loss: 13.5296
Epoch 945/2000
4/4 [=====] - 0s 0s/step - loss: 13.5061
Epoch 946/2000
4/4 [=====] - 0s 2ms/step - loss: 13.4824
Epoch 947/2000
4/4 [=====] - 0s 0s/step - loss: 13.4589
Epoch 948/2000
4/4 [=====] - 0s 0s/step - loss: 13.4352
Epoch 949/2000
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Epoch 950/2000
4/4 [=====] - 0s 0s/step - loss: 13.3883
Epoch 951/2000
4/4 [=====] - 0s 0s/step - loss: 13.3650
Epoch 952/2000
4/4 [=====] - 0s 5ms/step - loss: 13.3412
Epoch 953/2000
4/4 [=====] - 0s 0s/step - loss: 13.3175
Epoch 954/2000
4/4 [=====] - 0s 0s/step - loss: 13.2944
Epoch 955/2000
4/4 [=====] - 0s 6ms/step - loss: 13.2708
Epoch 956/2000
4/4 [=====] - 0s 0s/step - loss: 13.2475
Epoch 957/2000
4/4 [=====] - 0s 5ms/step - loss: 13.2244
Epoch 958/2000
4/4 [=====] - 0s 0s/step - loss: 13.2011
Epoch 959/2000
4/4 [=====] - 0s 0s/step - loss: 13.1779
Epoch 960/2000
4/4 [=====] - 0s 5ms/step - loss: 13.1545
Epoch 961/2000
4/4 [=====] - 0s 0s/step - loss: 13.1314
Epoch 962/2000
4/4 [=====] - 0s 226us/step - loss: 13.1081
Epoch 963/2000
4/4 [=====] - 0s 5ms/step - loss: 13.0849
Epoch 964/2000
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Epoch 965/2000
4/4 [=====] - 0s 1ms/step - loss: 13.0384
Epoch 966/2000
4/4 [=====] - 0s 5ms/step - loss: 13.0159
Epoch 967/2000
4/4 [=====] - 0s 0s/step - loss: 12.9928
Epoch 968/2000
4/4 [=====] - 0s 814us/step - loss: 12.9695
Epoch 969/2000

4/4 [=====] - 0s 5ms/step - loss: 12.9466
Epoch 970/2000
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Epoch 971/2000
4/4 [=====] - 0s 5ms/step - loss: 12.9006
Epoch 972/2000
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Epoch 973/2000
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Epoch 974/2000
4/4 [=====] - 0s 7ms/step - loss: 12.8319
Epoch 975/2000
4/4 [=====] - 0s 3ms/step - loss: 12.8092
Epoch 976/2000
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Epoch 977/2000
4/4 [=====] - 0s 2ms/step - loss: 12.7638
Epoch 978/2000
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Epoch 979/2000
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Epoch 980/2000
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Epoch 981/2000
4/4 [=====] - 0s 3ms/step - loss: 12.6728
Epoch 982/2000
4/4 [=====] - 0s 7ms/step - loss: 12.6500
Epoch 983/2000
4/4 [=====] - 0s 0s/step - loss: 12.6275
Epoch 984/2000
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Epoch 985/2000
4/4 [=====] - 0s 6ms/step - loss: 12.5824
Epoch 986/2000
4/4 [=====] - 0s 3ms/step - loss: 12.5599
Epoch 987/2000
4/4 [=====] - 0s 2ms/step - loss: 12.5369
Epoch 988/2000
4/4 [=====] - 0s 83us/step - loss: 12.5148
Epoch 989/2000
4/4 [=====] - 0s 6ms/step - loss: 12.4918
Epoch 990/2000
4/4 [=====] - 0s 0s/step - loss: 12.4695
Epoch 991/2000
4/4 [=====] - 0s 11ms/step - loss: 12.4472
Epoch 992/2000
4/4 [=====] - 0s 5ms/step - loss: 12.4247
Epoch 993/2000
4/4 [=====] - 0s 5ms/step - loss: 12.4023
Epoch 994/2000
4/4 [=====] - 0s 0s/step - loss: 12.3799

Epoch 995/2000
4/4 [=====] - 0s 4ms/step - loss: 12.3577
Epoch 996/2000
4/4 [=====] - 0s 3ms/step - loss: 12.3354
Epoch 997/2000
4/4 [=====] - 0s 2ms/step - loss: 12.3130
Epoch 998/2000
4/4 [=====] - 0s 1ms/step - loss: 12.2906
Epoch 999/2000
4/4 [=====] - 0s 2ms/step - loss: 12.2684
Epoch 1000/2000
4/4 [=====] - 0s 4ms/step - loss: 12.2462
Epoch 1001/2000
4/4 [=====] - 0s 2ms/step - loss: 12.2239
Epoch 1002/2000
4/4 [=====] - 0s 3ms/step - loss: 12.2019
Epoch 1003/2000
4/4 [=====] - 0s 2ms/step - loss: 12.1798
Epoch 1004/2000
4/4 [=====] - 0s 0s/step - loss: 12.1578
Epoch 1005/2000
4/4 [=====] - 0s 5ms/step - loss: 12.1355
Epoch 1006/2000
4/4 [=====] - 0s 0s/step - loss: 12.1134
Epoch 1007/2000
4/4 [=====] - 0s 3ms/step - loss: 12.0917
Epoch 1008/2000
4/4 [=====] - 0s 0s/step - loss: 12.0695
Epoch 1009/2000
4/4 [=====] - 0s 292us/step - loss: 12.0475
Epoch 1010/2000
4/4 [=====] - 0s 5ms/step - loss: 12.0257
Epoch 1011/2000
4/4 [=====] - 0s 0s/step - loss: 12.0038
Epoch 1012/2000
4/4 [=====] - 0s 0s/step - loss: 11.9820
Epoch 1013/2000
4/4 [=====] - 0s 5ms/step - loss: 11.9596
Epoch 1014/2000
4/4 [=====] - 0s 0s/step - loss: 11.9382
Epoch 1015/2000
4/4 [=====] - 0s 5ms/step - loss: 11.9161
Epoch 1016/2000
4/4 [=====] - 0s 0s/step - loss: 11.8946
Epoch 1017/2000
4/4 [=====] - 0s 162us/step - loss: 11.8725
Epoch 1018/2000
4/4 [=====] - 0s 5ms/step - loss: 11.8511
Epoch 1019/2000
4/4 [=====] - 0s 0s/step - loss: 11.8291
Epoch 1020/2000

4/4 [=====] - 0s 5ms/step - loss: 11.8077
Epoch 1021/2000
4/4 [=====] - 0s 0s/step - loss: 11.7859
Epoch 1022/2000
4/4 [=====] - 0s 0s/step - loss: 11.7645
Epoch 1023/2000
4/4 [=====] - 0s 5ms/step - loss: 11.7426
Epoch 1024/2000
4/4 [=====] - 0s 0s/step - loss: 11.7209
Epoch 1025/2000
4/4 [=====] - 0s 0s/step - loss: 11.6996
Epoch 1026/2000
4/4 [=====] - 0s 5ms/step - loss: 11.6777
Epoch 1027/2000
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Epoch 1028/2000
4/4 [=====] - 0s 3ms/step - loss: 11.6349
Epoch 1029/2000
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Epoch 1030/2000
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Epoch 1031/2000
4/4 [=====] - 0s 5ms/step - loss: 11.5703
Epoch 1032/2000
4/4 [=====] - 0s 0s/step - loss: 11.5492
Epoch 1033/2000
4/4 [=====] - 0s 0s/step - loss: 11.5277
Epoch 1034/2000
4/4 [=====] - 0s 5ms/step - loss: 11.5063
Epoch 1035/2000
4/4 [=====] - 0s 0s/step - loss: 11.4851
Epoch 1036/2000
4/4 [=====] - 0s 0s/step - loss: 11.4638
Epoch 1037/2000
4/4 [=====] - 0s 5ms/step - loss: 11.4424
Epoch 1038/2000
4/4 [=====] - 0s 622us/step - loss: 11.4214
Epoch 1039/2000
4/4 [=====] - 0s 5ms/step - loss: 11.4002
Epoch 1040/2000
4/4 [=====] - 0s 0s/step - loss: 11.3789
Epoch 1041/2000
4/4 [=====] - 0s 0s/step - loss: 11.3578
Epoch 1042/2000
4/4 [=====] - 0s 5ms/step - loss: 11.3366
Epoch 1043/2000
4/4 [=====] - 0s 0s/step - loss: 11.3154
Epoch 1044/2000
4/4 [=====] - 0s 0s/step - loss: 11.2944
Epoch 1045/2000
4/4 [=====] - 0s 5ms/step - loss: 11.2734

Epoch 1046/2000
4/4 [=====] - 0s 0s/step - loss: 11.2521
Epoch 1047/2000
4/4 [=====] - 0s 0s/step - loss: 11.2312
Epoch 1048/2000
4/4 [=====] - 0s 0s/step - loss: 11.2100
Epoch 1049/2000
4/4 [=====] - 0s 0s/step - loss: 11.1896
Epoch 1050/2000
4/4 [=====] - 0s 5ms/step - loss: 11.1682
Epoch 1051/2000
4/4 [=====] - 0s 0s/step - loss: 11.1475
Epoch 1052/2000
4/4 [=====] - 0s 0s/step - loss: 11.1265
Epoch 1053/2000
4/4 [=====] - 0s 5ms/step - loss: 11.1057
Epoch 1054/2000
4/4 [=====] - 0s 5ms/step - loss: 11.0848
Epoch 1055/2000
4/4 [=====] - 0s 0s/step - loss: 11.0639
Epoch 1056/2000
4/4 [=====] - 0s 0s/step - loss: 11.0431
Epoch 1057/2000
4/4 [=====] - 0s 5ms/step - loss: 11.0227
Epoch 1058/2000
4/4 [=====] - 0s 5ms/step - loss: 11.0015
Epoch 1059/2000
4/4 [=====] - 0s 0s/step - loss: 10.9808
Epoch 1060/2000
4/4 [=====] - 0s 0s/step - loss: 10.9601
Epoch 1061/2000
4/4 [=====] - 0s 9ms/step - loss: 10.9396
Epoch 1062/2000
4/4 [=====] - 0s 8ms/step - loss: 10.9188
Epoch 1063/2000
4/4 [=====] - 0s 1ms/step - loss: 10.8984
Epoch 1064/2000
4/4 [=====] - 0s 416us/step - loss: 10.8778
Epoch 1065/2000
4/4 [=====] - 0s 8ms/step - loss: 10.8571
Epoch 1066/2000
4/4 [=====] - 0s 3ms/step - loss: 10.8367
Epoch 1067/2000
4/4 [=====] - 0s 2ms/step - loss: 10.8162
Epoch 1068/2000
4/4 [=====] - 0s 0s/step - loss: 10.7957
Epoch 1069/2000
4/4 [=====] - 0s 6ms/step - loss: 10.7751
Epoch 1070/2000
4/4 [=====] - 0s 2ms/step - loss: 10.7547
Epoch 1071/2000

4/4 [=====] - 0s 0s/step - loss: 10.7342
Epoch 1072/2000
4/4 [=====] - 0s 3ms/step - loss: 10.7137
Epoch 1073/2000
4/4 [=====] - 0s 3ms/step - loss: 10.6937
Epoch 1074/2000
4/4 [=====] - 0s 0s/step - loss: 10.6731
Epoch 1075/2000
4/4 [=====] - 0s 2ms/step - loss: 10.6528
Epoch 1076/2000
4/4 [=====] - 0s 2ms/step - loss: 10.6327
Epoch 1077/2000
4/4 [=====] - 0s 2ms/step - loss: 10.6124
Epoch 1078/2000
4/4 [=====] - 0s 1ms/step - loss: 10.5919
Epoch 1079/2000
4/4 [=====] - 0s 0s/step - loss: 10.5720
Epoch 1080/2000
4/4 [=====] - 0s 0s/step - loss: 10.5516
Epoch 1081/2000
4/4 [=====] - 0s 6ms/step - loss: 10.5313
Epoch 1082/2000
4/4 [=====] - 0s 0s/step - loss: 10.5114
Epoch 1083/2000
4/4 [=====] - 0s 5ms/step - loss: 10.4914
Epoch 1084/2000
4/4 [=====] - 0s 0s/step - loss: 10.4711
Epoch 1085/2000
4/4 [=====] - 0s 5ms/step - loss: 10.4512
Epoch 1086/2000
4/4 [=====] - 0s 0s/step - loss: 10.4310
Epoch 1087/2000
4/4 [=====] - 0s 0s/step - loss: 10.4109
Epoch 1088/2000
4/4 [=====] - 0s 5ms/step - loss: 10.3908
Epoch 1089/2000
4/4 [=====] - 0s 0s/step - loss: 10.3710
Epoch 1090/2000
4/4 [=====] - 0s 718us/step - loss: 10.3510
Epoch 1091/2000
4/4 [=====] - 0s 0s/step - loss: 10.3313
Epoch 1092/2000
4/4 [=====] - 0s 0s/step - loss: 10.3112
Epoch 1093/2000
4/4 [=====] - 0s 6ms/step - loss: 10.2912
Epoch 1094/2000
4/4 [=====] - 0s 0s/step - loss: 10.2712
Epoch 1095/2000
4/4 [=====] - 0s 5ms/step - loss: 10.2517
Epoch 1096/2000
4/4 [=====] - 0s 5ms/step - loss: 10.2319

Epoch 1097/2000
4/4 [=====] - 0s 0s/step - loss: 10.2119
Epoch 1098/2000
4/4 [=====] - 0s 5ms/step - loss: 10.1922
Epoch 1099/2000
4/4 [=====] - 0s 5ms/step - loss: 10.1725
Epoch 1100/2000
4/4 [=====] - 0s 0s/step - loss: 10.1529
Epoch 1101/2000
4/4 [=====] - 0s 5ms/step - loss: 10.1331
Epoch 1102/2000
4/4 [=====] - 0s 0s/step - loss: 10.1135
Epoch 1103/2000
4/4 [=====] - 0s 966us/step - loss: 10.0939
Epoch 1104/2000
4/4 [=====] - 0s 5ms/step - loss: 10.0743
Epoch 1105/2000
4/4 [=====] - 0s 0s/step - loss: 10.0546
Epoch 1106/2000
4/4 [=====] - 0s 0s/step - loss: 10.0350
Epoch 1107/2000
4/4 [=====] - 0s 5ms/step - loss: 10.0155
Epoch 1108/2000
4/4 [=====] - 0s 0s/step - loss: 9.9960
Epoch 1109/2000
4/4 [=====] - 0s 5ms/step - loss: 9.9765
Epoch 1110/2000
4/4 [=====] - 0s 0s/step - loss: 9.9575
Epoch 1111/2000
4/4 [=====] - 0s 0s/step - loss: 9.9377
Epoch 1112/2000
4/4 [=====] - 0s 7ms/step - loss: 9.9180
Epoch 1113/2000
4/4 [=====] - 0s 307us/step - loss: 9.8990
Epoch 1114/2000
4/4 [=====] - 0s 5ms/step - loss: 9.8793
Epoch 1115/2000
4/4 [=====] - 0s 0s/step - loss: 9.8601
Epoch 1116/2000
4/4 [=====] - 0s 0s/step - loss: 9.8408
Epoch 1117/2000
4/4 [=====] - 0s 5ms/step - loss: 9.8216
Epoch 1118/2000
4/4 [=====] - 0s 0s/step - loss: 9.8022
Epoch 1119/2000
4/4 [=====] - 0s 5ms/step - loss: 9.7829
Epoch 1120/2000
4/4 [=====] - 0s 0s/step - loss: 9.7639
Epoch 1121/2000
4/4 [=====] - 0s 0s/step - loss: 9.7446
Epoch 1122/2000

4/4 [=====] - 0s 5ms/step - loss: 9.7256
Epoch 1123/2000
4/4 [=====] - 0s 0s/step - loss: 9.7063
Epoch 1124/2000
4/4 [=====] - 0s 456us/step - loss: 9.6874
Epoch 1125/2000
4/4 [=====] - 0s 5ms/step - loss: 9.6682
Epoch 1126/2000
4/4 [=====] - 0s 0s/step - loss: 9.6490
Epoch 1127/2000
4/4 [=====] - 0s 5ms/step - loss: 9.6299
Epoch 1128/2000
4/4 [=====] - 0s 0s/step - loss: 9.6112
Epoch 1129/2000
4/4 [=====] - 0s 0s/step - loss: 9.5919
Epoch 1130/2000
4/4 [=====] - 0s 5ms/step - loss: 9.5730
Epoch 1131/2000
4/4 [=====] - 0s 0s/step - loss: 9.5538
Epoch 1132/2000
4/4 [=====] - 0s 0s/step - loss: 9.5351
Epoch 1133/2000
4/4 [=====] - 0s 7ms/step - loss: 9.5165
Epoch 1134/2000
4/4 [=====] - 0s 0s/step - loss: 9.4974
Epoch 1135/2000
4/4 [=====] - 0s 5ms/step - loss: 9.4784
Epoch 1136/2000
4/4 [=====] - 0s 0s/step - loss: 9.4596
Epoch 1137/2000
4/4 [=====] - 0s 0s/step - loss: 9.4412
Epoch 1138/2000
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Epoch 1139/2000
4/4 [=====] - 0s 0s/step - loss: 9.4034
Epoch 1140/2000
4/4 [=====] - 0s 0s/step - loss: 9.3842
Epoch 1141/2000
4/4 [=====] - 0s 5ms/step - loss: 9.3661
Epoch 1142/2000
4/4 [=====] - 0s 0s/step - loss: 9.3470
Epoch 1143/2000
4/4 [=====] - 0s 1ms/step - loss: 9.3284
Epoch 1144/2000
4/4 [=====] - 0s 0s/step - loss: 9.3097
Epoch 1145/2000
4/4 [=====] - 0s 0s/step - loss: 9.2911
Epoch 1146/2000
4/4 [=====] - 0s 5ms/step - loss: 9.2726
Epoch 1147/2000
4/4 [=====] - 0s 0s/step - loss: 9.2540

Epoch 1148/2000
4/4 [=====] - 0s 0s/step - loss: 9.2355
Epoch 1149/2000
4/4 [=====] - 0s 5ms/step - loss: 9.2170
Epoch 1150/2000
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Epoch 1151/2000
4/4 [=====] - 0s 5ms/step - loss: 9.1799
Epoch 1152/2000
4/4 [=====] - 0s 0s/step - loss: 9.1617
Epoch 1153/2000
4/4 [=====] - 0s 275us/step - loss: 9.1431
Epoch 1154/2000
4/4 [=====] - 0s 5ms/step - loss: 9.1245
Epoch 1155/2000
4/4 [=====] - 0s 0s/step - loss: 9.1063
Epoch 1156/2000
4/4 [=====] - 0s 5ms/step - loss: 9.0881
Epoch 1157/2000
4/4 [=====] - 0s 0s/step - loss: 9.0697
Epoch 1158/2000
4/4 [=====] - 0s 0s/step - loss: 9.0513
Epoch 1159/2000
4/4 [=====] - 0s 5ms/step - loss: 9.0333
Epoch 1160/2000
4/4 [=====] - 0s 0s/step - loss: 9.0148
Epoch 1161/2000
4/4 [=====] - 0s 0s/step - loss: 8.9965
Epoch 1162/2000
4/4 [=====] - 0s 5ms/step - loss: 8.9786
Epoch 1163/2000
4/4 [=====] - 0s 0s/step - loss: 8.9603
Epoch 1164/2000
4/4 [=====] - 0s 0s/step - loss: 8.9420
Epoch 1165/2000
4/4 [=====] - 0s 0s/step - loss: 8.9240
Epoch 1166/2000
4/4 [=====] - 0s 5ms/step - loss: 8.9059
Epoch 1167/2000
4/4 [=====] - 0s 5ms/step - loss: 8.8877
Epoch 1168/2000
4/4 [=====] - 0s 0s/step - loss: 8.8697
Epoch 1169/2000
4/4 [=====] - 0s 0s/step - loss: 8.8518
Epoch 1170/2000
4/4 [=====] - 0s 5ms/step - loss: 8.8337
Epoch 1171/2000
4/4 [=====] - 0s 14ms/step - loss: 8.8159
Epoch 1172/2000
4/4 [=====] - 0s 5ms/step - loss: 8.7977
Epoch 1173/2000

4/4 [=====] - 0s 5ms/step - loss: 8.7798
Epoch 1174/2000
4/4 [=====] - 0s 0s/step - loss: 8.7618
Epoch 1175/2000
4/4 [=====] - 0s 0s/step - loss: 8.7438
Epoch 1176/2000
4/4 [=====] - 0s 6ms/step - loss: 8.7260
Epoch 1177/2000
4/4 [=====] - 0s 510us/step - loss: 8.7082
Epoch 1178/2000
4/4 [=====] - 0s 2ms/step - loss: 8.6903
Epoch 1179/2000
4/4 [=====] - 0s 2ms/step - loss: 8.6727
Epoch 1180/2000
4/4 [=====] - 0s 0s/step - loss: 8.6546
Epoch 1181/2000
4/4 [=====] - 0s 0s/step - loss: 8.6374
Epoch 1182/2000
4/4 [=====] - 0s 6ms/step - loss: 8.6193
Epoch 1183/2000
4/4 [=====] - 0s 2ms/step - loss: 8.6016
Epoch 1184/2000
4/4 [=====] - 0s 2ms/step - loss: 8.5837
Epoch 1185/2000
4/4 [=====] - 0s 969us/step - loss: 8.5662
Epoch 1186/2000
4/4 [=====] - 0s 6ms/step - loss: 8.5487
Epoch 1187/2000
4/4 [=====] - 0s 0s/step - loss: 8.5309
Epoch 1188/2000
4/4 [=====] - 0s 2ms/step - loss: 8.5134
Epoch 1189/2000
4/4 [=====] - 0s 5ms/step - loss: 8.4958
Epoch 1190/2000
4/4 [=====] - 0s 2ms/step - loss: 8.4781
Epoch 1191/2000
4/4 [=====] - 0s 0s/step - loss: 8.4603
Epoch 1192/2000
4/4 [=====] - 0s 5ms/step - loss: 8.4436
Epoch 1193/2000
4/4 [=====] - 0s 5ms/step - loss: 8.4255
Epoch 1194/2000
4/4 [=====] - 0s 0s/step - loss: 8.4085
Epoch 1195/2000
4/4 [=====] - 0s 0s/step - loss: 8.3908
Epoch 1196/2000
4/4 [=====] - 0s 16ms/step - loss: 8.3734
Epoch 1197/2000
4/4 [=====] - 0s 3ms/step - loss: 8.3561
Epoch 1198/2000
4/4 [=====] - 0s 0s/step - loss: 8.3387

Epoch 1199/2000
4/4 [=====] - 0s 3ms/step - loss: 8.3214
Epoch 1200/2000
4/4 [=====] - 0s 2ms/step - loss: 8.3044
Epoch 1201/2000
4/4 [=====] - 0s 2ms/step - loss: 8.2867
Epoch 1202/2000
4/4 [=====] - 0s 0s/step - loss: 8.2696
Epoch 1203/2000
4/4 [=====] - 0s 7ms/step - loss: 8.2523
Epoch 1204/2000
4/4 [=====] - 0s 0s/step - loss: 8.2354
Epoch 1205/2000
4/4 [=====] - 0s 5ms/step - loss: 8.2179
Epoch 1206/2000
4/4 [=====] - 0s 0s/step - loss: 8.2007
Epoch 1207/2000
4/4 [=====] - 0s 0s/step - loss: 8.1838
Epoch 1208/2000
4/4 [=====] - 0s 5ms/step - loss: 8.1666
Epoch 1209/2000
4/4 [=====] - 0s 0s/step - loss: 8.1497
Epoch 1210/2000
4/4 [=====] - 0s 0s/step - loss: 8.1325
Epoch 1211/2000
4/4 [=====] - 0s 5ms/step - loss: 8.1154
Epoch 1212/2000
4/4 [=====] - 0s 0s/step - loss: 8.0984
Epoch 1213/2000
4/4 [=====] - 0s 7ms/step - loss: 8.0814
Epoch 1214/2000
4/4 [=====] - 0s 0s/step - loss: 8.0645
Epoch 1215/2000
4/4 [=====] - 0s 5ms/step - loss: 8.0475
Epoch 1216/2000
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Epoch 1217/2000
4/4 [=====] - 0s 0s/step - loss: 8.0137
Epoch 1218/2000
4/4 [=====] - 0s 5ms/step - loss: 7.9967
Epoch 1219/2000
4/4 [=====] - 0s 0s/step - loss: 7.9799
Epoch 1220/2000
4/4 [=====] - 0s 0s/step - loss: 7.9629
Epoch 1221/2000
4/4 [=====] - 0s 5ms/step - loss: 7.9462
Epoch 1222/2000
4/4 [=====] - 0s 0s/step - loss: 7.9294
Epoch 1223/2000
4/4 [=====] - 0s 7ms/step - loss: 7.9127
Epoch 1224/2000

4/4 [=====] - 0s 0s/step - loss: 7.8957
Epoch 1225/2000
4/4 [=====] - 0s 5ms/step - loss: 7.8792
Epoch 1226/2000
4/4 [=====] - 0s 0s/step - loss: 7.8624
Epoch 1227/2000
4/4 [=====] - 0s 0s/step - loss: 7.8459
Epoch 1228/2000
4/4 [=====] - 0s 5ms/step - loss: 7.8292
Epoch 1229/2000
4/4 [=====] - 0s 0s/step - loss: 7.8127
Epoch 1230/2000
4/4 [=====] - 0s 0s/step - loss: 7.7960
Epoch 1231/2000
4/4 [=====] - 0s 5ms/step - loss: 7.7797
Epoch 1232/2000
4/4 [=====] - 0s 0s/step - loss: 7.7628
Epoch 1233/2000
4/4 [=====] - 0s 5ms/step - loss: 7.7463
Epoch 1234/2000
4/4 [=====] - 0s 5ms/step - loss: 7.7298
Epoch 1235/2000
4/4 [=====] - 0s 122us/step - loss: 7.7134
Epoch 1236/2000
4/4 [=====] - 0s 5ms/step - loss: 7.6970
Epoch 1237/2000
4/4 [=====] - 0s 0s/step - loss: 7.6803
Epoch 1238/2000
4/4 [=====] - 0s 5ms/step - loss: 7.6639
Epoch 1239/2000
4/4 [=====] - 0s 5ms/step - loss: 7.6478
Epoch 1240/2000
4/4 [=====] - 0s 0s/step - loss: 7.6313
Epoch 1241/2000
4/4 [=====] - 0s 5ms/step - loss: 7.6152
Epoch 1242/2000
4/4 [=====] - 0s 0s/step - loss: 7.5983
Epoch 1243/2000
4/4 [=====] - 0s 0s/step - loss: 7.5824
Epoch 1244/2000
4/4 [=====] - 0s 6ms/step - loss: 7.5659
Epoch 1245/2000
4/4 [=====] - 0s 0s/step - loss: 7.5498
Epoch 1246/2000
4/4 [=====] - 0s 670us/step - loss: 7.5335
Epoch 1247/2000
4/4 [=====] - 0s 0s/step - loss: 7.5174
Epoch 1248/2000
4/4 [=====] - 0s 0s/step - loss: 7.5013
Epoch 1249/2000
4/4 [=====] - 0s 5ms/step - loss: 7.4851

Epoch 1250/2000
4/4 [=====] - 0s 0s/step - loss: 7.4689
Epoch 1251/2000
4/4 [=====] - 0s 0s/step - loss: 7.4529
Epoch 1252/2000
4/4 [=====] - 0s 5ms/step - loss: 7.4367
Epoch 1253/2000
4/4 [=====] - 0s 0s/step - loss: 7.4206
Epoch 1254/2000
4/4 [=====] - 0s 0s/step - loss: 7.4047
Epoch 1255/2000
4/4 [=====] - 0s 7ms/step - loss: 7.3885
Epoch 1256/2000
4/4 [=====] - 0s 0s/step - loss: 7.3725
Epoch 1257/2000
4/4 [=====] - 0s 5ms/step - loss: 7.3568
Epoch 1258/2000
4/4 [=====] - 0s 0s/step - loss: 7.3408
Epoch 1259/2000
4/4 [=====] - 0s 0s/step - loss: 7.3248
Epoch 1260/2000
4/4 [=====] - 0s 5ms/step - loss: 7.3088
Epoch 1261/2000
4/4 [=====] - 0s 0s/step - loss: 7.2930
Epoch 1262/2000
4/4 [=====] - 0s 0s/step - loss: 7.2772
Epoch 1263/2000
4/4 [=====] - 0s 5ms/step - loss: 7.2612
Epoch 1264/2000
4/4 [=====] - 0s 0s/step - loss: 7.2455
Epoch 1265/2000
4/4 [=====] - 0s 2ms/step - loss: 7.2296
Epoch 1266/2000
4/4 [=====] - 0s 0s/step - loss: 7.2140
Epoch 1267/2000
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Epoch 1268/2000
4/4 [=====] - 0s 0s/step - loss: 7.1827
Epoch 1269/2000
4/4 [=====] - 0s 0s/step - loss: 7.1666
Epoch 1270/2000
4/4 [=====] - 0s 968us/step - loss: 7.1510
Epoch 1271/2000
4/4 [=====] - 0s 0s/step - loss: 7.1353
Epoch 1272/2000
4/4 [=====] - 0s 0s/step - loss: 7.1195
Epoch 1273/2000
4/4 [=====] - 0s 5ms/step - loss: 7.1041
Epoch 1274/2000
4/4 [=====] - 0s 0s/step - loss: 7.0884
Epoch 1275/2000

4/4 [=====] - 0s 708us/step - loss: 7.0729
Epoch 1276/2000
4/4 [=====] - 0s 0s/step - loss: 7.0574
Epoch 1277/2000
4/4 [=====] - 0s 0s/step - loss: 7.0417
Epoch 1278/2000
4/4 [=====] - 0s 5ms/step - loss: 7.0261
Epoch 1279/2000
4/4 [=====] - 0s 0s/step - loss: 7.0108
Epoch 1280/2000
4/4 [=====] - 0s 0s/step - loss: 6.9953
Epoch 1281/2000
4/4 [=====] - 0s 5ms/step - loss: 6.9800
Epoch 1282/2000
4/4 [=====] - 0s 0s/step - loss: 6.9647
Epoch 1283/2000
4/4 [=====] - 0s 5ms/step - loss: 6.9492
Epoch 1284/2000
4/4 [=====] - 0s 0s/step - loss: 6.9339
Epoch 1285/2000
4/4 [=====] - 0s 0s/step - loss: 6.9186
Epoch 1286/2000
4/4 [=====] - 0s 7ms/step - loss: 6.9031
Epoch 1287/2000
4/4 [=====] - 0s 0s/step - loss: 6.8880
Epoch 1288/2000
4/4 [=====] - 0s 5ms/step - loss: 6.8727
Epoch 1289/2000
4/4 [=====] - 0s 4ms/step - loss: 6.8574
Epoch 1290/2000
4/4 [=====] - 0s 0s/step - loss: 6.8423
Epoch 1291/2000
4/4 [=====] - 0s 5ms/step - loss: 6.8271
Epoch 1292/2000
4/4 [=====] - 0s 0s/step - loss: 6.8117
Epoch 1293/2000
4/4 [=====] - 0s 0s/step - loss: 6.7968
Epoch 1294/2000
4/4 [=====] - 0s 5ms/step - loss: 6.7815
Epoch 1295/2000
4/4 [=====] - 0s 0s/step - loss: 6.7667
Epoch 1296/2000
4/4 [=====] - 0s 7ms/step - loss: 6.7513
Epoch 1297/2000
4/4 [=====] - 0s 0s/step - loss: 6.7362
Epoch 1298/2000
4/4 [=====] - 0s 786us/step - loss: 6.7209
Epoch 1299/2000
4/4 [=====] - 0s 5ms/step - loss: 6.7063
Epoch 1300/2000
4/4 [=====] - 0s 0s/step - loss: 6.6910

Epoch 1301/2000
4/4 [=====] - 0s 0s/step - loss: 6.6762
Epoch 1302/2000
4/4 [=====] - 0s 5ms/step - loss: 6.6611
Epoch 1303/2000
4/4 [=====] - 0s 0s/step - loss: 6.6461
Epoch 1304/2000
4/4 [=====] - 0s 5ms/step - loss: 6.6312
Epoch 1305/2000
4/4 [=====] - 0s 0s/step - loss: 6.6163
Epoch 1306/2000
4/4 [=====] - 0s 819us/step - loss: 6.6014
Epoch 1307/2000
4/4 [=====] - 0s 5ms/step - loss: 6.5865
Epoch 1308/2000
4/4 [=====] - 0s 5ms/step - loss: 6.5720
Epoch 1309/2000
4/4 [=====] - 0s 0s/step - loss: 6.5568
Epoch 1310/2000
4/4 [=====] - 0s 0s/step - loss: 6.5421
Epoch 1311/2000
4/4 [=====] - 0s 5ms/step - loss: 6.5275
Epoch 1312/2000
4/4 [=====] - 0s 0s/step - loss: 6.5128
Epoch 1313/2000
4/4 [=====] - 0s 0s/step - loss: 6.4979
Epoch 1314/2000
4/4 [=====] - 0s 5ms/step - loss: 6.4835
Epoch 1315/2000
4/4 [=====] - 0s 5ms/step - loss: 6.4686
Epoch 1316/2000
4/4 [=====] - 0s 0s/step - loss: 6.4540
Epoch 1317/2000
4/4 [=====] - 0s 0s/step - loss: 6.4394
Epoch 1318/2000
4/4 [=====] - 0s 5ms/step - loss: 6.4248
Epoch 1319/2000
4/4 [=====] - 0s 0s/step - loss: 6.4100
Epoch 1320/2000
4/4 [=====] - 0s 0s/step - loss: 6.3957
Epoch 1321/2000
4/4 [=====] - 0s 5ms/step - loss: 6.3810
Epoch 1322/2000
4/4 [=====] - 0s 5ms/step - loss: 6.3667
Epoch 1323/2000
4/4 [=====] - 0s 0s/step - loss: 6.3520
Epoch 1324/2000
4/4 [=====] - 0s 5ms/step - loss: 6.3376
Epoch 1325/2000
4/4 [=====] - 0s 5ms/step - loss: 6.3231
Epoch 1326/2000

4/4 [=====] - 0s 0s/step - loss: 6.3087
Epoch 1327/2000
4/4 [=====] - 0s 0s/step - loss: 6.2945
Epoch 1328/2000
4/4 [=====] - 0s 5ms/step - loss: 6.2798
Epoch 1329/2000
4/4 [=====] - 0s 0s/step - loss: 6.2655
Epoch 1330/2000
4/4 [=====] - 0s 0s/step - loss: 6.2510
Epoch 1331/2000
4/4 [=====] - 0s 5ms/step - loss: 6.2367
Epoch 1332/2000
4/4 [=====] - 0s 6ms/step - loss: 6.2228
Epoch 1333/2000
4/4 [=====] - 0s 3ms/step - loss: 6.2082
Epoch 1334/2000
4/4 [=====] - 0s 2ms/step - loss: 6.1938
Epoch 1335/2000
4/4 [=====] - 0s 86us/step - loss: 6.1797
Epoch 1336/2000
4/4 [=====] - 0s 6ms/step - loss: 6.1656
Epoch 1337/2000
4/4 [=====] - 0s 0s/step - loss: 6.1514
Epoch 1338/2000
4/4 [=====] - 0s 3ms/step - loss: 6.1371
Epoch 1339/2000
4/4 [=====] - 0s 2ms/step - loss: 6.1232
Epoch 1340/2000
4/4 [=====] - 0s 1ms/step - loss: 6.1090
Epoch 1341/2000
4/4 [=====] - 0s 5ms/step - loss: 6.0948
Epoch 1342/2000
4/4 [=====] - 0s 0s/step - loss: 6.0806
Epoch 1343/2000
4/4 [=====] - 0s 3ms/step - loss: 6.0667
Epoch 1344/2000
4/4 [=====] - 0s 3ms/step - loss: 6.0525
Epoch 1345/2000
4/4 [=====] - 0s 2ms/step - loss: 6.0387
Epoch 1346/2000
4/4 [=====] - 0s 0s/step - loss: 6.0248
Epoch 1347/2000
4/4 [=====] - 0s 6ms/step - loss: 6.0106
Epoch 1348/2000
4/4 [=====] - 0s 0s/step - loss: 5.9967
Epoch 1349/2000
4/4 [=====] - 0s 2ms/step - loss: 5.9830
Epoch 1350/2000
4/4 [=====] - 0s 1ms/step - loss: 5.9688
Epoch 1351/2000
4/4 [=====] - 0s 11ms/step - loss: 5.9550

Epoch 1352/2000
4/4 [=====] - 0s 5ms/step - loss: 5.9413
Epoch 1353/2000
4/4 [=====] - 0s 5ms/step - loss: 5.9272
Epoch 1354/2000
4/4 [=====] - 0s 5ms/step - loss: 5.9134
Epoch 1355/2000
4/4 [=====] - 0s 0s/step - loss: 5.8999
Epoch 1356/2000
4/4 [=====] - 0s 0s/step - loss: 5.8859
Epoch 1357/2000
4/4 [=====] - 0s 3ms/step - loss: 5.8722
Epoch 1358/2000
4/4 [=====] - 0s 2ms/step - loss: 5.8584
Epoch 1359/2000
4/4 [=====] - 0s 624us/step - loss: 5.8446
Epoch 1360/2000
4/4 [=====] - 0s 0s/step - loss: 5.8311
Epoch 1361/2000
4/4 [=====] - 0s 0s/step - loss: 5.8176
Epoch 1362/2000
4/4 [=====] - 0s 5ms/step - loss: 5.8037
Epoch 1363/2000
4/4 [=====] - 0s 5ms/step - loss: 5.7900
Epoch 1364/2000
4/4 [=====] - 0s 0s/step - loss: 5.7766
Epoch 1365/2000
4/4 [=====] - 0s 0s/step - loss: 5.7630
Epoch 1366/2000
4/4 [=====] - 0s 5ms/step - loss: 5.7494
Epoch 1367/2000
4/4 [=====] - 0s 0s/step - loss: 5.7359
Epoch 1368/2000
4/4 [=====] - 0s 0s/step - loss: 5.7223
Epoch 1369/2000
4/4 [=====] - 0s 5ms/step - loss: 5.7089
Epoch 1370/2000
4/4 [=====] - 0s 16ms/step - loss: 5.6956
Epoch 1371/2000
4/4 [=====] - 0s 0s/step - loss: 5.6822
Epoch 1372/2000
4/4 [=====] - 0s 0s/step - loss: 5.6686
Epoch 1373/2000
4/4 [=====] - 0s 0s/step - loss: 5.6551
Epoch 1374/2000
4/4 [=====] - 0s 5ms/step - loss: 5.6419
Epoch 1375/2000
4/4 [=====] - 0s 0s/step - loss: 5.6289
Epoch 1376/2000
4/4 [=====] - 0s 0s/step - loss: 5.6153
Epoch 1377/2000

4/4 [=====] - 0s 5ms/step - loss: 5.6019
Epoch 1378/2000
4/4 [=====] - 0s 0s/step - loss: 5.5883
Epoch 1379/2000
4/4 [=====] - 0s 4ms/step - loss: 5.5753
Epoch 1380/2000
4/4 [=====] - 0s 3ms/step - loss: 5.5624
Epoch 1381/2000
4/4 [=====] - 0s 0s/step - loss: 5.5489
Epoch 1382/2000
4/4 [=====] - 0s 0s/step - loss: 5.5356
Epoch 1383/2000
4/4 [=====] - 0s 5ms/step - loss: 5.5224
Epoch 1384/2000
4/4 [=====] - 0s 2ms/step - loss: 5.5094
Epoch 1385/2000
4/4 [=====] - 0s 728us/step - loss: 5.4961
Epoch 1386/2000
4/4 [=====] - 0s 0s/step - loss: 5.4830
Epoch 1387/2000
4/4 [=====] - 0s 0s/step - loss: 5.4699
Epoch 1388/2000
4/4 [=====] - 0s 5ms/step - loss: 5.4569
Epoch 1389/2000
4/4 [=====] - 0s 0s/step - loss: 5.4437
Epoch 1390/2000
4/4 [=====] - 0s 2ms/step - loss: 5.4306
Epoch 1391/2000
4/4 [=====] - 0s 0s/step - loss: 5.4178
Epoch 1392/2000
4/4 [=====] - 0s 0s/step - loss: 5.4047
Epoch 1393/2000
4/4 [=====] - 0s 5ms/step - loss: 5.3917
Epoch 1394/2000
4/4 [=====] - 0s 0s/step - loss: 5.3787
Epoch 1395/2000
4/4 [=====] - 0s 5ms/step - loss: 5.3656
Epoch 1396/2000
4/4 [=====] - 0s 0s/step - loss: 5.3529
Epoch 1397/2000
4/4 [=====] - 0s 0s/step - loss: 5.3398
Epoch 1398/2000
4/4 [=====] - 0s 5ms/step - loss: 5.3272
Epoch 1399/2000
4/4 [=====] - 0s 0s/step - loss: 5.3143
Epoch 1400/2000
4/4 [=====] - 0s 1ms/step - loss: 5.3017
Epoch 1401/2000
4/4 [=====] - 0s 0s/step - loss: 5.2885
Epoch 1402/2000
4/4 [=====] - 0s 0s/step - loss: 5.2756

Epoch 1403/2000
4/4 [=====] - 0s 5ms/step - loss: 5.2630
Epoch 1404/2000
4/4 [=====] - 0s 0s/step - loss: 5.2503
Epoch 1405/2000
4/4 [=====] - 0s 0s/step - loss: 5.2375
Epoch 1406/2000
4/4 [=====] - 0s 5ms/step - loss: 5.2248
Epoch 1407/2000
4/4 [=====] - 0s 0s/step - loss: 5.2122
Epoch 1408/2000
4/4 [=====] - 0s 0s/step - loss: 5.1994
Epoch 1409/2000
4/4 [=====] - 0s 5ms/step - loss: 5.1865
Epoch 1410/2000
4/4 [=====] - 0s 0s/step - loss: 5.1740
Epoch 1411/2000
4/4 [=====] - 0s 8ms/step - loss: 5.1616
Epoch 1412/2000
4/4 [=====] - 0s 0s/step - loss: 5.1488
Epoch 1413/2000
4/4 [=====] - 0s 0s/step - loss: 5.1363
Epoch 1414/2000
4/4 [=====] - 0s 5ms/step - loss: 5.1239
Epoch 1415/2000
4/4 [=====] - 0s 0s/step - loss: 5.1113
Epoch 1416/2000
4/4 [=====] - 0s 5ms/step - loss: 5.0986
Epoch 1417/2000
4/4 [=====] - 0s 0s/step - loss: 5.0863
Epoch 1418/2000
4/4 [=====] - 0s 0s/step - loss: 5.0736
Epoch 1419/2000
4/4 [=====] - 0s 5ms/step - loss: 5.0613
Epoch 1420/2000
4/4 [=====] - 0s 0s/step - loss: 5.0489
Epoch 1421/2000
4/4 [=====] - 0s 888us/step - loss: 5.0366
Epoch 1422/2000
4/4 [=====] - 0s 0s/step - loss: 5.0244
Epoch 1423/2000
4/4 [=====] - 0s 0s/step - loss: 5.0118
Epoch 1424/2000
4/4 [=====] - 0s 5ms/step - loss: 4.9996
Epoch 1425/2000
4/4 [=====] - 0s 0s/step - loss: 4.9872
Epoch 1426/2000
4/4 [=====] - 0s 0s/step - loss: 4.9750
Epoch 1427/2000
4/4 [=====] - 0s 5ms/step - loss: 4.9627
Epoch 1428/2000

4/4 [=====] - 0s 0s/step - loss: 4.9503
Epoch 1429/2000
4/4 [=====] - 0s 0s/step - loss: 4.9382
Epoch 1430/2000
4/4 [=====] - 0s 6ms/step - loss: 4.9262
Epoch 1431/2000
4/4 [=====] - 0s 0s/step - loss: 4.9138
Epoch 1432/2000
4/4 [=====] - 0s 5ms/step - loss: 4.9017
Epoch 1433/2000
4/4 [=====] - 0s 0s/step - loss: 4.8897
Epoch 1434/2000
4/4 [=====] - 0s 0s/step - loss: 4.8775
Epoch 1435/2000
4/4 [=====] - 0s 6ms/step - loss: 4.8654
Epoch 1436/2000
4/4 [=====] - 0s 0s/step - loss: 4.8531
Epoch 1437/2000
4/4 [=====] - 0s 0s/step - loss: 4.8410
Epoch 1438/2000
4/4 [=====] - 0s 5ms/step - loss: 4.8293
Epoch 1439/2000
4/4 [=====] - 0s 0s/step - loss: 4.8172
Epoch 1440/2000
4/4 [=====] - 0s 0s/step - loss: 4.8051
Epoch 1441/2000
4/4 [=====] - 0s 7ms/step - loss: 4.7932
Epoch 1442/2000
4/4 [=====] - 0s 0s/step - loss: 4.7812
Epoch 1443/2000
4/4 [=====] - 0s 5ms/step - loss: 4.7697
Epoch 1444/2000
4/4 [=====] - 0s 0s/step - loss: 4.7574
Epoch 1445/2000
4/4 [=====] - 0s 0s/step - loss: 4.7456
Epoch 1446/2000
4/4 [=====] - 0s 5ms/step - loss: 4.7336
Epoch 1447/2000
4/4 [=====] - 0s 0s/step - loss: 4.7218
Epoch 1448/2000
4/4 [=====] - 0s 0s/step - loss: 4.7099
Epoch 1449/2000
4/4 [=====] - 0s 6ms/step - loss: 4.6982
Epoch 1450/2000
4/4 [=====] - 0s 0s/step - loss: 4.6863
Epoch 1451/2000
4/4 [=====] - 0s 924us/step - loss: 4.6748
Epoch 1452/2000
4/4 [=====] - 0s 4ms/step - loss: 4.6629
Epoch 1453/2000
4/4 [=====] - 0s 0s/step - loss: 4.6512

Epoch 1454/2000
4/4 [=====] - 0s 0s/step - loss: 4.6397
Epoch 1455/2000
4/4 [=====] - 0s 5ms/step - loss: 4.6279
Epoch 1456/2000
4/4 [=====] - 0s 0s/step - loss: 4.6162
Epoch 1457/2000
4/4 [=====] - 0s 5ms/step - loss: 4.6048
Epoch 1458/2000
4/4 [=====] - 0s 0s/step - loss: 4.5929
Epoch 1459/2000
4/4 [=====] - 0s 0s/step - loss: 4.5814
Epoch 1460/2000
4/4 [=====] - 0s 5ms/step - loss: 4.5698
Epoch 1461/2000
4/4 [=====] - 0s 0s/step - loss: 4.5581
Epoch 1462/2000
4/4 [=====] - 0s 5ms/step - loss: 4.5467
Epoch 1463/2000
4/4 [=====] - 0s 0s/step - loss: 4.5353
Epoch 1464/2000
4/4 [=====] - 0s 0s/step - loss: 4.5236
Epoch 1465/2000
4/4 [=====] - 0s 5ms/step - loss: 4.5122
Epoch 1466/2000
4/4 [=====] - 0s 0s/step - loss: 4.5007
Epoch 1467/2000
4/4 [=====] - 0s 0s/step - loss: 4.4894
Epoch 1468/2000
4/4 [=====] - 0s 5ms/step - loss: 4.4779
Epoch 1469/2000
4/4 [=====] - 0s 0s/step - loss: 4.4667
Epoch 1470/2000
4/4 [=====] - 0s 0s/step - loss: 4.4551
Epoch 1471/2000
4/4 [=====] - 0s 5ms/step - loss: 4.4437
Epoch 1472/2000
4/4 [=====] - 0s 186us/step - loss: 4.4325
Epoch 1473/2000
4/4 [=====] - 0s 5ms/step - loss: 4.4210
Epoch 1474/2000
4/4 [=====] - 0s 0s/step - loss: 4.4098
Epoch 1475/2000
4/4 [=====] - 0s 0s/step - loss: 4.3985
Epoch 1476/2000
4/4 [=====] - 0s 5ms/step - loss: 4.3874
Epoch 1477/2000
4/4 [=====] - 0s 0s/step - loss: 4.3760
Epoch 1478/2000
4/4 [=====] - 0s 5ms/step - loss: 4.3648
Epoch 1479/2000

4/4 [=====] - 0s 0s/step - loss: 4.3536
Epoch 1480/2000
4/4 [=====] - 0s 0s/step - loss: 4.3425
Epoch 1481/2000
4/4 [=====] - 0s 2ms/step - loss: 4.3313
Epoch 1482/2000
4/4 [=====] - 0s 0s/step - loss: 4.3201
Epoch 1483/2000
4/4 [=====] - 0s 0s/step - loss: 4.3092
Epoch 1484/2000
4/4 [=====] - 0s 5ms/step - loss: 4.2981
Epoch 1485/2000
4/4 [=====] - 0s 0s/step - loss: 4.2868
Epoch 1486/2000
4/4 [=====] - 0s 289us/step - loss: 4.2762
Epoch 1487/2000
4/4 [=====] - 0s 5ms/step - loss: 4.2648
Epoch 1488/2000
4/4 [=====] - 0s 0s/step - loss: 4.2540
Epoch 1489/2000
4/4 [=====] - 0s 5ms/step - loss: 4.2428
Epoch 1490/2000
4/4 [=====] - 0s 0s/step - loss: 4.2318
Epoch 1491/2000
4/4 [=====] - 0s 479us/step - loss: 4.2208
Epoch 1492/2000
4/4 [=====] - 0s 5ms/step - loss: 4.2098
Epoch 1493/2000
4/4 [=====] - 0s 0s/step - loss: 4.1991
Epoch 1494/2000
4/4 [=====] - 0s 0s/step - loss: 4.1883
Epoch 1495/2000
4/4 [=====] - 0s 5ms/step - loss: 4.1772
Epoch 1496/2000
4/4 [=====] - 0s 0s/step - loss: 4.1664
Epoch 1497/2000
4/4 [=====] - 0s 6ms/step - loss: 4.1554
Epoch 1498/2000
4/4 [=====] - 0s 0s/step - loss: 4.1446
Epoch 1499/2000
4/4 [=====] - 0s 0s/step - loss: 4.1337
Epoch 1500/2000
4/4 [=====] - 0s 6ms/step - loss: 4.1230
Epoch 1501/2000
4/4 [=====] - 0s 0s/step - loss: 4.1123
Epoch 1502/2000
4/4 [=====] - 0s 5ms/step - loss: 4.1015
Epoch 1503/2000
4/4 [=====] - 0s 0s/step - loss: 4.0910
Epoch 1504/2000
4/4 [=====] - 0s 0s/step - loss: 4.0801

Epoch 1505/2000
4/4 [=====] - 0s 5ms/step - loss: 4.0695
Epoch 1506/2000
4/4 [=====] - 0s 0s/step - loss: 4.0589
Epoch 1507/2000
4/4 [=====] - 0s 5ms/step - loss: 4.0483
Epoch 1508/2000
4/4 [=====] - 0s 5ms/step - loss: 4.0377
Epoch 1509/2000
4/4 [=====] - 0s 0s/step - loss: 4.0270
Epoch 1510/2000
4/4 [=====] - 0s 5ms/step - loss: 4.0165
Epoch 1511/2000
4/4 [=====] - 0s 0s/step - loss: 4.0059
Epoch 1512/2000
4/4 [=====] - 0s 679us/step - loss: 3.9955
Epoch 1513/2000
4/4 [=====] - 0s 5ms/step - loss: 3.9850
Epoch 1514/2000
4/4 [=====] - 0s 0s/step - loss: 3.9745
Epoch 1515/2000
4/4 [=====] - 0s 0s/step - loss: 3.9640
Epoch 1516/2000
4/4 [=====] - 0s 5ms/step - loss: 3.9535
Epoch 1517/2000
4/4 [=====] - 0s 5ms/step - loss: 3.9432
Epoch 1518/2000
4/4 [=====] - 0s 0s/step - loss: 3.9327
Epoch 1519/2000
4/4 [=====] - 0s 0s/step - loss: 3.9224
Epoch 1520/2000
4/4 [=====] - 0s 5ms/step - loss: 3.9120
Epoch 1521/2000
4/4 [=====] - 0s 5ms/step - loss: 3.9014
Epoch 1522/2000
4/4 [=====] - 0s 0s/step - loss: 3.8914
Epoch 1523/2000
4/4 [=====] - 0s 0s/step - loss: 3.8811
Epoch 1524/2000
4/4 [=====] - 0s 5ms/step - loss: 3.8709
Epoch 1525/2000
4/4 [=====] - 0s 0s/step - loss: 3.8604
Epoch 1526/2000
4/4 [=====] - 0s 0s/step - loss: 3.8502
Epoch 1527/2000
4/4 [=====] - 0s 5ms/step - loss: 3.8399
Epoch 1528/2000
4/4 [=====] - 0s 5ms/step - loss: 3.8296
Epoch 1529/2000
4/4 [=====] - 0s 5ms/step - loss: 3.8195
Epoch 1530/2000

4/4 [=====] - 0s 3ms/step - loss: 3.8094
Epoch 1531/2000
4/4 [=====] - 0s 2ms/step - loss: 3.7990
Epoch 1532/2000
4/4 [=====] - 0s 824us/step - loss: 3.7890
Epoch 1533/2000
4/4 [=====] - 0s 6ms/step - loss: 3.7789
Epoch 1534/2000
4/4 [=====] - 0s 0s/step - loss: 3.7689
Epoch 1535/2000
4/4 [=====] - 0s 2ms/step - loss: 3.7587
Epoch 1536/2000
4/4 [=====] - 0s 2ms/step - loss: 3.7487
Epoch 1537/2000
4/4 [=====] - 0s 0s/step - loss: 3.7384
Epoch 1538/2000
4/4 [=====] - 0s 328us/step - loss: 3.7285
Epoch 1539/2000
4/4 [=====] - 0s 6ms/step - loss: 3.7185
Epoch 1540/2000
4/4 [=====] - 0s 2ms/step - loss: 3.7085
Epoch 1541/2000
4/4 [=====] - 0s 0s/step - loss: 3.6987
Epoch 1542/2000
4/4 [=====] - 0s 7ms/step - loss: 3.6886
Epoch 1543/2000
4/4 [=====] - 0s 8ms/step - loss: 3.6788
Epoch 1544/2000
4/4 [=====] - 0s 0s/step - loss: 3.6688
Epoch 1545/2000
4/4 [=====] - 0s 6ms/step - loss: 3.6590
Epoch 1546/2000
4/4 [=====] - 0s 5ms/step - loss: 3.6490
Epoch 1547/2000
4/4 [=====] - 0s 5ms/step - loss: 3.6394
Epoch 1548/2000
4/4 [=====] - 0s 506us/step - loss: 3.6294
Epoch 1549/2000
4/4 [=====] - 0s 3ms/step - loss: 3.6195
Epoch 1550/2000
4/4 [=====] - 0s 2ms/step - loss: 3.6097
Epoch 1551/2000
4/4 [=====] - 0s 0s/step - loss: 3.6000
Epoch 1552/2000
4/4 [=====] - 0s 5ms/step - loss: 3.5902
Epoch 1553/2000
4/4 [=====] - 0s 6ms/step - loss: 3.5806
Epoch 1554/2000
4/4 [=====] - 0s 0s/step - loss: 3.5708
Epoch 1555/2000
4/4 [=====] - 0s 2ms/step - loss: 3.5611

Epoch 1556/2000
4/4 [=====] - 0s 2ms/step - loss: 3.5516
Epoch 1557/2000
4/4 [=====] - 0s 0s/step - loss: 3.5419
Epoch 1558/2000
4/4 [=====] - 0s 0s/step - loss: 3.5323
Epoch 1559/2000
4/4 [=====] - 0s 5ms/step - loss: 3.5225
Epoch 1560/2000
4/4 [=====] - 0s 0s/step - loss: 3.5128
Epoch 1561/2000
4/4 [=====] - 0s 0s/step - loss: 3.5035
Epoch 1562/2000
4/4 [=====] - 0s 5ms/step - loss: 3.4938
Epoch 1563/2000
4/4 [=====] - 0s 0s/step - loss: 3.4842
Epoch 1564/2000
4/4 [=====] - 0s 0s/step - loss: 3.4748
Epoch 1565/2000
4/4 [=====] - 0s 3ms/step - loss: 3.4653
Epoch 1566/2000
4/4 [=====] - 0s 2ms/step - loss: 3.4558
Epoch 1567/2000
4/4 [=====] - 0s 0s/step - loss: 3.4463
Epoch 1568/2000
4/4 [=====] - 0s 5ms/step - loss: 3.4368
Epoch 1569/2000
4/4 [=====] - 0s 0s/step - loss: 3.4275
Epoch 1570/2000
4/4 [=====] - 0s 10ms/step - loss: 3.4180
Epoch 1571/2000
4/4 [=====] - 0s 0s/step - loss: 3.4087
Epoch 1572/2000
4/4 [=====] - 0s 5ms/step - loss: 3.3992
Epoch 1573/2000
4/4 [=====] - 0s 5ms/step - loss: 3.3899
Epoch 1574/2000
4/4 [=====] - 0s 5ms/step - loss: 3.3806
Epoch 1575/2000
4/4 [=====] - 0s 0s/step - loss: 3.3715
Epoch 1576/2000
4/4 [=====] - 0s 5ms/step - loss: 3.3619
Epoch 1577/2000
4/4 [=====] - 0s 5ms/step - loss: 3.3527
Epoch 1578/2000
4/4 [=====] - 0s 0s/step - loss: 3.3434
Epoch 1579/2000
4/4 [=====] - 0s 5ms/step - loss: 3.3341
Epoch 1580/2000
4/4 [=====] - 0s 5ms/step - loss: 3.3249
Epoch 1581/2000

4/4 [=====] - 0s 0s/step - loss: 3.3157
Epoch 1582/2000
4/4 [=====] - 0s 0s/step - loss: 3.3066
Epoch 1583/2000
4/4 [=====] - 0s 5ms/step - loss: 3.2975
Epoch 1584/2000
4/4 [=====] - 0s 5ms/step - loss: 3.2884
Epoch 1585/2000
4/4 [=====] - 0s 0s/step - loss: 3.2793
Epoch 1586/2000
4/4 [=====] - 0s 0s/step - loss: 3.2698
Epoch 1587/2000
4/4 [=====] - 0s 5ms/step - loss: 3.2610
Epoch 1588/2000
4/4 [=====] - 0s 0s/step - loss: 3.2522
Epoch 1589/2000
4/4 [=====] - 0s 0s/step - loss: 3.2429
Epoch 1590/2000
4/4 [=====] - 0s 5ms/step - loss: 3.2338
Epoch 1591/2000
4/4 [=====] - 0s 5ms/step - loss: 3.2249
Epoch 1592/2000
4/4 [=====] - 0s 0s/step - loss: 3.2157
Epoch 1593/2000
4/4 [=====] - 0s 0s/step - loss: 3.2068
Epoch 1594/2000
4/4 [=====] - 0s 5ms/step - loss: 3.1978
Epoch 1595/2000
4/4 [=====] - 0s 0s/step - loss: 3.1889
Epoch 1596/2000
4/4 [=====] - 0s 0s/step - loss: 3.1800
Epoch 1597/2000
4/4 [=====] - 0s 0s/step - loss: 3.1709
Epoch 1598/2000
4/4 [=====] - 0s 5ms/step - loss: 3.1621
Epoch 1599/2000
4/4 [=====] - 0s 0s/step - loss: 3.1533
Epoch 1600/2000
4/4 [=====] - 0s 0s/step - loss: 3.1445
Epoch 1601/2000
4/4 [=====] - 0s 5ms/step - loss: 3.1356
Epoch 1602/2000
4/4 [=====] - 0s 5ms/step - loss: 3.1267
Epoch 1603/2000
4/4 [=====] - 0s 0s/step - loss: 3.1179
Epoch 1604/2000
4/4 [=====] - 0s 0s/step - loss: 3.1092
Epoch 1605/2000
4/4 [=====] - 0s 5ms/step - loss: 3.1005
Epoch 1606/2000
4/4 [=====] - 0s 5ms/step - loss: 3.0918

Epoch 1607/2000
4/4 [=====] - 0s 0s/step - loss: 3.0830
Epoch 1608/2000
4/4 [=====] - 0s 0s/step - loss: 3.0742
Epoch 1609/2000
4/4 [=====] - 0s 5ms/step - loss: 3.0656
Epoch 1610/2000
4/4 [=====] - 0s 0s/step - loss: 3.0569
Epoch 1611/2000
4/4 [=====] - 0s 0s/step - loss: 3.0483
Epoch 1612/2000
4/4 [=====] - 0s 8ms/step - loss: 3.0395
Epoch 1613/2000
4/4 [=====] - 0s 3ms/step - loss: 3.0310
Epoch 1614/2000
4/4 [=====] - 0s 2ms/step - loss: 3.0223
Epoch 1615/2000
4/4 [=====] - 0s 1ms/step - loss: 3.0137
Epoch 1616/2000
4/4 [=====] - 0s 7ms/step - loss: 3.0051
Epoch 1617/2000
4/4 [=====] - 0s 769us/step - loss: 2.9965
Epoch 1618/2000
4/4 [=====] - 0s 424us/step - loss: 2.9880
Epoch 1619/2000
4/4 [=====] - 0s 5ms/step - loss: 2.9795
Epoch 1620/2000
4/4 [=====] - 0s 2ms/step - loss: 2.9711
Epoch 1621/2000
4/4 [=====] - 0s 2ms/step - loss: 2.9624
Epoch 1622/2000
4/4 [=====] - 0s 3ms/step - loss: 2.9542
Epoch 1623/2000
4/4 [=====] - 0s 0s/step - loss: 2.9457
Epoch 1624/2000
4/4 [=====] - 0s 5ms/step - loss: 2.9371
Epoch 1625/2000
4/4 [=====] - 0s 0s/step - loss: 2.9288
Epoch 1626/2000
4/4 [=====] - 0s 0s/step - loss: 2.9207
Epoch 1627/2000
4/4 [=====] - 0s 5ms/step - loss: 2.9121
Epoch 1628/2000
4/4 [=====] - 0s 596us/step - loss: 2.9039
Epoch 1629/2000
4/4 [=====] - 0s 0s/step - loss: 2.8955
Epoch 1630/2000
4/4 [=====] - 0s 0s/step - loss: 2.8872
Epoch 1631/2000
4/4 [=====] - 0s 5ms/step - loss: 2.8789
Epoch 1632/2000

4/4 [=====] - 0s 0s/step - loss: 2.8705
Epoch 1633/2000
4/4 [=====] - 0s 0s/step - loss: 2.8623
Epoch 1634/2000
4/4 [=====] - 0s 5ms/step - loss: 2.8542
Epoch 1635/2000
4/4 [=====] - 0s 5ms/step - loss: 2.8458
Epoch 1636/2000
4/4 [=====] - 0s 7ms/step - loss: 2.8377
Epoch 1637/2000
4/4 [=====] - 0s 0s/step - loss: 2.8296
Epoch 1638/2000
4/4 [=====] - 0s 0s/step - loss: 2.8212
Epoch 1639/2000
4/4 [=====] - 0s 4ms/step - loss: 2.8131
Epoch 1640/2000
4/4 [=====] - 0s 0s/step - loss: 2.8054
Epoch 1641/2000
4/4 [=====] - 0s 0s/step - loss: 2.7968
Epoch 1642/2000
4/4 [=====] - 0s 0s/step - loss: 2.7890
Epoch 1643/2000
4/4 [=====] - 0s 2ms/step - loss: 2.7808
Epoch 1644/2000
4/4 [=====] - 0s 5ms/step - loss: 2.7727
Epoch 1645/2000
4/4 [=====] - 0s 0s/step - loss: 2.7648
Epoch 1646/2000
4/4 [=====] - 0s 0s/step - loss: 2.7568
Epoch 1647/2000
4/4 [=====] - 0s 0s/step - loss: 2.7487
Epoch 1648/2000
4/4 [=====] - 0s 0s/step - loss: 2.7409
Epoch 1649/2000
4/4 [=====] - 0s 5ms/step - loss: 2.7328
Epoch 1650/2000
4/4 [=====] - 0s 5ms/step - loss: 2.7249
Epoch 1651/2000
4/4 [=====] - 0s 321us/step - loss: 2.7171
Epoch 1652/2000
4/4 [=====] - 0s 5ms/step - loss: 2.7089
Epoch 1653/2000
4/4 [=====] - 0s 5ms/step - loss: 2.7013
Epoch 1654/2000
4/4 [=====] - 0s 0s/step - loss: 2.6932
Epoch 1655/2000
4/4 [=====] - 0s 5ms/step - loss: 2.6856
Epoch 1656/2000
4/4 [=====] - 0s 5ms/step - loss: 2.6776
Epoch 1657/2000
4/4 [=====] - 0s 6ms/step - loss: 2.6699

Epoch 1658/2000
4/4 [=====] - 0s 2ms/step - loss: 2.6621
Epoch 1659/2000
4/4 [=====] - 0s 2ms/step - loss: 2.6544
Epoch 1660/2000
4/4 [=====] - 0s 2ms/step - loss: 2.6467
Epoch 1661/2000
4/4 [=====] - 0s 2ms/step - loss: 2.6389
Epoch 1662/2000
4/4 [=====] - 0s 3ms/step - loss: 2.6311
Epoch 1663/2000
4/4 [=====] - 0s 2ms/step - loss: 2.6235
Epoch 1664/2000
4/4 [=====] - 0s 2ms/step - loss: 2.6158
Epoch 1665/2000
4/4 [=====] - 0s 2ms/step - loss: 2.6083
Epoch 1666/2000
4/4 [=====] - 0s 2ms/step - loss: 2.6004
Epoch 1667/2000
4/4 [=====] - 0s 2ms/step - loss: 2.5927
Epoch 1668/2000
4/4 [=====] - 0s 2ms/step - loss: 2.5853
Epoch 1669/2000
4/4 [=====] - 0s 2ms/step - loss: 2.5776
Epoch 1670/2000
4/4 [=====] - 0s 2ms/step - loss: 2.5700
Epoch 1671/2000
4/4 [=====] - 0s 2ms/step - loss: 2.5625
Epoch 1672/2000
4/4 [=====] - 0s 2ms/step - loss: 2.5548
Epoch 1673/2000
4/4 [=====] - 0s 2ms/step - loss: 2.5476
Epoch 1674/2000
4/4 [=====] - 0s 2ms/step - loss: 2.5400
Epoch 1675/2000
4/4 [=====] - 0s 2ms/step - loss: 2.5324
Epoch 1676/2000
4/4 [=====] - 0s 2ms/step - loss: 2.5248
Epoch 1677/2000
4/4 [=====] - 0s 2ms/step - loss: 2.5174
Epoch 1678/2000
4/4 [=====] - 0s 2ms/step - loss: 2.5102
Epoch 1679/2000
4/4 [=====] - 0s 2ms/step - loss: 2.5027
Epoch 1680/2000
4/4 [=====] - 0s 2ms/step - loss: 2.4952
Epoch 1681/2000
4/4 [=====] - 0s 2ms/step - loss: 2.4879
Epoch 1682/2000
4/4 [=====] - 0s 2ms/step - loss: 2.4804
Epoch 1683/2000

4/4 [=====] - 0s 3ms/step - loss: 2.4734
Epoch 1684/2000
4/4 [=====] - 0s 2ms/step - loss: 2.4658
Epoch 1685/2000
4/4 [=====] - 0s 2ms/step - loss: 2.4586
Epoch 1686/2000
4/4 [=====] - 0s 2ms/step - loss: 2.4511
Epoch 1687/2000
4/4 [=====] - 0s 2ms/step - loss: 2.4439
Epoch 1688/2000
4/4 [=====] - 0s 3ms/step - loss: 2.4367
Epoch 1689/2000
4/4 [=====] - 0s 2ms/step - loss: 2.4294
Epoch 1690/2000
4/4 [=====] - 0s 2ms/step - loss: 2.4222
Epoch 1691/2000
4/4 [=====] - 0s 2ms/step - loss: 2.4149
Epoch 1692/2000
4/4 [=====] - 0s 2ms/step - loss: 2.4079
Epoch 1693/2000
4/4 [=====] - 0s 2ms/step - loss: 2.4007
Epoch 1694/2000
4/4 [=====] - 0s 2ms/step - loss: 2.3934
Epoch 1695/2000
4/4 [=====] - 0s 2ms/step - loss: 2.3863
Epoch 1696/2000
4/4 [=====] - 0s 2ms/step - loss: 2.3791
Epoch 1697/2000
4/4 [=====] - 0s 2ms/step - loss: 2.3721
Epoch 1698/2000
4/4 [=====] - 0s 2ms/step - loss: 2.3650
Epoch 1699/2000
4/4 [=====] - 0s 3ms/step - loss: 2.3579
Epoch 1700/2000
4/4 [=====] - 0s 2ms/step - loss: 2.3507
Epoch 1701/2000
4/4 [=====] - 0s 2ms/step - loss: 2.3437
Epoch 1702/2000
4/4 [=====] - 0s 2ms/step - loss: 2.3367
Epoch 1703/2000
4/4 [=====] - 0s 2ms/step - loss: 2.3298
Epoch 1704/2000
4/4 [=====] - 0s 2ms/step - loss: 2.3227
Epoch 1705/2000
4/4 [=====] - 0s 2ms/step - loss: 2.3157
Epoch 1706/2000
4/4 [=====] - 0s 2ms/step - loss: 2.3088
Epoch 1707/2000
4/4 [=====] - 0s 3ms/step - loss: 2.3018
Epoch 1708/2000
4/4 [=====] - 0s 2ms/step - loss: 2.2948

Epoch 1709/2000
4/4 [=====] - 0s 2ms/step - loss: 2.2881
Epoch 1710/2000
4/4 [=====] - 0s 2ms/step - loss: 2.2810
Epoch 1711/2000
4/4 [=====] - 0s 2ms/step - loss: 2.2743
Epoch 1712/2000
4/4 [=====] - 0s 2ms/step - loss: 2.2673
Epoch 1713/2000
4/4 [=====] - 0s 2ms/step - loss: 2.2606
Epoch 1714/2000
4/4 [=====] - 0s 2ms/step - loss: 2.2535
Epoch 1715/2000
4/4 [=====] - 0s 2ms/step - loss: 2.2468
Epoch 1716/2000
4/4 [=====] - 0s 2ms/step - loss: 2.2401
Epoch 1717/2000
4/4 [=====] - 0s 2ms/step - loss: 2.2333
Epoch 1718/2000
4/4 [=====] - 0s 2ms/step - loss: 2.2264
Epoch 1719/2000
4/4 [=====] - 0s 2ms/step - loss: 2.2198
Epoch 1720/2000
4/4 [=====] - 0s 2ms/step - loss: 2.2130
Epoch 1721/2000
4/4 [=====] - 0s 2ms/step - loss: 2.2064
Epoch 1722/2000
4/4 [=====] - 0s 2ms/step - loss: 2.1997
Epoch 1723/2000
4/4 [=====] - 0s 2ms/step - loss: 2.1930
Epoch 1724/2000
4/4 [=====] - 0s 2ms/step - loss: 2.1862
Epoch 1725/2000
4/4 [=====] - 0s 2ms/step - loss: 2.1796
Epoch 1726/2000
4/4 [=====] - 0s 2ms/step - loss: 2.1730
Epoch 1727/2000
4/4 [=====] - 0s 2ms/step - loss: 2.1664
Epoch 1728/2000
4/4 [=====] - 0s 2ms/step - loss: 2.1597
Epoch 1729/2000
4/4 [=====] - 0s 2ms/step - loss: 2.1531
Epoch 1730/2000
4/4 [=====] - 0s 2ms/step - loss: 2.1466
Epoch 1731/2000
4/4 [=====] - 0s 3ms/step - loss: 2.1400
Epoch 1732/2000
4/4 [=====] - 0s 2ms/step - loss: 2.1336
Epoch 1733/2000
4/4 [=====] - 0s 2ms/step - loss: 2.1271
Epoch 1734/2000

4/4 [=====] - 0s 2ms/step - loss: 2.1205
Epoch 1735/2000
4/4 [=====] - 0s 2ms/step - loss: 2.1141
Epoch 1736/2000
4/4 [=====] - 0s 2ms/step - loss: 2.1076
Epoch 1737/2000
4/4 [=====] - 0s 2ms/step - loss: 2.1012
Epoch 1738/2000
4/4 [=====] - 0s 2ms/step - loss: 2.0947
Epoch 1739/2000
4/4 [=====] - 0s 3ms/step - loss: 2.0883
Epoch 1740/2000
4/4 [=====] - 0s 2ms/step - loss: 2.0819
Epoch 1741/2000
4/4 [=====] - 0s 2ms/step - loss: 2.0755
Epoch 1742/2000
4/4 [=====] - 0s 2ms/step - loss: 2.0694
Epoch 1743/2000
4/4 [=====] - 0s 1ms/step - loss: 2.0629
Epoch 1744/2000
4/4 [=====] - 0s 0s/step - loss: 2.0564
Epoch 1745/2000
4/4 [=====] - 0s 0s/step - loss: 2.0503
Epoch 1746/2000
4/4 [=====] - 0s 5ms/step - loss: 2.0439
Epoch 1747/2000
4/4 [=====] - 0s 0s/step - loss: 2.0377
Epoch 1748/2000
4/4 [=====] - 0s 0s/step - loss: 2.0314
Epoch 1749/2000
4/4 [=====] - 0s 5ms/step - loss: 2.0253
Epoch 1750/2000
4/4 [=====] - 0s 0s/step - loss: 2.0188
Epoch 1751/2000
4/4 [=====] - 0s 715us/step - loss: 2.0125
Epoch 1752/2000
4/4 [=====] - 0s 0s/step - loss: 2.0065
Epoch 1753/2000
4/4 [=====] - 0s 0s/step - loss: 2.0003
Epoch 1754/2000
4/4 [=====] - 0s 5ms/step - loss: 1.9940
Epoch 1755/2000
4/4 [=====] - 0s 0s/step - loss: 1.9880
Epoch 1756/2000
4/4 [=====] - 0s 0s/step - loss: 1.9818
Epoch 1757/2000
4/4 [=====] - 0s 5ms/step - loss: 1.9757
Epoch 1758/2000
4/4 [=====] - 0s 0s/step - loss: 1.9696
Epoch 1759/2000
4/4 [=====] - 0s 656us/step - loss: 1.9636

Epoch 1760/2000
4/4 [=====] - 0s 5ms/step - loss: 1.9574
Epoch 1761/2000
4/4 [=====] - 0s 0s/step - loss: 1.9514
Epoch 1762/2000
4/4 [=====] - 0s 5ms/step - loss: 1.9455
Epoch 1763/2000
4/4 [=====] - 0s 0s/step - loss: 1.9394
Epoch 1764/2000
4/4 [=====] - 0s 0s/step - loss: 1.9333
Epoch 1765/2000
4/4 [=====] - 0s 6ms/step - loss: 1.9272
Epoch 1766/2000
4/4 [=====] - 0s 0s/step - loss: 1.9214
Epoch 1767/2000
4/4 [=====] - 0s 0s/step - loss: 1.9155
Epoch 1768/2000
4/4 [=====] - 0s 5ms/step - loss: 1.9094
Epoch 1769/2000
4/4 [=====] - 0s 0s/step - loss: 1.9035
Epoch 1770/2000
4/4 [=====] - 0s 0s/step - loss: 1.8976
Epoch 1771/2000
4/4 [=====] - 0s 6ms/step - loss: 1.8916
Epoch 1772/2000
4/4 [=====] - 0s 0s/step - loss: 1.8857
Epoch 1773/2000
4/4 [=====] - 0s 5ms/step - loss: 1.8799
Epoch 1774/2000
4/4 [=====] - 0s 0s/step - loss: 1.8742
Epoch 1775/2000
4/4 [=====] - 0s 0s/step - loss: 1.8684
Epoch 1776/2000
4/4 [=====] - 0s 5ms/step - loss: 1.8623
Epoch 1777/2000
4/4 [=====] - 0s 0s/step - loss: 1.8566
Epoch 1778/2000
4/4 [=====] - 0s 0s/step - loss: 1.8509
Epoch 1779/2000
4/4 [=====] - 0s 5ms/step - loss: 1.8450
Epoch 1780/2000
4/4 [=====] - 0s 0s/step - loss: 1.8393
Epoch 1781/2000
4/4 [=====] - 0s 733us/step - loss: 1.8337
Epoch 1782/2000
4/4 [=====] - 0s 0s/step - loss: 1.8278
Epoch 1783/2000
4/4 [=====] - 0s 0s/step - loss: 1.8221
Epoch 1784/2000
4/4 [=====] - 0s 5ms/step - loss: 1.8164
Epoch 1785/2000

4/4 [=====] - 0s 0s/step - loss: 1.8108
Epoch 1786/2000
4/4 [=====] - 0s 0s/step - loss: 1.8051
Epoch 1787/2000
4/4 [=====] - 0s 5ms/step - loss: 1.7995
Epoch 1788/2000
4/4 [=====] - 0s 0s/step - loss: 1.7939
Epoch 1789/2000
4/4 [=====] - 0s 0s/step - loss: 1.7881
Epoch 1790/2000
4/4 [=====] - 0s 5ms/step - loss: 1.7826
Epoch 1791/2000
4/4 [=====] - 0s 0s/step - loss: 1.7769
Epoch 1792/2000
4/4 [=====] - 0s 3ms/step - loss: 1.7714
Epoch 1793/2000
4/4 [=====] - 0s 0s/step - loss: 1.7659
Epoch 1794/2000
4/4 [=====] - 0s 5ms/step - loss: 1.7604
Epoch 1795/2000
4/4 [=====] - 0s 0s/step - loss: 1.7548
Epoch 1796/2000
4/4 [=====] - 0s 0s/step - loss: 1.7492
Epoch 1797/2000
4/4 [=====] - 0s 5ms/step - loss: 1.7439
Epoch 1798/2000
4/4 [=====] - 0s 0s/step - loss: 1.7384
Epoch 1799/2000
4/4 [=====] - 0s 0s/step - loss: 1.7329
Epoch 1800/2000
4/4 [=====] - 0s 5ms/step - loss: 1.7275
Epoch 1801/2000
4/4 [=====] - 0s 0s/step - loss: 1.7221
Epoch 1802/2000
4/4 [=====] - 0s 1ms/step - loss: 1.7166
Epoch 1803/2000
4/4 [=====] - 0s 0s/step - loss: 1.7112
Epoch 1804/2000
4/4 [=====] - 0s 0s/step - loss: 1.7058
Epoch 1805/2000
4/4 [=====] - 0s 6ms/step - loss: 1.7006
Epoch 1806/2000
4/4 [=====] - 0s 0s/step - loss: 1.6953
Epoch 1807/2000
4/4 [=====] - 0s 0s/step - loss: 1.6898
Epoch 1808/2000
4/4 [=====] - 0s 5ms/step - loss: 1.6844
Epoch 1809/2000
4/4 [=====] - 0s 0s/step - loss: 1.6793
Epoch 1810/2000
4/4 [=====] - 0s 5ms/step - loss: 1.6740

Epoch 1811/2000
4/4 [=====] - 0s 5ms/step - loss: 1.6687
Epoch 1812/2000
4/4 [=====] - 0s 0s/step - loss: 1.6634
Epoch 1813/2000
4/4 [=====] - 0s 7ms/step - loss: 1.6581
Epoch 1814/2000
4/4 [=====] - 0s 0s/step - loss: 1.6529
Epoch 1815/2000
4/4 [=====] - 0s 0s/step - loss: 1.6477
Epoch 1816/2000
4/4 [=====] - 0s 5ms/step - loss: 1.6425
Epoch 1817/2000
4/4 [=====] - 0s 0s/step - loss: 1.6371
Epoch 1818/2000
4/4 [=====] - 0s 0s/step - loss: 1.6321
Epoch 1819/2000
4/4 [=====] - 0s 5ms/step - loss: 1.6269
Epoch 1820/2000
4/4 [=====] - 0s 0s/step - loss: 1.6218
Epoch 1821/2000
4/4 [=====] - 0s 5ms/step - loss: 1.6166
Epoch 1822/2000
4/4 [=====] - 0s 0s/step - loss: 1.6114
Epoch 1823/2000
4/4 [=====] - 0s 860us/step - loss: 1.6063
Epoch 1824/2000
4/4 [=====] - 0s 0s/step - loss: 1.6012
Epoch 1825/2000
4/4 [=====] - 0s 0s/step - loss: 1.5962
Epoch 1826/2000
4/4 [=====] - 0s 5ms/step - loss: 1.5911
Epoch 1827/2000
4/4 [=====] - 0s 0s/step - loss: 1.5860
Epoch 1828/2000
4/4 [=====] - 0s 0s/step - loss: 1.5809
Epoch 1829/2000
4/4 [=====] - 0s 5ms/step - loss: 1.5760
Epoch 1830/2000
4/4 [=====] - 0s 0s/step - loss: 1.5708
Epoch 1831/2000
4/4 [=====] - 0s 0s/step - loss: 1.5661
Epoch 1832/2000
4/4 [=====] - 0s 0s/step - loss: 1.5611
Epoch 1833/2000
4/4 [=====] - 0s 0s/step - loss: 1.5560
Epoch 1834/2000
4/4 [=====] - 0s 7ms/step - loss: 1.5511
Epoch 1835/2000
4/4 [=====] - 0s 0s/step - loss: 1.5462
Epoch 1836/2000

4/4 [=====] - 0s 5ms/step - loss: 1.5415
Epoch 1837/2000
4/4 [=====] - 0s 0s/step - loss: 1.5364
Epoch 1838/2000
4/4 [=====] - 0s 0s/step - loss: 1.5315
Epoch 1839/2000
4/4 [=====] - 0s 5ms/step - loss: 1.5266
Epoch 1840/2000
4/4 [=====] - 0s 0s/step - loss: 1.5218
Epoch 1841/2000
4/4 [=====] - 0s 0s/step - loss: 1.5169
Epoch 1842/2000
4/4 [=====] - 0s 5ms/step - loss: 1.5120
Epoch 1843/2000
4/4 [=====] - 0s 0s/step - loss: 1.5073
Epoch 1844/2000
4/4 [=====] - 0s 7ms/step - loss: 1.5025
Epoch 1845/2000
4/4 [=====] - 0s 0s/step - loss: 1.4975
Epoch 1846/2000
4/4 [=====] - 0s 0s/step - loss: 1.4929
Epoch 1847/2000
4/4 [=====] - 0s 5ms/step - loss: 1.4881
Epoch 1848/2000
4/4 [=====] - 0s 0s/step - loss: 1.4834
Epoch 1849/2000
4/4 [=====] - 0s 0s/step - loss: 1.4786
Epoch 1850/2000
4/4 [=====] - 0s 5ms/step - loss: 1.4738
Epoch 1851/2000
4/4 [=====] - 0s 0s/step - loss: 1.4692
Epoch 1852/2000
4/4 [=====] - 0s 0s/step - loss: 1.4645
Epoch 1853/2000
4/4 [=====] - 0s 6ms/step - loss: 1.4598
Epoch 1854/2000
4/4 [=====] - 0s 0s/step - loss: 1.4551
Epoch 1855/2000
4/4 [=====] - 0s 5ms/step - loss: 1.4505
Epoch 1856/2000
4/4 [=====] - 0s 0s/step - loss: 1.4458
Epoch 1857/2000
4/4 [=====] - 0s 5ms/step - loss: 1.4413
Epoch 1858/2000
4/4 [=====] - 0s 0s/step - loss: 1.4366
Epoch 1859/2000
4/4 [=====] - 0s 0s/step - loss: 1.4321
Epoch 1860/2000
4/4 [=====] - 0s 5ms/step - loss: 1.4275
Epoch 1861/2000
4/4 [=====] - 0s 0s/step - loss: 1.4229

Epoch 1862/2000
4/4 [=====] - 0s 0s/step - loss: 1.4184
Epoch 1863/2000
4/4 [=====] - 0s 5ms/step - loss: 1.4139
Epoch 1864/2000
4/4 [=====] - 0s 0s/step - loss: 1.4092
Epoch 1865/2000
4/4 [=====] - 0s 3ms/step - loss: 1.4049
Epoch 1866/2000
4/4 [=====] - 0s 3ms/step - loss: 1.4003
Epoch 1867/2000
4/4 [=====] - 0s 0s/step - loss: 1.3959
Epoch 1868/2000
4/4 [=====] - 0s 5ms/step - loss: 1.3914
Epoch 1869/2000
4/4 [=====] - 0s 0s/step - loss: 1.3871
Epoch 1870/2000
4/4 [=====] - 0s 0s/step - loss: 1.3826
Epoch 1871/2000
4/4 [=====] - 0s 5ms/step - loss: 1.3782
Epoch 1872/2000
4/4 [=====] - 0s 0s/step - loss: 1.3737
Epoch 1873/2000
4/4 [=====] - 0s 5ms/step - loss: 1.3694
Epoch 1874/2000
4/4 [=====] - 0s 5ms/step - loss: 1.3650
Epoch 1875/2000
4/4 [=====] - 0s 623us/step - loss: 1.3606
Epoch 1876/2000
4/4 [=====] - 0s 0s/step - loss: 1.3563
Epoch 1877/2000
4/4 [=====] - 0s 0s/step - loss: 1.3520
Epoch 1878/2000
4/4 [=====] - 0s 5ms/step - loss: 1.3476
Epoch 1879/2000
4/4 [=====] - 0s 0s/step - loss: 1.3433
Epoch 1880/2000
4/4 [=====] - 0s 0s/step - loss: 1.3389
Epoch 1881/2000
4/4 [=====] - 0s 5ms/step - loss: 1.3347
Epoch 1882/2000
4/4 [=====] - 0s 0s/step - loss: 1.3306
Epoch 1883/2000
4/4 [=====] - 0s 5ms/step - loss: 1.3262
Epoch 1884/2000
4/4 [=====] - 0s 0s/step - loss: 1.3219
Epoch 1885/2000
4/4 [=====] - 0s 469us/step - loss: 1.3176
Epoch 1886/2000
4/4 [=====] - 0s 5ms/step - loss: 1.3135
Epoch 1887/2000

4/4 [=====] - 0s 0s/step - loss: 1.3093
Epoch 1888/2000
4/4 [=====] - 0s 0s/step - loss: 1.3050
Epoch 1889/2000
4/4 [=====] - 0s 5ms/step - loss: 1.3009
Epoch 1890/2000
4/4 [=====] - 0s 0s/step - loss: 1.2966
Epoch 1891/2000
4/4 [=====] - 0s 5ms/step - loss: 1.2926
Epoch 1892/2000
4/4 [=====] - 0s 5ms/step - loss: 1.2885
Epoch 1893/2000
4/4 [=====] - 0s 0s/step - loss: 1.2844
Epoch 1894/2000
4/4 [=====] - 0s 7ms/step - loss: 1.2801
Epoch 1895/2000
4/4 [=====] - 0s 0s/step - loss: 1.2759
Epoch 1896/2000
4/4 [=====] - 0s 5ms/step - loss: 1.2719
Epoch 1897/2000
4/4 [=====] - 0s 0s/step - loss: 1.2679
Epoch 1898/2000
4/4 [=====] - 0s 0s/step - loss: 1.2639
Epoch 1899/2000
4/4 [=====] - 0s 5ms/step - loss: 1.2598
Epoch 1900/2000
4/4 [=====] - 0s 0s/step - loss: 1.2558
Epoch 1901/2000
4/4 [=====] - 0s 0s/step - loss: 1.2518
Epoch 1902/2000
4/4 [=====] - 0s 6ms/step - loss: 1.2477
Epoch 1903/2000
4/4 [=====] - 0s 0s/step - loss: 1.2438
Epoch 1904/2000
4/4 [=====] - 0s 0s/step - loss: 1.2398
Epoch 1905/2000
4/4 [=====] - 0s 6ms/step - loss: 1.2358
Epoch 1906/2000
4/4 [=====] - 0s 0s/step - loss: 1.2319
Epoch 1907/2000
4/4 [=====] - 0s 0s/step - loss: 1.2279
Epoch 1908/2000
4/4 [=====] - 0s 5ms/step - loss: 1.2240
Epoch 1909/2000
4/4 [=====] - 0s 0s/step - loss: 1.2202
Epoch 1910/2000
4/4 [=====] - 0s 0s/step - loss: 1.2162
Epoch 1911/2000
4/4 [=====] - 0s 5ms/step - loss: 1.2123
Epoch 1912/2000
4/4 [=====] - 0s 0s/step - loss: 1.2084

Epoch 1913/2000
4/4 [=====] - 0s 0s/step - loss: 1.2047
Epoch 1914/2000
4/4 [=====] - 0s 5ms/step - loss: 1.2008
Epoch 1915/2000
4/4 [=====] - 0s 532us/step - loss: 1.1969
Epoch 1916/2000
4/4 [=====] - 0s 0s/step - loss: 1.1932
Epoch 1917/2000
4/4 [=====] - 0s 0s/step - loss: 1.1894
Epoch 1918/2000
4/4 [=====] - 0s 509us/step - loss: 1.1856
Epoch 1919/2000
4/4 [=====] - 0s 0s/step - loss: 1.1818
Epoch 1920/2000
4/4 [=====] - 0s 0s/step - loss: 1.1778
Epoch 1921/2000
4/4 [=====] - 0s 5ms/step - loss: 1.1743
Epoch 1922/2000
4/4 [=====] - 0s 5ms/step - loss: 1.1704
Epoch 1923/2000
4/4 [=====] - 0s 5ms/step - loss: 1.1668
Epoch 1924/2000
4/4 [=====] - 0s 5ms/step - loss: 1.1630
Epoch 1925/2000
4/4 [=====] - 0s 0s/step - loss: 1.1594
Epoch 1926/2000
4/4 [=====] - 0s 0s/step - loss: 1.1556
Epoch 1927/2000
4/4 [=====] - 0s 0s/step - loss: 1.1519
Epoch 1928/2000
4/4 [=====] - 0s 5ms/step - loss: 1.1482
Epoch 1929/2000
4/4 [=====] - 0s 0s/step - loss: 1.1447
Epoch 1930/2000
4/4 [=====] - 0s 0s/step - loss: 1.1409
Epoch 1931/2000
4/4 [=====] - 0s 5ms/step - loss: 1.1374
Epoch 1932/2000
4/4 [=====] - 0s 5ms/step - loss: 1.1338
Epoch 1933/2000
4/4 [=====] - 0s 0s/step - loss: 1.1302
Epoch 1934/2000
4/4 [=====] - 0s 0s/step - loss: 1.1266
Epoch 1935/2000
4/4 [=====] - 0s 19ms/step - loss: 1.1230
Epoch 1936/2000
4/4 [=====] - 0s 0s/step - loss: 1.1194
Epoch 1937/2000
4/4 [=====] - 0s 0s/step - loss: 1.1158
Epoch 1938/2000

4/4 [=====] - 0s 5ms/step - loss: 1.1123
Epoch 1939/2000
4/4 [=====] - 0s 5ms/step - loss: 1.1089
Epoch 1940/2000
4/4 [=====] - 0s 0s/step - loss: 1.1054
Epoch 1941/2000
4/4 [=====] - 0s 6ms/step - loss: 1.1018
Epoch 1942/2000
4/4 [=====] - 0s 5ms/step - loss: 1.0983
Epoch 1943/2000
4/4 [=====] - 0s 2ms/step - loss: 1.0948
Epoch 1944/2000
4/4 [=====] - 0s 2ms/step - loss: 1.0913
Epoch 1945/2000
4/4 [=====] - 0s 5ms/step - loss: 1.0878
Epoch 1946/2000
4/4 [=====] - 0s 2ms/step - loss: 1.0845
Epoch 1947/2000
4/4 [=====] - 0s 5ms/step - loss: 1.0809
Epoch 1948/2000
4/4 [=====] - 0s 2ms/step - loss: 1.0775
Epoch 1949/2000
4/4 [=====] - 0s 0s/step - loss: 1.0742
Epoch 1950/2000
4/4 [=====] - 0s 5ms/step - loss: 1.0708
Epoch 1951/2000
4/4 [=====] - 0s 17ms/step - loss: 1.0673
Epoch 1952/2000
4/4 [=====] - 0s 0s/step - loss: 1.0640
Epoch 1953/2000
4/4 [=====] - 0s 0s/step - loss: 1.0606
Epoch 1954/2000
4/4 [=====] - 0s 5ms/step - loss: 1.0573
Epoch 1955/2000
4/4 [=====] - 0s 6ms/step - loss: 1.0539
Epoch 1956/2000
4/4 [=====] - 0s 0s/step - loss: 1.0505
Epoch 1957/2000
4/4 [=====] - 0s 2ms/step - loss: 1.0473
Epoch 1958/2000
4/4 [=====] - 0s 2ms/step - loss: 1.0441
Epoch 1959/2000
4/4 [=====] - 0s 0s/step - loss: 1.0407
Epoch 1960/2000
4/4 [=====] - 0s 0s/step - loss: 1.0374
Epoch 1961/2000
4/4 [=====] - 0s 7ms/step - loss: 1.0341
Epoch 1962/2000
4/4 [=====] - 0s 2ms/step - loss: 1.0309
Epoch 1963/2000
4/4 [=====] - 0s 0s/step - loss: 1.0276

Epoch 1964/2000
4/4 [=====] - 0s 6ms/step - loss: 1.0244
Epoch 1965/2000
4/4 [=====] - 0s 0s/step - loss: 1.0212
Epoch 1966/2000
4/4 [=====] - 0s 0s/step - loss: 1.0180
Epoch 1967/2000
4/4 [=====] - 0s 5ms/step - loss: 1.0147
Epoch 1968/2000
4/4 [=====] - 0s 5ms/step - loss: 1.0115
Epoch 1969/2000
4/4 [=====] - 0s 5ms/step - loss: 1.0085
Epoch 1970/2000
4/4 [=====] - 0s 5ms/step - loss: 1.0052
Epoch 1971/2000
4/4 [=====] - 0s 0s/step - loss: 1.0022
Epoch 1972/2000
4/4 [=====] - 0s 0s/step - loss: 0.9990
Epoch 1973/2000
4/4 [=====] - 0s 5ms/step - loss: 0.9958
Epoch 1974/2000
4/4 [=====] - 0s 2ms/step - loss: 0.9927
Epoch 1975/2000
4/4 [=====] - 0s 4ms/step - loss: 0.9897
Epoch 1976/2000
4/4 [=====] - 0s 2ms/step - loss: 0.9866
Epoch 1977/2000
4/4 [=====] - 0s 1ms/step - loss: 0.9835
Epoch 1978/2000
4/4 [=====] - 0s 6ms/step - loss: 0.9804
Epoch 1979/2000
4/4 [=====] - 0s 0s/step - loss: 0.9773
Epoch 1980/2000
4/4 [=====] - 0s 0s/step - loss: 0.9743
Epoch 1981/2000
4/4 [=====] - 0s 5ms/step - loss: 0.9713
Epoch 1982/2000
4/4 [=====] - 0s 0s/step - loss: 0.9683
Epoch 1983/2000
4/4 [=====] - 0s 5ms/step - loss: 0.9653
Epoch 1984/2000
4/4 [=====] - 0s 5ms/step - loss: 0.9622
Epoch 1985/2000
4/4 [=====] - 0s 0s/step - loss: 0.9593
Epoch 1986/2000
4/4 [=====] - 0s 0s/step - loss: 0.9564
Epoch 1987/2000
4/4 [=====] - 0s 5ms/step - loss: 0.9534
Epoch 1988/2000
4/4 [=====] - 0s 0s/step - loss: 0.9503
Epoch 1989/2000

```

4/4 [=====] - 0s 0s/step - loss: 0.9475
Epoch 1990/2000
4/4 [=====] - 0s 5ms/step - loss: 0.9446
Epoch 1991/2000
4/4 [=====] - 0s 0s/step - loss: 0.9417
Epoch 1992/2000
4/4 [=====] - 0s 0s/step - loss: 0.9387
Epoch 1993/2000
4/4 [=====] - 0s 5ms/step - loss: 0.9359
Epoch 1994/2000
4/4 [=====] - 0s 542us/step - loss: 0.9330
Epoch 1995/2000
4/4 [=====] - 0s 5ms/step - loss: 0.9301
Epoch 1996/2000
4/4 [=====] - 0s 0s/step - loss: 0.9273
Epoch 1997/2000
4/4 [=====] - 0s 5ms/step - loss: 0.9245
Epoch 1998/2000
4/4 [=====] - 0s 5ms/step - loss: 0.9216
Epoch 1999/2000
4/4 [=====] - 0s 0s/step - loss: 0.9187
Epoch 2000/2000
4/4 [=====] - 0s 5ms/step - loss: 0.9160

```

```
<keras.src.callbacks.History at 0x18363c63520>
```

```

# Nhập dữ liệu từ người dùng để dự đoán
input_data = []
for i in range(3):
    value = float(input(f"Nhập giá trị cho đặc trưng {X.columns[i]}: "))
    input_data.append(value)

# Chuẩn hóa dữ liệu đầu vào
input_data_scaled = scaler.transform([input_data])

# Dự đoán điểm số
predicted_score = model.predict(input_data_scaled)[0][0]
print(f"Dự đoán điểm số: {predicted_score:.2f}")

# Đánh giá mô hình
y_pred = model.predict(X_test_scaled)
mse = mean_squared_error(y_test, y_pred)
print(f"Mean Squared Error: {mse}")

```

1/1 [=====] - 0s 86ms/step

c:\Users\tien2\miniconda3\envs\intel\lib\site-packages\sklearn\base.py:464: UserWarning: X does
warnings.warn(

Dự đoán điểm số: 7.02

1/1 [=====] - 0s 13ms/step

Mean Squared Error: 0.9821849418587908

Deploy: FastAPI

```
import uvicorn
import pickle
import numpy as np
from pydantic import BaseModel
from fastapi import FastAPI

class Features(BaseModel):
    score_1: float
    score_2: float
    score_3: float

app = FastAPI()

filename1 = "./scores.sav"
filename2 = "./linear.sav"

loaded_model1 = pickle.load(open(filename1, "rb"))
loaded_model2 = pickle.load(open(filename2, "rb"))

@app.get("/")
def index():
    return "Hello world!"

@app.post("/score/v1/predict/knregression")
def knregression(features: Features):
    features_arr = np.array([features.score_1, features.score_2, features.score_3])

    prediction = loaded_model1.predict([features_arr])

    response = {"prediction": prediction[0]}

    return response

@app.post("/score/v1/predict/linear")
def linear(features: Features):
    features_arr = np.array([features.score_1, features.score_2, features.score_3])

    prediction = loaded_model2.predict([features_arr])

    response = {"prediction": prediction[0]}

    return response
```

```
if __name__ == "__main__":  
    uvicorn.run(app, host="localhost", port=8000, reload=True)
```

