simple case inspireret af tensorfloplayground : https://playground.tensorflow.org/ Løsningsmodellen er inspireret af Tensorflow in 10 min.. - https://www.youtube.com/watch?v=6_2hzRopPbQ&t=5s

Installer libraries

In [1]:
```
!python.exe -m pip install --upgrade pip
```

```
Requirement already satisfied: pip in c:\users\chr_v\documents\eaa23itek\3semeste
r\kunstig-intelligens\ai\lib\site-packages (24.2)
```

In [2]:
```
!pip install pandas
```

```
Collecting pandas
  Downloading pandas-2.2.2-cp39-cp39-win_amd64.whl.metadata (19 kB)
Requirement already satisfied: numpy>=1.22.4 in c:\users\chr_v\documents\eaa23ite
k\3semester\kunstig-intelligens\ai\lib\site-packages (from pandas) (2.0.2)
Requirement already satisfied: python-dateutil>=2.8.2 in c:\users\chr_v\documents
\eaa23itek\3semester\kunstig-intelligens\ai\lib\site-packages (from pandas) (2.9.
0.post0)
Collecting pytz>=2020.1 (from pandas)
  Downloading pytz-2024.2-py2.py3-none-any.whl.metadata (22 kB)
Collecting tzdata>=2022.7 (from pandas)
  Downloading tzdata-2024.1-py2.py3-none-any.whl.metadata (1.4 kB)
Requirement already satisfied: six>=1.5 in c:\users\chr_v\documents\eaa23itek\3se
mester\kunstig-intelligens\ai\lib\site-packages (from python-dateutil>=2.8.2->pan
das) (1.16.0)
Downloading pandas-2.2.2-cp39-cp39-win_amd64.whl (11.6 MB)
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   ---------------------------------------- 11.6/11.6 MB 14.9 MB/s eta 0:00:00
Downloading pytz-2024.2-py2.py3-none-any.whl (508 kB)
Downloading tzdata-2024.1-py2.py3-none-any.whl (345 kB)
Installing collected packages: pytz, tzdata, pandas
Successfully installed pandas-2.2.2 pytz-2024.2 tzdata-2024.1
```

In [3]:
```
!pip install scikit-learn
```

```
Collecting scikit-learn
  Downloading scikit_learn-1.5.1-cp39-cp39-win_amd64.whl.metadata (12 kB)
Requirement already satisfied: numpy>=1.19.5 in c:\users\chr_v\documents\eaa23ite
k\3semester\kunstig-intelligens\ai\lib\site-packages (from scikit-learn) (2.0.2)
Collecting scipy>=1.6.0 (from scikit-learn)
  Using cached scipy-1.13.1-cp39-cp39-win_amd64.whl.metadata (60 kB)
Collecting joblib>=1.2.0 (from scikit-learn)
  Downloading joblib-1.4.2-py3-none-any.whl.metadata (5.4 kB)
Collecting threadpoolctl>=3.1.0 (from scikit-learn)
  Downloading threadpoolctl-3.5.0-py3-none-any.whl.metadata (13 kB)
Downloading scikit_learn-1.5.1-cp39-cp39-win_amd64.whl (11.0 MB)
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Downloading joblib-1.4.2-py3-none-any.whl (301 kB)
Downloading scipy-1.13.1-cp39-cp39-win_amd64.whl (46.2 MB)
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Downloading threadpoolctl-3.5.0-py3-none-any.whl (18 kB)
Installing collected packages: threadpoolctl, scipy, joblib, scikit-learn
Successfully installed joblib-1.4.2 scikit-learn-1.5.1 scipy-1.13.1 threadpoolctl
-3.5.0
```

In [4]:
```
!pip install tensorflow
```

```
Collecting tensorflow
  Downloading tensorflow-2.17.0-cp39-cp39-win_amd64.whl.metadata (3.2 kB)
Collecting tensorflow-intel==2.17.0 (from tensorflow)
  Downloading tensorflow_intel-2.17.0-cp39-cp39-win_amd64.whl.metadata (5.0 kB)
Collecting absl-py>=1.0.0 (from tensorflow-intel==2.17.0->tensorflow)
  Downloading absl_py-2.1.0-py3-none-any.whl.metadata (2.3 kB)
Collecting astunparse>=1.6.0 (from tensorflow-intel==2.17.0->tensorflow)
  Downloading astunparse-1.6.3-py2.py3-none-any.whl.metadata (4.4 kB)
Collecting flatbuffers>=24.3.25 (from tensorflow-intel==2.17.0->tensorflow)
  Downloading flatbuffers-24.3.25-py2.py3-none-any.whl.metadata (850 bytes)
Collecting gast!=0.5.0,!=0.5.1,!=0.5.2,>=0.2.1 (from tensorflow-intel==2.17.0->te
nsorflow)
  Downloading gast-0.6.0-py3-none-any.whl.metadata (1.3 kB)
Collecting google-pasta>=0.1.1 (from tensorflow-intel==2.17.0->tensorflow)
  Downloading google_pasta-0.2.0-py3-none-any.whl.metadata (814 bytes)
Collecting h5py>=3.10.0 (from tensorflow-intel==2.17.0->tensorflow)
  Downloading h5py-3.11.0-cp39-cp39-win_amd64.whl.metadata (2.5 kB)
Collecting libclang>=13.0.0 (from tensorflow-intel==2.17.0->tensorflow)
  Downloading libclang-18.1.1-py2.py3-none-win_amd64.whl.metadata (5.3 kB)
Collecting ml-dtypes<0.5.0,>=0.3.1 (from tensorflow-intel==2.17.0->tensorflow)
  Downloading ml_dtypes-0.4.0-cp39-cp39-win_amd64.whl.metadata (20 kB)
Collecting opt-einsum>=2.3.2 (from tensorflow-intel==2.17.0->tensorflow)
  Downloading opt_einsum-3.3.0-py3-none-any.whl.metadata (6.5 kB)
Requirement already satisfied: packaging in c:\users\chr_v\documents\eaa23itek\3s
emester\kunstig-intelligens\ai\lib\site-packages (from tensorflow-intel==2.17.0->
tensorflow) (24.1)
Collecting protobuf!=4.21.0,!=4.21.1,!=4.21.2,!=4.21.3,!=4.21.4,!=4.21.5,<5.0.0de
v,>=3.20.3 (from tensorflow-intel==2.17.0->tensorflow)
  Downloading protobuf-4.25.4-cp39-cp39-win_amd64.whl.metadata (541 bytes)
Requirement already satisfied: requests<3,>=2.21.0 in c:\users\chr_v\documents\ea
a23itek\3semester\kunstig-intelligens\ai\lib\site-packages (from tensorflow-intel
==2.17.0->tensorflow) (2.32.3)
Requirement already satisfied: setuptools in c:\users\chr_v\documents\eaa23itek\3
semester\kunstig-intelligens\ai\lib\site-packages (from tensorflow-intel==2.17.0-
>tensorflow) (57.4.0)
Requirement already satisfied: six>=1.12.0 in c:\users\chr_v\documents\eaa23itek
\3semester\kunstig-intelligens\ai\lib\site-packages (from tensorflow-intel==2.17.
0->tensorflow) (1.16.0)
Collecting termcolor>=1.1.0 (from tensorflow-intel==2.17.0->tensorflow)
  Downloading termcolor-2.4.0-py3-none-any.whl.metadata (6.1 kB)
Requirement already satisfied: typing-extensions>=3.6.6 in c:\users\chr_v\documen
ts\eaa23itek\3semester\kunstig-intelligens\ai\lib\site-packages (from tensorflow-
intel==2.17.0->tensorflow) (4.12.2)
Collecting wrapt>=1.11.0 (from tensorflow-intel==2.17.0->tensorflow)
  Downloading wrapt-1.16.0-cp39-cp39-win_amd64.whl.metadata (6.8 kB)
Collecting grpcio<2.0,>=1.24.3 (from tensorflow-intel==2.17.0->tensorflow)
  Downloading grpcio-1.66.1-cp39-cp39-win_amd64.whl.metadata (4.0 kB)
Collecting tensorboard<2.18,>=2.17 (from tensorflow-intel==2.17.0->tensorflow)
  Downloading tensorboard-2.17.1-py3-none-any.whl.metadata (1.6 kB)
Collecting keras>=3.2.0 (from tensorflow-intel==2.17.0->tensorflow)
  Downloading keras-3.5.0-py3-none-any.whl.metadata (5.8 kB)
Collecting tensorflow-io-gcs-filesystem>=0.23.1 (from tensorflow-intel==2.17.0->t
ensorflow)
  Downloading tensorflow_io_gcs_filesystem-0.31.0-cp39-cp39-win_amd64.whl.metadat
a (14 kB)
Collecting numpy<2.0.0,>=1.23.5 (from tensorflow-intel==2.17.0->tensorflow)
  Downloading numpy-1.26.4-cp39-cp39-win_amd64.whl.metadata (61 kB)
Collecting wheel<1.0,>=0.23.0 (from astunparse>=1.6.0->tensorflow-intel==2.17.0->
tensorflow)
  Downloading wheel-0.44.0-py3-none-any.whl.metadata (2.3 kB)
```

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Collecting rich (from keras>=3.2.0->tensorflow-intel==2.17.0->tensorflow)
  Downloading rich-13.8.1-py3-none-any.whl.metadata (18 kB)
Collecting namex (from keras>=3.2.0->tensorflow-intel==2.17.0->tensorflow)
  Downloading namex-0.0.8-py3-none-any.whl.metadata (246 bytes)
Collecting optree (from keras>=3.2.0->tensorflow-intel==2.17.0->tensorflow)
  Downloading optree-0.12.1-cp39-cp39-win_amd64.whl.metadata (48 kB)
Requirement already satisfied: charset-normalizer<4,>=2 in c:\users\chr_v\documen
ts\eaa23itek\3semester\kunstig-intelligens\ai\lib\site-packages (from requests<3,
>=2.21.0->tensorflow-intel==2.17.0->tensorflow) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in c:\users\chr_v\documents\eaa23itek
\3semester\kunstig-intelligens\ai\lib\site-packages (from requests<3,>=2.21.0->te
nsorflow-intel==2.17.0->tensorflow) (3.8)
Requirement already satisfied: urllib3<3,>=1.21.1 in c:\users\chr_v\documents\eaa
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1.0->tensorflow-intel==2.17.0->tensorflow) (2.2.2)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\chr_v\documents\eaa
23itek\3semester\kunstig-intelligens\ai\lib\site-packages (from requests<3,>=2.2
1.0->tensorflow-intel==2.17.0->tensorflow) (2024.8.30)
Collecting markdown>=2.6.8 (from tensorboard<2.18,>=2.17->tensorflow-intel==2.17.
0->tensorflow)
  Downloading Markdown-3.7-py3-none-any.whl.metadata (7.0 kB)
Collecting tensorboard-data-server<0.8.0,>=0.7.0 (from tensorboard<2.18,>=2.17->t
ensorflow-intel==2.17.0->tensorflow)
  Downloading tensorboard_data_server-0.7.2-py3-none-any.whl.metadata (1.1 kB)
Collecting werkzeug>=1.0.1 (from tensorboard<2.18,>=2.17->tensorflow-intel==2.17.
0->tensorflow)
  Downloading werkzeug-3.0.4-py3-none-any.whl.metadata (3.7 kB)
Requirement already satisfied: importlib-metadata>=4.4 in c:\users\chr_v\document
s\eaa23itek\3semester\kunstig-intelligens\ai\lib\site-packages (from markdown>=2.
6.8->tensorboard<2.18,>=2.17->tensorflow-intel==2.17.0->tensorflow) (8.4.0)
Requirement already satisfied: MarkupSafe>=2.1.1 in c:\users\chr_v\documents\eaa2
3itek\3semester\kunstig-intelligens\ai\lib\site-packages (from werkzeug>=1.0.1->t
ensorboard<2.18,>=2.17->tensorflow-intel==2.17.0->tensorflow) (2.1.5)
Collecting markdown-it-py>=2.2.0 (from rich->keras>=3.2.0->tensorflow-intel==2.1
7.0->tensorflow)
  Downloading markdown_it_py-3.0.0-py3-none-any.whl.metadata (6.9 kB)
Requirement already satisfied: pygments<3.0.0,>=2.13.0 in c:\users\chr_v\document
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=3.2.0->tensorflow-intel==2.17.0->tensorflow) (2.18.0)
Requirement already satisfied: zipp>=0.5 in c:\users\chr_v\documents\eaa23itek\3s
emester\kunstig-intelligens\ai\lib\site-packages (from importlib-metadata>=4.4->m
arkdown>=2.6.8->tensorboard<2.18,>=2.17->tensorflow-intel==2.17.0->tensorflow)
(3.20.1)
Collecting mdurl~=0.1 (from markdown-it-py>=2.2.0->rich->keras>=3.2.0->tensorflow
-intel==2.17.0->tensorflow)
  Downloading mdurl-0.1.2-py3-none-any.whl.metadata (1.6 kB)
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----------------------- ---------------- 235.4/385.0 MB 8.7 MB/s eta 0:00:18
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```

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Downloading absl_py-2.1.0-py3-none-any.whl (133 kB)
Downloading astunparse-1.6.3-py2.py3-none-any.whl (12 kB)
Downloading flatbuffers-24.3.25-py2.py3-none-any.whl (26 kB)
Downloading gast-0.6.0-py3-none-any.whl (21 kB)
Downloading google_pasta-0.2.0-py3-none-any.whl (57 kB)
```

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   ---------------------------------------- 15.8/15.8 MB 14.9 MB/s eta 0:00:00
Downloading opt_einsum-3.3.0-py3-none-any.whl (65 kB)
Downloading protobuf-4.25.4-cp39-cp39-win_amd64.whl (413 kB)
Downloading tensorboard-2.17.1-py3-none-any.whl (5.5 MB)
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Downloading termcolor-2.4.0-py3-none-any.whl (7.7 kB)
Downloading wrapt-1.16.0-cp39-cp39-win_amd64.whl (37 kB)
Downloading Markdown-3.7-py3-none-any.whl (106 kB)
Downloading tensorboard_data_server-0.7.2-py3-none-any.whl (2.4 kB)
Downloading werkzeug-3.0.4-py3-none-any.whl (227 kB)
Downloading wheel-0.44.0-py3-none-any.whl (67 kB)
Downloading namex-0.0.8-py3-none-any.whl (5.8 kB)
Downloading optree-0.12.1-cp39-cp39-win_amd64.whl (263 kB)
Downloading rich-13.8.1-py3-none-any.whl (241 kB)
Downloading markdown_it_py-3.0.0-py3-none-any.whl (87 kB)
Downloading mdurl-0.1.2-py3-none-any.whl (10.0 kB)
Installing collected packages: namex, libclang, flatbuffers, wrapt, wheel, werkze
ug, termcolor, tensorflow-io-gcs-filesystem, tensorboard-data-server, protobuf, o
ptree, numpy, mdurl, grpcio, google-pasta, gast, absl-py, opt-einsum, ml-dtypes,
markdown-it-py, markdown, h5py, astunparse, tensorboard, rich, keras, tensorflow-
intel, tensorflow
  Attempting uninstall: numpy
    Found existing installation: numpy 2.0.2
```

```
    Uninstalling numpy-2.0.2:
      Successfully uninstalled numpy-2.0.2
Successfully installed absl-py-2.1.0 astunparse-1.6.3 flatbuffers-24.3.25 gast-0.
6.0 google-pasta-0.2.0 grpcio-1.66.1 h5py-3.11.0 keras-3.5.0 libclang-18.1.1 mark
down-3.7 markdown-it-py-3.0.0 mdurl-0.1.2 ml-dtypes-0.4.0 namex-0.0.8 numpy-1.26.
4 opt-einsum-3.3.0 optree-0.12.1 protobuf-4.25.4 rich-13.8.1 tensorboard-2.17.1 t
ensorboard-data-server-0.7.2 tensorflow-2.17.0 tensorflow-intel-2.17.0 tensorflow
-io-gcs-filesystem-0.31.0 termcolor-2.4.0 werkzeug-3.0.4 wheel-0.44.0 wrapt-1.16.
0
  WARNING: Failed to remove contents in a temporary directory 'C:\Users\chr_v\Doc
uments\eaa23itek\3semester\Kunstig-Intelligens\ai\Lib\site-packages\~umpy.libs'.
  You can safely remove it manually.
  WARNING: Failed to remove contents in a temporary directory 'C:\Users\chr_v\Doc
uments\eaa23itek\3semester\Kunstig-Intelligens\ai\Lib\site-packages\~umpy'.
  You can safely remove it manually.
```

In [5]:
```
!pip install numpy
```

```
Requirement already satisfied: numpy in c:\users\chr_v\documents\eaa23itek\3semes
ter\kunstig-intelligens\ai\lib\site-packages (1.26.4)
```

In [6]:
```
!pip install matplotlib
```

```
Requirement already satisfied: matplotlib in c:\users\chr_v\documents\eaa23itek\3
semester\kunstig-intelligens\ai\lib\site-packages (3.9.2)
Requirement already satisfied: contourpy>=1.0.1 in c:\users\chr_v\documents\eaa23
itek\3semester\kunstig-intelligens\ai\lib\site-packages (from matplotlib) (1.3.0)
Requirement already satisfied: cycler>=0.10 in c:\users\chr_v\documents\eaa23itek
\3semester\kunstig-intelligens\ai\lib\site-packages (from matplotlib) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\chr_v\documents\eaa2
3itek\3semester\kunstig-intelligens\ai\lib\site-packages (from matplotlib) (4.53.
1)
Requirement already satisfied: kiwisolver>=1.3.1 in c:\users\chr_v\documents\eaa2
3itek\3semester\kunstig-intelligens\ai\lib\site-packages (from matplotlib) (1.4.
5)
Requirement already satisfied: numpy>=1.23 in c:\users\chr_v\documents\eaa23itek
\3semester\kunstig-intelligens\ai\lib\site-packages (from matplotlib) (1.26.4)
Requirement already satisfied: packaging>=20.0 in c:\users\chr_v\documents\eaa23i
tek\3semester\kunstig-intelligens\ai\lib\site-packages (from matplotlib) (24.1)
Requirement already satisfied: pillow>=8 in c:\users\chr_v\documents\eaa23itek\3s
emester\kunstig-intelligens\ai\lib\site-packages (from matplotlib) (10.4.0)
Requirement already satisfied: pyparsing>=2.3.1 in c:\users\chr_v\documents\eaa23
itek\3semester\kunstig-intelligens\ai\lib\site-packages (from matplotlib) (3.1.4)
Requirement already satisfied: python-dateutil>=2.7 in c:\users\chr_v\documents\e
aa23itek\3semester\kunstig-intelligens\ai\lib\site-packages (from matplotlib) (2.
9.0.post0)
Requirement already satisfied: importlib-resources>=3.2.0 in c:\users\chr_v\docum
ents\eaa23itek\3semester\kunstig-intelligens\ai\lib\site-packages (from matplotli
b) (6.4.4)
Requirement already satisfied: zipp>=3.1.0 in c:\users\chr_v\documents\eaa23itek
\3semester\kunstig-intelligens\ai\lib\site-packages (from importlib-resources>=3.
2.0->matplotlib) (3.20.1)
Requirement already satisfied: six>=1.5 in c:\users\chr_v\documents\eaa23itek\3se
mester\kunstig-intelligens\ai\lib\site-packages (from python-dateutil>=2.7->matpl
otlib) (1.16.0)
```

Brug Panda til at læse (og vise) data fra csv-regnearket som indeholder

træningsdata

In [7]:
```
import pandas as pd
#from sklearn.model_selection import train_test_split

df = pd.read_csv('data.csv')  # kan også læse excel filer med pd.read_excel()  i

Y = pd.get_dummies(df.drop(['X1','X2'], axis=1))  # Values
X = pd.get_dummies(df.drop(['Value test'], axis=1))  #  X1,X2

print(X)    #input til AI
print(Y)    # output fra AI
```

```
           X1        X2
0     4.015273  0.806483
1    -1.885671 -0.096012
2    -1.698679 -3.532364
3     1.810753  0.982904
4    -2.324976  3.636576
...        ...       ...
2395  0.176359  2.439269
2396  2.285077 -3.060542
2397 -0.634184  0.285939
2398  4.313096 -1.644443
2399  1.657631 -0.019839

[2400 rows x 2 columns]
      Value test
0             -1
1              1
2             -1
3              1
4             -1
...           ...
2395           1
2396          -1
2397           1
2398          -1
2399           1

[2400 rows x 1 columns]
```

Byg nu efter bedste fornemmelse et neuralt netværk

In [8]:
```
from tensorflow.keras.models import Sequential, load_model
from tensorflow.keras.layers import Dense

model = Sequential()
model.add(Dense(units=6, activation='relu', input_dim=2))          # 2 input til
model.add(Dense(units=6, activation='relu'))          # 4 input til 6 neuroner i
model.add(Dense(units=1, activation='linear'))  #sigmoid kan ikke bruges da posi

model.compile(loss="mean_squared_error", optimizer='Adam')#, metrics='accuracy')
```

```
C:\Users\chr_v\Documents\eaa23itek\3semester\Kunstig-Intelligens\ai\lib\site-packages\keras\src\layers\core\dense.py:87: UserWarning: Do not pass an `input_shape`/`input_dim` argument to a layer. When using Sequential models, prefer using an `Input(shape)` object as the first layer in the model instead.
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

Konverter træningsdata til et array af float

In [9]:
```
import numpy as np

X_train = np.asarray(X).astype('float32')
y_train = np.asarray(Y).astype('float32')
```

In [10]:
```
X_train
```

Out[10]:
```
array([[ 4.0152726 ,  0.80648327],
       [-1.8856708 , -0.096012  ],
       [-1.6986793 , -3.5323644 ],
       ...,
       [-0.6341844 ,  0.28593886],
       [ 4.313096  , -1.6444433 ],
       [ 1.6576308 , -0.01983912]], dtype=float32)
```

Og træn med disse data

In [11]:
```
model.fit(X_train, y_train, epochs=400, batch_size=200)
```

```
Epoch 1/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 3s 6ms/step - loss: 3.5467
Epoch 2/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 2.9487
Epoch 3/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 2.7024
Epoch 4/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 2.3987
Epoch 5/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 2.0536
Epoch 6/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 1.9136
Epoch 7/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 1.7445
Epoch 8/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 1.6137
Epoch 9/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 1.4659
Epoch 10/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 1.3645
Epoch 11/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 1.2417
Epoch 12/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 1.1741
Epoch 13/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 1.0945
Epoch 14/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 1.0375
Epoch 15/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 1.0027
Epoch 16/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.9061
Epoch 17/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.8451
Epoch 18/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.7955
Epoch 19/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.7454
Epoch 20/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.6881
Epoch 21/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.6458
Epoch 22/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.6198
Epoch 23/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.5642
Epoch 24/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.5428
Epoch 25/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 6ms/step - loss: 0.5127
Epoch 26/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.4771
Epoch 27/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.4284
Epoch 28/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.4197
Epoch 29/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.3751
Epoch 30/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.3523
```

```
Epoch 31/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.3320
Epoch 32/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.3162
Epoch 33/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.2856
Epoch 34/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.2619
Epoch 35/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.2430
Epoch 36/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.2251
Epoch 37/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.2011
Epoch 38/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.1896
Epoch 39/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.1773
Epoch 40/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.1602
Epoch 41/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.1572
Epoch 42/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.1447
Epoch 43/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 7ms/step - loss: 0.1375
Epoch 44/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.1328
Epoch 45/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.1254
Epoch 46/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.1196
Epoch 47/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.1116
Epoch 48/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.1134
Epoch 49/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.1079
Epoch 50/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.1039
Epoch 51/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.1012
Epoch 52/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0967
Epoch 53/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0931
Epoch 54/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0915
Epoch 55/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0926
Epoch 56/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 6ms/step - loss: 0.0877
Epoch 57/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0855
Epoch 58/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0854
Epoch 59/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0869
Epoch 60/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0881
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Epoch 61/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0829
Epoch 62/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0780
Epoch 63/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0850
Epoch 64/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0804
Epoch 65/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0784
Epoch 66/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0760
Epoch 67/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0819
Epoch 68/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0764
Epoch 69/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0783
Epoch 70/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0768
Epoch 71/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0728
Epoch 72/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0750
Epoch 73/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 5ms/step - loss: 0.0753
Epoch 74/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0757
Epoch 75/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0742
Epoch 76/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0754
Epoch 77/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0724
Epoch 78/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0750
Epoch 79/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0748
Epoch 80/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 7ms/step - loss: 0.0708
Epoch 81/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0704
Epoch 82/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0722
Epoch 83/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0690
Epoch 84/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0734
Epoch 85/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0704
Epoch 86/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0704
Epoch 87/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0699
Epoch 88/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0729
Epoch 89/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0698
Epoch 90/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0711
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Epoch 91/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0685
Epoch 92/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0690
Epoch 93/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0710
Epoch 94/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0722
Epoch 95/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0683
Epoch 96/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0646
Epoch 97/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0685
Epoch 98/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0684
Epoch 99/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0673
Epoch 100/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0674
Epoch 101/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0648
Epoch 102/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0642
Epoch 103/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0655
Epoch 104/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0651
Epoch 105/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0659
Epoch 106/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0631
Epoch 107/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0647
Epoch 108/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 6ms/step - loss: 0.0649
Epoch 109/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0621
Epoch 110/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0656
Epoch 111/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0612
Epoch 112/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0644
Epoch 113/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0645
Epoch 114/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0631
Epoch 115/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0643
Epoch 116/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0614
Epoch 117/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0657
Epoch 118/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0617
Epoch 119/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0674
Epoch 120/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0635
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Epoch 121/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0645
Epoch 122/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0631
Epoch 123/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0617
Epoch 124/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0631
Epoch 125/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0608
Epoch 126/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0603
Epoch 127/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0636
Epoch 128/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0646
Epoch 129/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0610
Epoch 130/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0636
Epoch 131/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0606
Epoch 132/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0627
Epoch 133/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0644
Epoch 134/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0621
Epoch 135/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0598
Epoch 136/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0612
Epoch 137/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0561
Epoch 138/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0597
Epoch 139/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0603
Epoch 140/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0614
Epoch 141/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0619
Epoch 142/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0622
Epoch 143/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0592
Epoch 144/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0609
Epoch 145/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0612
Epoch 146/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0600
Epoch 147/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0598
Epoch 148/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0591
Epoch 149/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0589
Epoch 150/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0602
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Epoch 151/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0618
Epoch 152/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0602
Epoch 153/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0580
Epoch 154/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0597
Epoch 155/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0590
Epoch 156/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0602
Epoch 157/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0607
Epoch 158/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0571
Epoch 159/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0569
Epoch 160/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0586
Epoch 161/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - loss: 0.0575
Epoch 162/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0584
Epoch 163/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0588
Epoch 164/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0627
Epoch 165/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0557
Epoch 166/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0581
Epoch 167/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0593
Epoch 168/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0561
Epoch 169/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0608
Epoch 170/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0589
Epoch 171/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0586
Epoch 172/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 6ms/step - loss: 0.0593
Epoch 173/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0546
Epoch 174/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0573
Epoch 175/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0577
Epoch 176/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0607
Epoch 177/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - loss: 0.0576
Epoch 178/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0561
Epoch 179/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0602
Epoch 180/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0585
```

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Epoch 181/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0564
Epoch 182/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0567
Epoch 183/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0565
Epoch 184/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0585
Epoch 185/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0569
Epoch 186/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0576
Epoch 187/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0561
Epoch 188/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0581
Epoch 189/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0568
Epoch 190/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0530
Epoch 191/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0581
Epoch 192/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0554
Epoch 193/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0582
Epoch 194/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0568
Epoch 195/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0585
Epoch 196/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0574
Epoch 197/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0554
Epoch 198/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0578
Epoch 199/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0587
Epoch 200/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0579
Epoch 201/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0592
Epoch 202/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0580
Epoch 203/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0555
Epoch 204/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0546
Epoch 205/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0565
Epoch 206/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0567
Epoch 207/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0580
Epoch 208/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0564
Epoch 209/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0594
Epoch 210/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0583
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Epoch 211/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0566
Epoch 212/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0549
Epoch 213/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0541
Epoch 214/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0594
Epoch 215/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0537
Epoch 216/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0550
Epoch 217/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0583
Epoch 218/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0581
Epoch 219/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0567
Epoch 220/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0547
Epoch 221/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0572
Epoch 222/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0571
Epoch 223/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 6ms/step - loss: 0.0581
Epoch 224/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0565
Epoch 225/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0584
Epoch 226/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0582
Epoch 227/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0561
Epoch 228/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0551
Epoch 229/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0564
Epoch 230/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0561
Epoch 231/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0559
Epoch 232/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 7ms/step - loss: 0.0569
Epoch 233/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0552
Epoch 234/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0583
Epoch 235/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0554
Epoch 236/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0543
Epoch 237/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0568
Epoch 238/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0564
Epoch 239/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0571
Epoch 240/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0564
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Epoch 241/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0579
Epoch 242/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0541
Epoch 243/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0559
Epoch 244/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0546
Epoch 245/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0544
Epoch 246/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0532
Epoch 247/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0545
Epoch 248/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0543
Epoch 249/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0578
Epoch 250/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0546
Epoch 251/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0574
Epoch 252/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0544
Epoch 253/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0535
Epoch 254/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0551
Epoch 255/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0547
Epoch 256/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0570
Epoch 257/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0541
Epoch 258/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0552
Epoch 259/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0550
Epoch 260/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0553
Epoch 261/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0545
Epoch 262/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 7ms/step - loss: 0.0586
Epoch 263/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0580
Epoch 264/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0574
Epoch 265/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0562
Epoch 266/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0532
Epoch 267/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0564
Epoch 268/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0557
Epoch 269/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0539
Epoch 270/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0539
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Epoch 271/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0541
Epoch 272/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0544
Epoch 273/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0557
Epoch 274/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0548
Epoch 275/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0545
Epoch 276/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0549
Epoch 277/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0567
Epoch 278/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0546
Epoch 279/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0555
Epoch 280/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 6ms/step - loss: 0.0540
Epoch 281/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0504
Epoch 282/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0532
Epoch 283/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0524
Epoch 284/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0540
Epoch 285/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0526
Epoch 286/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0547
Epoch 287/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0531
Epoch 288/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0543
Epoch 289/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0527
Epoch 290/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0532
Epoch 291/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0553
Epoch 292/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0542
Epoch 293/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0513
Epoch 294/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0516
Epoch 295/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0543
Epoch 296/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0538
Epoch 297/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0534
Epoch 298/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0531
Epoch 299/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0552
Epoch 300/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - loss: 0.0520
```

```
Epoch 301/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0528
Epoch 302/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0529
Epoch 303/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0539
Epoch 304/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0526
Epoch 305/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - loss: 0.0521
Epoch 306/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0512
Epoch 307/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0522
Epoch 308/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0539
Epoch 309/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 9ms/step - loss: 0.0532
Epoch 310/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0533
Epoch 311/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0567
Epoch 312/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0527
Epoch 313/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0545
Epoch 314/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0533
Epoch 315/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0533
Epoch 316/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0541
Epoch 317/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0543
Epoch 318/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0516
Epoch 319/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0528
Epoch 320/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0543
Epoch 321/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0534
Epoch 322/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0522
Epoch 323/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0523
Epoch 324/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0539
Epoch 325/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0530
Epoch 326/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0514
Epoch 327/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0515
Epoch 328/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0514
Epoch 329/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0535
Epoch 330/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0519
```

```
Epoch 331/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0525
Epoch 332/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0521
Epoch 333/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0532
Epoch 334/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0514
Epoch 335/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0499
Epoch 336/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0536
Epoch 337/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0525
Epoch 338/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0498
Epoch 339/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0536
Epoch 340/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0540
Epoch 341/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0547
Epoch 342/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 7ms/step - loss: 0.0520
Epoch 343/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0528
Epoch 344/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0510
Epoch 345/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0540
Epoch 346/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0522
Epoch 347/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0534
Epoch 348/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0518
Epoch 349/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0502
Epoch 350/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - loss: 0.0513
Epoch 351/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0523
Epoch 352/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0530
Epoch 353/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 6ms/step - loss: 0.0509
Epoch 354/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0509
Epoch 355/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0512
Epoch 356/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0520
Epoch 357/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0524
Epoch 358/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0512
Epoch 359/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0526
Epoch 360/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0505
```

```
Epoch 361/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0550
Epoch 362/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0495
Epoch 363/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 9ms/step - loss: 0.0523
Epoch 364/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0524
Epoch 365/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0532
Epoch 366/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0512
Epoch 367/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0510
Epoch 368/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0536
Epoch 369/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0518
Epoch 370/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0523
Epoch 371/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0514
Epoch 372/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0513
Epoch 373/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0535
Epoch 374/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0516
Epoch 375/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0511
Epoch 376/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0502
Epoch 377/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0499
Epoch 378/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0510
Epoch 379/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0488
Epoch 380/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0498
Epoch 381/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0492
Epoch 382/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0488
Epoch 383/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0510
Epoch 384/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0501
Epoch 385/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0495
Epoch 386/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0519
Epoch 387/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0510
Epoch 388/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0487
Epoch 389/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0501
Epoch 390/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - loss: 0.0492
```

```
Epoch 391/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0512
Epoch 392/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0513
Epoch 393/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0506
Epoch 394/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0511
Epoch 395/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0513
Epoch 396/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0481
Epoch 397/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0487
Epoch 398/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0492
Epoch 399/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0512
Epoch 400/400
12/12 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - loss: 0.0508
```

Out[11]: <keras.src.callbacks.history.History at 0x20f3f056d60>

In [12]:
```
Xtestdata  = np.array([[-6,-6]])
#print(Xtestdata )

for x1 in range (-5,5):
    for x2 in range(-5,5):
        Xtestdata = np.concatenate((Xtestdata,np.array([[x1,x2]])))
```

In [13]:
```
Ypredicted = model.predict(Xtestdata)
```

```
4/4 ━━━━━━━━━━━━━━━━━━━━ 0s 31ms/step
```

In [14]:
```
Ypredicted[6]
```

Out[14]: array([-1.361693], dtype=float32)

In [15]:
```
print(Xtestdata[6,0])
print(Xtestdata[6,1])
type(Xtestdata[6,0])
```

```
-5
0
```

Out[15]: numpy.int32

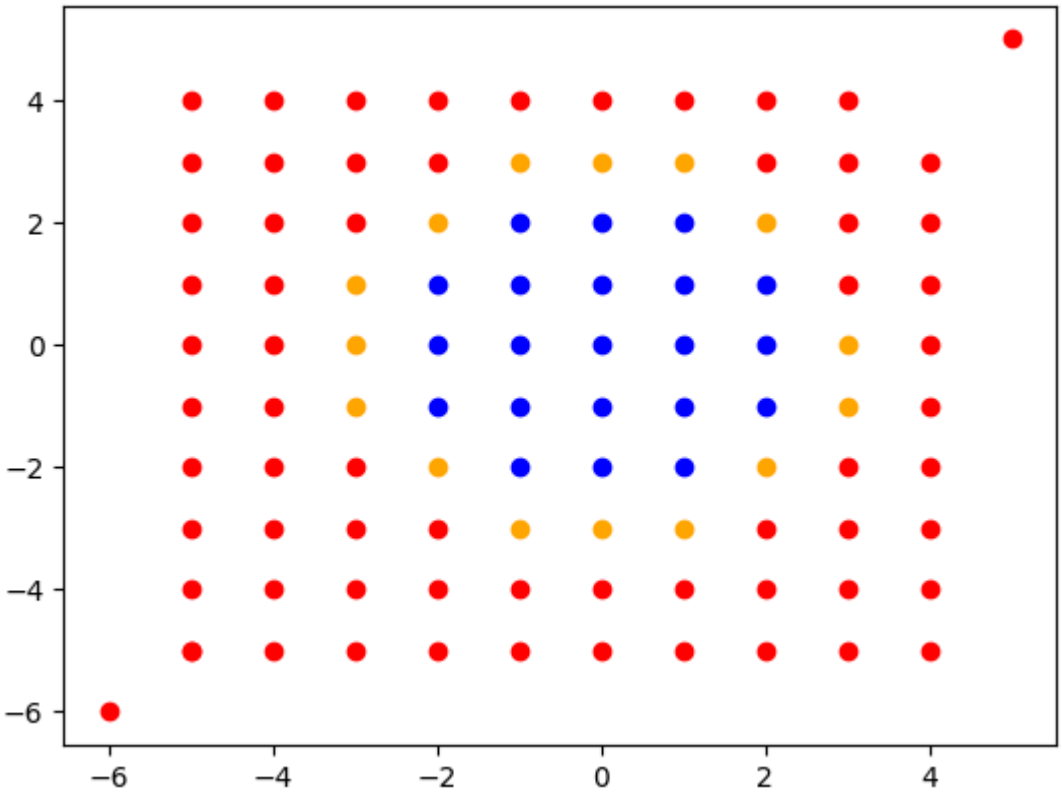
plot resultatet

In [16]:
```
import matplotlib.pyplot as plt

plt.scatter(5,5,color='red') #marker
plt.scatter(-5,-5,color='red') #marker

for n in range (100):  #prøve-plot
    if Ypredicted[n] >= 0.25:
        c = 'blue'
    else:
        if Ypredicted[n] <= -0.25:
```

```
            c = 'red'
        else:
            c = 'orange'
    #print(Xtestdata[n,0],Xtestdata[n,1],c)
    plt.scatter(Xtestdata[n,0],Xtestdata[n,1],color=c)
plt.show()
```



In [17]:
```
import matplotlib.pyplot as plt

print("A")

Xtestdata  = np.array([[-6,-6]])
#print(Xtestdata )

for x1 in range (-50,50):
    for x2 in range(-50,50):
        Xtestdata = np.concatenate((Xtestdata,np.array([[x1/10,x2/10]])))

Ypredicted = model.predict(Xtestdata)


plt.scatter(5,5,color='red') #marker
plt.scatter(-5,-5,color='red') #marker

for n in range (10000):  #prøve-plot
    if Ypredicted[n] >= 0.25:
        c = 'blue'
    else:
        if Ypredicted[n] <= -0.25:
            c = 'red'
        else:
            c = 'orange'
    #print(Xtestdata[n,0],Xtestdata[n,1],c)
    plt.scatter(Xtestdata[n,0],Xtestdata[n,1],color=c)
plt.show()
```

```
A
313/313 ━━━━━━━━━━━━━━━━━━━━ 1s 3ms/step
```