

Technological Institute of the Philippines	Quezon City - Computer Engineering
Course Code:	CPE 313
Code Title:	Advance Machine Learning and Deep Learning
2nd Semester	AY 2024-2025
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<b>Section</b>	CPE31S3
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## Activity 1.2 : Training Neural Networks

### Objective(s):

This activity aims to demonstrate how to train neural networks using keras

### Intended Learning Outcomes (ILOs):

- Demonstrate how to build and train neural networks
- Demonstrate how to evaluate and plot the model using training and validation loss

### Resources:

- Jupyter Notebook

CI Pima Diabetes Dataset

- pima-indians-diabetes.csv

### Procedures

Load the necessary libraries

```
In [ ]: import numpy as np
import pandas as pd
import matplotlib.pyplot as plt

from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import confusion_matrix, precision_recall_curve, roc_auc_score, roc_curve, accuracy_score
from sklearn.ensemble import RandomForestClassifier

import seaborn as sns

%matplotlib inline
```

```
In [ ]: ## Import Keras objects for Deep Learning

from keras.models import Sequential
from keras.layers import Input, Dense, Flatten, Dropout, BatchNormalization
from keras.optimizers import Adam, SGD, RMSprop
```

Load the dataset

```
In [ ]: filepath = "/content/pima-indians-diabetes (1).csv"
names = ["times_pregnant", "glucose_tolerance_test", "blood_pressure", "skin_thickness", "insulin",
         "bmi", "pedigree_function", "age", "has_diabetes"]
diabetes_df = pd.read_csv(filepath, names=names)
```

Check the top 5 samples of the data

```
In [ ]: print(diabetes_df.shape)
diabetes_df.sample(5)
```

(768, 9)

```
Out [ ]:
```

	times_pregnant	glucose_tolerance_test	blood_pressure	skin_thickness	insulin	bmi	pedigree_function	age	has_
<b>747</b>	1	81	74	41	57	46.3	1.096	32	
<b>684</b>	5	136	82	0	0	0.0	0.640	69	
<b>411</b>	1	112	72	30	176	34.4	0.528	25	
<b>479</b>	4	132	86	31	0	28.0	0.419	63	
<b>28</b>	13	145	82	19	110	22.2	0.245	57	

```
In [ ]: diabetes_df.dtypes
```

```
Out [ ]:
```

	<b>0</b>
<b>times_pregnant</b>	int64
<b>glucose_tolerance_test</b>	int64
<b>blood_pressure</b>	int64
<b>skin_thickness</b>	int64
<b>insulin</b>	int64
<b>bmi</b>	float64
<b>pedigree_function</b>	float64
<b>age</b>	int64
<b>has_diabetes</b>	int64

**dtype:** object

```
In [ ]: X = diabetes_df.iloc[:, :-1].values
y = diabetes_df["has_diabetes"].values
```

Split the data to Train, and Test (75%, 25%)

```
In [ ]: X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=11111)
```

```
In [ ]: np.mean(y), np.mean(1-y)
```

```
Out [ ]: (0.3489583333333333, 0.6510416666666666)
```

Build a single hidden layer neural network using 12 nodes. Use the sequential model with single layer network and input shape to 8.

Normalize the data

```
In [ ]: normalizer = StandardScaler()
X_train_norm = normalizer.fit_transform(X_train)
```

```
X_test_norm = normalizer.transform(X_test)
```

Define the model:

- Input size is 8-dimensional
- 1 hidden layer, 12 hidden nodes, sigmoid activation
- Final layer with one node and sigmoid activation (standard for binary classification)

```
In [ ]: model = Sequential([
    Dense(12, input_shape=(8,), activation="relu"),
    Dense(1, activation="sigmoid")
])
```

```
/usr/local/lib/python3.11/dist-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)
```

View the model summary

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

Model: "sequential"

Layer (type)	Output Shape	Param #
dense (Dense)	(None, 12)	108
dense_1 (Dense)	(None, 1)	13

Total params: 121 (484.00 B)


Trainable params: 121 (484.00 B)


Non-trainable params: 0 (0.00 B)


Train the model


- Compile the model with optimizer, loss function and metrics
- Use the fit function to return the run history.


```
In [ ]: model.compile(SGD(learning_rate = .003), "binary_crossentropy", metrics=["accuracy"])
run_hist_1 = model.fit(X_train_norm, y_train, validation_data=(X_test_norm, y_test), epochs=200)
```


Epoch 1/200  
18/18  1s 25ms/step - accuracy: 0.4030 - loss: 0.7692 - val\_accuracy: 0.4167 - val\_loss: 0.7539


Epoch 2/200  
18/18  0s 6ms/step - accuracy: 0.4166 - loss: 0.7537 - val\_accuracy: 0.4323 - val\_loss: 0.7452


Epoch 3/200  
18/18  0s 5ms/step - accuracy: 0.4201 - loss: 0.7536 - val\_accuracy: 0.4375 - val\_loss: 0.7370


Epoch 4/200  
18/18  0s 6ms/step - accuracy: 0.4407 - loss: 0.7431 - val\_accuracy: 0.4427 - val\_loss: 0.7293


Epoch 5/200  
18/18  0s 6ms/step - accuracy: 0.4671 - loss: 0.7305 - val\_accuracy: 0.4479 - val\_loss: 0.7220


Epoch 6/200  
18/18  0s 7ms/step - accuracy: 0.4815 - loss: 0.7225 - val\_accuracy: 0.4583 - val\_loss: 0.7152


Epoch 7/200  
18/18  0s 8ms/step - accuracy: 0.5299 - loss: 0.6982 - val\_accuracy: 0.4688 - val\_loss: 0.7087


Epoch 8/200  
18/18  0s 5ms/step - accuracy: 0.5130 - loss: 0.7121 - val\_accuracy: 0.4740 - val\_loss: 0.7026


Epoch 9/200  
18/18  0s 5ms/step - accuracy: 0.4972 - loss: 0.7102 - val\_accuracy: 0.4792 - val\_loss: 0.6967


Epoch 10/200  
18/18  0s 5ms/step - accuracy: 0.5378 - loss: 0.6930 - val\_accuracy: 0.4896 - val\_loss: 0.6912


Epoch 11/200  
18/18  0s 6ms/step - accuracy: 0.5351 - loss: 0.6908 - val\_accuracy: 0.5104 - val\_loss: 0.6859


Epoch 12/200  
18/18  0s 5ms/step - accuracy: 0.5291 - loss: 0.6849 - val\_accuracy: 0.5104 - val\_loss: 0.6809


Epoch 13/200  
18/18  0s 7ms/step - accuracy: 0.5466 - loss: 0.6861 - val\_accuracy: 0.5208 - val\_loss: 0.6761


Epoch 14/200  
18/18  0s 6ms/step - accuracy: 0.5499 - loss: 0.6846 - val\_accuracy: 0.5365 - val\_loss: 0.6715


Epoch 15/200  
18/18  0s 8ms/step - accuracy: 0.5849 - loss: 0.6693 - val\_accuracy: 0.5521 - val\_loss: 0.6671


Epoch 16/200  
18/18  0s 6ms/step - accuracy: 0.5995 - loss: 0.6639 - val\_accuracy: 0.5573 - val\_loss: 0.6630


Epoch 17/200  
18/18  0s 5ms/step - accuracy: 0.5618 - loss: 0.6717 - val\_accuracy: 0.5781 - val\_loss: 0.6590


Epoch 18/200  
18/18  0s 6ms/step - accuracy: 0.5956 - loss: 0.6633 - val\_accuracy: 0.5885 - val\_loss: 0.6551

Epoch 19/200  
18/18  0s 8ms/step - accuracy: 0.6420 - loss: 0.6341 - val\_accuracy: 0.5990 - val\_loss: 0.6514

Epoch 20/200  
18/18  0s 6ms/step - accuracy: 0.6212 - loss: 0.6382 - val\_accuracy: 0.6146 - val\_loss: 0.6479

Epoch 21/200  
18/18  0s 5ms/step - accuracy: 0.6457 - loss: 0.6351 - val\_accuracy: 0.6146 - val\_loss: 0.6445


Epoch 22/200  
18/18  0s 5ms/step - accuracy: 0.6172 - loss: 0.6563 - val\_accuracy: 0.6198 - val\_loss: 0.6412


Epoch 23/200  
18/18  0s 5ms/step - accuracy: 0.6573 - loss: 0.6363 - val\_accuracy: 0.6198 - val\_loss: 0.6380


Epoch 24/200


18/18 ————— 0s 6ms/step - accuracy: 0.6520 - loss: 0.6309 - val\_accuracy: 0.6250 - val\_loss: 0.6350  
Epoch 25/200  
18/18 ————— 0s 7ms/step - accuracy: 0.6525 - loss: 0.6240 - val\_accuracy: 0.6354 - val\_loss: 0.6320  
Epoch 26/200  
18/18 ————— 0s 6ms/step - accuracy: 0.6368 - loss: 0.6312 - val\_accuracy: 0.6406 - val\_loss: 0.6291  
Epoch 27/200  
18/18 ————— 0s 6ms/step - accuracy: 0.6554 - loss: 0.6331 - val\_accuracy: 0.6406 - val\_loss: 0.6263  
Epoch 28/200  
18/18 ————— 0s 6ms/step - accuracy: 0.6563 - loss: 0.6307 - val\_accuracy: 0.6458 - val\_loss: 0.6236  
Epoch 29/200  
18/18 ————— 0s 6ms/step - accuracy: 0.6762 - loss: 0.6145 - val\_accuracy: 0.6510 - val\_loss: 0.6210  
Epoch 30/200  
18/18 ————— 0s 6ms/step - accuracy: 0.6508 - loss: 0.6140 - val\_accuracy: 0.6615 - val\_loss: 0.6184  
Epoch 31/200  
18/18 ————— 0s 8ms/step - accuracy: 0.6785 - loss: 0.6059 - val\_accuracy: 0.6667 - val\_loss: 0.6159  
Epoch 32/200  
18/18 ————— 0s 6ms/step - accuracy: 0.6762 - loss: 0.6134 - val\_accuracy: 0.6667 - val\_loss: 0.6135  
Epoch 33/200  
18/18 ————— 0s 6ms/step - accuracy: 0.6684 - loss: 0.6104 - val\_accuracy: 0.6667 - val\_loss: 0.6112  
Epoch 34/200  
18/18 ————— 0s 6ms/step - accuracy: 0.6975 - loss: 0.5942 - val\_accuracy: 0.6719 - val\_loss: 0.6090  
Epoch 35/200  
18/18 ————— 0s 6ms/step - accuracy: 0.6755 - loss: 0.6076 - val\_accuracy: 0.6823 - val\_loss: 0.6068  
Epoch 36/200  
18/18 ————— 0s 6ms/step - accuracy: 0.6570 - loss: 0.6183 - val\_accuracy: 0.6823 - val\_loss: 0.6047  
Epoch 37/200  
18/18 ————— 0s 7ms/step - accuracy: 0.7049 - loss: 0.5822 - val\_accuracy: 0.6927 - val\_loss: 0.6026  
Epoch 38/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7006 - loss: 0.5888 - val\_accuracy: 0.6927 - val\_loss: 0.6006  
Epoch 39/200  
18/18 ————— 0s 6ms/step - accuracy: 0.6790 - loss: 0.6017 - val\_accuracy: 0.6979 - val\_loss: 0.5986  
Epoch 40/200  
18/18 ————— 0s 7ms/step - accuracy: 0.6684 - loss: 0.6030 - val\_accuracy: 0.7031 - val\_loss: 0.5967  
Epoch 41/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7095 - loss: 0.5857 - val\_accuracy: 0.6979 - val\_loss: 0.5948  
Epoch 42/200  
18/18 ————— 0s 6ms/step - accuracy: 0.6818 - loss: 0.5976 - val\_accuracy: 0.6979 - val\_loss: 0.5929  
Epoch 43/200  
18/18 ————— 0s 7ms/step - accuracy: 0.7085 - loss: 0.5682 - val\_accuracy: 0.6979 - val\_loss: 0.5911  
Epoch 44/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7229 - loss: 0.5715 - val\_accuracy: 0.6979 - val\_loss: 0.5894  
Epoch 45/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7022 - loss: 0.5942 - val\_accuracy: 0.7031 - val\_loss: 0.5877  
Epoch 46/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7007 - loss: 0.5804 - val\_accuracy: 0.7031 - val\_loss: 0.5860  
Epoch 47/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7187 - loss: 0.5713 - val\_accuracy: 0.7031 - val\_loss:


0.5843  
Epoch 48/200  
18/18 ————— 0s 7ms/step - accuracy: 0.7162 - loss: 0.5646 - val\_accuracy: 0.7135 - val\_loss: 0.5827  
Epoch 49/200  
18/18 ————— 0s 7ms/step - accuracy: 0.7350 - loss: 0.5483 - val\_accuracy: 0.7135 - val\_loss: 0.5812  
Epoch 50/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7284 - loss: 0.5626 - val\_accuracy: 0.7135 - val\_loss: 0.5796  
Epoch 51/200  
18/18 ————— 0s 5ms/step - accuracy: 0.7137 - loss: 0.5711 - val\_accuracy: 0.7135 - val\_loss: 0.5781  
Epoch 52/200  
18/18 ————— 0s 7ms/step - accuracy: 0.7321 - loss: 0.5495 - val\_accuracy: 0.7135 - val\_loss: 0.5766  
Epoch 53/200  
18/18 ————— 0s 8ms/step - accuracy: 0.7201 - loss: 0.5579 - val\_accuracy: 0.7135 - val\_loss: 0.5752  
Epoch 54/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7211 - loss: 0.5624 - val\_accuracy: 0.7135 - val\_loss: 0.5738  
Epoch 55/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7312 - loss: 0.5590 - val\_accuracy: 0.7135 - val\_loss: 0.5724  
Epoch 56/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7325 - loss: 0.5625 - val\_accuracy: 0.7188 - val\_loss: 0.5710  
Epoch 57/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7128 - loss: 0.5675 - val\_accuracy: 0.7188 - val\_loss: 0.5697  
Epoch 58/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7260 - loss: 0.5684 - val\_accuracy: 0.7240 - val\_loss: 0.5683  
Epoch 59/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7095 - loss: 0.5642 - val\_accuracy: 0.7240 - val\_loss: 0.5670  
Epoch 60/200  
18/18 ————— 0s 5ms/step - accuracy: 0.7081 - loss: 0.5551 - val\_accuracy: 0.7344 - val\_loss: 0.5658  
Epoch 61/200  
18/18 ————— 0s 7ms/step - accuracy: 0.7198 - loss: 0.5578 - val\_accuracy: 0.7344 - val\_loss: 0.5645  
Epoch 62/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7030 - loss: 0.5698 - val\_accuracy: 0.7396 - val\_loss: 0.5632  
Epoch 63/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7311 - loss: 0.5524 - val\_accuracy: 0.7396 - val\_loss: 0.5620  
Epoch 64/200  
18/18 ————— 0s 10ms/step - accuracy: 0.7448 - loss: 0.5351 - val\_accuracy: 0.7396 - val\_loss: 0.5608  
Epoch 65/200  
18/18 ————— 0s 9ms/step - accuracy: 0.7085 - loss: 0.5418 - val\_accuracy: 0.7396 - val\_loss: 0.5596  
Epoch 66/200  
18/18 ————— 0s 10ms/step - accuracy: 0.7198 - loss: 0.5522 - val\_accuracy: 0.7396 - val\_loss: 0.5584  
Epoch 67/200  
18/18 ————— 0s 10ms/step - accuracy: 0.7359 - loss: 0.5406 - val\_accuracy: 0.7396 - val\_loss: 0.5573  
Epoch 68/200  
18/18 ————— 0s 9ms/step - accuracy: 0.7407 - loss: 0.5341 - val\_accuracy: 0.7396 - val\_loss: 0.5562  
Epoch 69/200  
18/18 ————— 0s 10ms/step - accuracy: 0.7457 - loss: 0.5391 - val\_accuracy: 0.7396 - val\_loss: 0.5551  
Epoch 70/200  
18/18 ————— 0s 10ms/step - accuracy: 0.7582 - loss: 0.5319 - val\_accuracy: 0.7448 - val\_loss: 0.5540


Epoch 71/200  
18/18  0s 15ms/step - accuracy: 0.7419 - loss: 0.5322 - val\_accuracy: 0.7396 - val\_loss: 0.5530


Epoch 72/200  
18/18  1s 13ms/step - accuracy: 0.7046 - loss: 0.5654 - val\_accuracy: 0.7396 - val\_loss: 0.5519


Epoch 73/200  
18/18  0s 5ms/step - accuracy: 0.7437 - loss: 0.5332 - val\_accuracy: 0.7396 - val\_loss: 0.5509


Epoch 74/200  
18/18  0s 6ms/step - accuracy: 0.7393 - loss: 0.5406 - val\_accuracy: 0.7396 - val\_loss: 0.5499


Epoch 75/200  
18/18  0s 6ms/step - accuracy: 0.7600 - loss: 0.5393 - val\_accuracy: 0.7396 - val\_loss: 0.5489


Epoch 76/200  
18/18  0s 6ms/step - accuracy: 0.7550 - loss: 0.5326 - val\_accuracy: 0.7396 - val\_loss: 0.5479


Epoch 77/200  
18/18  0s 5ms/step - accuracy: 0.7391 - loss: 0.5436 - val\_accuracy: 0.7396 - val\_loss: 0.5470


Epoch 78/200  
18/18  0s 6ms/step - accuracy: 0.7364 - loss: 0.5494 - val\_accuracy: 0.7396 - val\_loss: 0.5460


Epoch 79/200  
18/18  0s 6ms/step - accuracy: 0.7469 - loss: 0.5414 - val\_accuracy: 0.7396 - val\_loss: 0.5451


Epoch 80/200  
18/18  0s 6ms/step - accuracy: 0.7389 - loss: 0.5378 - val\_accuracy: 0.7396 - val\_loss: 0.5442


Epoch 81/200  
18/18  0s 6ms/step - accuracy: 0.7235 - loss: 0.5547 - val\_accuracy: 0.7396 - val\_loss: 0.5433


Epoch 82/200  
18/18  0s 7ms/step - accuracy: 0.7661 - loss: 0.5263 - val\_accuracy: 0.7396 - val\_loss: 0.5424


Epoch 83/200  
18/18  0s 6ms/step - accuracy: 0.7508 - loss: 0.5387 - val\_accuracy: 0.7500 - val\_loss: 0.5416


Epoch 84/200  
18/18  0s 7ms/step - accuracy: 0.7865 - loss: 0.5024 - val\_accuracy: 0.7500 - val\_loss: 0.5407


Epoch 85/200  
18/18  0s 5ms/step - accuracy: 0.7469 - loss: 0.5193 - val\_accuracy: 0.7500 - val\_loss: 0.5399


Epoch 86/200  
18/18  0s 6ms/step - accuracy: 0.7343 - loss: 0.5397 - val\_accuracy: 0.7500 - val\_loss: 0.5391


Epoch 87/200  
18/18  0s 6ms/step - accuracy: 0.7783 - loss: 0.5165 - val\_accuracy: 0.7500 - val\_loss: 0.5383


Epoch 88/200  
18/18  0s 6ms/step - accuracy: 0.7347 - loss: 0.5244 - val\_accuracy: 0.7500 - val\_loss: 0.5375

Epoch 89/200  
18/18  0s 6ms/step - accuracy: 0.7515 - loss: 0.5217 - val\_accuracy: 0.7500 - val\_loss: 0.5366

Epoch 90/200  
18/18  0s 6ms/step - accuracy: 0.7354 - loss: 0.5305 - val\_accuracy: 0.7500 - val\_loss: 0.5359

Epoch 91/200  
18/18  0s 7ms/step - accuracy: 0.7212 - loss: 0.5350 - val\_accuracy: 0.7500 - val\_loss: 0.5351

Epoch 92/200  
18/18  0s 6ms/step - accuracy: 0.7317 - loss: 0.5274 - val\_accuracy: 0.7500 - val\_loss: 0.5343


Epoch 93/200  
18/18  0s 5ms/step - accuracy: 0.7504 - loss: 0.5233 - val\_accuracy: 0.7500 - val\_loss: 0.5336


Epoch 94/200


18/18 ————— 0s 6ms/step - accuracy: 0.7543 - loss: 0.5174 - val\_accuracy: 0.7500 - val\_loss: 0.5328  
Epoch 95/200  
18/18 ————— 0s 8ms/step - accuracy: 0.7292 - loss: 0.5227 - val\_accuracy: 0.7500 - val\_loss: 0.5321  
Epoch 96/200  
18/18 ————— 0s 7ms/step - accuracy: 0.7341 - loss: 0.5342 - val\_accuracy: 0.7500 - val\_loss: 0.5314  
Epoch 97/200  
18/18 ————— 0s 8ms/step - accuracy: 0.7482 - loss: 0.5180 - val\_accuracy: 0.7500 - val\_loss: 0.5307  
Epoch 98/200  
18/18 ————— 0s 5ms/step - accuracy: 0.7642 - loss: 0.5257 - val\_accuracy: 0.7552 - val\_loss: 0.5300  
Epoch 99/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7786 - loss: 0.4997 - val\_accuracy: 0.7552 - val\_loss: 0.5293  
Epoch 100/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7347 - loss: 0.5308 - val\_accuracy: 0.7552 - val\_loss: 0.5286  
Epoch 101/200  
18/18 ————— 0s 9ms/step - accuracy: 0.7740 - loss: 0.5005 - val\_accuracy: 0.7604 - val\_loss: 0.5279  
Epoch 102/200  
18/18 ————— 0s 7ms/step - accuracy: 0.7513 - loss: 0.5083 - val\_accuracy: 0.7604 - val\_loss: 0.5272  
Epoch 103/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7249 - loss: 0.5269 - val\_accuracy: 0.7604 - val\_loss: 0.5266  
Epoch 104/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7669 - loss: 0.5131 - val\_accuracy: 0.7604 - val\_loss: 0.5259  
Epoch 105/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7644 - loss: 0.5020 - val\_accuracy: 0.7604 - val\_loss: 0.5253  
Epoch 106/200  
18/18 ————— 0s 5ms/step - accuracy: 0.7584 - loss: 0.5049 - val\_accuracy: 0.7604 - val\_loss: 0.5246  
Epoch 107/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7580 - loss: 0.5179 - val\_accuracy: 0.7552 - val\_loss: 0.5240  
Epoch 108/200  
18/18 ————— 0s 8ms/step - accuracy: 0.7742 - loss: 0.5010 - val\_accuracy: 0.7552 - val\_loss: 0.5234  
Epoch 109/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7619 - loss: 0.4988 - val\_accuracy: 0.7552 - val\_loss: 0.5228  
Epoch 110/200  
18/18 ————— 0s 5ms/step - accuracy: 0.7527 - loss: 0.5090 - val\_accuracy: 0.7552 - val\_loss: 0.5222  
Epoch 111/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7576 - loss: 0.5141 - val\_accuracy: 0.7552 - val\_loss: 0.5216  
Epoch 112/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7855 - loss: 0.5006 - val\_accuracy: 0.7552 - val\_loss: 0.5210  
Epoch 113/200  
18/18 ————— 0s 7ms/step - accuracy: 0.7700 - loss: 0.4902 - val\_accuracy: 0.7500 - val\_loss: 0.5205  
Epoch 114/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7113 - loss: 0.5414 - val\_accuracy: 0.7500 - val\_loss: 0.5199  
Epoch 115/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7584 - loss: 0.5153 - val\_accuracy: 0.7500 - val\_loss: 0.5194  
Epoch 116/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7377 - loss: 0.5249 - val\_accuracy: 0.7500 - val\_loss: 0.5189  
Epoch 117/200  
18/18 ————— 0s 8ms/step - accuracy: 0.7567 - loss: 0.5026 - val\_accuracy: 0.7500 - val\_loss:





0.5183  
Epoch 118/200  
18/18 ————— 0s 8ms/step - accuracy: 0.7402 - loss: 0.5094 - val\_accuracy: 0.7500 - val\_loss: 0.5178  
Epoch 119/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7669 - loss: 0.5013 - val\_accuracy: 0.7500 - val\_loss: 0.5173  
Epoch 120/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7731 - loss: 0.5038 - val\_accuracy: 0.7500 - val\_loss: 0.5168  
Epoch 121/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7641 - loss: 0.4816 - val\_accuracy: 0.7500 - val\_loss: 0.5163  
Epoch 122/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7610 - loss: 0.5008 - val\_accuracy: 0.7500 - val\_loss: 0.5158  
Epoch 123/200  
18/18 ————— 0s 8ms/step - accuracy: 0.7619 - loss: 0.4911 - val\_accuracy: 0.7500 - val\_loss: 0.5153  
Epoch 124/200  
18/18 ————— 0s 8ms/step - accuracy: 0.7740 - loss: 0.4897 - val\_accuracy: 0.7500 - val\_loss: 0.5148  
Epoch 125/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7777 - loss: 0.4971 - val\_accuracy: 0.7500 - val\_loss: 0.5143  
Epoch 126/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7806 - loss: 0.4952 - val\_accuracy: 0.7500 - val\_loss: 0.5138  
Epoch 127/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7692 - loss: 0.4841 - val\_accuracy: 0.7500 - val\_loss: 0.5134  
Epoch 128/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7485 - loss: 0.5155 - val\_accuracy: 0.7500 - val\_loss: 0.5129  
Epoch 129/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7727 - loss: 0.4707 - val\_accuracy: 0.7500 - val\_loss: 0.5124  
Epoch 130/200  
18/18 ————— 0s 8ms/step - accuracy: 0.7531 - loss: 0.4979 - val\_accuracy: 0.7500 - val\_loss: 0.5120  
Epoch 131/200  
18/18 ————— 0s 10ms/step - accuracy: 0.7831 - loss: 0.4875 - val\_accuracy: 0.7500 - val\_loss: 0.5116  
Epoch 132/200  
18/18 ————— 0s 10ms/step - accuracy: 0.7525 - loss: 0.4976 - val\_accuracy: 0.7500 - val\_loss: 0.5111  
Epoch 133/200  
18/18 ————— 0s 8ms/step - accuracy: 0.7680 - loss: 0.4883 - val\_accuracy: 0.7500 - val\_loss: 0.5107  
Epoch 134/200  
18/18 ————— 0s 7ms/step - accuracy: 0.7506 - loss: 0.5014 - val\_accuracy: 0.7500 - val\_loss: 0.5103  
Epoch 135/200  
18/18 ————— 0s 9ms/step - accuracy: 0.7889 - loss: 0.4774 - val\_accuracy: 0.7500 - val\_loss: 0.5099  
Epoch 136/200  
18/18 ————— 0s 10ms/step - accuracy: 0.7719 - loss: 0.4859 - val\_accuracy: 0.7500 - val\_loss: 0.5094  
Epoch 137/200  
18/18 ————— 0s 11ms/step - accuracy: 0.7601 - loss: 0.4946 - val\_accuracy: 0.7500 - val\_loss: 0.5090  
Epoch 138/200  
18/18 ————— 0s 11ms/step - accuracy: 0.7483 - loss: 0.5044 - val\_accuracy: 0.7500 - val\_loss: 0.5086  
Epoch 139/200  
18/18 ————— 0s 10ms/step - accuracy: 0.7463 - loss: 0.5148 - val\_accuracy: 0.7500 - val\_loss: 0.5082  
Epoch 140/200  
18/18 ————— 0s 10ms/step - accuracy: 0.7357 - loss: 0.5094 - val\_accuracy: 0.7552 - val\_loss: 0.5079


Epoch 141/200  
18/18  0s 10ms/step - accuracy: 0.7923 - loss: 0.4727 - val\_accuracy: 0.7552 - val\_loss: 0.5075


Epoch 142/200  
18/18  0s 9ms/step - accuracy: 0.7639 - loss: 0.4794 - val\_accuracy: 0.7552 - val\_loss: 0.5071


Epoch 143/200  
18/18  0s 5ms/step - accuracy: 0.7728 - loss: 0.4852 - val\_accuracy: 0.7604 - val\_loss: 0.5067


Epoch 144/200  
18/18  0s 6ms/step - accuracy: 0.7606 - loss: 0.5033 - val\_accuracy: 0.7604 - val\_loss: 0.5064


Epoch 145/200  
18/18  0s 6ms/step - accuracy: 0.7728 - loss: 0.4805 - val\_accuracy: 0.7604 - val\_loss: 0.5060


Epoch 146/200  
18/18  0s 6ms/step - accuracy: 0.7676 - loss: 0.4863 - val\_accuracy: 0.7604 - val\_loss: 0.5057


Epoch 147/200  
18/18  0s 5ms/step - accuracy: 0.7722 - loss: 0.4757 - val\_accuracy: 0.7604 - val\_loss: 0.5053


Epoch 148/200  
18/18  0s 7ms/step - accuracy: 0.7909 - loss: 0.4601 - val\_accuracy: 0.7604 - val\_loss: 0.5050


Epoch 149/200  
18/18  0s 6ms/step - accuracy: 0.7512 - loss: 0.4964 - val\_accuracy: 0.7604 - val\_loss: 0.5047


Epoch 150/200  
18/18  0s 6ms/step - accuracy: 0.7582 - loss: 0.4879 - val\_accuracy: 0.7604 - val\_loss: 0.5043


Epoch 151/200  
18/18  0s 5ms/step - accuracy: 0.7658 - loss: 0.4887 - val\_accuracy: 0.7604 - val\_loss: 0.5040


Epoch 152/200  
18/18  0s 6ms/step - accuracy: 0.7677 - loss: 0.4730 - val\_accuracy: 0.7604 - val\_loss: 0.5037


Epoch 153/200  
18/18  0s 6ms/step - accuracy: 0.7437 - loss: 0.5035 - val\_accuracy: 0.7604 - val\_loss: 0.5034


Epoch 154/200  
18/18  0s 6ms/step - accuracy: 0.7754 - loss: 0.4754 - val\_accuracy: 0.7604 - val\_loss: 0.5031


Epoch 155/200  
18/18  0s 9ms/step - accuracy: 0.7737 - loss: 0.4918 - val\_accuracy: 0.7604 - val\_loss: 0.5028


Epoch 156/200  
18/18  0s 5ms/step - accuracy: 0.7422 - loss: 0.4949 - val\_accuracy: 0.7604 - val\_loss: 0.5025


Epoch 157/200  
18/18  0s 8ms/step - accuracy: 0.7871 - loss: 0.4788 - val\_accuracy: 0.7604 - val\_loss: 0.5022


Epoch 158/200  
18/18  0s 5ms/step - accuracy: 0.7581 - loss: 0.5000 - val\_accuracy: 0.7604 - val\_loss: 0.5019

Epoch 159/200  
18/18  0s 6ms/step - accuracy: 0.7710 - loss: 0.4675 - val\_accuracy: 0.7604 - val\_loss: 0.5016

Epoch 160/200  
18/18  0s 6ms/step - accuracy: 0.7829 - loss: 0.4718 - val\_accuracy: 0.7552 - val\_loss: 0.5014

Epoch 161/200  
18/18  0s 7ms/step - accuracy: 0.7472 - loss: 0.5133 - val\_accuracy: 0.7552 - val\_loss: 0.5011

Epoch 162/200  
18/18  0s 6ms/step - accuracy: 0.7738 - loss: 0.4695 - val\_accuracy: 0.7552 - val\_loss: 0.5008

Epoch 163/200  
18/18  0s 6ms/step - accuracy: 0.7849 - loss: 0.4574 - val\_accuracy: 0.7552 - val\_loss: 0.5005

Epoch 164/200

18/18 ————— 0s 6ms/step - accuracy: 0.7544 - loss: 0.4853 - val\_accuracy: 0.7552 - val\_loss: 0.5003  
Epoch 165/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7591 - loss: 0.4960 - val\_accuracy: 0.7552 - val\_loss: 0.5000  
Epoch 166/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7903 - loss: 0.4767 - val\_accuracy: 0.7604 - val\_loss: 0.4998  
Epoch 167/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7772 - loss: 0.4730 - val\_accuracy: 0.7656 - val\_loss: 0.4995  
Epoch 168/200  
18/18 ————— 0s 8ms/step - accuracy: 0.7721 - loss: 0.4858 - val\_accuracy: 0.7656 - val\_loss: 0.4993  
Epoch 169/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7431 - loss: 0.5107 - val\_accuracy: 0.7656 - val\_loss: 0.4990  
Epoch 170/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7956 - loss: 0.4586 - val\_accuracy: 0.7656 - val\_loss: 0.4988  
Epoch 171/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7658 - loss: 0.4921 - val\_accuracy: 0.7656 - val\_loss: 0.4985  
Epoch 172/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7916 - loss: 0.4683 - val\_accuracy: 0.7656 - val\_loss: 0.4983  
Epoch 173/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7778 - loss: 0.4594 - val\_accuracy: 0.7656 - val\_loss: 0.4981  
Epoch 174/200  
18/18 ————— 0s 5ms/step - accuracy: 0.7974 - loss: 0.4502 - val\_accuracy: 0.7656 - val\_loss: 0.4978  
Epoch 175/200  
18/18 ————— 0s 9ms/step - accuracy: 0.7702 - loss: 0.4857 - val\_accuracy: 0.7656 - val\_loss: 0.4976  
Epoch 176/200  
18/18 ————— 0s 8ms/step - accuracy: 0.7675 - loss: 0.4737 - val\_accuracy: 0.7656 - val\_loss: 0.4974  
Epoch 177/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7738 - loss: 0.4813 - val\_accuracy: 0.7656 - val\_loss: 0.4972  
Epoch 178/200  
18/18 ————— 0s 5ms/step - accuracy: 0.7756 - loss: 0.4769 - val\_accuracy: 0.7656 - val\_loss: 0.4970  
Epoch 179/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7658 - loss: 0.4841 - val\_accuracy: 0.7656 - val\_loss: 0.4968  
Epoch 180/200  
18/18 ————— 0s 14ms/step - accuracy: 0.7829 - loss: 0.4619 - val\_accuracy: 0.7656 - val\_loss: 0.4965  
Epoch 181/200  
18/18 ————— 0s 5ms/step - accuracy: 0.8114 - loss: 0.4409 - val\_accuracy: 0.7656 - val\_loss: 0.4963  
Epoch 182/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7579 - loss: 0.4899 - val\_accuracy: 0.7656 - val\_loss: 0.4961  
Epoch 183/200  
18/18 ————— 0s 8ms/step - accuracy: 0.7883 - loss: 0.4435 - val\_accuracy: 0.7656 - val\_loss: 0.4959  
Epoch 184/200  
18/18 ————— 0s 6ms/step - accuracy: 0.7540 - loss: 0.4908 - val\_accuracy: 0.7604 - val\_loss: 0.4957  
Epoch 185/200  
18/18 ————— 0s 8ms/step - accuracy: 0.7769 - loss: 0.4609 - val\_accuracy: 0.7604 - val\_loss: 0.4955  
Epoch 186/200  
18/18 ————— 0s 7ms/step - accuracy: 0.7637 - loss: 0.4791 - val\_accuracy: 0.7604 - val\_loss: 0.4954  
Epoch 187/200  
18/18 ————— 0s 6ms/step - accuracy: 0.8011 - loss: 0.4398 - val\_accuracy: 0.7604 - val\_loss:

```

0.4952
Epoch 188/200
18/18 ————— 0s 6ms/step - accuracy: 0.8077 - loss: 0.4399 - val_accuracy: 0.7604 - val_loss: 0.4950
Epoch 189/200
18/18 ————— 0s 6ms/step - accuracy: 0.7729 - loss: 0.4819 - val_accuracy: 0.7604 - val_loss: 0.4948
Epoch 190/200
18/18 ————— 0s 6ms/step - accuracy: 0.7845 - loss: 0.4618 - val_accuracy: 0.7604 - val_loss: 0.4946
Epoch 191/200
18/18 ————— 0s 8ms/step - accuracy: 0.8033 - loss: 0.4568 - val_accuracy: 0.7604 - val_loss: 0.4944
Epoch 192/200
18/18 ————— 0s 8ms/step - accuracy: 0.7526 - loss: 0.4955 - val_accuracy: 0.7604 - val_loss: 0.4942
Epoch 193/200
18/18 ————— 0s 7ms/step - accuracy: 0.7773 - loss: 0.4586 - val_accuracy: 0.7604 - val_loss: 0.4940
Epoch 194/200
18/18 ————— 0s 6ms/step - accuracy: 0.7830 - loss: 0.4702 - val_accuracy: 0.7604 - val_loss: 0.4939
Epoch 195/200
18/18 ————— 0s 6ms/step - accuracy: 0.7663 - loss: 0.4823 - val_accuracy: 0.7604 - val_loss: 0.4937
Epoch 196/200
18/18 ————— 0s 6ms/step - accuracy: 0.7960 - loss: 0.4553 - val_accuracy: 0.7604 - val_loss: 0.4935
Epoch 197/200
18/18 ————— 0s 6ms/step - accuracy: 0.7635 - loss: 0.4860 - val_accuracy: 0.7604 - val_loss: 0.4934
Epoch 198/200
18/18 ————— 0s 5ms/step - accuracy: 0.7660 - loss: 0.4802 - val_accuracy: 0.7604 - val_loss: 0.4932
Epoch 199/200
18/18 ————— 0s 7ms/step - accuracy: 0.7670 - loss: 0.4571 - val_accuracy: 0.7604 - val_loss: 0.4930
Epoch 200/200
18/18 ————— 0s 5ms/step - accuracy: 0.7968 - loss: 0.4493 - val_accuracy: 0.7604 - val_loss: 0.4929

```

```

In [ ]: predict_x = model.predict(X_test_norm)
        classes_x = np.argmax(predict_x, axis=1)

```

```

6/6 ————— 0s 5ms/step

```

```

In [ ]: ## Like we did for the Random Forest, we generate two kinds of predictions
        # One is a hard decision, the other is a probabilistic score.

        y_pred_prob_nn_1 = model.predict(X_test_norm) # Get prediction probabilities
        y_pred_class_nn_1 = (y_pred_prob_nn_1 > 0.5).astype(int) # Convert probabilities to class predictions (0 or

```

```

6/6 ————— 0s 5ms/step

```

```

In [ ]: # Let's check out the outputs to get a feel for how keras apis work.
        y_pred_class_nn_1[:10]

```

```

Out[ ]: array([[1],
               [1],
               [0],
               [0],
               [0],
               [1],
               [0],
               [0],
               [1],
               [0]])

```

```

In [ ]: y_pred_prob_nn_1[:10]

```

```
Out[ ]: array([[0.5543312 ],
               [0.6622211 ],
               [0.29766244],
               [0.29785973],
               [0.15071392],
               [0.5545716 ],
               [0.12527676],
               [0.3993809 ],
               [0.81022954],
               [0.22050647]], dtype=float32)
```

Create the plot\_roc function

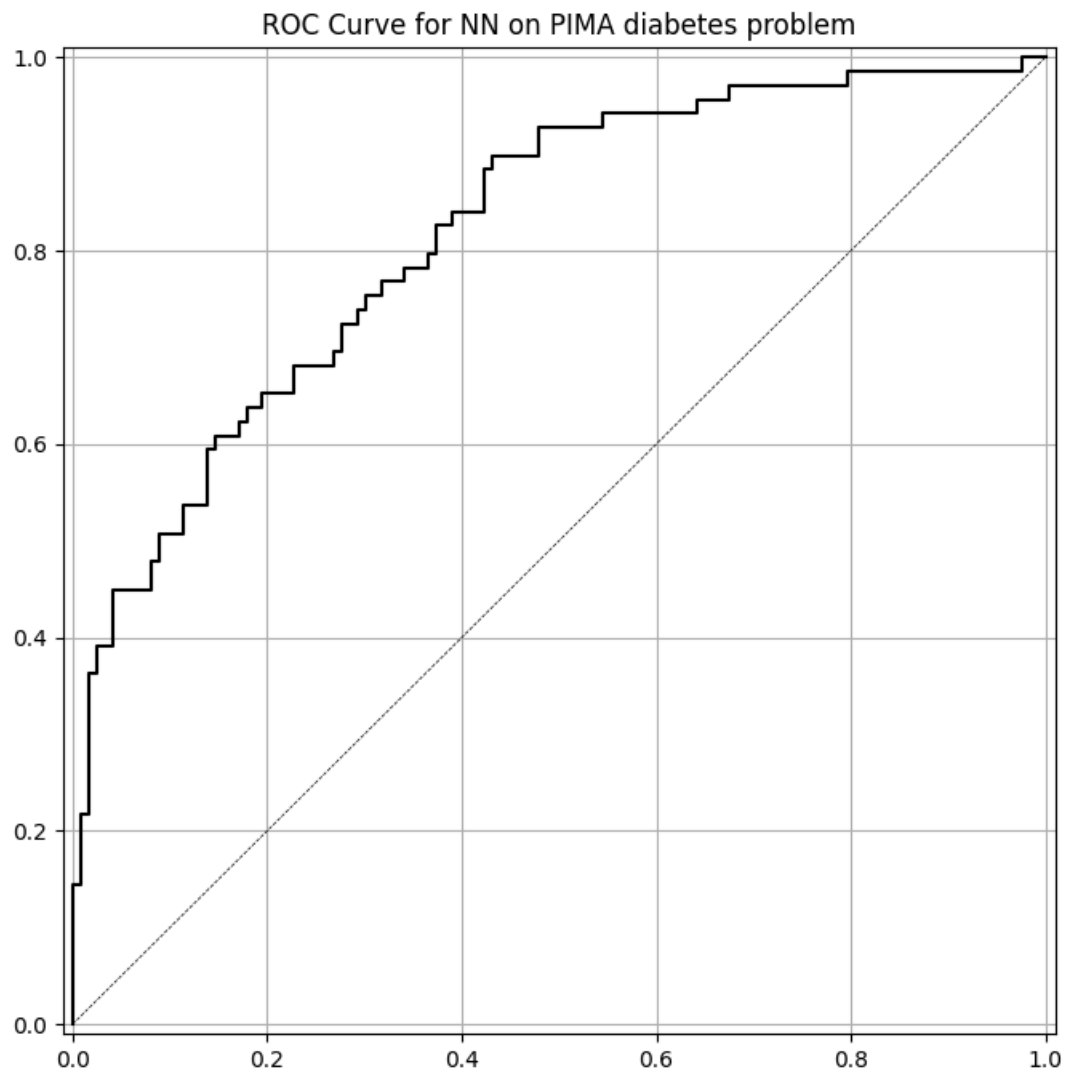
```
In [ ]: def plot_roc(y_test, y_pred, model_name):
        fpr, tpr, thr = roc_curve(y_test, y_pred)
        fig, ax = plt.subplots(figsize=(8, 8))
        ax.plot(fpr, tpr, 'k-')
        ax.plot([0, 1], [0, 1], 'k--', linewidth=.5) # roc curve for random model
        ax.grid(True)
        ax.set(title='ROC Curve for {} on PIMA diabetes problem'.format(model_name),
              xlim=[-0.01, 1.01], ylim=[-0.01, 1.01])
```

Evaluate the model performance and plot the ROC CURVE

```
In [ ]: print('accuracy is {:.3f}'.format(accuracy_score(y_test,y_pred_class_nn_1)))
        print('roc-auc is {:.3f}'.format(roc_auc_score(y_test,y_pred_prob_nn_1)))

        plot_roc(y_test, y_pred_prob_nn_1, 'NN')
```

```
accuracy is 0.760
roc-auc is 0.818
```



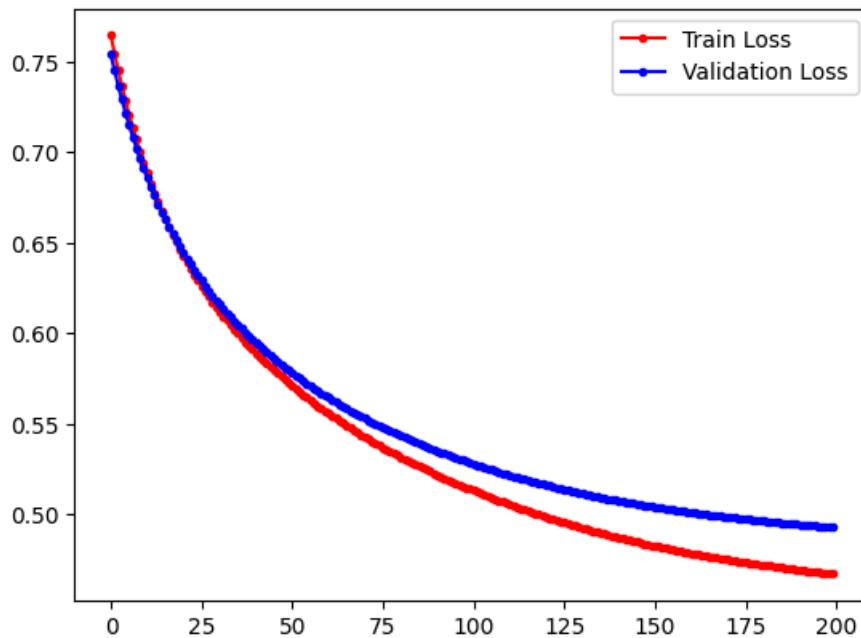
Plot the training loss and the validation loss over the different epochs and see how it looks

```
In [ ]: run_hist_1.history.keys()
```

```
Out[ ]: dict_keys(['accuracy', 'loss', 'val_accuracy', 'val_loss'])
```

```
In [ ]: fig, ax = plt.subplots()
ax.plot(run_hist_1.history["loss"], 'r', marker='.', label="Train Loss")
ax.plot(run_hist_1.history["val_loss"], 'b', marker='.', label="Validation Loss")
ax.legend()
```

```
Out[ ]: <matplotlib.legend.Legend at 0x79b5ea8a0990>
```



What is your interpretation about the result of the train and validation loss?

In this activity we train a neural network model for binary classification using Pima Indians Diabetes dataset. During the training, both validation and training loss decreases which indicates that the model is learning and improving its ability to predict the target variable. We can also notice that after a certain number of epoch, the validation loss start to slightly increase, while the training loss continuous to decrease. This could be sign of overfitting which the model is too complex and learns the training to well including the noise and fluctuations which lead to poor generalization of data.

### Supplementary Activity

- Build a model with two hidden layers, each with 6 nodes
- Use the "relu" activation function for the hidden layers, and "sigmoid" for the final layer
- Use a learning rate of .003 and train for 1500 epochs
- Graph the trajectory of the loss functions, accuracy on both train and test set
- Plot the roc curve for the predictions
- Use different learning rates, numbers of epochs, and network structures.
- Plot the results of training and validation loss using different learning rates, number of epochs and network structures
- Interpret your result

```
In [ ]: # import the necessary libraries and file

from keras.models import Sequential
from keras.layers import Input, Dense, Flatten, Dropout, BatchNormalization
from keras.optimizers import Adam, SGD, RMSprop

filepath = "/content/pima-indians-diabetes (1).csv"
names = ["times_pregnant", "glucose_tolerance_test", "blood_pressure", "skin_thickness", "insulin",
         "bmi", "pedigree_function", "age", "has_diabetes"]

X = diabetes_df.iloc[:, :-1].values
y = diabetes_df["has_diabetes"].values

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=11111)
```

```
In [ ]: # Normalize the data
normalizer = StandardScaler()
```

```
X_train_norm = normalizer.fit_transform(X_train)
X_test_norm = normalizer.transform(X_test)
```

```
In [ ]: #Build a model with two hidden Layers, each with 6 nodes
#Use the "relu" activation function for the hidden layers, and "sigmoid" for the final layer
model = Sequential([
    Dense(6, input_shape=(8,), activation="relu"),
    Dense(6, activation="relu"),
    Dense(1, activation="sigmoid")
])
```

```
/usr/local/lib/python3.11/dist-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)
```

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

Model: "sequential\_1"

Layer (type)	Output Shape	Param #
dense_2 (Dense)	(None, 6)	54
dense_3 (Dense)	(None, 6)	42
dense_4 (Dense)	(None, 1)	7


Total params: 103 (412.00 B)


Trainable params: 103 (412.00 B)


Non-trainable params: 0 (0.00 B)


```
In [ ]: #Use a Learning rate of .003 and train for 1500 epochs
model.compile(SGD(learning_rate = .003), "binary_crossentropy", metrics=["accuracy"])
history = model.fit(X_train_norm, y_train, validation_data=(X_test_norm, y_test), epochs=1500)
```





Epoch 1/1500  
18/18  1s 16ms/step - accuracy: 0.3649 - loss: 0.7895 - val\_accuracy: 0.3958 - val\_loss: 0.7600


Epoch 2/1500  
18/18  0s 6ms/step - accuracy: 0.3983 - loss: 0.7790 - val\_accuracy: 0.3906 - val\_loss: 0.7505


Epoch 3/1500  
18/18  0s 5ms/step - accuracy: 0.3746 - loss: 0.7585 - val\_accuracy: 0.3958 - val\_loss: 0.7421


Epoch 4/1500  
18/18  0s 5ms/step - accuracy: 0.4287 - loss: 0.7531 - val\_accuracy: 0.4115 - val\_loss: 0.7345


Epoch 5/1500  
18/18  0s 6ms/step - accuracy: 0.4280 - loss: 0.7397 - val\_accuracy: 0.4219 - val\_loss: 0.7277


Epoch 6/1500  
18/18  0s 8ms/step - accuracy: 0.4859 - loss: 0.7434 - val\_accuracy: 0.4583 - val\_loss: 0.7215


Epoch 7/1500  
18/18  0s 5ms/step - accuracy: 0.4434 - loss: 0.7273 - val\_accuracy: 0.4635 - val\_loss: 0.7159


Epoch 8/1500  
18/18  0s 5ms/step - accuracy: 0.4474 - loss: 0.7308 - val\_accuracy: 0.4740 - val\_loss: 0.7109


Epoch 9/1500  
18/18  0s 6ms/step - accuracy: 0.4728 - loss: 0.7193 - val\_accuracy: 0.4896 - val\_loss: 0.7063


Epoch 10/1500  
18/18  0s 8ms/step - accuracy: 0.4851 - loss: 0.7137 - val\_accuracy: 0.5156 - val\_loss: 0.7021


Epoch 11/1500  
18/18  0s 6ms/step - accuracy: 0.5113 - loss: 0.7135 - val\_accuracy: 0.5260 - val\_loss: 0.6983


Epoch 12/1500  
18/18  0s 6ms/step - accuracy: 0.5241 - loss: 0.7009 - val\_accuracy: 0.5312 - val\_loss: 0.6948


Epoch 13/1500  
18/18  0s 8ms/step - accuracy: 0.5010 - loss: 0.7038 - val\_accuracy: 0.5417 - val\_loss: 0.6916


Epoch 14/1500  
18/18  0s 6ms/step - accuracy: 0.5515 - loss: 0.6969 - val\_accuracy: 0.5573 - val\_loss: 0.6887


Epoch 15/1500  
18/18  0s 7ms/step - accuracy: 0.5631 - loss: 0.6907 - val\_accuracy: 0.5573 - val\_loss: 0.6861


Epoch 16/1500  
18/18  0s 7ms/step - accuracy: 0.5730 - loss: 0.6881 - val\_accuracy: 0.5521 - val\_loss: 0.6837


Epoch 17/1500  
18/18  0s 6ms/step - accuracy: 0.5853 - loss: 0.6843 - val\_accuracy: 0.5833 - val\_loss: 0.6815


Epoch 18/1500  
18/18  0s 5ms/step - accuracy: 0.5863 - loss: 0.6843 - val\_accuracy: 0.5938 - val\_loss: 0.6793

Epoch 19/1500  
18/18  0s 8ms/step - accuracy: 0.6014 - loss: 0.6794 - val\_accuracy: 0.5938 - val\_loss: 0.6774

Epoch 20/1500  
18/18  0s 6ms/step - accuracy: 0.6411 - loss: 0.6745 - val\_accuracy: 0.6094 - val\_loss: 0.6757

Epoch 21/1500  
18/18  0s 6ms/step - accuracy: 0.6123 - loss: 0.6793 - val\_accuracy: 0.6302 - val\_loss: 0.6742


Epoch 22/1500  
18/18  0s 6ms/step - accuracy: 0.6435 - loss: 0.6735 - val\_accuracy: 0.6406 - val\_loss: 0.6728


Epoch 23/1500  
18/18  0s 5ms/step - accuracy: 0.6734 - loss: 0.6628 - val\_accuracy: 0.6354 - val\_loss: 0.6715


Epoch 24/1500


18/18 ————— 0s 6ms/step - accuracy: 0.6432 - loss: 0.6713 - val\_accuracy: 0.6406 - val\_loss: 0.6703  
Epoch 25/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.6563 - loss: 0.6668 - val\_accuracy: 0.6354 - val\_loss: 0.6691  
Epoch 26/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6674 - loss: 0.6644 - val\_accuracy: 0.6354 - val\_loss: 0.6681  
Epoch 27/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.6288 - loss: 0.6701 - val\_accuracy: 0.6354 - val\_loss: 0.6671  
Epoch 28/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6567 - loss: 0.6647 - val\_accuracy: 0.6354 - val\_loss: 0.6661  
Epoch 29/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.6344 - loss: 0.6682 - val\_accuracy: 0.6406 - val\_loss: 0.6652  
Epoch 30/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.6431 - loss: 0.6641 - val\_accuracy: 0.6406 - val\_loss: 0.6643  
Epoch 31/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.6439 - loss: 0.6638 - val\_accuracy: 0.6406 - val\_loss: 0.6634  
Epoch 32/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.6821 - loss: 0.6533 - val\_accuracy: 0.6406 - val\_loss: 0.6626  
Epoch 33/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.6588 - loss: 0.6560 - val\_accuracy: 0.6458 - val\_loss: 0.6619  
Epoch 34/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.5930 - loss: 0.6755 - val\_accuracy: 0.6458 - val\_loss: 0.6612  
Epoch 35/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.6504 - loss: 0.6576 - val\_accuracy: 0.6458 - val\_loss: 0.6605  
Epoch 36/1500  
18/18 ————— 0s 5ms/step - accuracy: 0.6458 - loss: 0.6572 - val\_accuracy: 0.6458 - val\_loss: 0.6599  
Epoch 37/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6583 - loss: 0.6546 - val\_accuracy: 0.6458 - val\_loss: 0.6593  
Epoch 38/1500  
18/18 ————— 0s 5ms/step - accuracy: 0.6512 - loss: 0.6554 - val\_accuracy: 0.6458 - val\_loss: 0.6587  
Epoch 39/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6447 - loss: 0.6563 - val\_accuracy: 0.6458 - val\_loss: 0.6581  
Epoch 40/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6756 - loss: 0.6485 - val\_accuracy: 0.6458 - val\_loss: 0.6575  
Epoch 41/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6306 - loss: 0.6608 - val\_accuracy: 0.6458 - val\_loss: 0.6570  
Epoch 42/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6638 - loss: 0.6485 - val\_accuracy: 0.6458 - val\_loss: 0.6565  
Epoch 43/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6402 - loss: 0.6558 - val\_accuracy: 0.6458 - val\_loss: 0.6559  
Epoch 44/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.6474 - loss: 0.6538 - val\_accuracy: 0.6458 - val\_loss: 0.6554  
Epoch 45/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6486 - loss: 0.6551 - val\_accuracy: 0.6458 - val\_loss: 0.6550  
Epoch 46/1500  
18/18 ————— 0s 5ms/step - accuracy: 0.6713 - loss: 0.6463 - val\_accuracy: 0.6458 - val\_loss: 0.6545  
Epoch 47/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.6704 - loss: 0.6469 - val\_accuracy: 0.6458 - val\_loss:


0.6540  
Epoch 48/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6477 - loss: 0.6517 - val\_accuracy: 0.6458 - val\_loss: 0.6536  
Epoch 49/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6768 - loss: 0.6444 - val\_accuracy: 0.6458 - val\_loss: 0.6532  
Epoch 50/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7004 - loss: 0.6324 - val\_accuracy: 0.6458 - val\_loss: 0.6527  
Epoch 51/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6610 - loss: 0.6455 - val\_accuracy: 0.6458 - val\_loss: 0.6523  
Epoch 52/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6629 - loss: 0.6427 - val\_accuracy: 0.6458 - val\_loss: 0.6519  
Epoch 53/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6533 - loss: 0.6485 - val\_accuracy: 0.6458 - val\_loss: 0.6515  
Epoch 54/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6795 - loss: 0.6394 - val\_accuracy: 0.6458 - val\_loss: 0.6512  
Epoch 55/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6390 - loss: 0.6526 - val\_accuracy: 0.6458 - val\_loss: 0.6508  
Epoch 56/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6397 - loss: 0.6510 - val\_accuracy: 0.6458 - val\_loss: 0.6504  
Epoch 57/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6661 - loss: 0.6414 - val\_accuracy: 0.6458 - val\_loss: 0.6500  
Epoch 58/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6682 - loss: 0.6419 - val\_accuracy: 0.6458 - val\_loss: 0.6496  
Epoch 59/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6167 - loss: 0.6567 - val\_accuracy: 0.6458 - val\_loss: 0.6493  
Epoch 60/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6334 - loss: 0.6533 - val\_accuracy: 0.6458 - val\_loss: 0.6489  
Epoch 61/1500  
18/18 ————— 0s 5ms/step - accuracy: 0.6545 - loss: 0.6425 - val\_accuracy: 0.6458 - val\_loss: 0.6486  
Epoch 62/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6690 - loss: 0.6381 - val\_accuracy: 0.6458 - val\_loss: 0.6482  
Epoch 63/1500  
18/18 ————— 0s 5ms/step - accuracy: 0.6498 - loss: 0.6453 - val\_accuracy: 0.6458 - val\_loss: 0.6478  
Epoch 64/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6586 - loss: 0.6420 - val\_accuracy: 0.6458 - val\_loss: 0.6475  
Epoch 65/1500  
18/18 ————— 0s 5ms/step - accuracy: 0.6377 - loss: 0.6481 - val\_accuracy: 0.6458 - val\_loss: 0.6471  
Epoch 66/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6569 - loss: 0.6403 - val\_accuracy: 0.6458 - val\_loss: 0.6467  
Epoch 67/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6566 - loss: 0.6413 - val\_accuracy: 0.6458 - val\_loss: 0.6464  
Epoch 68/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6638 - loss: 0.6379 - val\_accuracy: 0.6458 - val\_loss: 0.6460  
Epoch 69/1500  
18/18 ————— 0s 5ms/step - accuracy: 0.6793 - loss: 0.6298 - val\_accuracy: 0.6458 - val\_loss: 0.6457  
Epoch 70/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6507 - loss: 0.6439 - val\_accuracy: 0.6458 - val\_loss: 0.6453


Epoch 71/1500  
18/18  0s 5ms/step - accuracy: 0.6489 - loss: 0.6423 - val\_accuracy: 0.6458 - val\_loss: 0.6450


Epoch 72/1500  
18/18  0s 5ms/step - accuracy: 0.6297 - loss: 0.6511 - val\_accuracy: 0.6458 - val\_loss: 0.6447


Epoch 73/1500  
18/18  0s 8ms/step - accuracy: 0.6697 - loss: 0.6323 - val\_accuracy: 0.6458 - val\_loss: 0.6443


Epoch 74/1500  
18/18  0s 6ms/step - accuracy: 0.6801 - loss: 0.6282 - val\_accuracy: 0.6458 - val\_loss: 0.6440


Epoch 75/1500  
18/18  0s 6ms/step - accuracy: 0.6888 - loss: 0.6229 - val\_accuracy: 0.6458 - val\_loss: 0.6436


Epoch 76/1500  
18/18  0s 6ms/step - accuracy: 0.6416 - loss: 0.6416 - val\_accuracy: 0.6458 - val\_loss: 0.6433


Epoch 77/1500  
18/18  0s 5ms/step - accuracy: 0.6795 - loss: 0.6271 - val\_accuracy: 0.6458 - val\_loss: 0.6429


Epoch 78/1500  
18/18  0s 5ms/step - accuracy: 0.6535 - loss: 0.6380 - val\_accuracy: 0.6458 - val\_loss: 0.6426


Epoch 79/1500  
18/18  0s 6ms/step - accuracy: 0.6568 - loss: 0.6344 - val\_accuracy: 0.6458 - val\_loss: 0.6422


Epoch 80/1500  
18/18  0s 5ms/step - accuracy: 0.6592 - loss: 0.6345 - val\_accuracy: 0.6458 - val\_loss: 0.6419


Epoch 81/1500  
18/18  0s 21ms/step - accuracy: 0.6800 - loss: 0.6266 - val\_accuracy: 0.6458 - val\_loss: 0.6416


Epoch 82/1500  
18/18  0s 8ms/step - accuracy: 0.6355 - loss: 0.6471 - val\_accuracy: 0.6458 - val\_loss: 0.6412


Epoch 83/1500  
18/18  0s 13ms/step - accuracy: 0.6380 - loss: 0.6426 - val\_accuracy: 0.6458 - val\_loss: 0.6409


Epoch 84/1500  
18/18  0s 12ms/step - accuracy: 0.6612 - loss: 0.6327 - val\_accuracy: 0.6458 - val\_loss: 0.6405


Epoch 85/1500  
18/18  0s 6ms/step - accuracy: 0.6263 - loss: 0.6449 - val\_accuracy: 0.6458 - val\_loss: 0.6402


Epoch 86/1500  
18/18  0s 6ms/step - accuracy: 0.6558 - loss: 0.6339 - val\_accuracy: 0.6458 - val\_loss: 0.6398


Epoch 87/1500  
18/18  0s 6ms/step - accuracy: 0.6528 - loss: 0.6334 - val\_accuracy: 0.6458 - val\_loss: 0.6395


Epoch 88/1500  
18/18  0s 8ms/step - accuracy: 0.6615 - loss: 0.6297 - val\_accuracy: 0.6458 - val\_loss: 0.6391

Epoch 89/1500  
18/18  0s 5ms/step - accuracy: 0.6476 - loss: 0.6377 - val\_accuracy: 0.6458 - val\_loss: 0.6388

Epoch 90/1500  
18/18  0s 5ms/step - accuracy: 0.6394 - loss: 0.6384 - val\_accuracy: 0.6458 - val\_loss: 0.6384

Epoch 91/1500  
18/18  0s 8ms/step - accuracy: 0.6389 - loss: 0.6385 - val\_accuracy: 0.6458 - val\_loss: 0.6381


Epoch 92/1500  
18/18  0s 8ms/step - accuracy: 0.6478 - loss: 0.6343 - val\_accuracy: 0.6458 - val\_loss: 0.6377


Epoch 93/1500  
18/18  0s 11ms/step - accuracy: 0.6636 - loss: 0.6276 - val\_accuracy: 0.6458 - val\_loss: 0.6373


Epoch 94/1500


18/18 ————— 0s 10ms/step - accuracy: 0.6402 - loss: 0.6354 - val\_accuracy: 0.6458 - val\_loss: 0.6369  
Epoch 95/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.6581 - loss: 0.6282 - val\_accuracy: 0.6458 - val\_loss: 0.6365  
Epoch 96/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.6526 - loss: 0.6292 - val\_accuracy: 0.6406 - val\_loss: 0.6362  
Epoch 97/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.6348 - loss: 0.6388 - val\_accuracy: 0.6406 - val\_loss: 0.6358  
Epoch 98/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6338 - loss: 0.6372 - val\_accuracy: 0.6406 - val\_loss: 0.6354  
Epoch 99/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.6624 - loss: 0.6237 - val\_accuracy: 0.6406 - val\_loss: 0.6350  
Epoch 100/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6370 - loss: 0.6405 - val\_accuracy: 0.6406 - val\_loss: 0.6346  
Epoch 101/1500  
18/18 ————— 0s 5ms/step - accuracy: 0.6706 - loss: 0.6187 - val\_accuracy: 0.6406 - val\_loss: 0.6342  
Epoch 102/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6529 - loss: 0.6249 - val\_accuracy: 0.6406 - val\_loss: 0.6338  
Epoch 103/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6788 - loss: 0.6123 - val\_accuracy: 0.6406 - val\_loss: 0.6334  
Epoch 104/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6522 - loss: 0.6267 - val\_accuracy: 0.6406 - val\_loss: 0.6330  
Epoch 105/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6470 - loss: 0.6276 - val\_accuracy: 0.6406 - val\_loss: 0.6326  
Epoch 106/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6703 - loss: 0.6192 - val\_accuracy: 0.6406 - val\_loss: 0.6321  
Epoch 107/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6548 - loss: 0.6229 - val\_accuracy: 0.6406 - val\_loss: 0.6317  
Epoch 108/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.6545 - loss: 0.6256 - val\_accuracy: 0.6406 - val\_loss: 0.6313  
Epoch 109/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6662 - loss: 0.6164 - val\_accuracy: 0.6406 - val\_loss: 0.6309  
Epoch 110/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6708 - loss: 0.6111 - val\_accuracy: 0.6406 - val\_loss: 0.6304  
Epoch 111/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6569 - loss: 0.6183 - val\_accuracy: 0.6406 - val\_loss: 0.6300  
Epoch 112/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6476 - loss: 0.6256 - val\_accuracy: 0.6406 - val\_loss: 0.6296  
Epoch 113/1500  
18/18 ————— 0s 5ms/step - accuracy: 0.6867 - loss: 0.6088 - val\_accuracy: 0.6406 - val\_loss: 0.6292  
Epoch 114/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6612 - loss: 0.6174 - val\_accuracy: 0.6406 - val\_loss: 0.6287  
Epoch 115/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6761 - loss: 0.6086 - val\_accuracy: 0.6406 - val\_loss: 0.6283  
Epoch 116/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6641 - loss: 0.6169 - val\_accuracy: 0.6406 - val\_loss: 0.6278  
Epoch 117/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6369 - loss: 0.6279 - val\_accuracy: 0.6406 - val\_loss:


0.6274  
Epoch 118/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6575 - loss: 0.6175 - val\_accuracy: 0.6406 - val\_loss: 0.6269  
Epoch 119/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6101 - loss: 0.6440 - val\_accuracy: 0.6406 - val\_loss: 0.6265  
Epoch 120/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6433 - loss: 0.6247 - val\_accuracy: 0.6406 - val\_loss: 0.6260  
Epoch 121/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.6668 - loss: 0.6104 - val\_accuracy: 0.6406 - val\_loss: 0.6256  
Epoch 122/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6451 - loss: 0.6199 - val\_accuracy: 0.6406 - val\_loss: 0.6251  
Epoch 123/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6591 - loss: 0.6194 - val\_accuracy: 0.6406 - val\_loss: 0.6247  
Epoch 124/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6386 - loss: 0.6259 - val\_accuracy: 0.6406 - val\_loss: 0.6242  
Epoch 125/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6287 - loss: 0.6264 - val\_accuracy: 0.6406 - val\_loss: 0.6237  
Epoch 126/1500  
18/18 ————— 0s 5ms/step - accuracy: 0.6484 - loss: 0.6143 - val\_accuracy: 0.6406 - val\_loss: 0.6233  
Epoch 127/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6376 - loss: 0.6259 - val\_accuracy: 0.6406 - val\_loss: 0.6228  
Epoch 128/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6479 - loss: 0.6197 - val\_accuracy: 0.6406 - val\_loss: 0.6223  
Epoch 129/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6398 - loss: 0.6231 - val\_accuracy: 0.6406 - val\_loss: 0.6218  
Epoch 130/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6362 - loss: 0.6232 - val\_accuracy: 0.6406 - val\_loss: 0.6213  
Epoch 131/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6906 - loss: 0.5907 - val\_accuracy: 0.6406 - val\_loss: 0.6208  
Epoch 132/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6364 - loss: 0.6231 - val\_accuracy: 0.6406 - val\_loss: 0.6203  
Epoch 133/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.6883 - loss: 0.5962 - val\_accuracy: 0.6406 - val\_loss: 0.6198  
Epoch 134/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6267 - loss: 0.6279 - val\_accuracy: 0.6406 - val\_loss: 0.6192  
Epoch 135/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6659 - loss: 0.6021 - val\_accuracy: 0.6406 - val\_loss: 0.6187  
Epoch 136/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6371 - loss: 0.6142 - val\_accuracy: 0.6406 - val\_loss: 0.6181  
Epoch 137/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6472 - loss: 0.6166 - val\_accuracy: 0.6406 - val\_loss: 0.6176  
Epoch 138/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6781 - loss: 0.5982 - val\_accuracy: 0.6406 - val\_loss: 0.6170  
Epoch 139/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6739 - loss: 0.6044 - val\_accuracy: 0.6406 - val\_loss: 0.6164  
Epoch 140/1500  
18/18 ————— 0s 5ms/step - accuracy: 0.6705 - loss: 0.6018 - val\_accuracy: 0.6406 - val\_loss: 0.6158


Epoch 141/1500  
18/18  0s 8ms/step - accuracy: 0.6525 - loss: 0.6105 - val\_accuracy: 0.6406 - val\_loss: 0.6151


Epoch 142/1500  
18/18  0s 5ms/step - accuracy: 0.6699 - loss: 0.5970 - val\_accuracy: 0.6406 - val\_loss: 0.6144


Epoch 143/1500  
18/18  0s 8ms/step - accuracy: 0.6660 - loss: 0.5975 - val\_accuracy: 0.6406 - val\_loss: 0.6137


Epoch 144/1500  
18/18  0s 6ms/step - accuracy: 0.6257 - loss: 0.6206 - val\_accuracy: 0.6406 - val\_loss: 0.6130


Epoch 145/1500  
18/18  0s 9ms/step - accuracy: 0.6592 - loss: 0.6005 - val\_accuracy: 0.6406 - val\_loss: 0.6123


Epoch 146/1500  
18/18  0s 5ms/step - accuracy: 0.6552 - loss: 0.5998 - val\_accuracy: 0.6406 - val\_loss: 0.6116


Epoch 147/1500  
18/18  0s 6ms/step - accuracy: 0.6446 - loss: 0.6060 - val\_accuracy: 0.6406 - val\_loss: 0.6109


Epoch 148/1500  
18/18  0s 6ms/step - accuracy: 0.6449 - loss: 0.6066 - val\_accuracy: 0.6406 - val\_loss: 0.6102


Epoch 149/1500  
18/18  0s 8ms/step - accuracy: 0.6501 - loss: 0.6007 - val\_accuracy: 0.6406 - val\_loss: 0.6095


Epoch 150/1500  
18/18  0s 6ms/step - accuracy: 0.6257 - loss: 0.6172 - val\_accuracy: 0.6406 - val\_loss: 0.6088


Epoch 151/1500  
18/18  0s 6ms/step - accuracy: 0.6816 - loss: 0.5865 - val\_accuracy: 0.6406 - val\_loss: 0.6081


Epoch 152/1500  
18/18  0s 8ms/step - accuracy: 0.6833 - loss: 0.5829 - val\_accuracy: 0.6406 - val\_loss: 0.6074


Epoch 153/1500  
18/18  0s 7ms/step - accuracy: 0.6527 - loss: 0.5962 - val\_accuracy: 0.6406 - val\_loss: 0.6067


Epoch 154/1500  
18/18  0s 6ms/step - accuracy: 0.6449 - loss: 0.5992 - val\_accuracy: 0.6406 - val\_loss: 0.6060


Epoch 155/1500  
18/18  0s 6ms/step - accuracy: 0.6588 - loss: 0.5892 - val\_accuracy: 0.6406 - val\_loss: 0.6053


Epoch 156/1500  
18/18  0s 6ms/step - accuracy: 0.6826 - loss: 0.5832 - val\_accuracy: 0.6406 - val\_loss: 0.6046


Epoch 157/1500  
18/18  0s 9ms/step - accuracy: 0.6577 - loss: 0.5965 - val\_accuracy: 0.6406 - val\_loss: 0.6039


Epoch 158/1500  
18/18  0s 9ms/step - accuracy: 0.6526 - loss: 0.6000 - val\_accuracy: 0.6406 - val\_loss: 0.6032

Epoch 159/1500  
18/18  0s 9ms/step - accuracy: 0.6486 - loss: 0.5977 - val\_accuracy: 0.6406 - val\_loss: 0.6025

Epoch 160/1500  
18/18  0s 9ms/step - accuracy: 0.6152 - loss: 0.6126 - val\_accuracy: 0.6406 - val\_loss: 0.6017

Epoch 161/1500  
18/18  0s 10ms/step - accuracy: 0.6370 - loss: 0.6038 - val\_accuracy: 0.6406 - val\_loss: 0.6010

Epoch 162/1500  
18/18  0s 11ms/step - accuracy: 0.6630 - loss: 0.5892 - val\_accuracy: 0.6406 - val\_loss: 0.6003

Epoch 163/1500  
18/18  0s 10ms/step - accuracy: 0.6321 - loss: 0.6016 - val\_accuracy: 0.6406 - val\_loss: 0.5995

Epoch 164/1500

18/18 ————— 0s 11ms/step - accuracy: 0.6679 - loss: 0.5782 - val\_accuracy: 0.6406 - val\_loss: 0.5988  
Epoch 165/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.6572 - loss: 0.5932 - val\_accuracy: 0.6406 - val\_loss: 0.5981  
Epoch 166/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.6340 - loss: 0.5969 - val\_accuracy: 0.6406 - val\_loss: 0.5973  
Epoch 167/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.6510 - loss: 0.5929 - val\_accuracy: 0.6406 - val\_loss: 0.5966  
Epoch 168/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6684 - loss: 0.5839 - val\_accuracy: 0.6406 - val\_loss: 0.5959  
Epoch 169/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6724 - loss: 0.5835 - val\_accuracy: 0.6406 - val\_loss: 0.5951  
Epoch 170/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6349 - loss: 0.5988 - val\_accuracy: 0.6406 - val\_loss: 0.5944  
Epoch 171/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6761 - loss: 0.5812 - val\_accuracy: 0.6406 - val\_loss: 0.5936  
Epoch 172/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6599 - loss: 0.5844 - val\_accuracy: 0.6406 - val\_loss: 0.5929  
Epoch 173/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.6525 - loss: 0.5864 - val\_accuracy: 0.6458 - val\_loss: 0.5921  
Epoch 174/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6794 - loss: 0.5766 - val\_accuracy: 0.6458 - val\_loss: 0.5914  
Epoch 175/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6329 - loss: 0.5953 - val\_accuracy: 0.6458 - val\_loss: 0.5906  
Epoch 176/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6459 - loss: 0.5858 - val\_accuracy: 0.6458 - val\_loss: 0.5899  
Epoch 177/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6807 - loss: 0.5747 - val\_accuracy: 0.6458 - val\_loss: 0.5891  
Epoch 178/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6381 - loss: 0.6023 - val\_accuracy: 0.6458 - val\_loss: 0.5884  
Epoch 179/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.6182 - loss: 0.6004 - val\_accuracy: 0.6458 - val\_loss: 0.5876  
Epoch 180/1500  
18/18 ————— 0s 5ms/step - accuracy: 0.6704 - loss: 0.5736 - val\_accuracy: 0.6458 - val\_loss: 0.5869  
Epoch 181/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6787 - loss: 0.5735 - val\_accuracy: 0.6458 - val\_loss: 0.5861  
Epoch 182/1500  
18/18 ————— 0s 5ms/step - accuracy: 0.6574 - loss: 0.5798 - val\_accuracy: 0.6458 - val\_loss: 0.5854  
Epoch 183/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6469 - loss: 0.5889 - val\_accuracy: 0.6458 - val\_loss: 0.5846  
Epoch 184/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6830 - loss: 0.5651 - val\_accuracy: 0.6510 - val\_loss: 0.5839  
Epoch 185/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.6789 - loss: 0.5659 - val\_accuracy: 0.6510 - val\_loss: 0.5831  
Epoch 186/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6650 - loss: 0.5778 - val\_accuracy: 0.6510 - val\_loss: 0.5823  
Epoch 187/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6729 - loss: 0.5684 - val\_accuracy: 0.6510 - val\_loss:



0.5816  
Epoch 188/1500  
18/18 — 0s 6ms/step - accuracy: 0.6443 - loss: 0.5803 - val\_accuracy: 0.6562 - val\_loss: 0.5808  
Epoch 189/1500  
18/18 — 0s 7ms/step - accuracy: 0.6397 - loss: 0.5920 - val\_accuracy: 0.6562 - val\_loss: 0.5801  
Epoch 190/1500  
18/18 — 0s 8ms/step - accuracy: 0.6470 - loss: 0.5889 - val\_accuracy: 0.6562 - val\_loss: 0.5793  
Epoch 191/1500  
18/18 — 0s 6ms/step - accuracy: 0.6334 - loss: 0.5884 - val\_accuracy: 0.6562 - val\_loss: 0.5786  
Epoch 192/1500  
18/18 — 0s 7ms/step - accuracy: 0.6427 - loss: 0.5922 - val\_accuracy: 0.6562 - val\_loss: 0.5779  
Epoch 193/1500  
18/18 — 0s 6ms/step - accuracy: 0.6723 - loss: 0.5790 - val\_accuracy: 0.6562 - val\_loss: 0.5772  
Epoch 194/1500  
18/18 — 0s 6ms/step - accuracy: 0.6652 - loss: 0.5719 - val\_accuracy: 0.6562 - val\_loss: 0.5765  
Epoch 195/1500  
18/18 — 0s 6ms/step - accuracy: 0.6695 - loss: 0.5731 - val\_accuracy: 0.6562 - val\_loss: 0.5758  
Epoch 196/1500  
18/18 — 0s 6ms/step - accuracy: 0.6683 - loss: 0.5655 - val\_accuracy: 0.6615 - val\_loss: 0.5751  
Epoch 197/1500  
18/18 — 0s 6ms/step - accuracy: 0.6475 - loss: 0.5855 - val\_accuracy: 0.6615 - val\_loss: 0.5744  
Epoch 198/1500  
18/18 — 0s 6ms/step - accuracy: 0.6554 - loss: 0.5614 - val\_accuracy: 0.6667 - val\_loss: 0.5737  
Epoch 199/1500  
18/18 — 0s 7ms/step - accuracy: 0.6695 - loss: 0.5633 - val\_accuracy: 0.6719 - val\_loss: 0.5730  
Epoch 200/1500  
18/18 — 0s 6ms/step - accuracy: 0.6568 - loss: 0.5757 - val\_accuracy: 0.6719 - val\_loss: 0.5723  
Epoch 201/1500  
18/18 — 0s 6ms/step - accuracy: 0.6797 - loss: 0.5641 - val\_accuracy: 0.6719 - val\_loss: 0.5717  
Epoch 202/1500  
18/18 — 0s 6ms/step - accuracy: 0.6698 - loss: 0.5642 - val\_accuracy: 0.6719 - val\_loss: 0.5710  
Epoch 203/1500  
18/18 — 0s 6ms/step - accuracy: 0.6475 - loss: 0.5758 - val\_accuracy: 0.6719 - val\_loss: 0.5703  
Epoch 204/1500  
18/18 — 0s 6ms/step - accuracy: 0.6731 - loss: 0.5535 - val\_accuracy: 0.6719 - val\_loss: 0.5697  
Epoch 205/1500  
18/18 — 0s 7ms/step - accuracy: 0.6970 - loss: 0.5384 - val\_accuracy: 0.6719 - val\_loss: 0.5690  
Epoch 206/1500  
18/18 — 0s 6ms/step - accuracy: 0.6612 - loss: 0.5572 - val\_accuracy: 0.6719 - val\_loss: 0.5684  
Epoch 207/1500  
18/18 — 0s 6ms/step - accuracy: 0.6909 - loss: 0.5544 - val\_accuracy: 0.6823 - val\_loss: 0.5677  
Epoch 208/1500  
18/18 — 0s 5ms/step - accuracy: 0.6869 - loss: 0.5594 - val\_accuracy: 0.6823 - val\_loss: 0.5671  
Epoch 209/1500  
18/18 — 0s 6ms/step - accuracy: 0.6653 - loss: 0.5665 - val\_accuracy: 0.6823 - val\_loss: 0.5665  
Epoch 210/1500  
18/18 — 0s 6ms/step - accuracy: 0.6586 - loss: 0.5852 - val\_accuracy: 0.6823 - val\_loss: 0.5658

Epoch 211/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6623 - loss: 0.5570 - val\_accuracy: 0.6823 - val\_loss: 0.5652  
Epoch 212/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6669 - loss: 0.5665 - val\_accuracy: 0.6823 - val\_loss: 0.5646  
Epoch 213/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6952 - loss: 0.5589 - val\_accuracy: 0.6823 - val\_loss: 0.5640  
Epoch 214/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7031 - loss: 0.5481 - val\_accuracy: 0.6823 - val\_loss: 0.5634  
Epoch 215/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7010 - loss: 0.5492 - val\_accuracy: 0.6823 - val\_loss: 0.5627  
Epoch 216/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6948 - loss: 0.5345 - val\_accuracy: 0.6823 - val\_loss: 0.5621  
Epoch 217/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6804 - loss: 0.5664 - val\_accuracy: 0.6823 - val\_loss: 0.5615  
Epoch 218/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.6889 - loss: 0.5623 - val\_accuracy: 0.6823 - val\_loss: 0.5609  
Epoch 219/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7021 - loss: 0.5535 - val\_accuracy: 0.6875 - val\_loss: 0.5603  
Epoch 220/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6887 - loss: 0.5523 - val\_accuracy: 0.6875 - val\_loss: 0.5598  
Epoch 221/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6924 - loss: 0.5468 - val\_accuracy: 0.6823 - val\_loss: 0.5592  
Epoch 222/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6403 - loss: 0.5679 - val\_accuracy: 0.6823 - val\_loss: 0.5586  
Epoch 223/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6689 - loss: 0.5753 - val\_accuracy: 0.6823 - val\_loss: 0.5581  
Epoch 224/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.6855 - loss: 0.5669 - val\_accuracy: 0.6927 - val\_loss: 0.5575  
Epoch 225/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7048 - loss: 0.5454 - val\_accuracy: 0.7031 - val\_loss: 0.5570  
Epoch 226/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.6936 - loss: 0.5420 - val\_accuracy: 0.7031 - val\_loss: 0.5565  
Epoch 227/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6698 - loss: 0.5659 - val\_accuracy: 0.7031 - val\_loss: 0.5559  
Epoch 228/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6929 - loss: 0.5453 - val\_accuracy: 0.7031 - val\_loss: 0.5554  
Epoch 229/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7016 - loss: 0.5478 - val\_accuracy: 0.7135 - val\_loss: 0.5549  
Epoch 230/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.6811 - loss: 0.5520 - val\_accuracy: 0.7135 - val\_loss: 0.5543  
Epoch 231/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7128 - loss: 0.5361 - val\_accuracy: 0.7135 - val\_loss: 0.5538  
Epoch 232/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.6921 - loss: 0.5601 - val\_accuracy: 0.7240 - val\_loss: 0.5533  
Epoch 233/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7060 - loss: 0.5368 - val\_accuracy: 0.7240 - val\_loss: 0.5528  
Epoch 234/1500


18/18 ————— 0s 11ms/step - accuracy: 0.6860 - loss: 0.5636 - val\_accuracy: 0.7240 - val\_loss: 0.5522  
Epoch 235/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7128 - loss: 0.5354 - val\_accuracy: 0.7240 - val\_loss: 0.5517  
Epoch 236/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7366 - loss: 0.5310 - val\_accuracy: 0.7240 - val\_loss: 0.5512  
Epoch 237/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.6973 - loss: 0.5517 - val\_accuracy: 0.7240 - val\_loss: 0.5507  
Epoch 238/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.6840 - loss: 0.5690 - val\_accuracy: 0.7240 - val\_loss: 0.5502  
Epoch 239/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6990 - loss: 0.5615 - val\_accuracy: 0.7240 - val\_loss: 0.5497  
Epoch 240/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.6954 - loss: 0.5486 - val\_accuracy: 0.7240 - val\_loss: 0.5492  
Epoch 241/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7448 - loss: 0.5238 - val\_accuracy: 0.7344 - val\_loss: 0.5487  
Epoch 242/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7335 - loss: 0.5322 - val\_accuracy: 0.7292 - val\_loss: 0.5482  
Epoch 243/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7205 - loss: 0.5439 - val\_accuracy: 0.7292 - val\_loss: 0.5477  
Epoch 244/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7143 - loss: 0.5482 - val\_accuracy: 0.7292 - val\_loss: 0.5472  
Epoch 245/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.6907 - loss: 0.5373 - val\_accuracy: 0.7448 - val\_loss: 0.5467  
Epoch 246/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7341 - loss: 0.5333 - val\_accuracy: 0.7448 - val\_loss: 0.5462  
Epoch 247/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7113 - loss: 0.5412 - val\_accuracy: 0.7448 - val\_loss: 0.5457  
Epoch 248/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7165 - loss: 0.5360 - val\_accuracy: 0.7396 - val\_loss: 0.5452  
Epoch 249/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7322 - loss: 0.5254 - val\_accuracy: 0.7344 - val\_loss: 0.5447  
Epoch 250/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7578 - loss: 0.5139 - val\_accuracy: 0.7344 - val\_loss: 0.5442  
Epoch 251/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7126 - loss: 0.5459 - val\_accuracy: 0.7344 - val\_loss: 0.5438  
Epoch 252/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7179 - loss: 0.5407 - val\_accuracy: 0.7396 - val\_loss: 0.5433  
Epoch 253/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7230 - loss: 0.5221 - val\_accuracy: 0.7396 - val\_loss: 0.5428  
Epoch 254/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7407 - loss: 0.5144 - val\_accuracy: 0.7344 - val\_loss: 0.5423  
Epoch 255/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7243 - loss: 0.5252 - val\_accuracy: 0.7396 - val\_loss: 0.5419  
Epoch 256/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7115 - loss: 0.5420 - val\_accuracy: 0.7396 - val\_loss: 0.5414  
Epoch 257/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7517 - loss: 0.5151 - val\_accuracy: 0.7396 - val\_loss:


0.5410  
Epoch 258/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7265 - loss: 0.5469 - val\_accuracy: 0.7396 - val\_loss: 0.5405  
Epoch 259/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7435 - loss: 0.5212 - val\_accuracy: 0.7396 - val\_loss: 0.5400  
Epoch 260/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7510 - loss: 0.5182 - val\_accuracy: 0.7344 - val\_loss: 0.5396  
Epoch 261/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7293 - loss: 0.5401 - val\_accuracy: 0.7344 - val\_loss: 0.5391  
Epoch 262/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7260 - loss: 0.5349 - val\_accuracy: 0.7396 - val\_loss: 0.5387  
Epoch 263/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7521 - loss: 0.5195 - val\_accuracy: 0.7448 - val\_loss: 0.5382  
Epoch 264/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7617 - loss: 0.5139 - val\_accuracy: 0.7396 - val\_loss: 0.5378  
Epoch 265/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7282 - loss: 0.5348 - val\_accuracy: 0.7396 - val\_loss: 0.5374  
Epoch 266/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7228 - loss: 0.5492 - val\_accuracy: 0.7344 - val\_loss: 0.5369  
Epoch 267/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7485 - loss: 0.5449 - val\_accuracy: 0.7344 - val\_loss: 0.5365  
Epoch 268/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7548 - loss: 0.5172 - val\_accuracy: 0.7344 - val\_loss: 0.5361  
Epoch 269/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7380 - loss: 0.5221 - val\_accuracy: 0.7396 - val\_loss: 0.5356  
Epoch 270/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7310 - loss: 0.5289 - val\_accuracy: 0.7396 - val\_loss: 0.5352  
Epoch 271/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7480 - loss: 0.5218 - val\_accuracy: 0.7396 - val\_loss: 0.5348  
Epoch 272/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7418 - loss: 0.5051 - val\_accuracy: 0.7396 - val\_loss: 0.5344  
Epoch 273/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7369 - loss: 0.5215 - val\_accuracy: 0.7396 - val\_loss: 0.5339  
Epoch 274/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7709 - loss: 0.4919 - val\_accuracy: 0.7344 - val\_loss: 0.5335  
Epoch 275/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7438 - loss: 0.5159 - val\_accuracy: 0.7396 - val\_loss: 0.5331  
Epoch 276/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7533 - loss: 0.5213 - val\_accuracy: 0.7396 - val\_loss: 0.5327  
Epoch 277/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7558 - loss: 0.5150 - val\_accuracy: 0.7396 - val\_loss: 0.5323  
Epoch 278/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7253 - loss: 0.5162 - val\_accuracy: 0.7344 - val\_loss: 0.5319  
Epoch 279/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7471 - loss: 0.5177 - val\_accuracy: 0.7344 - val\_loss: 0.5316  
Epoch 280/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7426 - loss: 0.5300 - val\_accuracy: 0.7344 - val\_loss: 0.5312


Epoch 281/1500  
18/18 — 0s 6ms/step - accuracy: 0.7163 - loss: 0.5445 - val\_accuracy: 0.7344 - val\_loss: 0.5308  
Epoch 282/1500  
18/18 — 0s 6ms/step - accuracy: 0.7418 - loss: 0.5225 - val\_accuracy: 0.7344 - val\_loss: 0.5304  
Epoch 283/1500  
18/18 — 0s 6ms/step - accuracy: 0.7371 - loss: 0.5244 - val\_accuracy: 0.7448 - val\_loss: 0.5301  
Epoch 284/1500  
18/18 — 0s 6ms/step - accuracy: 0.7404 - loss: 0.5367 - val\_accuracy: 0.7500 - val\_loss: 0.5297  
Epoch 285/1500  
18/18 — 0s 6ms/step - accuracy: 0.7291 - loss: 0.5329 - val\_accuracy: 0.7500 - val\_loss: 0.5294  
Epoch 286/1500  
18/18 — 0s 7ms/step - accuracy: 0.7625 - loss: 0.5069 - val\_accuracy: 0.7500 - val\_loss: 0.5290  
Epoch 287/1500  
18/18 — 0s 8ms/step - accuracy: 0.7694 - loss: 0.5068 - val\_accuracy: 0.7500 - val\_loss: 0.5286  
Epoch 288/1500  
18/18 — 0s 6ms/step - accuracy: 0.7579 - loss: 0.5171 - val\_accuracy: 0.7448 - val\_loss: 0.5283  
Epoch 289/1500  
18/18 — 0s 6ms/step - accuracy: 0.7144 - loss: 0.5194 - val\_accuracy: 0.7448 - val\_loss: 0.5280  
Epoch 290/1500  
18/18 — 0s 6ms/step - accuracy: 0.7374 - loss: 0.5145 - val\_accuracy: 0.7448 - val\_loss: 0.5276  
Epoch 291/1500  
18/18 — 0s 8ms/step - accuracy: 0.7434 - loss: 0.5158 - val\_accuracy: 0.7500 - val\_loss: 0.5273  
Epoch 292/1500  
18/18 — 0s 6ms/step - accuracy: 0.7466 - loss: 0.5083 - val\_accuracy: 0.7500 - val\_loss: 0.5269  
Epoch 293/1500  
18/18 — 0s 6ms/step - accuracy: 0.7389 - loss: 0.5155 - val\_accuracy: 0.7500 - val\_loss: 0.5266  
Epoch 294/1500  
18/18 — 0s 6ms/step - accuracy: 0.7395 - loss: 0.5269 - val\_accuracy: 0.7448 - val\_loss: 0.5262  
Epoch 295/1500  
18/18 — 0s 8ms/step - accuracy: 0.7117 - loss: 0.5261 - val\_accuracy: 0.7448 - val\_loss: 0.5259  
Epoch 296/1500  
18/18 — 0s 6ms/step - accuracy: 0.7686 - loss: 0.4869 - val\_accuracy: 0.7448 - val\_loss: 0.5256  
Epoch 297/1500  
18/18 — 0s 6ms/step - accuracy: 0.7312 - loss: 0.5254 - val\_accuracy: 0.7448 - val\_loss: 0.5253  
Epoch 298/1500  
18/18 — 0s 11ms/step - accuracy: 0.7658 - loss: 0.4959 - val\_accuracy: 0.7448 - val\_loss: 0.5250  
Epoch 299/1500  
18/18 — 0s 11ms/step - accuracy: 0.7223 - loss: 0.5342 - val\_accuracy: 0.7396 - val\_loss: 0.5246  
Epoch 300/1500  
18/18 — 0s 8ms/step - accuracy: 0.7170 - loss: 0.5402 - val\_accuracy: 0.7396 - val\_loss: 0.5243  
Epoch 301/1500  
18/18 — 0s 9ms/step - accuracy: 0.7368 - loss: 0.5153 - val\_accuracy: 0.7396 - val\_loss: 0.5240  
Epoch 302/1500  
18/18 — 0s 9ms/step - accuracy: 0.7361 - loss: 0.5189 - val\_accuracy: 0.7396 - val\_loss: 0.5237  
Epoch 303/1500  
18/18 — 0s 9ms/step - accuracy: 0.7283 - loss: 0.5345 - val\_accuracy: 0.7396 - val\_loss: 0.5234  
Epoch 304/1500


18/18 ————— 0s 10ms/step - accuracy: 0.7249 - loss: 0.5190 - val\_accuracy: 0.7396 - val\_loss: 0.5232  
Epoch 305/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7438 - loss: 0.5249 - val\_accuracy: 0.7396 - val\_loss: 0.5229  
Epoch 306/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7512 - loss: 0.5107 - val\_accuracy: 0.7396 - val\_loss: 0.5226  
Epoch 307/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7543 - loss: 0.5147 - val\_accuracy: 0.7344 - val\_loss: 0.5223  
Epoch 308/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7426 - loss: 0.5297 - val\_accuracy: 0.7344 - val\_loss: 0.5220  
Epoch 309/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7238 - loss: 0.5307 - val\_accuracy: 0.7344 - val\_loss: 0.5217  
Epoch 310/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7391 - loss: 0.5298 - val\_accuracy: 0.7344 - val\_loss: 0.5215  
Epoch 311/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7153 - loss: 0.5352 - val\_accuracy: 0.7344 - val\_loss: 0.5212  
Epoch 312/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7614 - loss: 0.5093 - val\_accuracy: 0.7344 - val\_loss: 0.5209  
Epoch 313/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7423 - loss: 0.4973 - val\_accuracy: 0.7344 - val\_loss: 0.5206  
Epoch 314/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7405 - loss: 0.5241 - val\_accuracy: 0.7344 - val\_loss: 0.5204  
Epoch 315/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7439 - loss: 0.5103 - val\_accuracy: 0.7344 - val\_loss: 0.5201  
Epoch 316/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7482 - loss: 0.5018 - val\_accuracy: 0.7344 - val\_loss: 0.5198  
Epoch 317/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7412 - loss: 0.5163 - val\_accuracy: 0.7344 - val\_loss: 0.5196  
Epoch 318/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7367 - loss: 0.5326 - val\_accuracy: 0.7344 - val\_loss: 0.5193  
Epoch 319/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7503 - loss: 0.5197 - val\_accuracy: 0.7344 - val\_loss: 0.5191  
Epoch 320/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7556 - loss: 0.5128 - val\_accuracy: 0.7344 - val\_loss: 0.5188  
Epoch 321/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7450 - loss: 0.5215 - val\_accuracy: 0.7344 - val\_loss: 0.5186  
Epoch 322/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7662 - loss: 0.4997 - val\_accuracy: 0.7344 - val\_loss: 0.5183  
Epoch 323/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7566 - loss: 0.5008 - val\_accuracy: 0.7344 - val\_loss: 0.5181  
Epoch 324/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7617 - loss: 0.5038 - val\_accuracy: 0.7292 - val\_loss: 0.5178  
Epoch 325/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7565 - loss: 0.4967 - val\_accuracy: 0.7292 - val\_loss: 0.5176  
Epoch 326/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7331 - loss: 0.5077 - val\_accuracy: 0.7292 - val\_loss: 0.5174  
Epoch 327/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7325 - loss: 0.5170 - val\_accuracy: 0.7292 - val\_loss:


0.5171  
Epoch 328/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7434 - loss: 0.5076 - val\_accuracy: 0.7292 - val\_loss: 0.5169  
Epoch 329/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7657 - loss: 0.4997 - val\_accuracy: 0.7292 - val\_loss: 0.5167  
Epoch 330/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7518 - loss: 0.5021 - val\_accuracy: 0.7292 - val\_loss: 0.5164  
Epoch 331/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7099 - loss: 0.5339 - val\_accuracy: 0.7292 - val\_loss: 0.5162  
Epoch 332/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7659 - loss: 0.5021 - val\_accuracy: 0.7292 - val\_loss: 0.5160  
Epoch 333/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7343 - loss: 0.5236 - val\_accuracy: 0.7292 - val\_loss: 0.5157  
Epoch 334/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7583 - loss: 0.5125 - val\_accuracy: 0.7292 - val\_loss: 0.5155  
Epoch 335/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7272 - loss: 0.5210 - val\_accuracy: 0.7292 - val\_loss: 0.5153  
Epoch 336/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7568 - loss: 0.4976 - val\_accuracy: 0.7292 - val\_loss: 0.5151  
Epoch 337/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7348 - loss: 0.5174 - val\_accuracy: 0.7292 - val\_loss: 0.5149  
Epoch 338/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7675 - loss: 0.4903 - val\_accuracy: 0.7292 - val\_loss: 0.5147  
Epoch 339/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7410 - loss: 0.5220 - val\_accuracy: 0.7292 - val\_loss: 0.5144  
Epoch 340/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7425 - loss: 0.4975 - val\_accuracy: 0.7292 - val\_loss: 0.5142  
Epoch 341/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7560 - loss: 0.4925 - val\_accuracy: 0.7292 - val\_loss: 0.5140  
Epoch 342/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7544 - loss: 0.5034 - val\_accuracy: 0.7344 - val\_loss: 0.5138  
Epoch 343/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7490 - loss: 0.5194 - val\_accuracy: 0.7344 - val\_loss: 0.5136  
Epoch 344/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7595 - loss: 0.4797 - val\_accuracy: 0.7344 - val\_loss: 0.5134  
Epoch 345/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7441 - loss: 0.5014 - val\_accuracy: 0.7344 - val\_loss: 0.5132  
Epoch 346/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7627 - loss: 0.4929 - val\_accuracy: 0.7344 - val\_loss: 0.5130  
Epoch 347/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7429 - loss: 0.5159 - val\_accuracy: 0.7396 - val\_loss: 0.5128  
Epoch 348/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7579 - loss: 0.4910 - val\_accuracy: 0.7396 - val\_loss: 0.5126  
Epoch 349/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7488 - loss: 0.4982 - val\_accuracy: 0.7396 - val\_loss: 0.5124  
Epoch 350/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7585 - loss: 0.4854 - val\_accuracy: 0.7396 - val\_loss: 0.5122


Epoch 351/1500  
18/18  0s 8ms/step - accuracy: 0.7660 - loss: 0.4957 - val\_accuracy: 0.7396 - val\_loss: 0.5120


Epoch 352/1500  
18/18  0s 7ms/step - accuracy: 0.7450 - loss: 0.4974 - val\_accuracy: 0.7396 - val\_loss: 0.5118


Epoch 353/1500  
18/18  0s 6ms/step - accuracy: 0.7508 - loss: 0.5093 - val\_accuracy: 0.7396 - val\_loss: 0.5116


Epoch 354/1500  
18/18  0s 6ms/step - accuracy: 0.7619 - loss: 0.4817 - val\_accuracy: 0.7396 - val\_loss: 0.5114


Epoch 355/1500  
18/18  0s 6ms/step - accuracy: 0.7570 - loss: 0.4947 - val\_accuracy: 0.7396 - val\_loss: 0.5112


Epoch 356/1500  
18/18  0s 6ms/step - accuracy: 0.7623 - loss: 0.4911 - val\_accuracy: 0.7396 - val\_loss: 0.5110


Epoch 357/1500  
18/18  0s 8ms/step - accuracy: 0.7447 - loss: 0.4932 - val\_accuracy: 0.7448 - val\_loss: 0.5109


Epoch 358/1500  
18/18  0s 6ms/step - accuracy: 0.7230 - loss: 0.5191 - val\_accuracy: 0.7448 - val\_loss: 0.5107


Epoch 359/1500  
18/18  0s 7ms/step - accuracy: 0.7374 - loss: 0.5206 - val\_accuracy: 0.7500 - val\_loss: 0.5105


Epoch 360/1500  
18/18  0s 6ms/step - accuracy: 0.7589 - loss: 0.4918 - val\_accuracy: 0.7500 - val\_loss: 0.5103


Epoch 361/1500  
18/18  0s 6ms/step - accuracy: 0.7635 - loss: 0.4756 - val\_accuracy: 0.7500 - val\_loss: 0.5101


Epoch 362/1500  
18/18  0s 6ms/step - accuracy: 0.7540 - loss: 0.5194 - val\_accuracy: 0.7500 - val\_loss: 0.5100


Epoch 363/1500  
18/18  0s 6ms/step - accuracy: 0.7436 - loss: 0.4998 - val\_accuracy: 0.7500 - val\_loss: 0.5098


Epoch 364/1500  
18/18  0s 6ms/step - accuracy: 0.7518 - loss: 0.4983 - val\_accuracy: 0.7500 - val\_loss: 0.5096


Epoch 365/1500  
18/18  0s 12ms/step - accuracy: 0.7485 - loss: 0.5042 - val\_accuracy: 0.7500 - val\_loss: 0.5095


Epoch 366/1500  
18/18  0s 8ms/step - accuracy: 0.7500 - loss: 0.5007 - val\_accuracy: 0.7500 - val\_loss: 0.5093


Epoch 367/1500  
18/18  0s 11ms/step - accuracy: 0.7554 - loss: 0.4829 - val\_accuracy: 0.7500 - val\_loss: 0.5091


Epoch 368/1500  
18/18  0s 8ms/step - accuracy: 0.7313 - loss: 0.4951 - val\_accuracy: 0.7500 - val\_loss: 0.5090

Epoch 369/1500  
18/18  0s 11ms/step - accuracy: 0.7765 - loss: 0.4806 - val\_accuracy: 0.7552 - val\_loss: 0.5088

Epoch 370/1500  
18/18  0s 11ms/step - accuracy: 0.7793 - loss: 0.4804 - val\_accuracy: 0.7552 - val\_loss: 0.5086

Epoch 371/1500  
18/18  0s 10ms/step - accuracy: 0.7654 - loss: 0.4910 - val\_accuracy: 0.7552 - val\_loss: 0.5085

Epoch 372/1500  
18/18  0s 10ms/step - accuracy: 0.7789 - loss: 0.4738 - val\_accuracy: 0.7552 - val\_loss: 0.5083

Epoch 373/1500  
18/18  0s 10ms/step - accuracy: 0.7475 - loss: 0.5032 - val\_accuracy: 0.7552 - val\_loss: 0.5082

Epoch 374/1500



18/18 ————— 0s 6ms/step - accuracy: 0.7284 - loss: 0.5437 - val\_accuracy: 0.7552 - val\_loss: 0.5080  
Epoch 375/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7433 - loss: 0.5044 - val\_accuracy: 0.7552 - val\_loss: 0.5078  
Epoch 376/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7326 - loss: 0.5128 - val\_accuracy: 0.7552 - val\_loss: 0.5077  
Epoch 377/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7529 - loss: 0.5010 - val\_accuracy: 0.7552 - val\_loss: 0.5075  
Epoch 378/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7678 - loss: 0.4841 - val\_accuracy: 0.7552 - val\_loss: 0.5074  
Epoch 379/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7471 - loss: 0.5214 - val\_accuracy: 0.7552 - val\_loss: 0.5072  
Epoch 380/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7503 - loss: 0.4889 - val\_accuracy: 0.7552 - val\_loss: 0.5071  
Epoch 381/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7571 - loss: 0.4822 - val\_accuracy: 0.7552 - val\_loss: 0.5070  
Epoch 382/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7735 - loss: 0.4861 - val\_accuracy: 0.7552 - val\_loss: 0.5068  
Epoch 383/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7753 - loss: 0.4650 - val\_accuracy: 0.7552 - val\_loss: 0.5067  
Epoch 384/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7752 - loss: 0.4812 - val\_accuracy: 0.7552 - val\_loss: 0.5066  
Epoch 385/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7401 - loss: 0.4926 - val\_accuracy: 0.7552 - val\_loss: 0.5064  
Epoch 386/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7569 - loss: 0.4962 - val\_accuracy: 0.7552 - val\_loss: 0.5063  
Epoch 387/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7616 - loss: 0.4897 - val\_accuracy: 0.7552 - val\_loss: 0.5061  
Epoch 388/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7798 - loss: 0.4784 - val\_accuracy: 0.7552 - val\_loss: 0.5060  
Epoch 389/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7513 - loss: 0.4806 - val\_accuracy: 0.7552 - val\_loss: 0.5058  
Epoch 390/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7468 - loss: 0.4935 - val\_accuracy: 0.7552 - val\_loss: 0.5057  
Epoch 391/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7935 - loss: 0.4690 - val\_accuracy: 0.7552 - val\_loss: 0.5055  
Epoch 392/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7635 - loss: 0.4790 - val\_accuracy: 0.7604 - val\_loss: 0.5054  
Epoch 393/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7378 - loss: 0.5005 - val\_accuracy: 0.7604 - val\_loss: 0.5053  
Epoch 394/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7855 - loss: 0.4690 - val\_accuracy: 0.7604 - val\_loss: 0.5051  
Epoch 395/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7705 - loss: 0.4868 - val\_accuracy: 0.7604 - val\_loss: 0.5050  
Epoch 396/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7398 - loss: 0.4944 - val\_accuracy: 0.7604 - val\_loss: 0.5049  
Epoch 397/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7670 - loss: 0.4889 - val\_accuracy: 0.7604 - val\_loss:

0.5047  
Epoch 398/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7728 - loss: 0.4719 - val\_accuracy: 0.7604 - val\_loss: 0.5046  
Epoch 399/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7960 - loss: 0.4453 - val\_accuracy: 0.7604 - val\_loss: 0.5045  
Epoch 400/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7511 - loss: 0.5005 - val\_accuracy: 0.7604 - val\_loss: 0.5043  
Epoch 401/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7663 - loss: 0.4734 - val\_accuracy: 0.7604 - val\_loss: 0.5042  
Epoch 402/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7692 - loss: 0.4676 - val\_accuracy: 0.7604 - val\_loss: 0.5041  
Epoch 403/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7705 - loss: 0.4857 - val\_accuracy: 0.7604 - val\_loss: 0.5040  
Epoch 404/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7699 - loss: 0.4790 - val\_accuracy: 0.7604 - val\_loss: 0.5038  
Epoch 405/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7453 - loss: 0.4826 - val\_accuracy: 0.7604 - val\_loss: 0.5037  
Epoch 406/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7757 - loss: 0.4571 - val\_accuracy: 0.7604 - val\_loss: 0.5036  
Epoch 407/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7988 - loss: 0.4633 - val\_accuracy: 0.7604 - val\_loss: 0.5035  
Epoch 408/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7486 - loss: 0.4931 - val\_accuracy: 0.7604 - val\_loss: 0.5034  
Epoch 409/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7590 - loss: 0.4881 - val\_accuracy: 0.7604 - val\_loss: 0.5033  
Epoch 410/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7669 - loss: 0.4867 - val\_accuracy: 0.7604 - val\_loss: 0.5032  
Epoch 411/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7583 - loss: 0.4853 - val\_accuracy: 0.7604 - val\_loss: 0.5031  
Epoch 412/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7640 - loss: 0.4810 - val\_accuracy: 0.7604 - val\_loss: 0.5030  
Epoch 413/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7593 - loss: 0.4946 - val\_accuracy: 0.7604 - val\_loss: 0.5029  
Epoch 414/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7478 - loss: 0.4978 - val\_accuracy: 0.7604 - val\_loss: 0.5028  
Epoch 415/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7643 - loss: 0.4616 - val\_accuracy: 0.7604 - val\_loss: 0.5027  
Epoch 416/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7784 - loss: 0.4632 - val\_accuracy: 0.7604 - val\_loss: 0.5026  
Epoch 417/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7624 - loss: 0.4806 - val\_accuracy: 0.7604 - val\_loss: 0.5025  
Epoch 418/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7760 - loss: 0.4660 - val\_accuracy: 0.7604 - val\_loss: 0.5024  
Epoch 419/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7759 - loss: 0.4765 - val\_accuracy: 0.7604 - val\_loss: 0.5023  
Epoch 420/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7279 - loss: 0.5212 - val\_accuracy: 0.7604 - val\_loss: 0.5022

Epoch 421/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7460 - loss: 0.4763 - val\_accuracy: 0.7604 - val\_loss: 0.5021

Epoch 422/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7584 - loss: 0.4855 - val\_accuracy: 0.7604 - val\_loss: 0.5020

Epoch 423/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7440 - loss: 0.4976 - val\_accuracy: 0.7604 - val\_loss: 0.5019

Epoch 424/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7489 - loss: 0.4938 - val\_accuracy: 0.7604 - val\_loss: 0.5018

Epoch 425/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7412 - loss: 0.4901 - val\_accuracy: 0.7604 - val\_loss: 0.5017

Epoch 426/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7696 - loss: 0.4827 - val\_accuracy: 0.7604 - val\_loss: 0.5016

Epoch 427/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7549 - loss: 0.4796 - val\_accuracy: 0.7604 - val\_loss: 0.5015

Epoch 428/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7688 - loss: 0.4814 - val\_accuracy: 0.7604 - val\_loss: 0.5014

Epoch 429/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7687 - loss: 0.4843 - val\_accuracy: 0.7604 - val\_loss: 0.5013

Epoch 430/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7858 - loss: 0.4621 - val\_accuracy: 0.7604 - val\_loss: 0.5012

Epoch 431/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7687 - loss: 0.4732 - val\_accuracy: 0.7604 - val\_loss: 0.5011

Epoch 432/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7399 - loss: 0.5007 - val\_accuracy: 0.7604 - val\_loss: 0.5010

Epoch 433/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7721 - loss: 0.4771 - val\_accuracy: 0.7604 - val\_loss: 0.5010

Epoch 434/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7647 - loss: 0.4679 - val\_accuracy: 0.7604 - val\_loss: 0.5009

Epoch 435/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7743 - loss: 0.4830 - val\_accuracy: 0.7604 - val\_loss: 0.5008

Epoch 436/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7736 - loss: 0.4828 - val\_accuracy: 0.7604 - val\_loss: 0.5007

Epoch 437/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7478 - loss: 0.4899 - val\_accuracy: 0.7604 - val\_loss: 0.5006

Epoch 438/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7723 - loss: 0.4624 - val\_accuracy: 0.7604 - val\_loss: 0.5005

Epoch 439/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7717 - loss: 0.4792 - val\_accuracy: 0.7604 - val\_loss: 0.5005

Epoch 440/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7552 - loss: 0.4910 - val\_accuracy: 0.7656 - val\_loss: 0.5004

Epoch 441/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7481 - loss: 0.5105 - val\_accuracy: 0.7656 - val\_loss: 0.5003

Epoch 442/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7701 - loss: 0.4787 - val\_accuracy: 0.7656 - val\_loss: 0.5002

Epoch 443/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7453 - loss: 0.4893 - val\_accuracy: 0.7656 - val\_loss: 0.5002

Epoch 444/1500

18/18 ————— 0s 9ms/step - accuracy: 0.7573 - loss: 0.4958 - val\_accuracy: 0.7656 - val\_loss: 0.5001  
Epoch 445/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7653 - loss: 0.4814 - val\_accuracy: 0.7656 - val\_loss: 0.5000  
Epoch 446/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7753 - loss: 0.4582 - val\_accuracy: 0.7656 - val\_loss: 0.4999  
Epoch 447/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7768 - loss: 0.4642 - val\_accuracy: 0.7656 - val\_loss: 0.4999  
Epoch 448/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7742 - loss: 0.4752 - val\_accuracy: 0.7656 - val\_loss: 0.4998  
Epoch 449/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7612 - loss: 0.4794 - val\_accuracy: 0.7656 - val\_loss: 0.4997  
Epoch 450/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7545 - loss: 0.5167 - val\_accuracy: 0.7656 - val\_loss: 0.4997  
Epoch 451/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7823 - loss: 0.4626 - val\_accuracy: 0.7656 - val\_loss: 0.4996  
Epoch 452/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7617 - loss: 0.4754 - val\_accuracy: 0.7656 - val\_loss: 0.4996  
Epoch 453/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7610 - loss: 0.4705 - val\_accuracy: 0.7656 - val\_loss: 0.4995  
Epoch 454/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7681 - loss: 0.4889 - val\_accuracy: 0.7656 - val\_loss: 0.4994  
Epoch 455/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7768 - loss: 0.4672 - val\_accuracy: 0.7656 - val\_loss: 0.4994  
Epoch 456/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7749 - loss: 0.4741 - val\_accuracy: 0.7656 - val\_loss: 0.4993  
Epoch 457/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7554 - loss: 0.4827 - val\_accuracy: 0.7656 - val\_loss: 0.4993  
Epoch 458/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7325 - loss: 0.5203 - val\_accuracy: 0.7656 - val\_loss: 0.4992  
Epoch 459/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7651 - loss: 0.4730 - val\_accuracy: 0.7656 - val\_loss: 0.4992  
Epoch 460/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7493 - loss: 0.4826 - val\_accuracy: 0.7656 - val\_loss: 0.4991  
Epoch 461/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7814 - loss: 0.4613 - val\_accuracy: 0.7656 - val\_loss: 0.4991  
Epoch 462/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7763 - loss: 0.4483 - val\_accuracy: 0.7656 - val\_loss: 0.4990  
Epoch 463/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7577 - loss: 0.5189 - val\_accuracy: 0.7656 - val\_loss: 0.4990  
Epoch 464/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7777 - loss: 0.4814 - val\_accuracy: 0.7656 - val\_loss: 0.4989  
Epoch 465/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7639 - loss: 0.4759 - val\_accuracy: 0.7656 - val\_loss: 0.4989  
Epoch 466/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7842 - loss: 0.4750 - val\_accuracy: 0.7656 - val\_loss: 0.4988  
Epoch 467/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7827 - loss: 0.4636 - val\_accuracy: 0.7656 - val\_loss:

0.4988  
Epoch 468/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7595 - loss: 0.4832 - val\_accuracy: 0.7656 - val\_loss: 0.4988  
Epoch 469/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7448 - loss: 0.4803 - val\_accuracy: 0.7656 - val\_loss: 0.4987  
Epoch 470/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7831 - loss: 0.4666 - val\_accuracy: 0.7656 - val\_loss: 0.4987  
Epoch 471/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7632 - loss: 0.4859 - val\_accuracy: 0.7656 - val\_loss: 0.4986  
Epoch 472/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7415 - loss: 0.4942 - val\_accuracy: 0.7656 - val\_loss: 0.4986  
Epoch 473/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7694 - loss: 0.4677 - val\_accuracy: 0.7656 - val\_loss: 0.4986  
Epoch 474/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7635 - loss: 0.4848 - val\_accuracy: 0.7656 - val\_loss: 0.4985  
Epoch 475/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7560 - loss: 0.4981 - val\_accuracy: 0.7656 - val\_loss: 0.4985  
Epoch 476/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7677 - loss: 0.4802 - val\_accuracy: 0.7656 - val\_loss: 0.4985  
Epoch 477/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7786 - loss: 0.4616 - val\_accuracy: 0.7656 - val\_loss: 0.4984  
Epoch 478/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7559 - loss: 0.4992 - val\_accuracy: 0.7656 - val\_loss: 0.4984  
Epoch 479/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7855 - loss: 0.4679 - val\_accuracy: 0.7656 - val\_loss: 0.4984  
Epoch 480/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7863 - loss: 0.4529 - val\_accuracy: 0.7656 - val\_loss: 0.4983  
Epoch 481/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7557 - loss: 0.4881 - val\_accuracy: 0.7656 - val\_loss: 0.4983  
Epoch 482/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7606 - loss: 0.4978 - val\_accuracy: 0.7656 - val\_loss: 0.4983  
Epoch 483/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7473 - loss: 0.4955 - val\_accuracy: 0.7656 - val\_loss: 0.4982  
Epoch 484/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7656 - loss: 0.4720 - val\_accuracy: 0.7656 - val\_loss: 0.4982  
Epoch 485/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8043 - loss: 0.4376 - val\_accuracy: 0.7656 - val\_loss: 0.4982  
Epoch 486/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7924 - loss: 0.4553 - val\_accuracy: 0.7656 - val\_loss: 0.4982  
Epoch 487/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7709 - loss: 0.4783 - val\_accuracy: 0.7656 - val\_loss: 0.4981  
Epoch 488/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7837 - loss: 0.4528 - val\_accuracy: 0.7656 - val\_loss: 0.4981  
Epoch 489/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7759 - loss: 0.4674 - val\_accuracy: 0.7656 - val\_loss: 0.4981  
Epoch 490/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7853 - loss: 0.4827 - val\_accuracy: 0.7656 - val\_loss: 0.4980

Epoch 491/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7783 - loss: 0.4824 - val\_accuracy: 0.7656 - val\_loss: 0.4980

Epoch 492/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7493 - loss: 0.4980 - val\_accuracy: 0.7656 - val\_loss: 0.4980

Epoch 493/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7842 - loss: 0.4739 - val\_accuracy: 0.7656 - val\_loss: 0.4980

Epoch 494/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7651 - loss: 0.4860 - val\_accuracy: 0.7656 - val\_loss: 0.4979

Epoch 495/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7734 - loss: 0.4791 - val\_accuracy: 0.7656 - val\_loss: 0.4979

Epoch 496/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7486 - loss: 0.5176 - val\_accuracy: 0.7656 - val\_loss: 0.4979

Epoch 497/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7774 - loss: 0.4713 - val\_accuracy: 0.7656 - val\_loss: 0.4979

Epoch 498/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7569 - loss: 0.4962 - val\_accuracy: 0.7656 - val\_loss: 0.4979

Epoch 499/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7555 - loss: 0.4828 - val\_accuracy: 0.7656 - val\_loss: 0.4979

Epoch 500/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7964 - loss: 0.4415 - val\_accuracy: 0.7656 - val\_loss: 0.4978

Epoch 501/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7614 - loss: 0.5033 - val\_accuracy: 0.7656 - val\_loss: 0.4978

Epoch 502/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7932 - loss: 0.4770 - val\_accuracy: 0.7656 - val\_loss: 0.4978

Epoch 503/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7801 - loss: 0.4680 - val\_accuracy: 0.7656 - val\_loss: 0.4978

Epoch 504/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7465 - loss: 0.4881 - val\_accuracy: 0.7656 - val\_loss: 0.4978

Epoch 505/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7855 - loss: 0.4592 - val\_accuracy: 0.7656 - val\_loss: 0.4978

Epoch 506/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7575 - loss: 0.4865 - val\_accuracy: 0.7656 - val\_loss: 0.4978

Epoch 507/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7902 - loss: 0.4514 - val\_accuracy: 0.7656 - val\_loss: 0.4977

Epoch 508/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7892 - loss: 0.4503 - val\_accuracy: 0.7656 - val\_loss: 0.4977

Epoch 509/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7679 - loss: 0.4775 - val\_accuracy: 0.7656 - val\_loss: 0.4977

Epoch 510/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7940 - loss: 0.4567 - val\_accuracy: 0.7656 - val\_loss: 0.4977













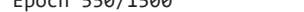










Epoch 511/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7860 - loss: 0.4521 - val\_accuracy: 0.7656 - val\_loss: 0.4977

Epoch 512/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7566 - loss: 0.4865 - val\_accuracy: 0.7656 - val\_loss: 0.4977

Epoch 513/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7763 - loss: 0.4625 - val\_accuracy: 0.7656 - val\_loss: 0.4977

Epoch 514/1500

18/18 ————— 0s 6ms/step - accuracy: 0.7839 - loss: 0.4553 - val\_accuracy: 0.7656 - val\_loss: 0.4977  
Epoch 515/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7910 - loss: 0.4434 - val\_accuracy: 0.7656 - val\_loss: 0.4977  
Epoch 516/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7700 - loss: 0.4772 - val\_accuracy: 0.7656 - val\_loss: 0.4977  
Epoch 517/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7565 - loss: 0.4742 - val\_accuracy: 0.7656 - val\_loss: 0.4977  
Epoch 518/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7958 - loss: 0.4467 - val\_accuracy: 0.7656 - val\_loss: 0.4977  
Epoch 519/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7855 - loss: 0.4652 - val\_accuracy: 0.7656 - val\_loss: 0.4977  
Epoch 520/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7622 - loss: 0.4868 - val\_accuracy: 0.7656 - val\_loss: 0.4976  
Epoch 521/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7892 - loss: 0.4549 - val\_accuracy: 0.7656 - val\_loss: 0.4976  
Epoch 522/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7703 - loss: 0.4730 - val\_accuracy: 0.7656 - val\_loss: 0.4976  
Epoch 523/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7676 - loss: 0.4727 - val\_accuracy: 0.7656 - val\_loss: 0.4976  
Epoch 524/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7721 - loss: 0.4610 - val\_accuracy: 0.7656 - val\_loss: 0.4976  
Epoch 525/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7716 - loss: 0.4733 - val\_accuracy: 0.7656 - val\_loss: 0.4976  
Epoch 526/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7735 - loss: 0.4733 - val\_accuracy: 0.7656 - val\_loss: 0.4975  
Epoch 527/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7798 - loss: 0.4742 - val\_accuracy: 0.7656 - val\_loss: 0.4975  
Epoch 528/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7803 - loss: 0.4703 - val\_accuracy: 0.7656 - val\_loss: 0.4975  
Epoch 529/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7620 - loss: 0.4943 - val\_accuracy: 0.7656 - val\_loss: 0.4975  
Epoch 530/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7850 - loss: 0.4609 - val\_accuracy: 0.7604 - val\_loss: 0.4974  
Epoch 531/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7955 - loss: 0.4469 - val\_accuracy: 0.7604 - val\_loss: 0.4974  
Epoch 532/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7548 - loss: 0.4911 - val\_accuracy: 0.7604 - val\_loss: 0.4974  
Epoch 533/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7878 - loss: 0.4642 - val\_accuracy: 0.7604 - val\_loss: 0.4973  
Epoch 534/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8057 - loss: 0.4371 - val\_accuracy: 0.7604 - val\_loss: 0.4973  
Epoch 535/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7553 - loss: 0.4859 - val\_accuracy: 0.7604 - val\_loss: 0.4973  
Epoch 536/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7958 - loss: 0.4647 - val\_accuracy: 0.7604 - val\_loss: 0.4973  
Epoch 537/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7910 - loss: 0.4586 - val\_accuracy: 0.7604 - val\_loss: 0.4973

0.4973  
Epoch 538/1500  
18/18  0s 8ms/step - accuracy: 0.7832 - loss: 0.4509 - val\_accuracy: 0.7604 - val\_loss: 0.4973  
Epoch 539/1500  
18/18  0s 6ms/step - accuracy: 0.7823 - loss: 0.4562 - val\_accuracy: 0.7604 - val\_loss: 0.4972  
Epoch 540/1500  
18/18  0s 6ms/step - accuracy: 0.7969 - loss: 0.4608 - val\_accuracy: 0.7604 - val\_loss: 0.4972  
Epoch 541/1500  
18/18  0s 8ms/step - accuracy: 0.7998 - loss: 0.4442 - val\_accuracy: 0.7604 - val\_loss: 0.4972  
Epoch 542/1500  
18/18  0s 6ms/step - accuracy: 0.7618 - loss: 0.4637 - val\_accuracy: 0.7604 - val\_loss: 0.4972  
Epoch 543/1500  
18/18  0s 6ms/step - accuracy: 0.8014 - loss: 0.4471 - val\_accuracy: 0.7604 - val\_loss: 0.4972  
Epoch 544/1500  
18/18  0s 6ms/step - accuracy: 0.7581 - loss: 0.4821 - val\_accuracy: 0.7604 - val\_loss: 0.4971  
Epoch 545/1500  
18/18  0s 6ms/step - accuracy: 0.7391 - loss: 0.5045 - val\_accuracy: 0.7604 - val\_loss: 0.4971  
Epoch 546/1500  
18/18  0s 8ms/step - accuracy: 0.7815 - loss: 0.4749 - val\_accuracy: 0.7604 - val\_loss: 0.4971  
Epoch 547/1500  
18/18  0s 6ms/step - accuracy: 0.7878 - loss: 0.4529 - val\_accuracy: 0.7604 - val\_loss: 0.4971  
Epoch 548/1500  
18/18  0s 6ms/step - accuracy: 0.7622 - loss: 0.4756 - val\_accuracy: 0.7604 - val\_loss: 0.4971  
Epoch 549/1500  
18/18  0s 8ms/step - accuracy: 0.7860 - loss: 0.4466 - val\_accuracy: 0.7604 - val\_loss: 0.4971  
Epoch 550/1500  
18/18  0s 6ms/step - accuracy: 0.7837 - loss: 0.4529 - val\_accuracy: 0.7604 - val\_loss: 0.4971  
Epoch 551/1500  
18/18  0s 6ms/step - accuracy: 0.7611 - loss: 0.4897 - val\_accuracy: 0.7604 - val\_loss: 0.4971  
Epoch 552/1500  
18/18  0s 6ms/step - accuracy: 0.7564 - loss: 0.5037 - val\_accuracy: 0.7604 - val\_loss: 0.4970  
Epoch 553/1500  
18/18  0s 6ms/step - accuracy: 0.7735 - loss: 0.4802 - val\_accuracy: 0.7604 - val\_loss: 0.4970  
Epoch 554/1500  
18/18  0s 6ms/step - accuracy: 0.7758 - loss: 0.4532 - val\_accuracy: 0.7604 - val\_loss: 0.4970  
Epoch 555/1500  
18/18  0s 6ms/step - accuracy: 0.7683 - loss: 0.4789 - val\_accuracy: 0.7604 - val\_loss: 0.4970  
Epoch 556/1500  
18/18  0s 8ms/step - accuracy: 0.7911 - loss: 0.4507 - val\_accuracy: 0.7604 - val\_loss: 0.4970  
Epoch 557/1500  
18/18  0s 6ms/step - accuracy: 0.7787 - loss: 0.4652 - val\_accuracy: 0.7604 - val\_loss: 0.4970  
Epoch 558/1500  
18/18  0s 8ms/step - accuracy: 0.7772 - loss: 0.4603 - val\_accuracy: 0.7604 - val\_loss: 0.4970  
Epoch 559/1500  
18/18  0s 6ms/step - accuracy: 0.7775 - loss: 0.4773 - val\_accuracy: 0.7604 - val\_loss: 0.4970  
Epoch 560/1500  
18/18  0s 6ms/step - accuracy: 0.7545 - loss: 0.4982 - val\_accuracy: 0.7604 - val\_loss: 0.4970



Epoch 561/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7470 - loss: 0.4877 - val\_accuracy: 0.7604 - val\_loss: 0.4970

Epoch 562/1500  
18/18 ————— 0s 5ms/step - accuracy: 0.7821 - loss: 0.4440 - val\_accuracy: 0.7604 - val\_loss: 0.4969

Epoch 563/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7567 - loss: 0.4795 - val\_accuracy: 0.7604 - val\_loss: 0.4969

Epoch 564/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7718 - loss: 0.4560 - val\_accuracy: 0.7604 - val\_loss: 0.4969

Epoch 565/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7535 - loss: 0.4960 - val\_accuracy: 0.7604 - val\_loss: 0.4969

Epoch 566/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7190 - loss: 0.5176 - val\_accuracy: 0.7604 - val\_loss: 0.4969

Epoch 567/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7710 - loss: 0.4491 - val\_accuracy: 0.7604 - val\_loss: 0.4969

Epoch 568/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7822 - loss: 0.4376 - val\_accuracy: 0.7604 - val\_loss: 0.4969

Epoch 569/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7736 - loss: 0.4610 - val\_accuracy: 0.7604 - val\_loss: 0.4969

Epoch 570/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7636 - loss: 0.4883 - val\_accuracy: 0.7604 - val\_loss: 0.4969

Epoch 571/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7535 - loss: 0.5107 - val\_accuracy: 0.7604 - val\_loss: 0.4969

Epoch 572/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7757 - loss: 0.4576 - val\_accuracy: 0.7604 - val\_loss: 0.4969

Epoch 573/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7551 - loss: 0.4813 - val\_accuracy: 0.7604 - val\_loss: 0.4969

Epoch 574/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7783 - loss: 0.4666 - val\_accuracy: 0.7604 - val\_loss: 0.4969

Epoch 575/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7925 - loss: 0.4499 - val\_accuracy: 0.7604 - val\_loss: 0.4969

Epoch 576/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7810 - loss: 0.4679 - val\_accuracy: 0.7604 - val\_loss: 0.4969

Epoch 577/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7799 - loss: 0.4527 - val\_accuracy: 0.7604 - val\_loss: 0.4968

Epoch 578/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7583 - loss: 0.4633 - val\_accuracy: 0.7604 - val\_loss: 0.4968

Epoch 579/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7642 - loss: 0.4821 - val\_accuracy: 0.7604 - val\_loss: 0.4968

Epoch 580/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8053 - loss: 0.4158 - val\_accuracy: 0.7604 - val\_loss: 0.4968

Epoch 581/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7695 - loss: 0.4771 - val\_accuracy: 0.7604 - val\_loss: 0.4968

Epoch 582/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7771 - loss: 0.4600 - val\_accuracy: 0.7604 - val\_loss: 0.4968

Epoch 583/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7685 - loss: 0.4888 - val\_accuracy: 0.7604 - val\_loss: 0.4968

Epoch 584/1500

18/18 ————— 0s 6ms/step - accuracy: 0.7690 - loss: 0.4699 - val\_accuracy: 0.7604 - val\_loss: 0.4968  
Epoch 585/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7748 - loss: 0.4656 - val\_accuracy: 0.7604 - val\_loss: 0.4968  
Epoch 586/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7468 - loss: 0.4810 - val\_accuracy: 0.7604 - val\_loss: 0.4968  
Epoch 587/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7901 - loss: 0.4407 - val\_accuracy: 0.7604 - val\_loss: 0.4968  
Epoch 588/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7371 - loss: 0.4949 - val\_accuracy: 0.7604 - val\_loss: 0.4968  
Epoch 589/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7934 - loss: 0.4503 - val\_accuracy: 0.7604 - val\_loss: 0.4968  
Epoch 590/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7728 - loss: 0.4638 - val\_accuracy: 0.7604 - val\_loss: 0.4968  
Epoch 591/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7737 - loss: 0.4822 - val\_accuracy: 0.7604 - val\_loss: 0.4968  
Epoch 592/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7573 - loss: 0.4770 - val\_accuracy: 0.7604 - val\_loss: 0.4967  
Epoch 593/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7574 - loss: 0.4838 - val\_accuracy: 0.7604 - val\_loss: 0.4967  
Epoch 594/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7881 - loss: 0.4441 - val\_accuracy: 0.7604 - val\_loss: 0.4967  
Epoch 595/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7664 - loss: 0.4600 - val\_accuracy: 0.7604 - val\_loss: 0.4967  
Epoch 596/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7425 - loss: 0.4835 - val\_accuracy: 0.7604 - val\_loss: 0.4967  
Epoch 597/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7926 - loss: 0.4556 - val\_accuracy: 0.7604 - val\_loss: 0.4967  
Epoch 598/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7802 - loss: 0.4509 - val\_accuracy: 0.7604 - val\_loss: 0.4967  
Epoch 599/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7628 - loss: 0.4674 - val\_accuracy: 0.7604 - val\_loss: 0.4967  
Epoch 600/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7945 - loss: 0.4397 - val\_accuracy: 0.7604 - val\_loss: 0.4967  
Epoch 601/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7636 - loss: 0.4452 - val\_accuracy: 0.7604 - val\_loss: 0.4967  
Epoch 602/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7917 - loss: 0.4650 - val\_accuracy: 0.7604 - val\_loss: 0.4967  
Epoch 603/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7844 - loss: 0.4602 - val\_accuracy: 0.7604 - val\_loss: 0.4967  
Epoch 604/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7737 - loss: 0.4767 - val\_accuracy: 0.7604 - val\_loss: 0.4967  
Epoch 605/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7917 - loss: 0.4446 - val\_accuracy: 0.7604 - val\_loss: 0.4966  
Epoch 606/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7770 - loss: 0.4616 - val\_accuracy: 0.7604 - val\_loss: 0.4966  
Epoch 607/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7802 - loss: 0.4366 - val\_accuracy: 0.7604 - val\_loss: 0.4966

0.4966  
Epoch 608/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7740 - loss: 0.4522 - val\_accuracy: 0.7604 - val\_loss: 0.4966  
Epoch 609/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7595 - loss: 0.4664 - val\_accuracy: 0.7604 - val\_loss: 0.4966  
Epoch 610/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7706 - loss: 0.4712 - val\_accuracy: 0.7604 - val\_loss: 0.4966  
Epoch 611/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7707 - loss: 0.4663 - val\_accuracy: 0.7604 - val\_loss: 0.4966  
Epoch 612/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7838 - loss: 0.4579 - val\_accuracy: 0.7604 - val\_loss: 0.4966  
Epoch 613/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7603 - loss: 0.4896 - val\_accuracy: 0.7604 - val\_loss: 0.4966  
Epoch 614/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7681 - loss: 0.4754 - val\_accuracy: 0.7604 - val\_loss: 0.4966  
Epoch 615/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7981 - loss: 0.4422 - val\_accuracy: 0.7604 - val\_loss: 0.4965  
Epoch 616/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7703 - loss: 0.4515 - val\_accuracy: 0.7604 - val\_loss: 0.4965  
Epoch 617/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8026 - loss: 0.4267 - val\_accuracy: 0.7604 - val\_loss: 0.4965  
Epoch 618/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7947 - loss: 0.4360 - val\_accuracy: 0.7604 - val\_loss: 0.4965  
Epoch 619/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7647 - loss: 0.4745 - val\_accuracy: 0.7604 - val\_loss: 0.4965  
Epoch 620/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7747 - loss: 0.4576 - val\_accuracy: 0.7604 - val\_loss: 0.4965  
Epoch 621/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8015 - loss: 0.4400 - val\_accuracy: 0.7604 - val\_loss: 0.4965  
Epoch 622/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7836 - loss: 0.4553 - val\_accuracy: 0.7604 - val\_loss: 0.4964  
Epoch 623/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7710 - loss: 0.4616 - val\_accuracy: 0.7604 - val\_loss: 0.4964  
Epoch 624/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7481 - loss: 0.4936 - val\_accuracy: 0.7604 - val\_loss: 0.4964  
Epoch 625/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7812 - loss: 0.4421 - val\_accuracy: 0.7604 - val\_loss: 0.4964  
Epoch 626/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7872 - loss: 0.4624 - val\_accuracy: 0.7604 - val\_loss: 0.4964  
Epoch 627/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7589 - loss: 0.4763 - val\_accuracy: 0.7604 - val\_loss: 0.4963  
Epoch 628/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7884 - loss: 0.4391 - val\_accuracy: 0.7604 - val\_loss: 0.4963  
Epoch 629/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7909 - loss: 0.4572 - val\_accuracy: 0.7604 - val\_loss: 0.4963  
Epoch 630/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7873 - loss: 0.4436 - val\_accuracy: 0.7604 - val\_loss: 0.4963

Epoch 631/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.7987 - loss: 0.4382 - val\_accuracy: 0.7604 - val\_loss: 0.4963  
Epoch 632/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7639 - loss: 0.4719 - val\_accuracy: 0.7604 - val\_loss: 0.4962  
Epoch 633/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7500 - loss: 0.4798 - val\_accuracy: 0.7604 - val\_loss: 0.4962  
Epoch 634/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7569 - loss: 0.4850 - val\_accuracy: 0.7604 - val\_loss: 0.4962  
Epoch 635/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7723 - loss: 0.4839 - val\_accuracy: 0.7604 - val\_loss: 0.4962  
Epoch 636/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7615 - loss: 0.4744 - val\_accuracy: 0.7604 - val\_loss: 0.4962  
Epoch 637/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7714 - loss: 0.4612 - val\_accuracy: 0.7604 - val\_loss: 0.4961  
Epoch 638/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7534 - loss: 0.4889 - val\_accuracy: 0.7604 - val\_loss: 0.4961  
Epoch 639/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7405 - loss: 0.4881 - val\_accuracy: 0.7604 - val\_loss: 0.4961  
Epoch 640/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7354 - loss: 0.5070 - val\_accuracy: 0.7604 - val\_loss: 0.4961  
Epoch 641/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7609 - loss: 0.4691 - val\_accuracy: 0.7604 - val\_loss: 0.4960  
Epoch 642/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7726 - loss: 0.4532 - val\_accuracy: 0.7604 - val\_loss: 0.4960  
Epoch 643/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7896 - loss: 0.4532 - val\_accuracy: 0.7604 - val\_loss: 0.4960  
Epoch 644/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7638 - loss: 0.4868 - val\_accuracy: 0.7604 - val\_loss: 0.4960  
Epoch 645/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7725 - loss: 0.4736 - val\_accuracy: 0.7604 - val\_loss: 0.4959  
Epoch 646/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7777 - loss: 0.4540 - val\_accuracy: 0.7604 - val\_loss: 0.4959  
Epoch 647/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7715 - loss: 0.4791 - val\_accuracy: 0.7604 - val\_loss: 0.4959  
Epoch 648/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7774 - loss: 0.4558 - val\_accuracy: 0.7604 - val\_loss: 0.4959  
Epoch 649/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7682 - loss: 0.4577 - val\_accuracy: 0.7604 - val\_loss: 0.4959  
Epoch 650/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7692 - loss: 0.4443 - val\_accuracy: 0.7604 - val\_loss: 0.4958  
Epoch 651/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7766 - loss: 0.4610 - val\_accuracy: 0.7604 - val\_loss: 0.4958  
Epoch 652/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7698 - loss: 0.4771 - val\_accuracy: 0.7604 - val\_loss: 0.4958  
Epoch 653/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7906 - loss: 0.4505 - val\_accuracy: 0.7604 - val\_loss: 0.4958  
Epoch 654/1500

18/18 ————— 0s 6ms/step - accuracy: 0.7830 - loss: 0.4698 - val\_accuracy: 0.7604 - val\_loss: 0.4958  
Epoch 655/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8143 - loss: 0.4273 - val\_accuracy: 0.7604 - val\_loss: 0.4957  
Epoch 656/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7850 - loss: 0.4584 - val\_accuracy: 0.7604 - val\_loss: 0.4957  
Epoch 657/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7475 - loss: 0.4790 - val\_accuracy: 0.7604 - val\_loss: 0.4957  
Epoch 658/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7869 - loss: 0.4321 - val\_accuracy: 0.7604 - val\_loss: 0.4957  
Epoch 659/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7752 - loss: 0.4583 - val\_accuracy: 0.7604 - val\_loss: 0.4956  
Epoch 660/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7808 - loss: 0.4633 - val\_accuracy: 0.7604 - val\_loss: 0.4956  
Epoch 661/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7445 - loss: 0.4845 - val\_accuracy: 0.7604 - val\_loss: 0.4956  
Epoch 662/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7743 - loss: 0.4680 - val\_accuracy: 0.7604 - val\_loss: 0.4955  
Epoch 663/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7943 - loss: 0.4387 - val\_accuracy: 0.7604 - val\_loss: 0.4955  
Epoch 664/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7538 - loss: 0.4675 - val\_accuracy: 0.7604 - val\_loss: 0.4954  
Epoch 665/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7508 - loss: 0.4623 - val\_accuracy: 0.7604 - val\_loss: 0.4954  
Epoch 666/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7699 - loss: 0.4829 - val\_accuracy: 0.7604 - val\_loss: 0.4954  
Epoch 667/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7767 - loss: 0.4418 - val\_accuracy: 0.7604 - val\_loss: 0.4953  
Epoch 668/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8075 - loss: 0.3988 - val\_accuracy: 0.7604 - val\_loss: 0.4953  
Epoch 669/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7525 - loss: 0.4661 - val\_accuracy: 0.7604 - val\_loss: 0.4953  
Epoch 670/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7719 - loss: 0.4468 - val\_accuracy: 0.7604 - val\_loss: 0.4952  
Epoch 671/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7538 - loss: 0.4959 - val\_accuracy: 0.7656 - val\_loss: 0.4952  
Epoch 672/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7520 - loss: 0.4862 - val\_accuracy: 0.7656 - val\_loss: 0.4952  
Epoch 673/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7647 - loss: 0.4643 - val\_accuracy: 0.7656 - val\_loss: 0.4951  
Epoch 674/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7945 - loss: 0.4254 - val\_accuracy: 0.7656 - val\_loss: 0.4951  
Epoch 675/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7979 - loss: 0.4399 - val\_accuracy: 0.7656 - val\_loss: 0.4951  
Epoch 676/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7778 - loss: 0.4622 - val\_accuracy: 0.7656 - val\_loss: 0.4950  
Epoch 677/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7567 - loss: 0.4767 - val\_accuracy: 0.7656 - val\_loss:

0.4950  
Epoch 678/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7704 - loss: 0.4613 - val\_accuracy: 0.7656 - val\_loss: 0.4950  
Epoch 679/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7736 - loss: 0.4399 - val\_accuracy: 0.7656 - val\_loss: 0.4949  
Epoch 680/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7663 - loss: 0.4599 - val\_accuracy: 0.7656 - val\_loss: 0.4949  
Epoch 681/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7754 - loss: 0.4545 - val\_accuracy: 0.7656 - val\_loss: 0.4949  
Epoch 682/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7613 - loss: 0.4652 - val\_accuracy: 0.7656 - val\_loss: 0.4948  
Epoch 683/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8072 - loss: 0.4372 - val\_accuracy: 0.7656 - val\_loss: 0.4948  
Epoch 684/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7631 - loss: 0.4779 - val\_accuracy: 0.7656 - val\_loss: 0.4948  
Epoch 685/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7724 - loss: 0.4721 - val\_accuracy: 0.7656 - val\_loss: 0.4947  
Epoch 686/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7778 - loss: 0.4524 - val\_accuracy: 0.7656 - val\_loss: 0.4947  
Epoch 687/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7599 - loss: 0.4646 - val\_accuracy: 0.7656 - val\_loss: 0.4947  
Epoch 688/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7681 - loss: 0.4701 - val\_accuracy: 0.7656 - val\_loss: 0.4946  
Epoch 689/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7743 - loss: 0.4479 - val\_accuracy: 0.7656 - val\_loss: 0.4946  
Epoch 690/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7765 - loss: 0.4603 - val\_accuracy: 0.7656 - val\_loss: 0.4946  
Epoch 691/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7611 - loss: 0.4375 - val\_accuracy: 0.7656 - val\_loss: 0.4945  
Epoch 692/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7629 - loss: 0.4585 - val\_accuracy: 0.7656 - val\_loss: 0.4945  
Epoch 693/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7596 - loss: 0.4669 - val\_accuracy: 0.7656 - val\_loss: 0.4945  
Epoch 694/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7660 - loss: 0.4528 - val\_accuracy: 0.7656 - val\_loss: 0.4944  
Epoch 695/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7526 - loss: 0.4837 - val\_accuracy: 0.7656 - val\_loss: 0.4944  
Epoch 696/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7499 - loss: 0.4764 - val\_accuracy: 0.7604 - val\_loss: 0.4944  
Epoch 697/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7979 - loss: 0.4177 - val\_accuracy: 0.7604 - val\_loss: 0.4943  
Epoch 698/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7743 - loss: 0.4575 - val\_accuracy: 0.7604 - val\_loss: 0.4943  
Epoch 699/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7875 - loss: 0.4418 - val\_accuracy: 0.7604 - val\_loss: 0.4943  
Epoch 700/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7869 - loss: 0.4444 - val\_accuracy: 0.7604 - val\_loss: 0.4943

Epoch 701/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7734 - loss: 0.4450 - val\_accuracy: 0.7604 - val\_loss: 0.4942

Epoch 702/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7506 - loss: 0.4763 - val\_accuracy: 0.7604 - val\_loss: 0.4942

Epoch 703/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7785 - loss: 0.4595 - val\_accuracy: 0.7604 - val\_loss: 0.4942

Epoch 704/1500  
18/18 ————— 0s 15ms/step - accuracy: 0.7773 - loss: 0.4428 - val\_accuracy: 0.7604 - val\_loss: 0.4941

Epoch 705/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7723 - loss: 0.4590 - val\_accuracy: 0.7604 - val\_loss: 0.4941

Epoch 706/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7696 - loss: 0.4831 - val\_accuracy: 0.7604 - val\_loss: 0.4941

Epoch 707/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7653 - loss: 0.4467 - val\_accuracy: 0.7604 - val\_loss: 0.4940

Epoch 708/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7827 - loss: 0.4605 - val\_accuracy: 0.7604 - val\_loss: 0.4940

Epoch 709/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7983 - loss: 0.4198 - val\_accuracy: 0.7604 - val\_loss: 0.4940

Epoch 710/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7558 - loss: 0.4587 - val\_accuracy: 0.7604 - val\_loss: 0.4940

Epoch 711/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7559 - loss: 0.4622 - val\_accuracy: 0.7604 - val\_loss: 0.4940

Epoch 712/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7661 - loss: 0.4756 - val\_accuracy: 0.7604 - val\_loss: 0.4939

Epoch 713/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7909 - loss: 0.4276 - val\_accuracy: 0.7604 - val\_loss: 0.4939

Epoch 714/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7964 - loss: 0.4389 - val\_accuracy: 0.7604 - val\_loss: 0.4939

Epoch 715/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7318 - loss: 0.5059 - val\_accuracy: 0.7604 - val\_loss: 0.4939

Epoch 716/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7989 - loss: 0.4308 - val\_accuracy: 0.7604 - val\_loss: 0.4939

Epoch 717/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8007 - loss: 0.4316 - val\_accuracy: 0.7604 - val\_loss: 0.4938

Epoch 718/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7886 - loss: 0.4398 - val\_accuracy: 0.7604 - val\_loss: 0.4938

Epoch 719/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7688 - loss: 0.4654 - val\_accuracy: 0.7604 - val\_loss: 0.4938

Epoch 720/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7769 - loss: 0.4649 - val\_accuracy: 0.7604 - val\_loss: 0.4938

Epoch 721/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7776 - loss: 0.4577 - val\_accuracy: 0.7604 - val\_loss: 0.4938

Epoch 722/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7713 - loss: 0.4647 - val\_accuracy: 0.7604 - val\_loss: 0.4938

Epoch 723/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7857 - loss: 0.4623 - val\_accuracy: 0.7604 - val\_loss: 0.4938

Epoch 724/1500

18/18 ————— 0s 7ms/step - accuracy: 0.7867 - loss: 0.4360 - val\_accuracy: 0.7604 - val\_loss: 0.4937  
Epoch 725/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7972 - loss: 0.4401 - val\_accuracy: 0.7604 - val\_loss: 0.4937  
Epoch 726/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7932 - loss: 0.4461 - val\_accuracy: 0.7552 - val\_loss: 0.4937  
Epoch 727/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7599 - loss: 0.4777 - val\_accuracy: 0.7552 - val\_loss: 0.4937  
Epoch 728/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8041 - loss: 0.4322 - val\_accuracy: 0.7552 - val\_loss: 0.4937  
Epoch 729/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8005 - loss: 0.4597 - val\_accuracy: 0.7500 - val\_loss: 0.4937  
Epoch 730/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7989 - loss: 0.4188 - val\_accuracy: 0.7500 - val\_loss: 0.4937  
Epoch 731/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7854 - loss: 0.4562 - val\_accuracy: 0.7500 - val\_loss: 0.4937  
Epoch 732/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7658 - loss: 0.4545 - val\_accuracy: 0.7500 - val\_loss: 0.4937  
Epoch 733/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7903 - loss: 0.4316 - val\_accuracy: 0.7500 - val\_loss: 0.4937  
Epoch 734/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7748 - loss: 0.4570 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 735/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7832 - loss: 0.4545 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 736/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7861 - loss: 0.4588 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 737/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8018 - loss: 0.4357 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 738/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7738 - loss: 0.4611 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 739/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7930 - loss: 0.4369 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 740/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7902 - loss: 0.4326 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 741/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8024 - loss: 0.4408 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 742/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7772 - loss: 0.4635 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 743/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8005 - loss: 0.4372 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 744/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7718 - loss: 0.4655 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 745/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7668 - loss: 0.4878 - val\_accuracy: 0.7500 - val\_loss: 0.4935  
Epoch 746/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8105 - loss: 0.4141 - val\_accuracy: 0.7500 - val\_loss: 0.4935  
Epoch 747/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7682 - loss: 0.4798 - val\_accuracy: 0.7500 - val\_loss: 0.4935



0.4935  
Epoch 748/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7545 - loss: 0.4606 - val\_accuracy: 0.7500 - val\_loss: 0.4935  
Epoch 749/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7865 - loss: 0.4420 - val\_accuracy: 0.7500 - val\_loss: 0.4935  
Epoch 750/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7971 - loss: 0.4462 - val\_accuracy: 0.7500 - val\_loss: 0.4935  
Epoch 751/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7807 - loss: 0.4734 - val\_accuracy: 0.7500 - val\_loss: 0.4934  
Epoch 752/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8013 - loss: 0.4604 - val\_accuracy: 0.7500 - val\_loss: 0.4934  
Epoch 753/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7764 - loss: 0.4657 - val\_accuracy: 0.7500 - val\_loss: 0.4934  
Epoch 754/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7910 - loss: 0.4510 - val\_accuracy: 0.7500 - val\_loss: 0.4934  
Epoch 755/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7924 - loss: 0.4595 - val\_accuracy: 0.7500 - val\_loss: 0.4934  
Epoch 756/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7852 - loss: 0.4542 - val\_accuracy: 0.7500 - val\_loss: 0.4933  
Epoch 757/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7818 - loss: 0.4543 - val\_accuracy: 0.7500 - val\_loss: 0.4933  
Epoch 758/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7886 - loss: 0.4360 - val\_accuracy: 0.7500 - val\_loss: 0.4933  
Epoch 759/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7824 - loss: 0.4530 - val\_accuracy: 0.7500 - val\_loss: 0.4933  
Epoch 760/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7890 - loss: 0.4494 - val\_accuracy: 0.7500 - val\_loss: 0.4932  
Epoch 761/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8109 - loss: 0.4188 - val\_accuracy: 0.7500 - val\_loss: 0.4932  
Epoch 762/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7803 - loss: 0.4516 - val\_accuracy: 0.7500 - val\_loss: 0.4932  
Epoch 763/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7911 - loss: 0.4356 - val\_accuracy: 0.7500 - val\_loss: 0.4932  
Epoch 764/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7495 - loss: 0.4866 - val\_accuracy: 0.7500 - val\_loss: 0.4931  
Epoch 765/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7665 - loss: 0.4579 - val\_accuracy: 0.7552 - val\_loss: 0.4931  
Epoch 766/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.8036 - loss: 0.4470 - val\_accuracy: 0.7552 - val\_loss: 0.4931  
Epoch 767/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7690 - loss: 0.4681 - val\_accuracy: 0.7552 - val\_loss: 0.4930  
Epoch 768/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7749 - loss: 0.4675 - val\_accuracy: 0.7552 - val\_loss: 0.4930  
Epoch 769/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7561 - loss: 0.4757 - val\_accuracy: 0.7552 - val\_loss: 0.4930  
Epoch 770/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7980 - loss: 0.4466 - val\_accuracy: 0.7552 - val\_loss: 0.4930

Epoch 771/1500  
18/18 — 0s 6ms/step - accuracy: 0.7829 - loss: 0.4572 - val\_accuracy: 0.7552 - val\_loss: 0.4929

Epoch 772/1500  
18/18 — 0s 6ms/step - accuracy: 0.7566 - loss: 0.4862 - val\_accuracy: 0.7552 - val\_loss: 0.4929

Epoch 773/1500  
18/18 — 0s 9ms/step - accuracy: 0.7638 - loss: 0.4832 - val\_accuracy: 0.7552 - val\_loss: 0.4929

Epoch 774/1500  
18/18 — 0s 6ms/step - accuracy: 0.7973 - loss: 0.4235 - val\_accuracy: 0.7552 - val\_loss: 0.4928

Epoch 775/1500  
18/18 — 0s 6ms/step - accuracy: 0.7685 - loss: 0.4677 - val\_accuracy: 0.7552 - val\_loss: 0.4928

Epoch 776/1500  
18/18 — 0s 6ms/step - accuracy: 0.7999 - loss: 0.4456 - val\_accuracy: 0.7552 - val\_loss: 0.4928

Epoch 777/1500  
18/18 — 0s 8ms/step - accuracy: 0.7878 - loss: 0.4461 - val\_accuracy: 0.7552 - val\_loss: 0.4928

Epoch 778/1500  
18/18 — 0s 7ms/step - accuracy: 0.7951 - loss: 0.4573 - val\_accuracy: 0.7552 - val\_loss: 0.4927

Epoch 779/1500  
18/18 — 0s 6ms/step - accuracy: 0.7838 - loss: 0.4410 - val\_accuracy: 0.7552 - val\_loss: 0.4927

Epoch 780/1500  
18/18 — 0s 6ms/step - accuracy: 0.7750 - loss: 0.4606 - val\_accuracy: 0.7552 - val\_loss: 0.4927

Epoch 781/1500  
18/18 — 0s 6ms/step - accuracy: 0.8041 - loss: 0.4297 - val\_accuracy: 0.7552 - val\_loss: 0.4927

Epoch 782/1500  
18/18 — 0s 7ms/step - accuracy: 0.7867 - loss: 0.4566 - val\_accuracy: 0.7552 - val\_loss: 0.4926

Epoch 783/1500  
18/18 — 0s 10ms/step - accuracy: 0.8010 - loss: 0.4275 - val\_accuracy: 0.7552 - val\_loss: 0.4926

Epoch 784/1500  
18/18 — 0s 7ms/step - accuracy: 0.7767 - loss: 0.4553 - val\_accuracy: 0.7552 - val\_loss: 0.4926

Epoch 785/1500  
18/18 — 0s 7ms/step - accuracy: 0.7958 - loss: 0.4406 - val\_accuracy: 0.7552 - val\_loss: 0.4926

Epoch 786/1500  
18/18 — 0s 6ms/step - accuracy: 0.7771 - loss: 0.4749 - val\_accuracy: 0.7552 - val\_loss: 0.4926

Epoch 787/1500  
18/18 — 0s 8ms/step - accuracy: 0.7932 - loss: 0.4290 - val\_accuracy: 0.7552 - val\_loss: 0.4925

Epoch 788/1500  
18/18 — 0s 6ms/step - accuracy: 0.7727 - loss: 0.4622 - val\_accuracy: 0.7552 - val\_loss: 0.4925

Epoch 789/1500  
18/18 — 0s 6ms/step - accuracy: 0.7947 - loss: 0.4383 - val\_accuracy: 0.7552 - val\_loss: 0.4925

Epoch 790/1500  
18/18 — 0s 6ms/step - accuracy: 0.7972 - loss: 0.4318 - val\_accuracy: 0.7552 - val\_loss: 0.4925

Epoch 791/1500  
18/18 — 0s 7ms/step - accuracy: 0.7752 - loss: 0.4742 - val\_accuracy: 0.7552 - val\_loss: 0.4924

Epoch 792/1500  
18/18 — 0s 8ms/step - accuracy: 0.8129 - loss: 0.4174 - val\_accuracy: 0.7552 - val\_loss: 0.4924

Epoch 793/1500  
18/18 — 0s 6ms/step - accuracy: 0.7878 - loss: 0.4375 - val\_accuracy: 0.7552 - val\_loss: 0.4924

Epoch 794/1500

18/18 ————— 0s 6ms/step - accuracy: 0.7584 - loss: 0.4972 - val\_accuracy: 0.7552 - val\_loss: 0.4924  
Epoch 795/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7883 - loss: 0.4395 - val\_accuracy: 0.7552 - val\_loss: 0.4923  
Epoch 796/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7886 - loss: 0.4437 - val\_accuracy: 0.7552 - val\_loss: 0.4923  
Epoch 797/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7755 - loss: 0.4596 - val\_accuracy: 0.7552 - val\_loss: 0.4923  
Epoch 798/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7927 - loss: 0.4556 - val\_accuracy: 0.7552 - val\_loss: 0.4923  
Epoch 799/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7890 - loss: 0.4341 - val\_accuracy: 0.7500 - val\_loss: 0.4922  
Epoch 800/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7985 - loss: 0.4322 - val\_accuracy: 0.7500 - val\_loss: 0.4922  
Epoch 801/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7831 - loss: 0.4725 - val\_accuracy: 0.7500 - val\_loss: 0.4922  
Epoch 802/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7938 - loss: 0.4408 - val\_accuracy: 0.7500 - val\_loss: 0.4922  
Epoch 803/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7919 - loss: 0.4291 - val\_accuracy: 0.7500 - val\_loss: 0.4921  
Epoch 804/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7641 - loss: 0.4646 - val\_accuracy: 0.7500 - val\_loss: 0.4921  
Epoch 805/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7774 - loss: 0.4601 - val\_accuracy: 0.7500 - val\_loss: 0.4921  
Epoch 806/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7909 - loss: 0.4454 - val\_accuracy: 0.7500 - val\_loss: 0.4921  
Epoch 807/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7897 - loss: 0.4386 - val\_accuracy: 0.7500 - val\_loss: 0.4920  
Epoch 808/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7978 - loss: 0.4389 - val\_accuracy: 0.7500 - val\_loss: 0.4920  
Epoch 809/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8193 - loss: 0.4281 - val\_accuracy: 0.7500 - val\_loss: 0.4920  
Epoch 810/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7777 - loss: 0.4601 - val\_accuracy: 0.7500 - val\_loss: 0.4920  
Epoch 811/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7979 - loss: 0.4330 - val\_accuracy: 0.7500 - val\_loss: 0.4919  
Epoch 812/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7722 - loss: 0.4569 - val\_accuracy: 0.7500 - val\_loss: 0.4919  
Epoch 813/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7928 - loss: 0.4416 - val\_accuracy: 0.7500 - val\_loss: 0.4919  
Epoch 814/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.8009 - loss: 0.4413 - val\_accuracy: 0.7500 - val\_loss: 0.4919  
Epoch 815/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7874 - loss: 0.4483 - val\_accuracy: 0.7500 - val\_loss: 0.4919  
Epoch 816/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8309 - loss: 0.4140 - val\_accuracy: 0.7500 - val\_loss: 0.4918  
Epoch 817/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7897 - loss: 0.4417 - val\_accuracy: 0.7500 - val\_loss: 0.4918

0.4918  
Epoch 818/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7875 - loss: 0.4517 - val\_accuracy: 0.7448 - val\_loss: 0.4918  
Epoch 819/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7733 - loss: 0.4546 - val\_accuracy: 0.7448 - val\_loss: 0.4918  
Epoch 820/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7771 - loss: 0.4577 - val\_accuracy: 0.7448 - val\_loss: 0.4917  
Epoch 821/1500  
18/18 ————— 0s 19ms/step - accuracy: 0.7755 - loss: 0.4387 - val\_accuracy: 0.7448 - val\_loss: 0.4917  
Epoch 822/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7914 - loss: 0.4716 - val\_accuracy: 0.7448 - val\_loss: 0.4917  
Epoch 823/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7957 - loss: 0.4317 - val\_accuracy: 0.7448 - val\_loss: 0.4917  
Epoch 824/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7845 - loss: 0.4574 - val\_accuracy: 0.7448 - val\_loss: 0.4916  
Epoch 825/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7838 - loss: 0.4420 - val\_accuracy: 0.7448 - val\_loss: 0.4916  
Epoch 826/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7816 - loss: 0.4562 - val\_accuracy: 0.7448 - val\_loss: 0.4916  
Epoch 827/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7940 - loss: 0.4475 - val\_accuracy: 0.7448 - val\_loss: 0.4916  
Epoch 828/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7935 - loss: 0.4377 - val\_accuracy: 0.7448 - val\_loss: 0.4915  
Epoch 829/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7875 - loss: 0.4274 - val\_accuracy: 0.7448 - val\_loss: 0.4915  
Epoch 830/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7820 - loss: 0.4487 - val\_accuracy: 0.7448 - val\_loss: 0.4915  
Epoch 831/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7724 - loss: 0.4762 - val\_accuracy: 0.7448 - val\_loss: 0.4915  
Epoch 832/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7823 - loss: 0.4463 - val\_accuracy: 0.7448 - val\_loss: 0.4914  
Epoch 833/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7857 - loss: 0.4576 - val\_accuracy: 0.7448 - val\_loss: 0.4914  
Epoch 834/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7843 - loss: 0.4531 - val\_accuracy: 0.7448 - val\_loss: 0.4914  
Epoch 835/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7753 - loss: 0.4741 - val\_accuracy: 0.7448 - val\_loss: 0.4914  
Epoch 836/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7686 - loss: 0.4585 - val\_accuracy: 0.7448 - val\_loss: 0.4914  
Epoch 837/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7469 - loss: 0.4816 - val\_accuracy: 0.7448 - val\_loss: 0.4913  
Epoch 838/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7914 - loss: 0.4460 - val\_accuracy: 0.7448 - val\_loss: 0.4913  
Epoch 839/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8066 - loss: 0.4114 - val\_accuracy: 0.7448 - val\_loss: 0.4913  
Epoch 840/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7812 - loss: 0.4572 - val\_accuracy: 0.7448 - val\_loss: 0.4913

Epoch 841/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7872 - loss: 0.4472 - val\_accuracy: 0.7448 - val\_loss: 0.4913  
Epoch 842/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7869 - loss: 0.4483 - val\_accuracy: 0.7448 - val\_loss: 0.4913  
Epoch 843/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8057 - loss: 0.4202 - val\_accuracy: 0.7448 - val\_loss: 0.4913  
Epoch 844/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7902 - loss: 0.4491 - val\_accuracy: 0.7500 - val\_loss: 0.4913  
Epoch 845/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7645 - loss: 0.4581 - val\_accuracy: 0.7500 - val\_loss: 0.4913  
Epoch 846/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7979 - loss: 0.4283 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 847/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7878 - loss: 0.4516 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 848/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7909 - loss: 0.4621 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 849/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7863 - loss: 0.4506 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 850/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7953 - loss: 0.4453 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 851/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8053 - loss: 0.4149 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 852/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7862 - loss: 0.4616 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 853/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7680 - loss: 0.4601 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 854/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7840 - loss: 0.4503 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 855/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7746 - loss: 0.4422 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 856/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7965 - loss: 0.4581 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 857/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8107 - loss: 0.4156 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 858/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7713 - loss: 0.4528 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 859/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7814 - loss: 0.4390 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 860/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7822 - loss: 0.4584 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 861/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7985 - loss: 0.4424 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 862/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7915 - loss: 0.4328 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 863/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7669 - loss: 0.4502 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 864/1500

18/18 ————— 0s 11ms/step - accuracy: 0.8178 - loss: 0.4240 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 865/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7718 - loss: 0.4410 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 866/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7838 - loss: 0.4502 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 867/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7905 - loss: 0.4439 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 868/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7747 - loss: 0.4489 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 869/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7858 - loss: 0.4403 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 870/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7469 - loss: 0.4792 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 871/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.8180 - loss: 0.4039 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 872/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7956 - loss: 0.4214 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 873/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7818 - loss: 0.4551 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 874/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.7812 - loss: 0.4520 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 875/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7844 - loss: 0.4553 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 876/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7909 - loss: 0.4341 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 877/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7998 - loss: 0.4415 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 878/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8030 - loss: 0.4452 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 879/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7765 - loss: 0.4547 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 880/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7609 - loss: 0.4891 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 881/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7996 - loss: 0.4402 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 882/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7624 - loss: 0.4799 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 883/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7689 - loss: 0.4767 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 884/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7809 - loss: 0.4491 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 885/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8056 - loss: 0.4099 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 886/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8099 - loss: 0.4038 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 887/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7843 - loss: 0.4444 - val\_accuracy: 0.7500 - val\_loss: 0.4911

0.4911  
Epoch 888/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7888 - loss: 0.4411 - val\_accuracy: 0.7500 - val\_loss: 0.4910  
Epoch 889/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7592 - loss: 0.4752 - val\_accuracy: 0.7500 - val\_loss: 0.4910  
Epoch 890/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7768 - loss: 0.4672 - val\_accuracy: 0.7500 - val\_loss: 0.4910  
Epoch 891/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7768 - loss: 0.4470 - val\_accuracy: 0.7500 - val\_loss: 0.4910  
Epoch 892/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7819 - loss: 0.4498 - val\_accuracy: 0.7500 - val\_loss: 0.4910  
Epoch 893/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8050 - loss: 0.4209 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 894/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7839 - loss: 0.4493 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 895/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7757 - loss: 0.4553 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 896/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7796 - loss: 0.4478 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 897/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7898 - loss: 0.4473 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 898/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7961 - loss: 0.4689 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 899/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7924 - loss: 0.4393 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 900/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7777 - loss: 0.4620 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 901/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7944 - loss: 0.4539 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 902/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7552 - loss: 0.4905 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 903/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7989 - loss: 0.4284 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 904/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8070 - loss: 0.4211 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 905/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7711 - loss: 0.4655 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 906/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7884 - loss: 0.4353 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 907/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8121 - loss: 0.4296 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 908/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8048 - loss: 0.4316 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 909/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7894 - loss: 0.4407 - val\_accuracy: 0.7500 - val\_loss: 0.4911  
Epoch 910/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7989 - loss: 0.4463 - val\_accuracy: 0.7500 - val\_loss: 0.4911

Epoch 911/1500  
18/18 — 0s 6ms/step - accuracy: 0.7715 - loss: 0.4653 - val\_accuracy: 0.7500 - val\_loss: 0.4911

Epoch 912/1500  
18/18 — 0s 9ms/step - accuracy: 0.8153 - loss: 0.4300 - val\_accuracy: 0.7500 - val\_loss: 0.4911

Epoch 913/1500  
18/18 — 0s 6ms/step - accuracy: 0.7882 - loss: 0.4336 - val\_accuracy: 0.7500 - val\_loss: 0.4911

Epoch 914/1500  
18/18 — 0s 6ms/step - accuracy: 0.8119 - loss: 0.4258 - val\_accuracy: 0.7500 - val\_loss: 0.4911

Epoch 915/1500  
18/18 — 0s 6ms/step - accuracy: 0.7800 - loss: 0.4391 - val\_accuracy: 0.7500 - val\_loss: 0.4911

Epoch 916/1500  
18/18 — 0s 6ms/step - accuracy: 0.7885 - loss: 0.4469 - val\_accuracy: 0.7500 - val\_loss: 0.4911

Epoch 917/1500  
18/18 — 0s 11ms/step - accuracy: 0.7936 - loss: 0.4584 - val\_accuracy: 0.7500 - val\_loss: 0.4911

Epoch 918/1500  
18/18 — 0s 9ms/step - accuracy: 0.7858 - loss: 0.4576 - val\_accuracy: 0.7500 - val\_loss: 0.4911

Epoch 919/1500  
18/18 — 0s 12ms/step - accuracy: 0.7728 - loss: 0.4752 - val\_accuracy: 0.7500 - val\_loss: 0.4911

Epoch 920/1500  
18/18 — 0s 10ms/step - accuracy: 0.7857 - loss: 0.4609 - val\_accuracy: 0.7500 - val\_loss: 0.4911

Epoch 921/1500  
18/18 — 0s 12ms/step - accuracy: 0.8061 - loss: 0.4190 - val\_accuracy: 0.7500 - val\_loss: 0.4911

Epoch 922/1500  
18/18 — 0s 10ms/step - accuracy: 0.7749 - loss: 0.4547 - val\_accuracy: 0.7500 - val\_loss: 0.4911

Epoch 923/1500  
18/18 — 0s 11ms/step - accuracy: 0.7982 - loss: 0.4345 - val\_accuracy: 0.7500 - val\_loss: 0.4912

Epoch 924/1500  
18/18 — 0s 12ms/step - accuracy: 0.7908 - loss: 0.4605 - val\_accuracy: 0.7500 - val\_loss: 0.4912

Epoch 925/1500  
18/18 — 0s 13ms/step - accuracy: 0.8014 - loss: 0.4333 - val\_accuracy: 0.7500 - val\_loss: 0.4912

Epoch 926/1500  
18/18 — 0s 10ms/step - accuracy: 0.8039 - loss: 0.4282 - val\_accuracy: 0.7500 - val\_loss: 0.4912

Epoch 927/1500  
18/18 — 0s 10ms/step - accuracy: 0.8081 - loss: 0.4137 - val\_accuracy: 0.7500 - val\_loss: 0.4912

Epoch 928/1500  
18/18 — 0s 10ms/step - accuracy: 0.8057 - loss: 0.4373 - val\_accuracy: 0.7500 - val\_loss: 0.4912

Epoch 929/1500  
18/18 — 0s 6ms/step - accuracy: 0.7772 - loss: 0.4412 - val\_accuracy: 0.7500 - val\_loss: 0.4912

Epoch 930/1500  
18/18 — 0s 6ms/step - accuracy: 0.7781 - loss: 0.4462 - val\_accuracy: 0.7500 - val\_loss: 0.4912

Epoch 931/1500  
18/18 — 0s 9ms/step - accuracy: 0.8111 - loss: 0.4083 - val\_accuracy: 0.7500 - val\_loss: 0.4912

Epoch 932/1500  
18/18 — 0s 6ms/step - accuracy: 0.8045 - loss: 0.4375 - val\_accuracy: 0.7500 - val\_loss: 0.4912

Epoch 933/1500  
18/18 — 0s 6ms/step - accuracy: 0.7856 - loss: 0.4394 - val\_accuracy: 0.7500 - val\_loss: 0.4912

Epoch 934/1500



18/18 ————— 0s 6ms/step - accuracy: 0.8087 - loss: 0.4110 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 935/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7935 - loss: 0.4265 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 936/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7982 - loss: 0.4379 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 937/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7964 - loss: 0.4363 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 938/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8052 - loss: 0.4324 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 939/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7825 - loss: 0.4488 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 940/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7786 - loss: 0.4548 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 941/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7950 - loss: 0.4375 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 942/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8063 - loss: 0.4548 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 943/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8047 - loss: 0.4332 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 944/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7879 - loss: 0.4407 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 945/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7922 - loss: 0.4351 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 946/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8073 - loss: 0.4212 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 947/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7844 - loss: 0.4498 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 948/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7827 - loss: 0.4380 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 949/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8190 - loss: 0.4213 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 950/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7907 - loss: 0.4501 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 951/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7868 - loss: 0.4424 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 952/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7908 - loss: 0.4508 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 953/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7587 - loss: 0.4733 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 954/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7898 - loss: 0.4313 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 955/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8009 - loss: 0.4363 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 956/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7765 - loss: 0.4619 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 957/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8102 - loss: 0.4205 - val\_accuracy: 0.7500 - val\_loss: 0.4912

0.4912  
Epoch 958/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7516 - loss: 0.4887 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 959/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8046 - loss: 0.4266 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 960/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7740 - loss: 0.4613 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 961/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7816 - loss: 0.4614 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 962/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8032 - loss: 0.4201 - val\_accuracy: 0.7500 - val\_loss: 0.4912  
Epoch 963/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8031 - loss: 0.4200 - val\_accuracy: 0.7500 - val\_loss: 0.4913  
Epoch 964/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7926 - loss: 0.4306 - val\_accuracy: 0.7500 - val\_loss: 0.4913  
Epoch 965/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7793 - loss: 0.4642 - val\_accuracy: 0.7500 - val\_loss: 0.4913  
Epoch 966/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7829 - loss: 0.4416 - val\_accuracy: 0.7500 - val\_loss: 0.4913  
Epoch 967/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7841 - loss: 0.4390 - val\_accuracy: 0.7500 - val\_loss: 0.4913  
Epoch 968/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7796 - loss: 0.4533 - val\_accuracy: 0.7500 - val\_loss: 0.4913  
Epoch 969/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7689 - loss: 0.4826 - val\_accuracy: 0.7500 - val\_loss: 0.4913  
Epoch 970/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7928 - loss: 0.4400 - val\_accuracy: 0.7500 - val\_loss: 0.4913  
Epoch 971/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.8052 - loss: 0.4274 - val\_accuracy: 0.7500 - val\_loss: 0.4913  
Epoch 972/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7795 - loss: 0.4511 - val\_accuracy: 0.7500 - val\_loss: 0.4913  
Epoch 973/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.7787 - loss: 0.4474 - val\_accuracy: 0.7552 - val\_loss: 0.4913  
Epoch 974/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7959 - loss: 0.4313 - val\_accuracy: 0.7552 - val\_loss: 0.4913  
Epoch 975/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7869 - loss: 0.4460 - val\_accuracy: 0.7552 - val\_loss: 0.4913  
Epoch 976/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7826 - loss: 0.4480 - val\_accuracy: 0.7552 - val\_loss: 0.4913  
Epoch 977/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7633 - loss: 0.4868 - val\_accuracy: 0.7552 - val\_loss: 0.4913  
Epoch 978/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.8138 - loss: 0.4226 - val\_accuracy: 0.7552 - val\_loss: 0.4913  
Epoch 979/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7936 - loss: 0.4320 - val\_accuracy: 0.7552 - val\_loss: 0.4913  
Epoch 980/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7797 - loss: 0.4634 - val\_accuracy: 0.7552 - val\_loss: 0.4913

Epoch 981/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.8183 - loss: 0.4203 - val\_accuracy: 0.7552 - val\_loss: 0.4913  
Epoch 982/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7712 - loss: 0.4583 - val\_accuracy: 0.7552 - val\_loss: 0.4914  
Epoch 983/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7796 - loss: 0.4558 - val\_accuracy: 0.7552 - val\_loss: 0.4914  
Epoch 984/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7967 - loss: 0.4321 - val\_accuracy: 0.7552 - val\_loss: 0.4914  
Epoch 985/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7994 - loss: 0.4176 - val\_accuracy: 0.7552 - val\_loss: 0.4914  
Epoch 986/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8051 - loss: 0.4284 - val\_accuracy: 0.7552 - val\_loss: 0.4914  
Epoch 987/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8107 - loss: 0.4286 - val\_accuracy: 0.7552 - val\_loss: 0.4914  
Epoch 988/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7769 - loss: 0.4587 - val\_accuracy: 0.7552 - val\_loss: 0.4914  
Epoch 989/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7883 - loss: 0.4507 - val\_accuracy: 0.7552 - val\_loss: 0.4914  
Epoch 990/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7995 - loss: 0.4370 - val\_accuracy: 0.7552 - val\_loss: 0.4914  
Epoch 991/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7697 - loss: 0.4662 - val\_accuracy: 0.7552 - val\_loss: 0.4915  
Epoch 992/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7975 - loss: 0.4196 - val\_accuracy: 0.7552 - val\_loss: 0.4915  
Epoch 993/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7751 - loss: 0.4681 - val\_accuracy: 0.7552 - val\_loss: 0.4915  
Epoch 994/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7729 - loss: 0.4659 - val\_accuracy: 0.7552 - val\_loss: 0.4915  
Epoch 995/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7735 - loss: 0.4462 - val\_accuracy: 0.7552 - val\_loss: 0.4915  
Epoch 996/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8033 - loss: 0.4268 - val\_accuracy: 0.7552 - val\_loss: 0.4915  
Epoch 997/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8101 - loss: 0.4477 - val\_accuracy: 0.7552 - val\_loss: 0.4915  
Epoch 998/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7872 - loss: 0.4446 - val\_accuracy: 0.7552 - val\_loss: 0.4915  
Epoch 999/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7822 - loss: 0.4448 - val\_accuracy: 0.7552 - val\_loss: 0.4916  
Epoch 1000/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7576 - loss: 0.4617 - val\_accuracy: 0.7552 - val\_loss: 0.4916  
Epoch 1001/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7957 - loss: 0.4408 - val\_accuracy: 0.7552 - val\_loss: 0.4916  
Epoch 1002/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7765 - loss: 0.4601 - val\_accuracy: 0.7552 - val\_loss: 0.4916  
Epoch 1003/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7801 - loss: 0.4274 - val\_accuracy: 0.7552 - val\_loss: 0.4916  
Epoch 1004/1500

18/18 ————— 0s 6ms/step - accuracy: 0.8131 - loss: 0.4008 - val\_accuracy: 0.7552 - val\_loss: 0.4916  
Epoch 1005/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7624 - loss: 0.4737 - val\_accuracy: 0.7552 - val\_loss: 0.4916  
Epoch 1006/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7759 - loss: 0.4356 - val\_accuracy: 0.7552 - val\_loss: 0.4916  
Epoch 1007/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7630 - loss: 0.4839 - val\_accuracy: 0.7552 - val\_loss: 0.4916  
Epoch 1008/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7551 - loss: 0.4874 - val\_accuracy: 0.7552 - val\_loss: 0.4917  
Epoch 1009/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8139 - loss: 0.4393 - val\_accuracy: 0.7552 - val\_loss: 0.4917  
Epoch 1010/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7968 - loss: 0.4299 - val\_accuracy: 0.7552 - val\_loss: 0.4917  
Epoch 1011/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8205 - loss: 0.4159 - val\_accuracy: 0.7552 - val\_loss: 0.4917  
Epoch 1012/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8109 - loss: 0.4056 - val\_accuracy: 0.7552 - val\_loss: 0.4917  
Epoch 1013/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8134 - loss: 0.4307 - val\_accuracy: 0.7552 - val\_loss: 0.4917  
Epoch 1014/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7877 - loss: 0.4348 - val\_accuracy: 0.7552 - val\_loss: 0.4917  
Epoch 1015/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8050 - loss: 0.4380 - val\_accuracy: 0.7552 - val\_loss: 0.4917  
Epoch 1016/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7917 - loss: 0.4178 - val\_accuracy: 0.7552 - val\_loss: 0.4917  
Epoch 1017/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7914 - loss: 0.4232 - val\_accuracy: 0.7552 - val\_loss: 0.4917  
Epoch 1018/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8016 - loss: 0.4135 - val\_accuracy: 0.7552 - val\_loss: 0.4917  
Epoch 1019/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8078 - loss: 0.4404 - val\_accuracy: 0.7552 - val\_loss: 0.4918  
Epoch 1020/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7928 - loss: 0.4533 - val\_accuracy: 0.7552 - val\_loss: 0.4918  
Epoch 1021/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7858 - loss: 0.4528 - val\_accuracy: 0.7552 - val\_loss: 0.4918  
Epoch 1022/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7972 - loss: 0.4339 - val\_accuracy: 0.7552 - val\_loss: 0.4918  
Epoch 1023/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7955 - loss: 0.4450 - val\_accuracy: 0.7552 - val\_loss: 0.4918  
Epoch 1024/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7913 - loss: 0.4639 - val\_accuracy: 0.7552 - val\_loss: 0.4918  
Epoch 1025/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8209 - loss: 0.4146 - val\_accuracy: 0.7552 - val\_loss: 0.4918  
Epoch 1026/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.8139 - loss: 0.4089 - val\_accuracy: 0.7552 - val\_loss: 0.4918  
Epoch 1027/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7920 - loss: 0.4384 - val\_accuracy: 0.7552 - val\_loss: 0.4918

0.4918  
Epoch 1028/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.8089 - loss: 0.4375 - val\_accuracy: 0.7552 - val\_loss: 0.4918  
Epoch 1029/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7931 - loss: 0.4347 - val\_accuracy: 0.7552 - val\_loss: 0.4918  
Epoch 1030/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7696 - loss: 0.4667 - val\_accuracy: 0.7604 - val\_loss: 0.4918  
Epoch 1031/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.8265 - loss: 0.3846 - val\_accuracy: 0.7604 - val\_loss: 0.4919  
Epoch 1032/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8098 - loss: 0.4271 - val\_accuracy: 0.7656 - val\_loss: 0.4919  
Epoch 1033/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8093 - loss: 0.4264 - val\_accuracy: 0.7656 - val\_loss: 0.4919  
Epoch 1034/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7803 - loss: 0.4541 - val\_accuracy: 0.7656 - val\_loss: 0.4919  
Epoch 1035/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7874 - loss: 0.4450 - val\_accuracy: 0.7656 - val\_loss: 0.4919  
Epoch 1036/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7886 - loss: 0.4349 - val\_accuracy: 0.7656 - val\_loss: 0.4919  
Epoch 1037/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7746 - loss: 0.4466 - val\_accuracy: 0.7656 - val\_loss: 0.4919  
Epoch 1038/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7882 - loss: 0.4384 - val\_accuracy: 0.7656 - val\_loss: 0.4919  
Epoch 1039/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7743 - loss: 0.4518 - val\_accuracy: 0.7656 - val\_loss: 0.4919  
Epoch 1040/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7881 - loss: 0.4465 - val\_accuracy: 0.7656 - val\_loss: 0.4919  
Epoch 1041/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8054 - loss: 0.4272 - val\_accuracy: 0.7656 - val\_loss: 0.4919  
Epoch 1042/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8034 - loss: 0.4225 - val\_accuracy: 0.7604 - val\_loss: 0.4919  
Epoch 1043/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7726 - loss: 0.4503 - val\_accuracy: 0.7604 - val\_loss: 0.4919  
Epoch 1044/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7846 - loss: 0.4413 - val\_accuracy: 0.7604 - val\_loss: 0.4919  
Epoch 1045/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7764 - loss: 0.4667 - val\_accuracy: 0.7604 - val\_loss: 0.4919  
Epoch 1046/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7737 - loss: 0.4548 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1047/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7822 - loss: 0.4543 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1048/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8045 - loss: 0.4326 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1049/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7838 - loss: 0.4663 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1050/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8001 - loss: 0.4331 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1051/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8048 - loss: 0.4372 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1052/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8126 - loss: 0.4237 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1053/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7996 - loss: 0.4339 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1054/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8142 - loss: 0.4136 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1055/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8058 - loss: 0.4462 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1056/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7584 - loss: 0.4727 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1057/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8077 - loss: 0.4228 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1058/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8097 - loss: 0.4531 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1059/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8021 - loss: 0.4208 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1060/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8015 - loss: 0.4324 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1061/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7886 - loss: 0.4525 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1062/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8264 - loss: 0.4219 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1063/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7806 - loss: 0.4368 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1064/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7670 - loss: 0.4612 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1065/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7905 - loss: 0.4338 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1066/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8218 - loss: 0.4020 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1067/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8092 - loss: 0.4267 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1068/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7957 - loss: 0.4416 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1069/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7774 - loss: 0.4403 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1070/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.8176 - loss: 0.4184 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1071/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.8070 - loss: 0.4328 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1072/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7920 - loss: 0.4484 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1073/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.8109 - loss: 0.4379 - val\_accuracy: 0.7604 - val\_loss: 0.4920

Epoch 1074/1500

18/18 ————— 0s 10ms/step - accuracy: 0.7917 - loss: 0.4481 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1075/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7935 - loss: 0.4512 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1076/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7995 - loss: 0.4488 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1077/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.8125 - loss: 0.4305 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1078/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7955 - loss: 0.4406 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1079/1500  
18/18 ————— 0s 17ms/step - accuracy: 0.8080 - loss: 0.4292 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1080/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7871 - loss: 0.4543 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1081/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7937 - loss: 0.4455 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1082/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7833 - loss: 0.4652 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1083/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7921 - loss: 0.4511 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1084/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7867 - loss: 0.4592 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1085/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7863 - loss: 0.4512 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1086/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8218 - loss: 0.4232 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1087/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8348 - loss: 0.3985 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1088/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8212 - loss: 0.4148 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1089/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8001 - loss: 0.4232 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1090/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7860 - loss: 0.4681 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1091/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7988 - loss: 0.4430 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1092/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7805 - loss: 0.4662 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1093/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8069 - loss: 0.4310 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1094/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7982 - loss: 0.4365 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1095/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8154 - loss: 0.4101 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1096/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8059 - loss: 0.4335 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1097/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7770 - loss: 0.4516 - val\_accuracy: 0.7604 - val\_loss: 0.4920

0.4920  
Epoch 1098/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7741 - loss: 0.4477 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1099/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8162 - loss: 0.4016 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1100/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8067 - loss: 0.4353 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1101/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7716 - loss: 0.4669 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1102/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7907 - loss: 0.4520 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1103/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8139 - loss: 0.4309 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1104/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8062 - loss: 0.4268 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1105/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7718 - loss: 0.4490 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1106/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8082 - loss: 0.4319 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1107/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7790 - loss: 0.4561 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1108/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7990 - loss: 0.4507 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1109/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7929 - loss: 0.4432 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1110/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7798 - loss: 0.4375 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1111/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8120 - loss: 0.4172 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1112/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7954 - loss: 0.4393 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1113/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8122 - loss: 0.4088 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1114/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7917 - loss: 0.4345 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1115/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7876 - loss: 0.4296 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1116/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7909 - loss: 0.4553 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1117/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8113 - loss: 0.4357 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1118/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7734 - loss: 0.4552 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1119/1500  
18/18 ————— 0s 16ms/step - accuracy: 0.8079 - loss: 0.4325 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1120/1500  
18/18 ————— 1s 9ms/step - accuracy: 0.7782 - loss: 0.4359 - val\_accuracy: 0.7604 - val\_loss: 0.4920



Epoch 1121/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7805 - loss: 0.4454 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1122/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7967 - loss: 0.4393 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1123/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7784 - loss: 0.4597 - val\_accuracy: 0.7604 - val\_loss: 0.4920  
Epoch 1124/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.8021 - loss: 0.4274 - val\_accuracy: 0.7604 - val\_loss: 0.4921  
Epoch 1125/1500  
18/18 ————— 0s 15ms/step - accuracy: 0.7839 - loss: 0.4524 - val\_accuracy: 0.7604 - val\_loss: 0.4921  
Epoch 1126/1500  
18/18 ————— 0s 15ms/step - accuracy: 0.7916 - loss: 0.4653 - val\_accuracy: 0.7604 - val\_loss: 0.4921  
Epoch 1127/1500  
18/18 ————— 1s 8ms/step - accuracy: 0.8177 - loss: 0.4201 - val\_accuracy: 0.7604 - val\_loss: 0.4921  
Epoch 1128/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8145 - loss: 0.4308 - val\_accuracy: 0.7604 - val\_loss: 0.4921  
Epoch 1129/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8002 - loss: 0.4179 - val\_accuracy: 0.7604 - val\_loss: 0.4921  
Epoch 1130/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8169 - loss: 0.4268 - val\_accuracy: 0.7604 - val\_loss: 0.4921  
Epoch 1131/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7976 - loss: 0.4535 - val\_accuracy: 0.7604 - val\_loss: 0.4921  
Epoch 1132/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7742 - loss: 0.4689 - val\_accuracy: 0.7604 - val\_loss: 0.4921  
Epoch 1133/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8079 - loss: 0.4433 - val\_accuracy: 0.7604 - val\_loss: 0.4921  
Epoch 1134/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8017 - loss: 0.4372 - val\_accuracy: 0.7604 - val\_loss: 0.4921  
Epoch 1135/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7992 - loss: 0.4425 - val\_accuracy: 0.7604 - val\_loss: 0.4921  
Epoch 1136/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7971 - loss: 0.4394 - val\_accuracy: 0.7604 - val\_loss: 0.4922  
Epoch 1137/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7796 - loss: 0.4714 - val\_accuracy: 0.7604 - val\_loss: 0.4922  
Epoch 1138/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7675 - loss: 0.4718 - val\_accuracy: 0.7604 - val\_loss: 0.4922  
Epoch 1139/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7967 - loss: 0.4300 - val\_accuracy: 0.7604 - val\_loss: 0.4922  
Epoch 1140/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8013 - loss: 0.4363 - val\_accuracy: 0.7604 - val\_loss: 0.4922  
Epoch 1141/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8089 - loss: 0.4050 - val\_accuracy: 0.7604 - val\_loss: 0.4922  
Epoch 1142/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7928 - loss: 0.4486 - val\_accuracy: 0.7604 - val\_loss: 0.4922  
Epoch 1143/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8110 - loss: 0.4377 - val\_accuracy: 0.7604 - val\_loss: 0.4922  
Epoch 1144/1500

18/18 ————— 0s 6ms/step - accuracy: 0.7928 - loss: 0.4550 - val\_accuracy: 0.7604 - val\_loss: 0.4922  
Epoch 1145/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8042 - loss: 0.4216 - val\_accuracy: 0.7604 - val\_loss: 0.4922  
Epoch 1146/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8059 - loss: 0.4458 - val\_accuracy: 0.7604 - val\_loss: 0.4923  
Epoch 1147/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8010 - loss: 0.4174 - val\_accuracy: 0.7604 - val\_loss: 0.4923  
Epoch 1148/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8007 - loss: 0.4348 - val\_accuracy: 0.7604 - val\_loss: 0.4923  
Epoch 1149/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7825 - loss: 0.4425 - val\_accuracy: 0.7604 - val\_loss: 0.4923  
Epoch 1150/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7991 - loss: 0.4269 - val\_accuracy: 0.7604 - val\_loss: 0.4923  
Epoch 1151/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7663 - loss: 0.4566 - val\_accuracy: 0.7604 - val\_loss: 0.4923  
Epoch 1152/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7998 - loss: 0.4306 - val\_accuracy: 0.7604 - val\_loss: 0.4923  
Epoch 1153/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7870 - loss: 0.4445 - val\_accuracy: 0.7604 - val\_loss: 0.4923  
Epoch 1154/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7905 - loss: 0.4195 - val\_accuracy: 0.7604 - val\_loss: 0.4923  
Epoch 1155/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8162 - loss: 0.4280 - val\_accuracy: 0.7604 - val\_loss: 0.4924  
Epoch 1156/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8129 - loss: 0.4092 - val\_accuracy: 0.7604 - val\_loss: 0.4924  
Epoch 1157/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8112 - loss: 0.4185 - val\_accuracy: 0.7604 - val\_loss: 0.4924  
Epoch 1158/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8290 - loss: 0.4059 - val\_accuracy: 0.7604 - val\_loss: 0.4924  
Epoch 1159/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7790 - loss: 0.4518 - val\_accuracy: 0.7604 - val\_loss: 0.4924  
Epoch 1160/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8227 - loss: 0.4115 - val\_accuracy: 0.7604 - val\_loss: 0.4924  
Epoch 1161/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7765 - loss: 0.4473 - val\_accuracy: 0.7604 - val\_loss: 0.4924  
Epoch 1162/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8154 - loss: 0.4193 - val\_accuracy: 0.7604 - val\_loss: 0.4924  
Epoch 1163/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7863 - loss: 0.4370 - val\_accuracy: 0.7604 - val\_loss: 0.4925  
Epoch 1164/1500  
18/18 ————— 0s 16ms/step - accuracy: 0.7890 - loss: 0.4473 - val\_accuracy: 0.7604 - val\_loss: 0.4925  
Epoch 1165/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.7893 - loss: 0.4507 - val\_accuracy: 0.7604 - val\_loss: 0.4925  
Epoch 1166/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7963 - loss: 0.4309 - val\_accuracy: 0.7604 - val\_loss: 0.4925  
Epoch 1167/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7787 - loss: 0.4580 - val\_accuracy: 0.7604 - val\_loss: 0.4925

0.4925  
Epoch 1168/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.8051 - loss: 0.4260 - val\_accuracy: 0.7604 - val\_loss: 0.4925  
Epoch 1169/1500  
18/18 ————— 0s 15ms/step - accuracy: 0.8101 - loss: 0.4115 - val\_accuracy: 0.7604 - val\_loss: 0.4925  
Epoch 1170/1500  
18/18 ————— 1s 12ms/step - accuracy: 0.7946 - loss: 0.4200 - val\_accuracy: 0.7604 - val\_loss: 0.4926  
Epoch 1171/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.7896 - loss: 0.4340 - val\_accuracy: 0.7604 - val\_loss: 0.4926  
Epoch 1172/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.8026 - loss: 0.4285 - val\_accuracy: 0.7604 - val\_loss: 0.4926  
Epoch 1173/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8039 - loss: 0.4177 - val\_accuracy: 0.7604 - val\_loss: 0.4926  
Epoch 1174/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7966 - loss: 0.4291 - val\_accuracy: 0.7604 - val\_loss: 0.4926  
Epoch 1175/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8007 - loss: 0.4290 - val\_accuracy: 0.7604 - val\_loss: 0.4926  
Epoch 1176/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7985 - loss: 0.4438 - val\_accuracy: 0.7604 - val\_loss: 0.4926  
Epoch 1177/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7936 - loss: 0.4226 - val\_accuracy: 0.7604 - val\_loss: 0.4926  
Epoch 1178/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7976 - loss: 0.4348 - val\_accuracy: 0.7604 - val\_loss: 0.4927  
Epoch 1179/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8080 - loss: 0.4234 - val\_accuracy: 0.7604 - val\_loss: 0.4927  
Epoch 1180/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7963 - loss: 0.4243 - val\_accuracy: 0.7604 - val\_loss: 0.4927  
Epoch 1181/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7867 - loss: 0.4480 - val\_accuracy: 0.7604 - val\_loss: 0.4927  
Epoch 1182/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8195 - loss: 0.4208 - val\_accuracy: 0.7604 - val\_loss: 0.4927  
Epoch 1183/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8057 - loss: 0.4214 - val\_accuracy: 0.7604 - val\_loss: 0.4927  
Epoch 1184/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8076 - loss: 0.4293 - val\_accuracy: 0.7604 - val\_loss: 0.4927  
Epoch 1185/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8108 - loss: 0.4275 - val\_accuracy: 0.7604 - val\_loss: 0.4927  
Epoch 1186/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8113 - loss: 0.4087 - val\_accuracy: 0.7604 - val\_loss: 0.4928  
Epoch 1187/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8023 - loss: 0.4603 - val\_accuracy: 0.7604 - val\_loss: 0.4928  
Epoch 1188/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7881 - loss: 0.4501 - val\_accuracy: 0.7604 - val\_loss: 0.4928  
Epoch 1189/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7809 - loss: 0.4647 - val\_accuracy: 0.7604 - val\_loss: 0.4928  
Epoch 1190/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8101 - loss: 0.4081 - val\_accuracy: 0.7604 - val\_loss: 0.4928

Epoch 1191/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8128 - loss: 0.4162 - val\_accuracy: 0.7604 - val\_loss: 0.4928  
Epoch 1192/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8078 - loss: 0.3964 - val\_accuracy: 0.7604 - val\_loss: 0.4928  
Epoch 1193/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8228 - loss: 0.4084 - val\_accuracy: 0.7604 - val\_loss: 0.4929  
Epoch 1194/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7768 - loss: 0.4643 - val\_accuracy: 0.7604 - val\_loss: 0.4929  
Epoch 1195/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8007 - loss: 0.4363 - val\_accuracy: 0.7604 - val\_loss: 0.4929  
Epoch 1196/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7849 - loss: 0.4366 - val\_accuracy: 0.7604 - val\_loss: 0.4929  
Epoch 1197/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7909 - loss: 0.4403 - val\_accuracy: 0.7604 - val\_loss: 0.4929  
Epoch 1198/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7927 - loss: 0.4330 - val\_accuracy: 0.7604 - val\_loss: 0.4929  
Epoch 1199/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7936 - loss: 0.4491 - val\_accuracy: 0.7604 - val\_loss: 0.4929  
Epoch 1200/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7794 - loss: 0.4469 - val\_accuracy: 0.7604 - val\_loss: 0.4929  
Epoch 1201/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8079 - loss: 0.4390 - val\_accuracy: 0.7604 - val\_loss: 0.4929  
Epoch 1202/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7954 - loss: 0.4329 - val\_accuracy: 0.7604 - val\_loss: 0.4929  
Epoch 1203/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8091 - loss: 0.4179 - val\_accuracy: 0.7656 - val\_loss: 0.4929  
Epoch 1204/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8071 - loss: 0.4265 - val\_accuracy: 0.7656 - val\_loss: 0.4930  
Epoch 1205/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7987 - loss: 0.4310 - val\_accuracy: 0.7604 - val\_loss: 0.4930  
Epoch 1206/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7938 - loss: 0.4538 - val\_accuracy: 0.7604 - val\_loss: 0.4930  
Epoch 1207/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8251 - loss: 0.3979 - val\_accuracy: 0.7604 - val\_loss: 0.4930  
Epoch 1208/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7758 - loss: 0.4514 - val\_accuracy: 0.7604 - val\_loss: 0.4930  
Epoch 1209/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7962 - loss: 0.4441 - val\_accuracy: 0.7604 - val\_loss: 0.4930  
Epoch 1210/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.8071 - loss: 0.4250 - val\_accuracy: 0.7604 - val\_loss: 0.4930  
Epoch 1211/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7984 - loss: 0.4408 - val\_accuracy: 0.7604 - val\_loss: 0.4930  
Epoch 1212/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.7703 - loss: 0.4829 - val\_accuracy: 0.7604 - val\_loss: 0.4930  
Epoch 1213/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.8036 - loss: 0.4234 - val\_accuracy: 0.7604 - val\_loss: 0.4930  
Epoch 1214/1500

18/18 ————— 0s 13ms/step - accuracy: 0.8051 - loss: 0.4290 - val\_accuracy: 0.7604 - val\_loss: 0.4930  
Epoch 1215/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.8003 - loss: 0.4270 - val\_accuracy: 0.7552 - val\_loss: 0.4930  
Epoch 1216/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.8020 - loss: 0.4291 - val\_accuracy: 0.7552 - val\_loss: 0.4930  
Epoch 1217/1500  
18/18 ————— 0s 19ms/step - accuracy: 0.8026 - loss: 0.4159 - val\_accuracy: 0.7552 - val\_loss: 0.4930  
Epoch 1218/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.7942 - loss: 0.4555 - val\_accuracy: 0.7552 - val\_loss: 0.4930  
Epoch 1219/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7919 - loss: 0.4386 - val\_accuracy: 0.7552 - val\_loss: 0.4931  
Epoch 1220/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8043 - loss: 0.4339 - val\_accuracy: 0.7552 - val\_loss: 0.4931  
Epoch 1221/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8008 - loss: 0.4618 - val\_accuracy: 0.7552 - val\_loss: 0.4931  
Epoch 1222/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8104 - loss: 0.4337 - val\_accuracy: 0.7552 - val\_loss: 0.4931  
Epoch 1223/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7806 - loss: 0.4778 - val\_accuracy: 0.7552 - val\_loss: 0.4931  
Epoch 1224/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7779 - loss: 0.4614 - val\_accuracy: 0.7552 - val\_loss: 0.4931  
Epoch 1225/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8180 - loss: 0.4207 - val\_accuracy: 0.7552 - val\_loss: 0.4931  
Epoch 1226/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8155 - loss: 0.4312 - val\_accuracy: 0.7552 - val\_loss: 0.4931  
Epoch 1227/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7987 - loss: 0.4399 - val\_accuracy: 0.7552 - val\_loss: 0.4931  
Epoch 1228/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8131 - loss: 0.4211 - val\_accuracy: 0.7552 - val\_loss: 0.4931  
Epoch 1229/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7943 - loss: 0.4139 - val\_accuracy: 0.7552 - val\_loss: 0.4931  
Epoch 1230/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7791 - loss: 0.4573 - val\_accuracy: 0.7552 - val\_loss: 0.4931  
Epoch 1231/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7911 - loss: 0.4417 - val\_accuracy: 0.7552 - val\_loss: 0.4931  
Epoch 1232/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8118 - loss: 0.4340 - val\_accuracy: 0.7552 - val\_loss: 0.4931  
Epoch 1233/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7629 - loss: 0.4823 - val\_accuracy: 0.7552 - val\_loss: 0.4932  
Epoch 1234/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7912 - loss: 0.4463 - val\_accuracy: 0.7552 - val\_loss: 0.4932  
Epoch 1235/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8206 - loss: 0.4114 - val\_accuracy: 0.7552 - val\_loss: 0.4932  
Epoch 1236/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7870 - loss: 0.4627 - val\_accuracy: 0.7552 - val\_loss: 0.4932  
Epoch 1237/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8048 - loss: 0.4295 - val\_accuracy: 0.7552 - val\_loss: 0.4932

0.4932  
Epoch 1238/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7809 - loss: 0.4553 - val\_accuracy: 0.7552 - val\_loss: 0.4932  
Epoch 1239/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8143 - loss: 0.4272 - val\_accuracy: 0.7552 - val\_loss: 0.4932  
Epoch 1240/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8066 - loss: 0.4299 - val\_accuracy: 0.7552 - val\_loss: 0.4932  
Epoch 1241/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7994 - loss: 0.4264 - val\_accuracy: 0.7552 - val\_loss: 0.4932  
Epoch 1242/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8076 - loss: 0.4171 - val\_accuracy: 0.7552 - val\_loss: 0.4932  
Epoch 1243/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7995 - loss: 0.4307 - val\_accuracy: 0.7552 - val\_loss: 0.4932  
Epoch 1244/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7781 - loss: 0.4513 - val\_accuracy: 0.7552 - val\_loss: 0.4933  
Epoch 1245/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8104 - loss: 0.4450 - val\_accuracy: 0.7552 - val\_loss: 0.4933  
Epoch 1246/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8029 - loss: 0.4178 - val\_accuracy: 0.7552 - val\_loss: 0.4933  
Epoch 1247/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8072 - loss: 0.4404 - val\_accuracy: 0.7552 - val\_loss: 0.4933  
Epoch 1248/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7958 - loss: 0.4448 - val\_accuracy: 0.7552 - val\_loss: 0.4933  
Epoch 1249/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8110 - loss: 0.4206 - val\_accuracy: 0.7552 - val\_loss: 0.4933  
Epoch 1250/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8105 - loss: 0.4205 - val\_accuracy: 0.7552 - val\_loss: 0.4933  
Epoch 1251/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8116 - loss: 0.4154 - val\_accuracy: 0.7552 - val\_loss: 0.4933  
Epoch 1252/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8043 - loss: 0.4320 - val\_accuracy: 0.7552 - val\_loss: 0.4933  
Epoch 1253/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8100 - loss: 0.4441 - val\_accuracy: 0.7552 - val\_loss: 0.4933  
Epoch 1254/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7966 - loss: 0.4323 - val\_accuracy: 0.7552 - val\_loss: 0.4933  
Epoch 1255/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8114 - loss: 0.4222 - val\_accuracy: 0.7552 - val\_loss: 0.4934  
Epoch 1256/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7930 - loss: 0.4308 - val\_accuracy: 0.7552 - val\_loss: 0.4934  
Epoch 1257/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.8149 - loss: 0.4071 - val\_accuracy: 0.7552 - val\_loss: 0.4934  
Epoch 1258/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.7939 - loss: 0.4415 - val\_accuracy: 0.7552 - val\_loss: 0.4934  
Epoch 1259/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.7987 - loss: 0.4403 - val\_accuracy: 0.7552 - val\_loss: 0.4934  
Epoch 1260/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7845 - loss: 0.4496 - val\_accuracy: 0.7552 - val\_loss: 0.4934

Epoch 1261/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7861 - loss: 0.4428 - val\_accuracy: 0.7552 - val\_loss: 0.4934  
Epoch 1262/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.8047 - loss: 0.4336 - val\_accuracy: 0.7552 - val\_loss: 0.4934  
Epoch 1263/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7821 - loss: 0.4527 - val\_accuracy: 0.7552 - val\_loss: 0.4934  
Epoch 1264/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7956 - loss: 0.4444 - val\_accuracy: 0.7552 - val\_loss: 0.4934  
Epoch 1265/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.8108 - loss: 0.4287 - val\_accuracy: 0.7500 - val\_loss: 0.4934  
Epoch 1266/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.8011 - loss: 0.4431 - val\_accuracy: 0.7500 - val\_loss: 0.4935  
Epoch 1267/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.7877 - loss: 0.4288 - val\_accuracy: 0.7500 - val\_loss: 0.4935  
Epoch 1268/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.7886 - loss: 0.4340 - val\_accuracy: 0.7500 - val\_loss: 0.4935  
Epoch 1269/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.8018 - loss: 0.4372 - val\_accuracy: 0.7500 - val\_loss: 0.4935  
Epoch 1270/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8208 - loss: 0.4129 - val\_accuracy: 0.7500 - val\_loss: 0.4935  
Epoch 1271/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8010 - loss: 0.4173 - val\_accuracy: 0.7500 - val\_loss: 0.4935  
Epoch 1272/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7678 - loss: 0.4683 - val\_accuracy: 0.7500 - val\_loss: 0.4935  
Epoch 1273/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7885 - loss: 0.4464 - val\_accuracy: 0.7500 - val\_loss: 0.4935  
Epoch 1274/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7855 - loss: 0.4499 - val\_accuracy: 0.7500 - val\_loss: 0.4935  
Epoch 1275/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7862 - loss: 0.4503 - val\_accuracy: 0.7500 - val\_loss: 0.4935  
Epoch 1276/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8013 - loss: 0.4203 - val\_accuracy: 0.7500 - val\_loss: 0.4935  
Epoch 1277/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7923 - loss: 0.4241 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 1278/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7641 - loss: 0.4777 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 1279/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7785 - loss: 0.4457 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 1280/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8213 - loss: 0.4224 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 1281/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8134 - loss: 0.4160 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 1282/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7997 - loss: 0.4440 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 1283/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7873 - loss: 0.4628 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 1284/1500

18/18 ————— 0s 7ms/step - accuracy: 0.8009 - loss: 0.4041 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 1285/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8041 - loss: 0.4342 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 1286/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7911 - loss: 0.4403 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 1287/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8272 - loss: 0.4182 - val\_accuracy: 0.7500 - val\_loss: 0.4936  
Epoch 1288/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7985 - loss: 0.4173 - val\_accuracy: 0.7500 - val\_loss: 0.4937  
Epoch 1289/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7945 - loss: 0.4243 - val\_accuracy: 0.7500 - val\_loss: 0.4937  
Epoch 1290/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7994 - loss: 0.4145 - val\_accuracy: 0.7500 - val\_loss: 0.4937  
Epoch 1291/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7685 - loss: 0.4610 - val\_accuracy: 0.7500 - val\_loss: 0.4937  
Epoch 1292/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7970 - loss: 0.4305 - val\_accuracy: 0.7500 - val\_loss: 0.4937  
Epoch 1293/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7679 - loss: 0.4657 - val\_accuracy: 0.7500 - val\_loss: 0.4937  
Epoch 1294/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7798 - loss: 0.4527 - val\_accuracy: 0.7500 - val\_loss: 0.4937  
Epoch 1295/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7891 - loss: 0.4526 - val\_accuracy: 0.7500 - val\_loss: 0.4937  
Epoch 1296/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7897 - loss: 0.4364 - val\_accuracy: 0.7500 - val\_loss: 0.4937  
Epoch 1297/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7865 - loss: 0.4817 - val\_accuracy: 0.7500 - val\_loss: 0.4938  
Epoch 1298/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8217 - loss: 0.4095 - val\_accuracy: 0.7500 - val\_loss: 0.4938  
Epoch 1299/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8169 - loss: 0.4227 - val\_accuracy: 0.7500 - val\_loss: 0.4938  
Epoch 1300/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8040 - loss: 0.4216 - val\_accuracy: 0.7500 - val\_loss: 0.4938  
Epoch 1301/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7885 - loss: 0.4417 - val\_accuracy: 0.7500 - val\_loss: 0.4938  
Epoch 1302/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7851 - loss: 0.4377 - val\_accuracy: 0.7500 - val\_loss: 0.4938  
Epoch 1303/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7834 - loss: 0.4495 - val\_accuracy: 0.7500 - val\_loss: 0.4938  
Epoch 1304/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8173 - loss: 0.4230 - val\_accuracy: 0.7500 - val\_loss: 0.4938  
Epoch 1305/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7944 - loss: 0.4228 - val\_accuracy: 0.7500 - val\_loss: 0.4938  
Epoch 1306/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.7909 - loss: 0.4423 - val\_accuracy: 0.7500 - val\_loss: 0.4938  
Epoch 1307/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.8246 - loss: 0.4029 - val\_accuracy: 0.7500 - val\_loss: 0.4938



0.4938  
Epoch 1308/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.7726 - loss: 0.4609 - val\_accuracy: 0.7500 - val\_loss: 0.4939  
Epoch 1309/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7850 - loss: 0.4538 - val\_accuracy: 0.7500 - val\_loss: 0.4939  
Epoch 1310/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7797 - loss: 0.4564 - val\_accuracy: 0.7500 - val\_loss: 0.4939  
Epoch 1311/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.7899 - loss: 0.4320 - val\_accuracy: 0.7500 - val\_loss: 0.4939  
Epoch 1312/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.7971 - loss: 0.4095 - val\_accuracy: 0.7500 - val\_loss: 0.4939  
Epoch 1313/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.7900 - loss: 0.4418 - val\_accuracy: 0.7500 - val\_loss: 0.4939  
Epoch 1314/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.8011 - loss: 0.4223 - val\_accuracy: 0.7500 - val\_loss: 0.4939  
Epoch 1315/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.8087 - loss: 0.4128 - val\_accuracy: 0.7500 - val\_loss: 0.4939  
Epoch 1316/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8211 - loss: 0.4070 - val\_accuracy: 0.7500 - val\_loss: 0.4939  
Epoch 1317/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7746 - loss: 0.4625 - val\_accuracy: 0.7500 - val\_loss: 0.4939  
Epoch 1318/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7880 - loss: 0.4331 - val\_accuracy: 0.7500 - val\_loss: 0.4939  
Epoch 1319/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8023 - loss: 0.4271 - val\_accuracy: 0.7500 - val\_loss: 0.4940  
Epoch 1320/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7896 - loss: 0.4344 - val\_accuracy: 0.7500 - val\_loss: 0.4940  
Epoch 1321/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8135 - loss: 0.4336 - val\_accuracy: 0.7500 - val\_loss: 0.4940  
Epoch 1322/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7912 - loss: 0.4304 - val\_accuracy: 0.7500 - val\_loss: 0.4940  
Epoch 1323/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7906 - loss: 0.4631 - val\_accuracy: 0.7500 - val\_loss: 0.4940  
Epoch 1324/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8079 - loss: 0.4376 - val\_accuracy: 0.7500 - val\_loss: 0.4940  
Epoch 1325/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7800 - loss: 0.4399 - val\_accuracy: 0.7500 - val\_loss: 0.4940  
Epoch 1326/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7895 - loss: 0.4324 - val\_accuracy: 0.7500 - val\_loss: 0.4940  
Epoch 1327/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7996 - loss: 0.4174 - val\_accuracy: 0.7500 - val\_loss: 0.4940  
Epoch 1328/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8012 - loss: 0.4232 - val\_accuracy: 0.7500 - val\_loss: 0.4940  
Epoch 1329/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8178 - loss: 0.3981 - val\_accuracy: 0.7500 - val\_loss: 0.4941  
Epoch 1330/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8169 - loss: 0.4202 - val\_accuracy: 0.7500 - val\_loss: 0.4941

Epoch 1331/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7911 - loss: 0.4328 - val\_accuracy: 0.7500 - val\_loss: 0.4941  
Epoch 1332/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7981 - loss: 0.4460 - val\_accuracy: 0.7500 - val\_loss: 0.4941  
Epoch 1333/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8168 - loss: 0.4191 - val\_accuracy: 0.7500 - val\_loss: 0.4941  
Epoch 1334/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7797 - loss: 0.4538 - val\_accuracy: 0.7500 - val\_loss: 0.4941  
Epoch 1335/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8049 - loss: 0.4347 - val\_accuracy: 0.7500 - val\_loss: 0.4941  
Epoch 1336/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7699 - loss: 0.4554 - val\_accuracy: 0.7500 - val\_loss: 0.4941  
Epoch 1337/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7783 - loss: 0.4621 - val\_accuracy: 0.7500 - val\_loss: 0.4941  
Epoch 1338/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8161 - loss: 0.4269 - val\_accuracy: 0.7500 - val\_loss: 0.4941  
Epoch 1339/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8153 - loss: 0.4099 - val\_accuracy: 0.7500 - val\_loss: 0.4942  
Epoch 1340/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8350 - loss: 0.3891 - val\_accuracy: 0.7500 - val\_loss: 0.4942  
Epoch 1341/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8204 - loss: 0.3920 - val\_accuracy: 0.7500 - val\_loss: 0.4942  
Epoch 1342/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8043 - loss: 0.4279 - val\_accuracy: 0.7500 - val\_loss: 0.4942  
Epoch 1343/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8133 - loss: 0.4096 - val\_accuracy: 0.7500 - val\_loss: 0.4942  
Epoch 1344/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8084 - loss: 0.4277 - val\_accuracy: 0.7500 - val\_loss: 0.4942  
Epoch 1345/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8085 - loss: 0.4393 - val\_accuracy: 0.7500 - val\_loss: 0.4942  
Epoch 1346/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.8061 - loss: 0.4251 - val\_accuracy: 0.7500 - val\_loss: 0.4942  
Epoch 1347/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7917 - loss: 0.4416 - val\_accuracy: 0.7500 - val\_loss: 0.4942  
Epoch 1348/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7972 - loss: 0.4267 - val\_accuracy: 0.7500 - val\_loss: 0.4942  
Epoch 1349/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7931 - loss: 0.4424 - val\_accuracy: 0.7500 - val\_loss: 0.4943  
Epoch 1350/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8104 - loss: 0.4204 - val\_accuracy: 0.7500 - val\_loss: 0.4943  
Epoch 1351/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8298 - loss: 0.4082 - val\_accuracy: 0.7500 - val\_loss: 0.4943  
Epoch 1352/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8277 - loss: 0.4135 - val\_accuracy: 0.7500 - val\_loss: 0.4943  
Epoch 1353/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7872 - loss: 0.4278 - val\_accuracy: 0.7500 - val\_loss: 0.4943  
Epoch 1354/1500

18/18 ————— 0s 11ms/step - accuracy: 0.8261 - loss: 0.4146 - val\_accuracy: 0.7500 - val\_loss: 0.4943  
Epoch 1355/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7924 - loss: 0.4488 - val\_accuracy: 0.7500 - val\_loss: 0.4943  
Epoch 1356/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.8220 - loss: 0.3883 - val\_accuracy: 0.7500 - val\_loss: 0.4943  
Epoch 1357/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7663 - loss: 0.4554 - val\_accuracy: 0.7500 - val\_loss: 0.4943  
Epoch 1358/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.8270 - loss: 0.3847 - val\_accuracy: 0.7500 - val\_loss: 0.4944  
Epoch 1359/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8147 - loss: 0.4254 - val\_accuracy: 0.7500 - val\_loss: 0.4944  
Epoch 1360/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.8029 - loss: 0.4155 - val\_accuracy: 0.7500 - val\_loss: 0.4944  
Epoch 1361/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.8146 - loss: 0.4195 - val\_accuracy: 0.7500 - val\_loss: 0.4944  
Epoch 1362/1500  
18/18 ————— 1s 13ms/step - accuracy: 0.7976 - loss: 0.4297 - val\_accuracy: 0.7500 - val\_loss: 0.4944  
Epoch 1363/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.8188 - loss: 0.4071 - val\_accuracy: 0.7500 - val\_loss: 0.4944  
Epoch 1364/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7988 - loss: 0.4261 - val\_accuracy: 0.7500 - val\_loss: 0.4944  
Epoch 1365/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8107 - loss: 0.4245 - val\_accuracy: 0.7500 - val\_loss: 0.4944  
Epoch 1366/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7777 - loss: 0.4470 - val\_accuracy: 0.7500 - val\_loss: 0.4944  
Epoch 1367/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7842 - loss: 0.4568 - val\_accuracy: 0.7500 - val\_loss: 0.4944  
Epoch 1368/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8012 - loss: 0.4193 - val\_accuracy: 0.7500 - val\_loss: 0.4945  
Epoch 1369/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8428 - loss: 0.3712 - val\_accuracy: 0.7500 - val\_loss: 0.4945  
Epoch 1370/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7902 - loss: 0.4190 - val\_accuracy: 0.7500 - val\_loss: 0.4945  
Epoch 1371/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7851 - loss: 0.4428 - val\_accuracy: 0.7500 - val\_loss: 0.4945  
Epoch 1372/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7778 - loss: 0.4578 - val\_accuracy: 0.7500 - val\_loss: 0.4945  
Epoch 1373/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7836 - loss: 0.4352 - val\_accuracy: 0.7500 - val\_loss: 0.4945  
Epoch 1374/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8055 - loss: 0.4308 - val\_accuracy: 0.7448 - val\_loss: 0.4945  
Epoch 1375/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7874 - loss: 0.4529 - val\_accuracy: 0.7448 - val\_loss: 0.4945  
Epoch 1376/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7829 - loss: 0.4522 - val\_accuracy: 0.7448 - val\_loss: 0.4945  
Epoch 1377/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7903 - loss: 0.4438 - val\_accuracy: 0.7448 - val\_loss:

0.4945  
Epoch 1378/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8181 - loss: 0.4067 - val\_accuracy: 0.7448 - val\_loss: 0.4946  
Epoch 1379/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8045 - loss: 0.4310 - val\_accuracy: 0.7448 - val\_loss: 0.4946  
Epoch 1380/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8017 - loss: 0.4448 - val\_accuracy: 0.7396 - val\_loss: 0.4946  
Epoch 1381/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7793 - loss: 0.4547 - val\_accuracy: 0.7396 - val\_loss: 0.4946  
Epoch 1382/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8006 - loss: 0.4210 - val\_accuracy: 0.7396 - val\_loss: 0.4946  
Epoch 1383/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7912 - loss: 0.4268 - val\_accuracy: 0.7396 - val\_loss: 0.4946  
Epoch 1384/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8023 - loss: 0.4135 - val\_accuracy: 0.7396 - val\_loss: 0.4946  
Epoch 1385/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8094 - loss: 0.4295 - val\_accuracy: 0.7396 - val\_loss: 0.4946  
Epoch 1386/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8211 - loss: 0.4001 - val\_accuracy: 0.7396 - val\_loss: 0.4947  
Epoch 1387/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8058 - loss: 0.4087 - val\_accuracy: 0.7396 - val\_loss: 0.4947  
Epoch 1388/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8039 - loss: 0.4315 - val\_accuracy: 0.7396 - val\_loss: 0.4947  
Epoch 1389/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8056 - loss: 0.4185 - val\_accuracy: 0.7396 - val\_loss: 0.4947  
Epoch 1390/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7844 - loss: 0.4381 - val\_accuracy: 0.7396 - val\_loss: 0.4947  
Epoch 1391/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8127 - loss: 0.4310 - val\_accuracy: 0.7396 - val\_loss: 0.4947  
Epoch 1392/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8121 - loss: 0.4283 - val\_accuracy: 0.7396 - val\_loss: 0.4947  
Epoch 1393/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7849 - loss: 0.4564 - val\_accuracy: 0.7396 - val\_loss: 0.4947  
Epoch 1394/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7697 - loss: 0.4745 - val\_accuracy: 0.7396 - val\_loss: 0.4948  
Epoch 1395/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7982 - loss: 0.4317 - val\_accuracy: 0.7396 - val\_loss: 0.4948  
Epoch 1396/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7911 - loss: 0.4553 - val\_accuracy: 0.7396 - val\_loss: 0.4948  
Epoch 1397/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7917 - loss: 0.4215 - val\_accuracy: 0.7396 - val\_loss: 0.4948  
Epoch 1398/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7851 - loss: 0.4411 - val\_accuracy: 0.7396 - val\_loss: 0.4948  
Epoch 1399/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7875 - loss: 0.4227 - val\_accuracy: 0.7396 - val\_loss: 0.4948  
Epoch 1400/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8016 - loss: 0.4411 - val\_accuracy: 0.7396 - val\_loss: 0.4948

Epoch 1401/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8151 - loss: 0.3940 - val\_accuracy: 0.7396 - val\_loss: 0.4948  
Epoch 1402/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8120 - loss: 0.4375 - val\_accuracy: 0.7396 - val\_loss: 0.4948  
Epoch 1403/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8046 - loss: 0.4268 - val\_accuracy: 0.7396 - val\_loss: 0.4948  
Epoch 1404/1500  
18/18 ————— 0s 11ms/step - accuracy: 0.7879 - loss: 0.4458 - val\_accuracy: 0.7396 - val\_loss: 0.4948  
Epoch 1405/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.7839 - loss: 0.4363 - val\_accuracy: 0.7396 - val\_loss: 0.4948  
Epoch 1406/1500  
18/18 ————— 0s 17ms/step - accuracy: 0.7875 - loss: 0.4775 - val\_accuracy: 0.7396 - val\_loss: 0.4948  
Epoch 1407/1500  
18/18 ————— 1s 13ms/step - accuracy: 0.7894 - loss: 0.4131 - val\_accuracy: 0.7396 - val\_loss: 0.4949  
Epoch 1408/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.8108 - loss: 0.4088 - val\_accuracy: 0.7396 - val\_loss: 0.4948  
Epoch 1409/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7947 - loss: 0.4546 - val\_accuracy: 0.7396 - val\_loss: 0.4948  
Epoch 1410/1500  
18/18 ————— 0s 19ms/step - accuracy: 0.7719 - loss: 0.4469 - val\_accuracy: 0.7396 - val\_loss: 0.4949  
Epoch 1411/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7884 - loss: 0.4254 - val\_accuracy: 0.7396 - val\_loss: 0.4948  
Epoch 1412/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8135 - loss: 0.4086 - val\_accuracy: 0.7396 - val\_loss: 0.4949  
Epoch 1413/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8049 - loss: 0.4390 - val\_accuracy: 0.7396 - val\_loss: 0.4949  
Epoch 1414/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7942 - loss: 0.4380 - val\_accuracy: 0.7396 - val\_loss: 0.4949  
Epoch 1415/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8058 - loss: 0.4229 - val\_accuracy: 0.7396 - val\_loss: 0.4949  
Epoch 1416/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7940 - loss: 0.4372 - val\_accuracy: 0.7396 - val\_loss: 0.4949  
Epoch 1417/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8164 - loss: 0.4166 - val\_accuracy: 0.7396 - val\_loss: 0.4949  
Epoch 1418/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7606 - loss: 0.4640 - val\_accuracy: 0.7396 - val\_loss: 0.4949  
Epoch 1419/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7879 - loss: 0.4521 - val\_accuracy: 0.7396 - val\_loss: 0.4949  
Epoch 1420/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8047 - loss: 0.4301 - val\_accuracy: 0.7396 - val\_loss: 0.4949  
Epoch 1421/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8021 - loss: 0.4070 - val\_accuracy: 0.7396 - val\_loss: 0.4949  
Epoch 1422/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8079 - loss: 0.4002 - val\_accuracy: 0.7396 - val\_loss: 0.4949  
Epoch 1423/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8054 - loss: 0.3963 - val\_accuracy: 0.7396 - val\_loss: 0.4950  
Epoch 1424/1500

18/18 ————— 0s 7ms/step - accuracy: 0.7832 - loss: 0.4590 - val\_accuracy: 0.7396 - val\_loss: 0.4950  
Epoch 1425/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8149 - loss: 0.4076 - val\_accuracy: 0.7396 - val\_loss: 0.4950  
Epoch 1426/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8041 - loss: 0.4336 - val\_accuracy: 0.7396 - val\_loss: 0.4950  
Epoch 1427/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8052 - loss: 0.4089 - val\_accuracy: 0.7396 - val\_loss: 0.4950  
Epoch 1428/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7915 - loss: 0.4321 - val\_accuracy: 0.7396 - val\_loss: 0.4950  
Epoch 1429/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8043 - loss: 0.3938 - val\_accuracy: 0.7396 - val\_loss: 0.4950  
Epoch 1430/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7981 - loss: 0.4283 - val\_accuracy: 0.7396 - val\_loss: 0.4950  
Epoch 1431/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8018 - loss: 0.4121 - val\_accuracy: 0.7396 - val\_loss: 0.4950  
Epoch 1432/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7904 - loss: 0.4557 - val\_accuracy: 0.7396 - val\_loss: 0.4951  
Epoch 1433/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8014 - loss: 0.4115 - val\_accuracy: 0.7396 - val\_loss: 0.4951  
Epoch 1434/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7717 - loss: 0.4539 - val\_accuracy: 0.7396 - val\_loss: 0.4951  
Epoch 1435/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7720 - loss: 0.4770 - val\_accuracy: 0.7396 - val\_loss: 0.4951  
Epoch 1436/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7969 - loss: 0.4355 - val\_accuracy: 0.7396 - val\_loss: 0.4951  
Epoch 1437/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7977 - loss: 0.4194 - val\_accuracy: 0.7396 - val\_loss: 0.4951  
Epoch 1438/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8066 - loss: 0.4256 - val\_accuracy: 0.7396 - val\_loss: 0.4951  
Epoch 1439/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7964 - loss: 0.4162 - val\_accuracy: 0.7396 - val\_loss: 0.4952  
Epoch 1440/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7917 - loss: 0.4240 - val\_accuracy: 0.7396 - val\_loss: 0.4952  
Epoch 1441/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8006 - loss: 0.4233 - val\_accuracy: 0.7396 - val\_loss: 0.4952  
Epoch 1442/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7670 - loss: 0.4626 - val\_accuracy: 0.7396 - val\_loss: 0.4952  
Epoch 1443/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7977 - loss: 0.4402 - val\_accuracy: 0.7396 - val\_loss: 0.4952  
Epoch 1444/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7923 - loss: 0.4330 - val\_accuracy: 0.7396 - val\_loss: 0.4952  
Epoch 1445/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8029 - loss: 0.4281 - val\_accuracy: 0.7396 - val\_loss: 0.4952  
Epoch 1446/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7978 - loss: 0.4200 - val\_accuracy: 0.7396 - val\_loss: 0.4952  
Epoch 1447/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8115 - loss: 0.3916 - val\_accuracy: 0.7396 - val\_loss:

0.4952  
Epoch 1448/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8034 - loss: 0.4119 - val\_accuracy: 0.7396 - val\_loss: 0.4953  
Epoch 1449/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.8069 - loss: 0.4290 - val\_accuracy: 0.7396 - val\_loss: 0.4953  
Epoch 1450/1500  
18/18 ————— 0s 10ms/step - accuracy: 0.8283 - loss: 0.3877 - val\_accuracy: 0.7396 - val\_loss: 0.4953  
Epoch 1451/1500  
18/18 ————— 0s 14ms/step - accuracy: 0.7867 - loss: 0.4315 - val\_accuracy: 0.7396 - val\_loss: 0.4953  
Epoch 1452/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7909 - loss: 0.4418 - val\_accuracy: 0.7396 - val\_loss: 0.4953  
Epoch 1453/1500  
18/18 ————— 0s 18ms/step - accuracy: 0.8009 - loss: 0.4319 - val\_accuracy: 0.7396 - val\_loss: 0.4953  
Epoch 1454/1500  
18/18 ————— 0s 12ms/step - accuracy: 0.8240 - loss: 0.3847 - val\_accuracy: 0.7396 - val\_loss: 0.4953  
Epoch 1455/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.8104 - loss: 0.4065 - val\_accuracy: 0.7448 - val\_loss: 0.4953  
Epoch 1456/1500  
18/18 ————— 0s 13ms/step - accuracy: 0.7860 - loss: 0.4142 - val\_accuracy: 0.7448 - val\_loss: 0.4953  
Epoch 1457/1500  
18/18 ————— 0s 15ms/step - accuracy: 0.8095 - loss: 0.4136 - val\_accuracy: 0.7448 - val\_loss: 0.4954  
Epoch 1458/1500  
18/18 ————— 0s 18ms/step - accuracy: 0.8063 - loss: 0.4167 - val\_accuracy: 0.7448 - val\_loss: 0.4954  
Epoch 1459/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8059 - loss: 0.4101 - val\_accuracy: 0.7448 - val\_loss: 0.4954  
Epoch 1460/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7934 - loss: 0.4399 - val\_accuracy: 0.7448 - val\_loss: 0.4954  
Epoch 1461/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8101 - loss: 0.4289 - val\_accuracy: 0.7448 - val\_loss: 0.4954  
Epoch 1462/1500  
18/18 ————— 0s 8ms/step - accuracy: 0.7854 - loss: 0.4536 - val\_accuracy: 0.7448 - val\_loss: 0.4954  
Epoch 1463/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7699 - loss: 0.4538 - val\_accuracy: 0.7448 - val\_loss: 0.4954  
Epoch 1464/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7915 - loss: 0.4463 - val\_accuracy: 0.7448 - val\_loss: 0.4954  
Epoch 1465/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8010 - loss: 0.4235 - val\_accuracy: 0.7448 - val\_loss: 0.4954  
Epoch 1466/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7957 - loss: 0.4409 - val\_accuracy: 0.7448 - val\_loss: 0.4954  
Epoch 1467/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7658 - loss: 0.4530 - val\_accuracy: 0.7448 - val\_loss: 0.4955  
Epoch 1468/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7909 - loss: 0.4396 - val\_accuracy: 0.7448 - val\_loss: 0.4955  
Epoch 1469/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7807 - loss: 0.4553 - val\_accuracy: 0.7448 - val\_loss: 0.4955  
Epoch 1470/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8047 - loss: 0.4271 - val\_accuracy: 0.7500 - val\_loss: 0.4955

Epoch 1471/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7761 - loss: 0.4514 - val\_accuracy: 0.7500 - val\_loss: 0.4955  
Epoch 1472/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8019 - loss: 0.4151 - val\_accuracy: 0.7500 - val\_loss: 0.4955  
Epoch 1473/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7792 - loss: 0.4470 - val\_accuracy: 0.7500 - val\_loss: 0.4956  
Epoch 1474/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8155 - loss: 0.3983 - val\_accuracy: 0.7500 - val\_loss: 0.4956  
Epoch 1475/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7716 - loss: 0.4535 - val\_accuracy: 0.7500 - val\_loss: 0.4956  
Epoch 1476/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7684 - loss: 0.4590 - val\_accuracy: 0.7500 - val\_loss: 0.4956  
Epoch 1477/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.8026 - loss: 0.4131 - val\_accuracy: 0.7500 - val\_loss: 0.4956  
Epoch 1478/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7905 - loss: 0.4494 - val\_accuracy: 0.7500 - val\_loss: 0.4956  
Epoch 1479/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8059 - loss: 0.4088 - val\_accuracy: 0.7500 - val\_loss: 0.4956  
Epoch 1480/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7991 - loss: 0.4396 - val\_accuracy: 0.7500 - val\_loss: 0.4956  
Epoch 1481/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7797 - loss: 0.4483 - val\_accuracy: 0.7500 - val\_loss: 0.4956  
Epoch 1482/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7747 - loss: 0.4620 - val\_accuracy: 0.7500 - val\_loss: 0.4956  
Epoch 1483/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8119 - loss: 0.3993 - val\_accuracy: 0.7500 - val\_loss: 0.4956  
Epoch 1484/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.8061 - loss: 0.4197 - val\_accuracy: 0.7500 - val\_loss: 0.4956  
Epoch 1485/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.8240 - loss: 0.3997 - val\_accuracy: 0.7500 - val\_loss: 0.4956  
Epoch 1486/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7855 - loss: 0.4324 - val\_accuracy: 0.7500 - val\_loss: 0.4957  
Epoch 1487/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7939 - loss: 0.4315 - val\_accuracy: 0.7500 - val\_loss: 0.4957  
Epoch 1488/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7905 - loss: 0.4388 - val\_accuracy: 0.7500 - val\_loss: 0.4957  
Epoch 1489/1500  
18/18 ————— 0s 6ms/step - accuracy: 0.7972 - loss: 0.4248 - val\_accuracy: 0.7500 - val\_loss: 0.4957  
Epoch 1490/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7726 - loss: 0.4435 - val\_accuracy: 0.7500 - val\_loss: 0.4957  
Epoch 1491/1500  
18/18 ————— 0s 9ms/step - accuracy: 0.7994 - loss: 0.4202 - val\_accuracy: 0.7500 - val\_loss: 0.4957  
Epoch 1492/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7909 - loss: 0.4281 - val\_accuracy: 0.7500 - val\_loss: 0.4957  
Epoch 1493/1500  
18/18 ————— 0s 7ms/step - accuracy: 0.7938 - loss: 0.4374 - val\_accuracy: 0.7500 - val\_loss: 0.4957  
Epoch 1494/1500



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18/18 ————— 0s 9ms/step - accuracy: 0.7935 - loss: 0.4377 - val_accuracy: 0.7500 - val_loss: 0.4957
Epoch 1495/1500
18/18 ————— 0s 7ms/step - accuracy: 0.8061 - loss: 0.4181 - val_accuracy: 0.7500 - val_loss: 0.4957
Epoch 1496/1500
18/18 ————— 0s 7ms/step - accuracy: 0.8081 - loss: 0.3956 - val_accuracy: 0.7500 - val_loss: 0.4957
Epoch 1497/1500
18/18 ————— 0s 10ms/step - accuracy: 0.7924 - loss: 0.4242 - val_accuracy: 0.7500 - val_loss: 0.4957
Epoch 1498/1500
18/18 ————— 0s 14ms/step - accuracy: 0.7999 - loss: 0.4298 - val_accuracy: 0.7500 - val_loss: 0.4958
Epoch 1499/1500
18/18 ————— 0s 9ms/step - accuracy: 0.7860 - loss: 0.4347 - val_accuracy: 0.7500 - val_loss: 0.4958
Epoch 1500/1500
18/18 ————— 0s 14ms/step - accuracy: 0.7862 - loss: 0.4277 - val_accuracy: 0.7500 - val_loss: 0.4958

```

For this particular model which has 2 hidden layer with 6 nodes each and has 0.003 learning rate at 1500 epochs, we achieved an accuracy of 78.62% for training and 75% accuracy for the validation is slightly lower. This is also evident for the loss for the training and validation loss. This could make our model susceptible for overfitting but still generalize.

Graph the trajectory of the loss functions, accuracy on both train and test set

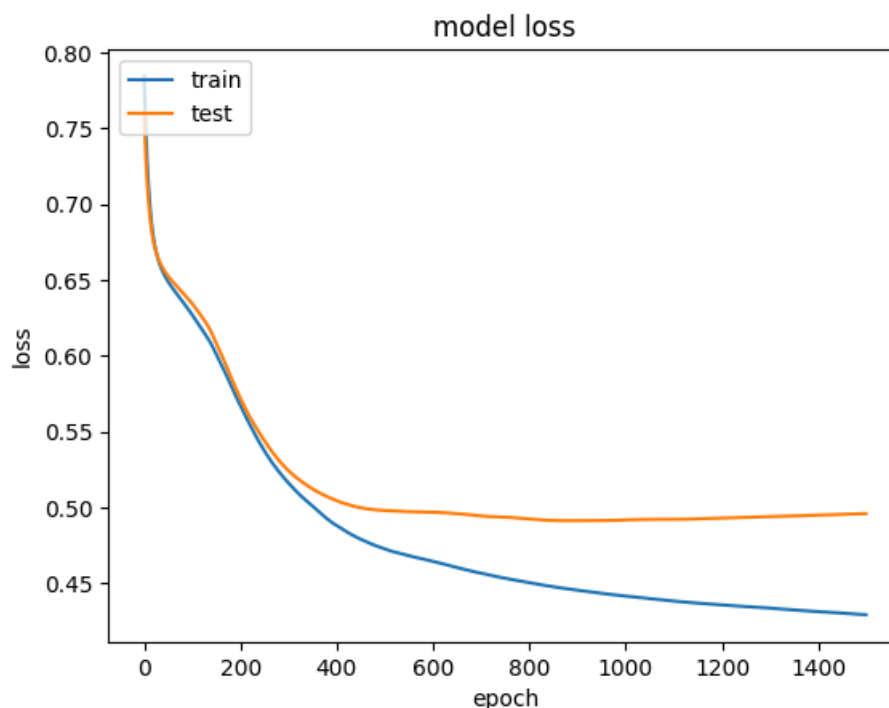
```

In [ ]: history.history.keys()

Out[ ]: dict_keys(['accuracy', 'loss', 'val_accuracy', 'val_loss'])

In [ ]: plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.title('model loss')
plt.ylabel('loss')
plt.xlabel('epoch')
plt.legend(['train', 'test'], loc='upper left')
plt.show()

```



The decreasing loss observed in both training and testing suggests the model's ability to generalize effectively as training progresses. Notably, the training loss is lower compared to the testing loss, implying superior model performance during

the testing phase.

```
In [ ]: y_pred_prob_nn_1 = model.predict(X_test_norm)
        y_pred_class_nn_1 = (y_pred_prob_nn_1 > 0.5).astype("int32")
```

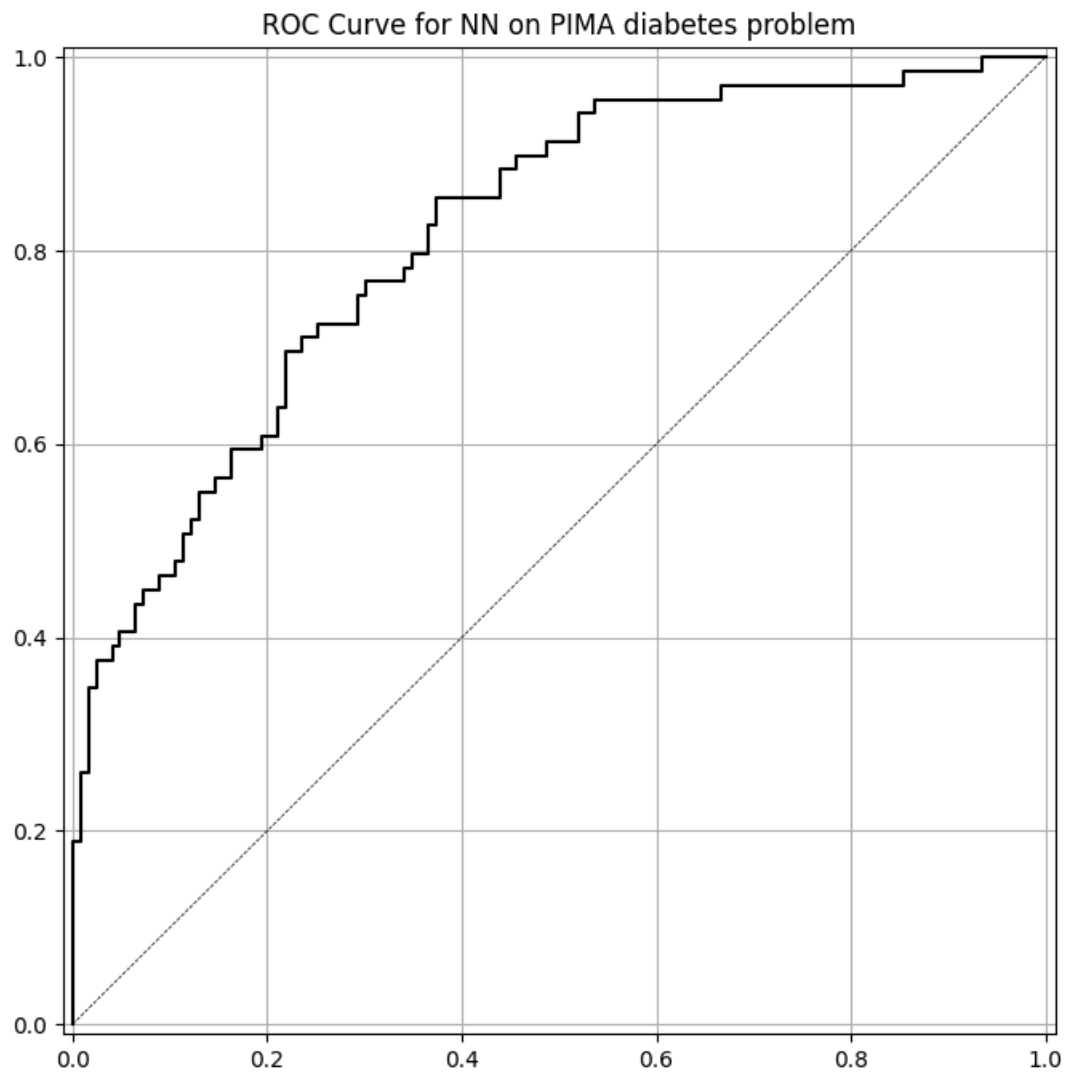
6/6 ————— 0s 8ms/step

```
In [ ]: def plot_roc(y_test, y_pred, model_name):
        fpr, tpr, thr = roc_curve(y_test, y_pred)
        fig, ax = plt.subplots(figsize=(8, 8))
        ax.plot(fpr, tpr, 'k-')
        ax.plot([0, 1], [0, 1], 'k--', linewidth=.5) # roc curve for random model
        ax.grid(True)
        ax.set(title='ROC Curve for {} on PIMA diabetes problem'.format(model_name),
              xlim=[-0.01, 1.01], ylim=[-0.01, 1.01])
```

```
In [ ]: print('accuracy is {:.3f}'.format(accuracy_score(y_test, y_pred_class_nn_1)))
        print('roc-auc is {:.3f}'.format(roc_auc_score(y_test, y_pred_prob_nn_1)))

        plot_roc(y_test, y_pred_prob_nn_1, 'NN')
```

accuracy is 0.750  
roc-auc is 0.817





In the 2nd model which is 6,6,1 it got an accuracy score of 0.750 and ROC-AUC of 0.840. Both accuracy of the model suggest that adding an extra hidden layer which significantly improve the model ability to make correct prediction on the test set.


On a 6,6,1 model with two hidden layer achieve a slight increased of ROC-AUC Score, this indicate that two-hidden layer is slightly better at classifying the two classes.


Use different learning rates, numbers of epochs, and network structures.


```
In [ ]: #Model 1: Learning rate = 0.0001, Epoch = 5000, 2 hidden Layer with 6 nodes
model_1 = Sequential([
    Dense(6, input_shape=(8,), activation="relu"),
    Dense(6, activation="relu"),
    Dense(1, activation="sigmoid")
])
model_1.compile(SGD(learning_rate = .0001), "binary_crossentropy", metrics=["accuracy"])
history_1 = model_1.fit(X_train_norm, y_train, validation_data=(X_test_norm, y_test), epochs=500)
```


Epoch 1/500  
18/18  4s 121ms/step - accuracy: 0.5784 - loss: 0.7263 - val\_accuracy: 0.5365 - val\_loss: 0.7415


Epoch 2/500  
18/18  1s 32ms/step - accuracy: 0.5672 - loss: 0.7299 - val\_accuracy: 0.5312 - val\_loss: 0.7414


Epoch 3/500  
18/18  1s 24ms/step - accuracy: 0.5475 - loss: 0.7311 - val\_accuracy: 0.5312 - val\_loss: 0.7413


Epoch 4/500  
18/18  1s 26ms/step - accuracy: 0.5453 - loss: 0.7301 - val\_accuracy: 0.5312 - val\_loss: 0.7412


Epoch 5/500  
18/18  1s 19ms/step - accuracy: 0.5461 - loss: 0.7233 - val\_accuracy: 0.5312 - val\_loss: 0.7411


Epoch 6/500  
18/18  1s 29ms/step - accuracy: 0.5409 - loss: 0.7384 - val\_accuracy: 0.5312 - val\_loss: 0.7410


Epoch 7/500  
18/18  0s 22ms/step - accuracy: 0.5931 - loss: 0.7178 - val\_accuracy: 0.5365 - val\_loss: 0.7408


Epoch 8/500  
18/18  1s 20ms/step - accuracy: 0.5968 - loss: 0.7293 - val\_accuracy: 0.5365 - val\_loss: 0.7407


Epoch 9/500  
18/18  0s 12ms/step - accuracy: 0.5821 - loss: 0.7272 - val\_accuracy: 0.5365 - val\_loss: 0.7406


Epoch 10/500  
18/18  0s 6ms/step - accuracy: 0.5505 - loss: 0.7358 - val\_accuracy: 0.5365 - val\_loss: 0.7405


Epoch 11/500  
18/18  0s 6ms/step - accuracy: 0.5610 - loss: 0.7398 - val\_accuracy: 0.5365 - val\_loss: 0.7404


Epoch 12/500  
18/18  0s 6ms/step - accuracy: 0.5721 - loss: 0.7303 - val\_accuracy: 0.5365 - val\_loss: 0.7403


Epoch 13/500  
18/18  0s 6ms/step - accuracy: 0.5709 - loss: 0.7408 - val\_accuracy: 0.5365 - val\_loss: 0.7402


Epoch 14/500  
18/18  0s 6ms/step - accuracy: 0.5779 - loss: 0.7199 - val\_accuracy: 0.5365 - val\_loss: 0.7400


Epoch 15/500  
18/18  0s 6ms/step - accuracy: 0.5823 - loss: 0.7305 - val\_accuracy: 0.5365 - val\_loss: 0.7399


Epoch 16/500  
18/18  0s 6ms/step - accuracy: 0.5722 - loss: 0.7218 - val\_accuracy: 0.5417 - val\_loss: 0.7398


Epoch 17/500  
18/18  0s 6ms/step - accuracy: 0.5621 - loss: 0.7387 - val\_accuracy: 0.5417 - val\_loss: 0.7397


Epoch 18/500  
18/18  0s 7ms/step - accuracy: 0.5861 - loss: 0.7270 - val\_accuracy: 0.5417 - val\_loss: 0.7396

Epoch 19/500  
18/18  0s 6ms/step - accuracy: 0.5942 - loss: 0.7275 - val\_accuracy: 0.5417 - val\_loss: 0.7395

Epoch 20/500  
18/18  0s 6ms/step - accuracy: 0.5258 - loss: 0.7432 - val\_accuracy: 0.5417 - val\_loss: 0.7394

Epoch 21/500  
18/18  0s 6ms/step - accuracy: 0.5858 - loss: 0.7182 - val\_accuracy: 0.5417 - val\_loss: 0.7392


Epoch 22/500  
18/18  0s 8ms/step - accuracy: 0.5893 - loss: 0.7157 - val\_accuracy: 0.5417 - val\_loss: 0.7391


Epoch 23/500  
18/18  0s 6ms/step - accuracy: 0.5739 - loss: 0.7311 - val\_accuracy: 0.5417 - val\_loss: 0.7390


Epoch 24/500


18/18 ————— 0s 6ms/step - accuracy: 0.5674 - loss: 0.7231 - val\_accuracy: 0.5417 - val\_loss: 0.7389  
Epoch 25/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5538 - loss: 0.7235 - val\_accuracy: 0.5417 - val\_loss: 0.7388  
Epoch 26/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5866 - loss: 0.7301 - val\_accuracy: 0.5469 - val\_loss: 0.7387  
Epoch 27/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5505 - loss: 0.7262 - val\_accuracy: 0.5469 - val\_loss: 0.7386  
Epoch 28/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5765 - loss: 0.7283 - val\_accuracy: 0.5469 - val\_loss: 0.7385  
Epoch 29/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5750 - loss: 0.7231 - val\_accuracy: 0.5469 - val\_loss: 0.7384  
Epoch 30/500  
18/18 ————— 0s 7ms/step - accuracy: 0.5866 - loss: 0.7269 - val\_accuracy: 0.5469 - val\_loss: 0.7382  
Epoch 31/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5563 - loss: 0.7320 - val\_accuracy: 0.5469 - val\_loss: 0.7381  
Epoch 32/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5696 - loss: 0.7289 - val\_accuracy: 0.5469 - val\_loss: 0.7380  
Epoch 33/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5994 - loss: 0.7180 - val\_accuracy: 0.5469 - val\_loss: 0.7379  
Epoch 34/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5904 - loss: 0.7277 - val\_accuracy: 0.5469 - val\_loss: 0.7378  
Epoch 35/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5805 - loss: 0.7234 - val\_accuracy: 0.5469 - val\_loss: 0.7377  
Epoch 36/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5615 - loss: 0.7275 - val\_accuracy: 0.5521 - val\_loss: 0.7376  
Epoch 37/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5642 - loss: 0.7309 - val\_accuracy: 0.5573 - val\_loss: 0.7375  
Epoch 38/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5659 - loss: 0.7289 - val\_accuracy: 0.5573 - val\_loss: 0.7374  
Epoch 39/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6152 - loss: 0.7145 - val\_accuracy: 0.5573 - val\_loss: 0.7372  
Epoch 40/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6099 - loss: 0.7227 - val\_accuracy: 0.5573 - val\_loss: 0.7371  
Epoch 41/500  
18/18 ————— 0s 8ms/step - accuracy: 0.5903 - loss: 0.7246 - val\_accuracy: 0.5625 - val\_loss: 0.7370  
Epoch 42/500  
18/18 ————— 0s 10ms/step - accuracy: 0.5723 - loss: 0.7275 - val\_accuracy: 0.5625 - val\_loss: 0.7369  
Epoch 43/500  
18/18 ————— 0s 10ms/step - accuracy: 0.5951 - loss: 0.7211 - val\_accuracy: 0.5625 - val\_loss: 0.7368  
Epoch 44/500  
18/18 ————— 0s 9ms/step - accuracy: 0.5885 - loss: 0.7239 - val\_accuracy: 0.5625 - val\_loss: 0.7367  
Epoch 45/500  
18/18 ————— 0s 9ms/step - accuracy: 0.5776 - loss: 0.7290 - val\_accuracy: 0.5625 - val\_loss: 0.7366  
Epoch 46/500  
18/18 ————— 0s 10ms/step - accuracy: 0.5883 - loss: 0.7298 - val\_accuracy: 0.5625 - val\_loss: 0.7365  
Epoch 47/500  
18/18 ————— 0s 10ms/step - accuracy: 0.6000 - loss: 0.7213 - val\_accuracy: 0.5625 - val\_loss: 0.7364


0.7364  
Epoch 48/500  
18/18 ————— 0s 10ms/step - accuracy: 0.5619 - loss: 0.7247 - val\_accuracy: 0.5625 - val\_loss: 0.7363  
Epoch 49/500  
18/18 ————— 0s 16ms/step - accuracy: 0.5967 - loss: 0.7155 - val\_accuracy: 0.5625 - val\_loss: 0.7361  
Epoch 50/500  
18/18 ————— 0s 10ms/step - accuracy: 0.5494 - loss: 0.7304 - val\_accuracy: 0.5625 - val\_loss: 0.7360  
Epoch 51/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6306 - loss: 0.7085 - val\_accuracy: 0.5625 - val\_loss: 0.7359  
Epoch 52/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5670 - loss: 0.7239 - val\_accuracy: 0.5625 - val\_loss: 0.7358  
Epoch 53/500  
18/18 ————— 0s 8ms/step - accuracy: 0.5311 - loss: 0.7250 - val\_accuracy: 0.5625 - val\_loss: 0.7357  
Epoch 54/500  
18/18 ————— 0s 9ms/step - accuracy: 0.5693 - loss: 0.7319 - val\_accuracy: 0.5625 - val\_loss: 0.7356  
Epoch 55/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5646 - loss: 0.7303 - val\_accuracy: 0.5625 - val\_loss: 0.7355  
Epoch 56/500  
18/18 ————— 0s 7ms/step - accuracy: 0.5694 - loss: 0.7279 - val\_accuracy: 0.5625 - val\_loss: 0.7354  
Epoch 57/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5682 - loss: 0.7269 - val\_accuracy: 0.5625 - val\_loss: 0.7353  
Epoch 58/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5886 - loss: 0.7236 - val\_accuracy: 0.5625 - val\_loss: 0.7352  
Epoch 59/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5896 - loss: 0.7265 - val\_accuracy: 0.5625 - val\_loss: 0.7351  
Epoch 60/500  
18/18 ————— 0s 7ms/step - accuracy: 0.5656 - loss: 0.7371 - val\_accuracy: 0.5625 - val\_loss: 0.7350  
Epoch 61/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5978 - loss: 0.7195 - val\_accuracy: 0.5625 - val\_loss: 0.7349  
Epoch 62/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5852 - loss: 0.7265 - val\_accuracy: 0.5625 - val\_loss: 0.7347  
Epoch 63/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6066 - loss: 0.7178 - val\_accuracy: 0.5625 - val\_loss: 0.7346  
Epoch 64/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5523 - loss: 0.7298 - val\_accuracy: 0.5625 - val\_loss: 0.7345  
Epoch 65/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5783 - loss: 0.7189 - val\_accuracy: 0.5625 - val\_loss: 0.7344  
Epoch 66/500  
18/18 ————— 0s 8ms/step - accuracy: 0.5510 - loss: 0.7264 - val\_accuracy: 0.5625 - val\_loss: 0.7343  
Epoch 67/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6007 - loss: 0.7134 - val\_accuracy: 0.5625 - val\_loss: 0.7342  
Epoch 68/500  
18/18 ————— 0s 8ms/step - accuracy: 0.5785 - loss: 0.7269 - val\_accuracy: 0.5625 - val\_loss: 0.7341  
Epoch 69/500  
18/18 ————— 0s 8ms/step - accuracy: 0.5486 - loss: 0.7345 - val\_accuracy: 0.5625 - val\_loss: 0.7340  
Epoch 70/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5606 - loss: 0.7351 - val\_accuracy: 0.5625 - val\_loss: 0.7339


Epoch 71/500  
18/18  0s 6ms/step - accuracy: 0.5708 - loss: 0.7256 - val\_accuracy: 0.5625 - val\_loss: 0.7338


Epoch 72/500  
18/18  0s 6ms/step - accuracy: 0.5923 - loss: 0.7184 - val\_accuracy: 0.5625 - val\_loss: 0.7337


Epoch 73/500  
18/18  0s 6ms/step - accuracy: 0.5992 - loss: 0.7237 - val\_accuracy: 0.5625 - val\_loss: 0.7336


Epoch 74/500  
18/18  0s 6ms/step - accuracy: 0.5873 - loss: 0.7249 - val\_accuracy: 0.5625 - val\_loss: 0.7335


Epoch 75/500  
18/18  0s 6ms/step - accuracy: 0.5806 - loss: 0.7358 - val\_accuracy: 0.5625 - val\_loss: 0.7334


Epoch 76/500  
18/18  0s 6ms/step - accuracy: 0.5724 - loss: 0.7300 - val\_accuracy: 0.5625 - val\_loss: 0.7333


Epoch 77/500  
18/18  0s 6ms/step - accuracy: 0.5916 - loss: 0.7176 - val\_accuracy: 0.5625 - val\_loss: 0.7331


Epoch 78/500  
18/18  0s 6ms/step - accuracy: 0.5931 - loss: 0.7217 - val\_accuracy: 0.5625 - val\_loss: 0.7330


Epoch 79/500  
18/18  0s 6ms/step - accuracy: 0.5995 - loss: 0.7243 - val\_accuracy: 0.5625 - val\_loss: 0.7329


Epoch 80/500  
18/18  0s 6ms/step - accuracy: 0.5957 - loss: 0.7224 - val\_accuracy: 0.5625 - val\_loss: 0.7328


Epoch 81/500  
18/18  0s 7ms/step - accuracy: 0.5731 - loss: 0.7370 - val\_accuracy: 0.5625 - val\_loss: 0.7327


Epoch 82/500  
18/18  0s 6ms/step - accuracy: 0.5755 - loss: 0.7227 - val\_accuracy: 0.5625 - val\_loss: 0.7326


Epoch 83/500  
18/18  0s 6ms/step - accuracy: 0.5835 - loss: 0.7216 - val\_accuracy: 0.5625 - val\_loss: 0.7325


Epoch 84/500  
18/18  0s 6ms/step - accuracy: 0.5744 - loss: 0.7190 - val\_accuracy: 0.5625 - val\_loss: 0.7324


Epoch 85/500  
18/18  0s 6ms/step - accuracy: 0.5969 - loss: 0.7181 - val\_accuracy: 0.5625 - val\_loss: 0.7323


Epoch 86/500  
18/18  0s 8ms/step - accuracy: 0.5994 - loss: 0.7222 - val\_accuracy: 0.5625 - val\_loss: 0.7322


Epoch 87/500  
18/18  0s 7ms/step - accuracy: 0.5973 - loss: 0.7170 - val\_accuracy: 0.5625 - val\_loss: 0.7321


Epoch 88/500  
18/18  0s 6ms/step - accuracy: 0.5923 - loss: 0.7191 - val\_accuracy: 0.5625 - val\_loss: 0.7320

Epoch 89/500  
18/18  0s 6ms/step - accuracy: 0.5677 - loss: 0.7340 - val\_accuracy: 0.5625 - val\_loss: 0.7319

Epoch 90/500  
18/18  0s 6ms/step - accuracy: 0.5794 - loss: 0.7180 - val\_accuracy: 0.5625 - val\_loss: 0.7318

Epoch 91/500  
18/18  0s 6ms/step - accuracy: 0.5674 - loss: 0.7358 - val\_accuracy: 0.5677 - val\_loss: 0.7317

Epoch 92/500  
18/18  0s 6ms/step - accuracy: 0.6056 - loss: 0.7135 - val\_accuracy: 0.5677 - val\_loss: 0.7316

Epoch 93/500  
18/18  0s 7ms/step - accuracy: 0.5737 - loss: 0.7282 - val\_accuracy: 0.5677 - val\_loss: 0.7315

Epoch 94/500

18/18 ————— 0s 6ms/step - accuracy: 0.6165 - loss: 0.7187 - val\_accuracy: 0.5677 - val\_loss: 0.7314  
Epoch 95/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5873 - loss: 0.7291 - val\_accuracy: 0.5677 - val\_loss: 0.7313  
Epoch 96/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6143 - loss: 0.7123 - val\_accuracy: 0.5677 - val\_loss: 0.7312  
Epoch 97/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5892 - loss: 0.7245 - val\_accuracy: 0.5677 - val\_loss: 0.7311  
Epoch 98/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6215 - loss: 0.7152 - val\_accuracy: 0.5677 - val\_loss: 0.7310  
Epoch 99/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6034 - loss: 0.7098 - val\_accuracy: 0.5677 - val\_loss: 0.7309  
Epoch 100/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5986 - loss: 0.7192 - val\_accuracy: 0.5677 - val\_loss: 0.7308  
Epoch 101/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6010 - loss: 0.7200 - val\_accuracy: 0.5677 - val\_loss: 0.7307  
Epoch 102/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6185 - loss: 0.7057 - val\_accuracy: 0.5677 - val\_loss: 0.7306  
Epoch 103/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5878 - loss: 0.7188 - val\_accuracy: 0.5677 - val\_loss: 0.7305  
Epoch 104/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5861 - loss: 0.7145 - val\_accuracy: 0.5677 - val\_loss: 0.7304  
Epoch 105/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6159 - loss: 0.7055 - val\_accuracy: 0.5677 - val\_loss: 0.7303  
Epoch 106/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6059 - loss: 0.7099 - val\_accuracy: 0.5677 - val\_loss: 0.7301  
Epoch 107/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5990 - loss: 0.7237 - val\_accuracy: 0.5677 - val\_loss: 0.7300  
Epoch 108/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6110 - loss: 0.7126 - val\_accuracy: 0.5677 - val\_loss: 0.7299  
Epoch 109/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5779 - loss: 0.7238 - val\_accuracy: 0.5677 - val\_loss: 0.7298  
Epoch 110/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6155 - loss: 0.7160 - val\_accuracy: 0.5677 - val\_loss: 0.7297  
Epoch 111/500  
18/18 ————— 0s 7ms/step - accuracy: 0.5898 - loss: 0.7197 - val\_accuracy: 0.5677 - val\_loss: 0.7296  
Epoch 112/500  
18/18 ————— 0s 7ms/step - accuracy: 0.5938 - loss: 0.7138 - val\_accuracy: 0.5677 - val\_loss: 0.7295  
Epoch 113/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6001 - loss: 0.7166 - val\_accuracy: 0.5677 - val\_loss: 0.7294  
Epoch 114/500  
18/18 ————— 0s 15ms/step - accuracy: 0.6088 - loss: 0.7105 - val\_accuracy: 0.5677 - val\_loss: 0.7293  
Epoch 115/500  
18/18 ————— 1s 29ms/step - accuracy: 0.6116 - loss: 0.7140 - val\_accuracy: 0.5677 - val\_loss: 0.7292  
Epoch 116/500  
18/18 ————— 1s 44ms/step - accuracy: 0.6104 - loss: 0.7124 - val\_accuracy: 0.5677 - val\_loss: 0.7291  
Epoch 117/500  
18/18 ————— 1s 21ms/step - accuracy: 0.5450 - loss: 0.7263 - val\_accuracy: 0.5677 - val\_loss:



0.7290  
Epoch 118/500  
18/18 ————— 0s 17ms/step - accuracy: 0.5706 - loss: 0.7194 - val\_accuracy: 0.5677 - val\_loss: 0.7289  
Epoch 119/500  
18/18 ————— 1s 18ms/step - accuracy: 0.5925 - loss: 0.7190 - val\_accuracy: 0.5677 - val\_loss: 0.7288  
Epoch 120/500  
18/18 ————— 0s 11ms/step - accuracy: 0.5988 - loss: 0.7236 - val\_accuracy: 0.5677 - val\_loss: 0.7287  
Epoch 121/500  
18/18 ————— 0s 10ms/step - accuracy: 0.6172 - loss: 0.7138 - val\_accuracy: 0.5677 - val\_loss: 0.7286  
Epoch 122/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6120 - loss: 0.7160 - val\_accuracy: 0.5677 - val\_loss: 0.7285  
Epoch 123/500  
18/18 ————— 0s 9ms/step - accuracy: 0.6184 - loss: 0.7131 - val\_accuracy: 0.5677 - val\_loss: 0.7284  
Epoch 124/500  
18/18 ————— 0s 13ms/step - accuracy: 0.6014 - loss: 0.7205 - val\_accuracy: 0.5677 - val\_loss: 0.7283  
Epoch 125/500  
18/18 ————— 0s 17ms/step - accuracy: 0.5822 - loss: 0.7212 - val\_accuracy: 0.5677 - val\_loss: 0.7282  
Epoch 126/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6005 - loss: 0.7151 - val\_accuracy: 0.5677 - val\_loss: 0.7281  
Epoch 127/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6141 - loss: 0.7090 - val\_accuracy: 0.5677 - val\_loss: 0.7280  
Epoch 128/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5970 - loss: 0.7146 - val\_accuracy: 0.5677 - val\_loss: 0.7279  
Epoch 129/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6020 - loss: 0.7149 - val\_accuracy: 0.5677 - val\_loss: 0.7278  
Epoch 130/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5976 - loss: 0.7206 - val\_accuracy: 0.5677 - val\_loss: 0.7277  
Epoch 131/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6038 - loss: 0.7167 - val\_accuracy: 0.5677 - val\_loss: 0.7276  
Epoch 132/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5799 - loss: 0.7237 - val\_accuracy: 0.5677 - val\_loss: 0.7275  
Epoch 133/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5845 - loss: 0.7241 - val\_accuracy: 0.5677 - val\_loss: 0.7274  
Epoch 134/500  
18/18 ————— 0s 8ms/step - accuracy: 0.5894 - loss: 0.7220 - val\_accuracy: 0.5677 - val\_loss: 0.7273  
Epoch 135/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6187 - loss: 0.7049 - val\_accuracy: 0.5677 - val\_loss: 0.7272  
Epoch 136/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6228 - loss: 0.7103 - val\_accuracy: 0.5677 - val\_loss: 0.7271  
Epoch 137/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6028 - loss: 0.7190 - val\_accuracy: 0.5677 - val\_loss: 0.7270  
Epoch 138/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6138 - loss: 0.7103 - val\_accuracy: 0.5677 - val\_loss: 0.7269  
Epoch 139/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5957 - loss: 0.7185 - val\_accuracy: 0.5677 - val\_loss: 0.7268  
Epoch 140/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5771 - loss: 0.7279 - val\_accuracy: 0.5677 - val\_loss: 0.7267

Epoch 141/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6193 - loss: 0.7103 - val\_accuracy: 0.5677 - val\_loss: 0.7266  
Epoch 142/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6006 - loss: 0.7139 - val\_accuracy: 0.5677 - val\_loss: 0.7265  
Epoch 143/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6004 - loss: 0.7128 - val\_accuracy: 0.5677 - val\_loss: 0.7264  
Epoch 144/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6128 - loss: 0.7051 - val\_accuracy: 0.5677 - val\_loss: 0.7263  
Epoch 145/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6115 - loss: 0.7115 - val\_accuracy: 0.5677 - val\_loss: 0.7262  
Epoch 146/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6217 - loss: 0.7089 - val\_accuracy: 0.5677 - val\_loss: 0.7261  
Epoch 147/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6122 - loss: 0.7103 - val\_accuracy: 0.5677 - val\_loss: 0.7260  
Epoch 148/500  
18/18 ————— 0s 9ms/step - accuracy: 0.6131 - loss: 0.7106 - val\_accuracy: 0.5677 - val\_loss: 0.7260  
Epoch 149/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6208 - loss: 0.7168 - val\_accuracy: 0.5677 - val\_loss: 0.7259  
Epoch 150/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5973 - loss: 0.7217 - val\_accuracy: 0.5677 - val\_loss: 0.7258  
Epoch 151/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6078 - loss: 0.7088 - val\_accuracy: 0.5677 - val\_loss: 0.7257  
Epoch 152/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6057 - loss: 0.7144 - val\_accuracy: 0.5677 - val\_loss: 0.7256  
Epoch 153/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5674 - loss: 0.7247 - val\_accuracy: 0.5677 - val\_loss: 0.7255  
Epoch 154/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5927 - loss: 0.7220 - val\_accuracy: 0.5677 - val\_loss: 0.7254  
Epoch 155/500  
18/18 ————— 0s 7ms/step - accuracy: 0.5893 - loss: 0.7191 - val\_accuracy: 0.5677 - val\_loss: 0.7253  
Epoch 156/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6173 - loss: 0.7108 - val\_accuracy: 0.5677 - val\_loss: 0.7252  
Epoch 157/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5775 - loss: 0.7231 - val\_accuracy: 0.5677 - val\_loss: 0.7251  
Epoch 158/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5934 - loss: 0.7169 - val\_accuracy: 0.5677 - val\_loss: 0.7250  
Epoch 159/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6079 - loss: 0.7104 - val\_accuracy: 0.5677 - val\_loss: 0.7249  
Epoch 160/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5789 - loss: 0.7158 - val\_accuracy: 0.5677 - val\_loss: 0.7248  
Epoch 161/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5891 - loss: 0.7151 - val\_accuracy: 0.5677 - val\_loss: 0.7247  
Epoch 162/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5894 - loss: 0.7118 - val\_accuracy: 0.5677 - val\_loss: 0.7246  
Epoch 163/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5798 - loss: 0.7207 - val\_accuracy: 0.5677 - val\_loss: 0.7245  
Epoch 164/500

18/18 ————— 0s 7ms/step - accuracy: 0.5993 - loss: 0.7127 - val\_accuracy: 0.5677 - val\_loss: 0.7244  
Epoch 165/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5902 - loss: 0.7102 - val\_accuracy: 0.5677 - val\_loss: 0.7243  
Epoch 166/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6044 - loss: 0.7158 - val\_accuracy: 0.5677 - val\_loss: 0.7242  
Epoch 167/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6201 - loss: 0.7061 - val\_accuracy: 0.5677 - val\_loss: 0.7241  
Epoch 168/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6163 - loss: 0.7055 - val\_accuracy: 0.5677 - val\_loss: 0.7240  
Epoch 169/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5840 - loss: 0.7250 - val\_accuracy: 0.5677 - val\_loss: 0.7239  
Epoch 170/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6333 - loss: 0.7064 - val\_accuracy: 0.5677 - val\_loss: 0.7238  
Epoch 171/500  
18/18 ————— 0s 8ms/step - accuracy: 0.5939 - loss: 0.7154 - val\_accuracy: 0.5677 - val\_loss: 0.7237  
Epoch 172/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6366 - loss: 0.7061 - val\_accuracy: 0.5677 - val\_loss: 0.7236  
Epoch 173/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5691 - loss: 0.7172 - val\_accuracy: 0.5677 - val\_loss: 0.7235  
Epoch 174/500  
18/18 ————— 0s 15ms/step - accuracy: 0.6129 - loss: 0.7080 - val\_accuracy: 0.5677 - val\_loss: 0.7234  
Epoch 175/500  
18/18 ————— 0s 15ms/step - accuracy: 0.5974 - loss: 0.7130 - val\_accuracy: 0.5729 - val\_loss: 0.7234  
Epoch 176/500  
18/18 ————— 1s 24ms/step - accuracy: 0.6323 - loss: 0.7036 - val\_accuracy: 0.5729 - val\_loss: 0.7233  
Epoch 177/500  
18/18 ————— 1s 21ms/step - accuracy: 0.6141 - loss: 0.7139 - val\_accuracy: 0.5729 - val\_loss: 0.7232  
Epoch 178/500  
18/18 ————— 0s 22ms/step - accuracy: 0.5858 - loss: 0.7117 - val\_accuracy: 0.5729 - val\_loss: 0.7231  
Epoch 179/500  
18/18 ————— 0s 10ms/step - accuracy: 0.5816 - loss: 0.7199 - val\_accuracy: 0.5729 - val\_loss: 0.7230  
Epoch 180/500  
18/18 ————— 1s 22ms/step - accuracy: 0.5942 - loss: 0.7121 - val\_accuracy: 0.5729 - val\_loss: 0.7229  
Epoch 181/500  
18/18 ————— 1s 23ms/step - accuracy: 0.5789 - loss: 0.7179 - val\_accuracy: 0.5729 - val\_loss: 0.7228  
Epoch 182/500  
18/18 ————— 0s 16ms/step - accuracy: 0.5938 - loss: 0.7144 - val\_accuracy: 0.5729 - val\_loss: 0.7227  
Epoch 183/500  
18/18 ————— 1s 9ms/step - accuracy: 0.6326 - loss: 0.7042 - val\_accuracy: 0.5729 - val\_loss: 0.7226  
Epoch 184/500  
18/18 ————— 0s 12ms/step - accuracy: 0.5980 - loss: 0.7180 - val\_accuracy: 0.5729 - val\_loss: 0.7225  
Epoch 185/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6120 - loss: 0.7095 - val\_accuracy: 0.5729 - val\_loss: 0.7224  
Epoch 186/500  
18/18 ————— 0s 11ms/step - accuracy: 0.5995 - loss: 0.7038 - val\_accuracy: 0.5729 - val\_loss: 0.7223  
Epoch 187/500  
18/18 ————— 0s 12ms/step - accuracy: 0.6367 - loss: 0.7035 - val\_accuracy: 0.5729 - val\_loss: 0.7222

0.7222  
Epoch 188/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6003 - loss: 0.7174 - val\_accuracy: 0.5729 - val\_loss: 0.7221  
Epoch 189/500  
18/18 ————— 0s 14ms/step - accuracy: 0.6085 - loss: 0.7039 - val\_accuracy: 0.5729 - val\_loss: 0.7220  
Epoch 190/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6462 - loss: 0.6954 - val\_accuracy: 0.5729 - val\_loss: 0.7219  
Epoch 191/500  
18/18 ————— 0s 21ms/step - accuracy: 0.6117 - loss: 0.7145 - val\_accuracy: 0.5729 - val\_loss: 0.7218  
Epoch 192/500  
18/18 ————— 1s 25ms/step - accuracy: 0.5718 - loss: 0.7197 - val\_accuracy: 0.5729 - val\_loss: 0.7218  
Epoch 193/500  
18/18 ————— 0s 16ms/step - accuracy: 0.5967 - loss: 0.7091 - val\_accuracy: 0.5729 - val\_loss: 0.7217  
Epoch 194/500  
18/18 ————— 1s 16ms/step - accuracy: 0.5720 - loss: 0.7245 - val\_accuracy: 0.5729 - val\_loss: 0.7216  
Epoch 195/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6285 - loss: 0.6958 - val\_accuracy: 0.5729 - val\_loss: 0.7215  
Epoch 196/500  
18/18 ————— 0s 15ms/step - accuracy: 0.5991 - loss: 0.7100 - val\_accuracy: 0.5729 - val\_loss: 0.7214  
Epoch 197/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5946 - loss: 0.7177 - val\_accuracy: 0.5729 - val\_loss: 0.7213  
Epoch 198/500  
18/18 ————— 0s 12ms/step - accuracy: 0.6002 - loss: 0.7071 - val\_accuracy: 0.5729 - val\_loss: 0.7212  
Epoch 199/500  
18/18 ————— 0s 17ms/step - accuracy: 0.5887 - loss: 0.7171 - val\_accuracy: 0.5729 - val\_loss: 0.7211  
Epoch 200/500  
18/18 ————— 0s 15ms/step - accuracy: 0.6105 - loss: 0.7137 - val\_accuracy: 0.5729 - val\_loss: 0.7210  
Epoch 201/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6232 - loss: 0.7031 - val\_accuracy: 0.5729 - val\_loss: 0.7209  
Epoch 202/500  
18/18 ————— 0s 11ms/step - accuracy: 0.5900 - loss: 0.7116 - val\_accuracy: 0.5729 - val\_loss: 0.7208  
Epoch 203/500  
18/18 ————— 0s 18ms/step - accuracy: 0.5878 - loss: 0.7135 - val\_accuracy: 0.5729 - val\_loss: 0.7207  
Epoch 204/500  
18/18 ————— 1s 13ms/step - accuracy: 0.5870 - loss: 0.7189 - val\_accuracy: 0.5729 - val\_loss: 0.7206  
Epoch 205/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6085 - loss: 0.7073 - val\_accuracy: 0.5729 - val\_loss: 0.7205  
Epoch 206/500  
18/18 ————— 0s 14ms/step - accuracy: 0.6189 - loss: 0.7092 - val\_accuracy: 0.5729 - val\_loss: 0.7205  
Epoch 207/500  
18/18 ————— 0s 15ms/step - accuracy: 0.6242 - loss: 0.7092 - val\_accuracy: 0.5729 - val\_loss: 0.7204  
Epoch 208/500  
18/18 ————— 0s 10ms/step - accuracy: 0.5948 - loss: 0.7145 - val\_accuracy: 0.5729 - val\_loss: 0.7203  
Epoch 209/500  
18/18 ————— 0s 9ms/step - accuracy: 0.5919 - loss: 0.7144 - val\_accuracy: 0.5729 - val\_loss: 0.7202  
Epoch 210/500  
18/18 ————— 0s 10ms/step - accuracy: 0.6009 - loss: 0.7113 - val\_accuracy: 0.5729 - val\_loss: 0.7201

Epoch 211/500  
18/18 ————— 0s 21ms/step - accuracy: 0.5865 - loss: 0.7207 - val\_accuracy: 0.5729 - val\_loss: 0.7200  
Epoch 212/500  
18/18 ————— 0s 22ms/step - accuracy: 0.5958 - loss: 0.7132 - val\_accuracy: 0.5729 - val\_loss: 0.7199  
Epoch 213/500  
18/18 ————— 0s 19ms/step - accuracy: 0.6069 - loss: 0.7047 - val\_accuracy: 0.5729 - val\_loss: 0.7198  
Epoch 214/500  
18/18 ————— 1s 15ms/step - accuracy: 0.6077 - loss: 0.7034 - val\_accuracy: 0.5729 - val\_loss: 0.7197  
Epoch 215/500  
18/18 ————— 1s 21ms/step - accuracy: 0.6200 - loss: 0.7103 - val\_accuracy: 0.5729 - val\_loss: 0.7196  
Epoch 216/500  
18/18 ————— 1s 22ms/step - accuracy: 0.6007 - loss: 0.7053 - val\_accuracy: 0.5729 - val\_loss: 0.7195  
Epoch 217/500  
18/18 ————— 0s 11ms/step - accuracy: 0.5964 - loss: 0.7060 - val\_accuracy: 0.5729 - val\_loss: 0.7195  
Epoch 218/500  
18/18 ————— 0s 9ms/step - accuracy: 0.6075 - loss: 0.7112 - val\_accuracy: 0.5729 - val\_loss: 0.7194  
Epoch 219/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6132 - loss: 0.6998 - val\_accuracy: 0.5729 - val\_loss: 0.7193  
Epoch 220/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5912 - loss: 0.7094 - val\_accuracy: 0.5729 - val\_loss: 0.7192  
Epoch 221/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5741 - loss: 0.7258 - val\_accuracy: 0.5729 - val\_loss: 0.7191  
Epoch 222/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6021 - loss: 0.7115 - val\_accuracy: 0.5729 - val\_loss: 0.7190  
Epoch 223/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6140 - loss: 0.7024 - val\_accuracy: 0.5729 - val\_loss: 0.7189  
Epoch 224/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6207 - loss: 0.7048 - val\_accuracy: 0.5729 - val\_loss: 0.7188  
Epoch 225/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5918 - loss: 0.7097 - val\_accuracy: 0.5729 - val\_loss: 0.7187  
Epoch 226/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6018 - loss: 0.7163 - val\_accuracy: 0.5729 - val\_loss: 0.7186  
Epoch 227/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6139 - loss: 0.7038 - val\_accuracy: 0.5729 - val\_loss: 0.7185  
Epoch 228/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6005 - loss: 0.7124 - val\_accuracy: 0.5729 - val\_loss: 0.7185  
Epoch 229/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6099 - loss: 0.7020 - val\_accuracy: 0.5729 - val\_loss: 0.7184  
Epoch 230/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5943 - loss: 0.7133 - val\_accuracy: 0.5729 - val\_loss: 0.7183  
Epoch 231/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6343 - loss: 0.6968 - val\_accuracy: 0.5729 - val\_loss: 0.7182  
Epoch 232/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6177 - loss: 0.6989 - val\_accuracy: 0.5781 - val\_loss: 0.7181  
Epoch 233/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5963 - loss: 0.7127 - val\_accuracy: 0.5781 - val\_loss: 0.7180  
Epoch 234/500

18/18 ————— 0s 6ms/step - accuracy: 0.6245 - loss: 0.7027 - val\_accuracy: 0.5781 - val\_loss: 0.7179  
Epoch 235/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6251 - loss: 0.7031 - val\_accuracy: 0.5781 - val\_loss: 0.7178  
Epoch 236/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6013 - loss: 0.7075 - val\_accuracy: 0.5781 - val\_loss: 0.7177  
Epoch 237/500  
18/18 ————— 0s 7ms/step - accuracy: 0.5967 - loss: 0.7098 - val\_accuracy: 0.5781 - val\_loss: 0.7177  
Epoch 238/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6198 - loss: 0.7058 - val\_accuracy: 0.5781 - val\_loss: 0.7176  
Epoch 239/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5946 - loss: 0.7104 - val\_accuracy: 0.5729 - val\_loss: 0.7175  
Epoch 240/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6198 - loss: 0.7046 - val\_accuracy: 0.5729 - val\_loss: 0.7174  
Epoch 241/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6064 - loss: 0.7100 - val\_accuracy: 0.5729 - val\_loss: 0.7173  
Epoch 242/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6017 - loss: 0.7152 - val\_accuracy: 0.5729 - val\_loss: 0.7172  
Epoch 243/500  
18/18 ————— 0s 9ms/step - accuracy: 0.5961 - loss: 0.7076 - val\_accuracy: 0.5729 - val\_loss: 0.7171  
Epoch 244/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6270 - loss: 0.7071 - val\_accuracy: 0.5729 - val\_loss: 0.7170  
Epoch 245/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6088 - loss: 0.7056 - val\_accuracy: 0.5729 - val\_loss: 0.7169  
Epoch 246/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6287 - loss: 0.7022 - val\_accuracy: 0.5729 - val\_loss: 0.7168  
Epoch 247/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6007 - loss: 0.7050 - val\_accuracy: 0.5729 - val\_loss: 0.7168  
Epoch 248/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6128 - loss: 0.7063 - val\_accuracy: 0.5729 - val\_loss: 0.7167  
Epoch 249/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6047 - loss: 0.7042 - val\_accuracy: 0.5729 - val\_loss: 0.7166  
Epoch 250/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6025 - loss: 0.7048 - val\_accuracy: 0.5729 - val\_loss: 0.7165  
Epoch 251/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6206 - loss: 0.7000 - val\_accuracy: 0.5729 - val\_loss: 0.7164  
Epoch 252/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6034 - loss: 0.7116 - val\_accuracy: 0.5729 - val\_loss: 0.7163  
Epoch 253/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6134 - loss: 0.7094 - val\_accuracy: 0.5729 - val\_loss: 0.7162  
Epoch 254/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5950 - loss: 0.7054 - val\_accuracy: 0.5729 - val\_loss: 0.7161  
Epoch 255/500  
18/18 ————— 0s 7ms/step - accuracy: 0.5905 - loss: 0.7197 - val\_accuracy: 0.5729 - val\_loss: 0.7160  
Epoch 256/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5819 - loss: 0.7162 - val\_accuracy: 0.5729 - val\_loss: 0.7160  
Epoch 257/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5994 - loss: 0.7080 - val\_accuracy: 0.5781 - val\_loss:


0.7159  
Epoch 258/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6061 - loss: 0.7105 - val\_accuracy: 0.5781 - val\_loss: 0.7158  
Epoch 259/500  
18/18 ————— 0s 9ms/step - accuracy: 0.6221 - loss: 0.7043 - val\_accuracy: 0.5781 - val\_loss: 0.7157  
Epoch 260/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6355 - loss: 0.6996 - val\_accuracy: 0.5781 - val\_loss: 0.7156  
Epoch 261/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6249 - loss: 0.6985 - val\_accuracy: 0.5781 - val\_loss: 0.7155  
Epoch 262/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6151 - loss: 0.6981 - val\_accuracy: 0.5781 - val\_loss: 0.7154  
Epoch 263/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6075 - loss: 0.7044 - val\_accuracy: 0.5781 - val\_loss: 0.7153  
Epoch 264/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6475 - loss: 0.6996 - val\_accuracy: 0.5781 - val\_loss: 0.7153  
Epoch 265/500  
18/18 ————— 0s 7ms/step - accuracy: 0.5887 - loss: 0.7092 - val\_accuracy: 0.5781 - val\_loss: 0.7152  
Epoch 266/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6272 - loss: 0.6986 - val\_accuracy: 0.5781 - val\_loss: 0.7151  
Epoch 267/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6170 - loss: 0.7061 - val\_accuracy: 0.5781 - val\_loss: 0.7150  
Epoch 268/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6266 - loss: 0.7007 - val\_accuracy: 0.5781 - val\_loss: 0.7149  
Epoch 269/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6045 - loss: 0.6986 - val\_accuracy: 0.5781 - val\_loss: 0.7148  
Epoch 270/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6049 - loss: 0.7025 - val\_accuracy: 0.5781 - val\_loss: 0.7147  
Epoch 271/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6113 - loss: 0.7024 - val\_accuracy: 0.5781 - val\_loss: 0.7146  
Epoch 272/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6084 - loss: 0.7047 - val\_accuracy: 0.5781 - val\_loss: 0.7146  
Epoch 273/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6314 - loss: 0.6872 - val\_accuracy: 0.5833 - val\_loss: 0.7145  
Epoch 274/500  
18/18 ————— 0s 11ms/step - accuracy: 0.5975 - loss: 0.7098 - val\_accuracy: 0.5833 - val\_loss: 0.7144  
Epoch 275/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6340 - loss: 0.6947 - val\_accuracy: 0.5885 - val\_loss: 0.7143  
Epoch 276/500  
18/18 ————— 0s 9ms/step - accuracy: 0.5977 - loss: 0.7114 - val\_accuracy: 0.5885 - val\_loss: 0.7142  
Epoch 277/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6017 - loss: 0.7022 - val\_accuracy: 0.5885 - val\_loss: 0.7141  
Epoch 278/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6374 - loss: 0.6900 - val\_accuracy: 0.5885 - val\_loss: 0.7140  
Epoch 279/500  
18/18 ————— 0s 12ms/step - accuracy: 0.5869 - loss: 0.7015 - val\_accuracy: 0.5885 - val\_loss: 0.7140  
Epoch 280/500  
18/18 ————— 0s 12ms/step - accuracy: 0.6295 - loss: 0.6902 - val\_accuracy: 0.5885 - val\_loss: 0.7139


Epoch 281/500  
18/18 ————— 0s 10ms/step - accuracy: 0.6406 - loss: 0.6885 - val\_accuracy: 0.5885 - val\_loss: 0.7138  
Epoch 282/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6322 - loss: 0.6963 - val\_accuracy: 0.5885 - val\_loss: 0.7137  
Epoch 283/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6044 - loss: 0.7045 - val\_accuracy: 0.5885 - val\_loss: 0.7136  
Epoch 284/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6352 - loss: 0.6933 - val\_accuracy: 0.5885 - val\_loss: 0.7135  
Epoch 285/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5889 - loss: 0.7143 - val\_accuracy: 0.5885 - val\_loss: 0.7134  
Epoch 286/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5641 - loss: 0.7188 - val\_accuracy: 0.5885 - val\_loss: 0.7134  
Epoch 287/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6054 - loss: 0.7026 - val\_accuracy: 0.5885 - val\_loss: 0.7133  
Epoch 288/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6251 - loss: 0.6967 - val\_accuracy: 0.5885 - val\_loss: 0.7132  
Epoch 289/500  
18/18 ————— 0s 9ms/step - accuracy: 0.6066 - loss: 0.7045 - val\_accuracy: 0.5885 - val\_loss: 0.7131  
Epoch 290/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6251 - loss: 0.6892 - val\_accuracy: 0.5885 - val\_loss: 0.7130  
Epoch 291/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6065 - loss: 0.6977 - val\_accuracy: 0.5885 - val\_loss: 0.7129  
Epoch 292/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6118 - loss: 0.7063 - val\_accuracy: 0.5885 - val\_loss: 0.7128  
Epoch 293/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6326 - loss: 0.6991 - val\_accuracy: 0.5885 - val\_loss: 0.7128  
Epoch 294/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6408 - loss: 0.6949 - val\_accuracy: 0.5885 - val\_loss: 0.7127  
Epoch 295/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6144 - loss: 0.6950 - val\_accuracy: 0.5885 - val\_loss: 0.7126  
Epoch 296/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6326 - loss: 0.7001 - val\_accuracy: 0.5885 - val\_loss: 0.7125  
Epoch 297/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6165 - loss: 0.7016 - val\_accuracy: 0.5885 - val\_loss: 0.7124  
Epoch 298/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6196 - loss: 0.7057 - val\_accuracy: 0.5885 - val\_loss: 0.7123  
Epoch 299/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5885 - loss: 0.7075 - val\_accuracy: 0.5885 - val\_loss: 0.7123  
Epoch 300/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6143 - loss: 0.7020 - val\_accuracy: 0.5885 - val\_loss: 0.7122  
Epoch 301/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6408 - loss: 0.6889 - val\_accuracy: 0.5885 - val\_loss: 0.7121  
Epoch 302/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6248 - loss: 0.7003 - val\_accuracy: 0.5885 - val\_loss: 0.7120  
Epoch 303/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6315 - loss: 0.7011 - val\_accuracy: 0.5885 - val\_loss: 0.7119  
Epoch 304/500





18/18 ————— 0s 8ms/step - accuracy: 0.6435 - loss: 0.6895 - val\_accuracy: 0.5885 - val\_loss: 0.7118  
Epoch 305/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5883 - loss: 0.7059 - val\_accuracy: 0.5885 - val\_loss: 0.7118  
Epoch 306/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6199 - loss: 0.6970 - val\_accuracy: 0.5885 - val\_loss: 0.7117  
Epoch 307/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6316 - loss: 0.6915 - val\_accuracy: 0.5885 - val\_loss: 0.7116  
Epoch 308/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6370 - loss: 0.6897 - val\_accuracy: 0.5885 - val\_loss: 0.7115  
Epoch 309/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6391 - loss: 0.6890 - val\_accuracy: 0.5885 - val\_loss: 0.7114  
Epoch 310/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6624 - loss: 0.6889 - val\_accuracy: 0.5885 - val\_loss: 0.7113  
Epoch 311/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6298 - loss: 0.6968 - val\_accuracy: 0.5885 - val\_loss: 0.7113  
Epoch 312/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6160 - loss: 0.7011 - val\_accuracy: 0.5885 - val\_loss: 0.7112  
Epoch 313/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5777 - loss: 0.7178 - val\_accuracy: 0.5885 - val\_loss: 0.7111  
Epoch 314/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6204 - loss: 0.6941 - val\_accuracy: 0.5885 - val\_loss: 0.7110  
Epoch 315/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6391 - loss: 0.6937 - val\_accuracy: 0.5885 - val\_loss: 0.7109  
Epoch 316/500  
18/18 ————— 0s 9ms/step - accuracy: 0.6189 - loss: 0.7002 - val\_accuracy: 0.5885 - val\_loss: 0.7108  
Epoch 317/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6212 - loss: 0.7018 - val\_accuracy: 0.5885 - val\_loss: 0.7108  
Epoch 318/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6102 - loss: 0.6971 - val\_accuracy: 0.5885 - val\_loss: 0.7107  
Epoch 319/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6259 - loss: 0.6939 - val\_accuracy: 0.5885 - val\_loss: 0.7106  
Epoch 320/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6385 - loss: 0.6937 - val\_accuracy: 0.5885 - val\_loss: 0.7105  
Epoch 321/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6100 - loss: 0.7033 - val\_accuracy: 0.5885 - val\_loss: 0.7104  
Epoch 322/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6072 - loss: 0.7002 - val\_accuracy: 0.5885 - val\_loss: 0.7103  
Epoch 323/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6056 - loss: 0.7011 - val\_accuracy: 0.5885 - val\_loss: 0.7103  
Epoch 324/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6186 - loss: 0.6878 - val\_accuracy: 0.5885 - val\_loss: 0.7102  
Epoch 325/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6378 - loss: 0.6980 - val\_accuracy: 0.5885 - val\_loss: 0.7101  
Epoch 326/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6053 - loss: 0.7072 - val\_accuracy: 0.5885 - val\_loss: 0.7100  
Epoch 327/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6147 - loss: 0.6972 - val\_accuracy: 0.5885 - val\_loss:


0.7099  
Epoch 328/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6300 - loss: 0.6992 - val\_accuracy: 0.5885 - val\_loss: 0.7098  
Epoch 329/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6416 - loss: 0.6878 - val\_accuracy: 0.5885 - val\_loss: 0.7098  
Epoch 330/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6176 - loss: 0.6996 - val\_accuracy: 0.5885 - val\_loss: 0.7097  
Epoch 331/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6332 - loss: 0.6971 - val\_accuracy: 0.5885 - val\_loss: 0.7096  
Epoch 332/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6310 - loss: 0.6959 - val\_accuracy: 0.5885 - val\_loss: 0.7095  
Epoch 333/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6434 - loss: 0.6974 - val\_accuracy: 0.5885 - val\_loss: 0.7094  
Epoch 334/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5706 - loss: 0.7175 - val\_accuracy: 0.5885 - val\_loss: 0.7094  
Epoch 335/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6313 - loss: 0.6882 - val\_accuracy: 0.5885 - val\_loss: 0.7093  
Epoch 336/500  
18/18 ————— 0s 9ms/step - accuracy: 0.5964 - loss: 0.7118 - val\_accuracy: 0.5885 - val\_loss: 0.7092  
Epoch 337/500  
18/18 ————— 0s 10ms/step - accuracy: 0.6315 - loss: 0.6927 - val\_accuracy: 0.5885 - val\_loss: 0.7091  
Epoch 338/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6153 - loss: 0.7067 - val\_accuracy: 0.5885 - val\_loss: 0.7090  
Epoch 339/500  
18/18 ————— 0s 9ms/step - accuracy: 0.6348 - loss: 0.6978 - val\_accuracy: 0.5885 - val\_loss: 0.7090  
Epoch 340/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6189 - loss: 0.6991 - val\_accuracy: 0.5885 - val\_loss: 0.7089  
Epoch 341/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6347 - loss: 0.6906 - val\_accuracy: 0.5885 - val\_loss: 0.7088  
Epoch 342/500  
18/18 ————— 0s 11ms/step - accuracy: 0.5915 - loss: 0.6997 - val\_accuracy: 0.5885 - val\_loss: 0.7087  
Epoch 343/500  
18/18 ————— 0s 10ms/step - accuracy: 0.6267 - loss: 0.6949 - val\_accuracy: 0.5885 - val\_loss: 0.7086  
Epoch 344/500  
18/18 ————— 0s 13ms/step - accuracy: 0.6366 - loss: 0.6828 - val\_accuracy: 0.5885 - val\_loss: 0.7086  
Epoch 345/500  
18/18 ————— 0s 12ms/step - accuracy: 0.6249 - loss: 0.6999 - val\_accuracy: 0.5938 - val\_loss: 0.7085  
Epoch 346/500  
18/18 ————— 0s 10ms/step - accuracy: 0.6037 - loss: 0.7062 - val\_accuracy: 0.5938 - val\_loss: 0.7084  
Epoch 347/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6347 - loss: 0.6926 - val\_accuracy: 0.5990 - val\_loss: 0.7083  
Epoch 348/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6328 - loss: 0.6939 - val\_accuracy: 0.5990 - val\_loss: 0.7082  
Epoch 349/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6570 - loss: 0.6814 - val\_accuracy: 0.5990 - val\_loss: 0.7082  
Epoch 350/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6263 - loss: 0.6884 - val\_accuracy: 0.5990 - val\_loss: 0.7081


Epoch 351/500  
18/18  0s 6ms/step - accuracy: 0.6087 - loss: 0.7001 - val\_accuracy: 0.5990 - val\_loss: 0.7080


Epoch 352/500  
18/18  0s 6ms/step - accuracy: 0.6370 - loss: 0.6861 - val\_accuracy: 0.5990 - val\_loss: 0.7079


Epoch 353/500  
18/18  0s 8ms/step - accuracy: 0.6273 - loss: 0.6983 - val\_accuracy: 0.5990 - val\_loss: 0.7078


Epoch 354/500  
18/18  0s 6ms/step - accuracy: 0.6472 - loss: 0.6888 - val\_accuracy: 0.5990 - val\_loss: 0.7078


Epoch 355/500  
18/18  0s 6ms/step - accuracy: 0.6402 - loss: 0.6884 - val\_accuracy: 0.5990 - val\_loss: 0.7077


Epoch 356/500  
18/18  0s 6ms/step - accuracy: 0.6337 - loss: 0.6903 - val\_accuracy: 0.5990 - val\_loss: 0.7076


Epoch 357/500  
18/18  0s 6ms/step - accuracy: 0.6147 - loss: 0.6928 - val\_accuracy: 0.5990 - val\_loss: 0.7075


Epoch 358/500  
18/18  0s 8ms/step - accuracy: 0.6046 - loss: 0.7014 - val\_accuracy: 0.5990 - val\_loss: 0.7074


Epoch 359/500  
18/18  0s 6ms/step - accuracy: 0.6349 - loss: 0.6903 - val\_accuracy: 0.5990 - val\_loss: 0.7074


Epoch 360/500  
18/18  0s 7ms/step - accuracy: 0.6325 - loss: 0.6849 - val\_accuracy: 0.5990 - val\_loss: 0.7073


Epoch 361/500  
18/18  0s 8ms/step - accuracy: 0.6356 - loss: 0.6850 - val\_accuracy: 0.5990 - val\_loss: 0.7072


Epoch 362/500  
18/18  0s 6ms/step - accuracy: 0.6070 - loss: 0.6947 - val\_accuracy: 0.6042 - val\_loss: 0.7071


Epoch 363/500  
18/18  0s 6ms/step - accuracy: 0.6336 - loss: 0.6958 - val\_accuracy: 0.6042 - val\_loss: 0.7070


Epoch 364/500  
18/18  0s 6ms/step - accuracy: 0.6235 - loss: 0.6918 - val\_accuracy: 0.6042 - val\_loss: 0.7070


Epoch 365/500  
18/18  0s 6ms/step - accuracy: 0.6402 - loss: 0.6824 - val\_accuracy: 0.6042 - val\_loss: 0.7069


Epoch 366/500  
18/18  0s 6ms/step - accuracy: 0.6342 - loss: 0.6852 - val\_accuracy: 0.6042 - val\_loss: 0.7068


Epoch 367/500  
18/18  0s 6ms/step - accuracy: 0.6287 - loss: 0.6918 - val\_accuracy: 0.6042 - val\_loss: 0.7067


Epoch 368/500  
18/18  0s 9ms/step - accuracy: 0.6382 - loss: 0.6872 - val\_accuracy: 0.6094 - val\_loss: 0.7067

Epoch 369/500  
18/18  0s 6ms/step - accuracy: 0.6113 - loss: 0.6977 - val\_accuracy: 0.6094 - val\_loss: 0.7066

Epoch 370/500  
18/18  0s 6ms/step - accuracy: 0.6537 - loss: 0.6849 - val\_accuracy: 0.6094 - val\_loss: 0.7065

Epoch 371/500  
18/18  0s 6ms/step - accuracy: 0.6354 - loss: 0.6866 - val\_accuracy: 0.6094 - val\_loss: 0.7064

Epoch 372/500  
18/18  0s 6ms/step - accuracy: 0.6246 - loss: 0.6934 - val\_accuracy: 0.6094 - val\_loss: 0.7063

Epoch 373/500  
18/18  0s 6ms/step - accuracy: 0.6328 - loss: 0.6850 - val\_accuracy: 0.6094 - val\_loss: 0.7063

Epoch 374/500

18/18 ————— 0s 7ms/step - accuracy: 0.6326 - loss: 0.6926 - val\_accuracy: 0.6094 - val\_loss: 0.7062  
Epoch 375/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6299 - loss: 0.6940 - val\_accuracy: 0.6094 - val\_loss: 0.7061  
Epoch 376/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6315 - loss: 0.6890 - val\_accuracy: 0.6094 - val\_loss: 0.7060  
Epoch 377/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6432 - loss: 0.6808 - val\_accuracy: 0.6094 - val\_loss: 0.7060  
Epoch 378/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6149 - loss: 0.6961 - val\_accuracy: 0.6094 - val\_loss: 0.7059  
Epoch 379/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6184 - loss: 0.6930 - val\_accuracy: 0.6094 - val\_loss: 0.7058  
Epoch 380/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6273 - loss: 0.6906 - val\_accuracy: 0.6094 - val\_loss: 0.7057  
Epoch 381/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6166 - loss: 0.6981 - val\_accuracy: 0.6094 - val\_loss: 0.7056  
Epoch 382/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6058 - loss: 0.7048 - val\_accuracy: 0.6094 - val\_loss: 0.7056  
Epoch 383/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6240 - loss: 0.6935 - val\_accuracy: 0.6094 - val\_loss: 0.7055  
Epoch 384/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6373 - loss: 0.6908 - val\_accuracy: 0.6094 - val\_loss: 0.7054  
Epoch 385/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6354 - loss: 0.6948 - val\_accuracy: 0.6094 - val\_loss: 0.7053  
Epoch 386/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6263 - loss: 0.6919 - val\_accuracy: 0.6094 - val\_loss: 0.7053  
Epoch 387/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6347 - loss: 0.6930 - val\_accuracy: 0.6094 - val\_loss: 0.7052  
Epoch 388/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6298 - loss: 0.6879 - val\_accuracy: 0.6094 - val\_loss: 0.7051  
Epoch 389/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6051 - loss: 0.6986 - val\_accuracy: 0.6094 - val\_loss: 0.7050  
Epoch 390/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6635 - loss: 0.6813 - val\_accuracy: 0.6094 - val\_loss: 0.7049  
Epoch 391/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6366 - loss: 0.6886 - val\_accuracy: 0.6094 - val\_loss: 0.7049  
Epoch 392/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6226 - loss: 0.6881 - val\_accuracy: 0.6094 - val\_loss: 0.7048  
Epoch 393/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6340 - loss: 0.6956 - val\_accuracy: 0.6094 - val\_loss: 0.7047  
Epoch 394/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6456 - loss: 0.6890 - val\_accuracy: 0.6094 - val\_loss: 0.7046  
Epoch 395/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6263 - loss: 0.6845 - val\_accuracy: 0.6094 - val\_loss: 0.7046  
Epoch 396/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6465 - loss: 0.6862 - val\_accuracy: 0.6094 - val\_loss: 0.7045  
Epoch 397/500  
18/18 ————— 0s 10ms/step - accuracy: 0.6460 - loss: 0.6806 - val\_accuracy: 0.6094 - val\_loss:











0.7044  
Epoch 398/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6225 - loss: 0.6880 - val\_accuracy: 0.6094 - val\_loss: 0.7043  
Epoch 399/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6108 - loss: 0.6896 - val\_accuracy: 0.6094 - val\_loss: 0.7043  
Epoch 400/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6206 - loss: 0.6876 - val\_accuracy: 0.6094 - val\_loss: 0.7042  
Epoch 401/500  
18/18 ————— 0s 12ms/step - accuracy: 0.6231 - loss: 0.6924 - val\_accuracy: 0.6094 - val\_loss: 0.7041  
Epoch 402/500  
18/18 ————— 0s 10ms/step - accuracy: 0.6443 - loss: 0.6885 - val\_accuracy: 0.6094 - val\_loss: 0.7040  
Epoch 403/500  
18/18 ————— 0s 10ms/step - accuracy: 0.5961 - loss: 0.7047 - val\_accuracy: 0.6094 - val\_loss: 0.7040  
Epoch 404/500  
18/18 ————— 0s 13ms/step - accuracy: 0.6175 - loss: 0.6931 - val\_accuracy: 0.6094 - val\_loss: 0.7039  
Epoch 405/500  
18/18 ————— 0s 16ms/step - accuracy: 0.6370 - loss: 0.6807 - val\_accuracy: 0.6094 - val\_loss: 0.7038  
Epoch 406/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6401 - loss: 0.6805 - val\_accuracy: 0.6094 - val\_loss: 0.7037  
Epoch 407/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6495 - loss: 0.6785 - val\_accuracy: 0.6094 - val\_loss: 0.7037  
Epoch 408/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6362 - loss: 0.6857 - val\_accuracy: 0.6094 - val\_loss: 0.7036  
Epoch 409/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6146 - loss: 0.6860 - val\_accuracy: 0.6094 - val\_loss: 0.7035  
Epoch 410/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6241 - loss: 0.6864 - val\_accuracy: 0.6094 - val\_loss: 0.7034  
Epoch 411/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6247 - loss: 0.6993 - val\_accuracy: 0.6094 - val\_loss: 0.7034  
Epoch 412/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5995 - loss: 0.6987 - val\_accuracy: 0.6094 - val\_loss: 0.7033  
Epoch 413/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6681 - loss: 0.6743 - val\_accuracy: 0.6094 - val\_loss: 0.7032  
Epoch 414/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6500 - loss: 0.6831 - val\_accuracy: 0.6094 - val\_loss: 0.7031  
Epoch 415/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6330 - loss: 0.6875 - val\_accuracy: 0.6094 - val\_loss: 0.7031  
Epoch 416/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6355 - loss: 0.6890 - val\_accuracy: 0.6094 - val\_loss: 0.7030  
Epoch 417/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6552 - loss: 0.6828 - val\_accuracy: 0.6094 - val\_loss: 0.7029  
Epoch 418/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6454 - loss: 0.6833 - val\_accuracy: 0.6094 - val\_loss: 0.7028  
Epoch 419/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6403 - loss: 0.6762 - val\_accuracy: 0.6094 - val\_loss: 0.7028  
Epoch 420/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6087 - loss: 0.6913 - val\_accuracy: 0.6094 - val\_loss: 0.7027

Epoch 421/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6303 - loss: 0.6796 - val\_accuracy: 0.6094 - val\_loss: 0.7026  
Epoch 422/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6192 - loss: 0.6857 - val\_accuracy: 0.6094 - val\_loss: 0.7025  
Epoch 423/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6244 - loss: 0.6848 - val\_accuracy: 0.6094 - val\_loss: 0.7025  
Epoch 424/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6490 - loss: 0.6827 - val\_accuracy: 0.6094 - val\_loss: 0.7024  
Epoch 425/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6584 - loss: 0.6751 - val\_accuracy: 0.6094 - val\_loss: 0.7023  
Epoch 426/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6007 - loss: 0.6991 - val\_accuracy: 0.6094 - val\_loss: 0.7023  
Epoch 427/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6094 - loss: 0.7052 - val\_accuracy: 0.6094 - val\_loss: 0.7022  
Epoch 428/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6408 - loss: 0.6851 - val\_accuracy: 0.6094 - val\_loss: 0.7021  
Epoch 429/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6402 - loss: 0.6880 - val\_accuracy: 0.6094 - val\_loss: 0.7020  
Epoch 430/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6491 - loss: 0.6788 - val\_accuracy: 0.6094 - val\_loss: 0.7020  
Epoch 431/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6148 - loss: 0.6948 - val\_accuracy: 0.6094 - val\_loss: 0.7019  
Epoch 432/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6491 - loss: 0.6780 - val\_accuracy: 0.6094 - val\_loss: 0.7018  
Epoch 433/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5802 - loss: 0.7051 - val\_accuracy: 0.6094 - val\_loss: 0.7017  
Epoch 434/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6618 - loss: 0.6788 - val\_accuracy: 0.6094 - val\_loss: 0.7017  
Epoch 435/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6285 - loss: 0.6869 - val\_accuracy: 0.6094 - val\_loss: 0.7016  
Epoch 436/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6360 - loss: 0.6837 - val\_accuracy: 0.6094 - val\_loss: 0.7015  
Epoch 437/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6371 - loss: 0.6825 - val\_accuracy: 0.6094 - val\_loss: 0.7015  
Epoch 438/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6563 - loss: 0.6811 - val\_accuracy: 0.6094 - val\_loss: 0.7014  
Epoch 439/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6216 - loss: 0.6913 - val\_accuracy: 0.6094 - val\_loss: 0.7013  
Epoch 440/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6339 - loss: 0.6857 - val\_accuracy: 0.6094 - val\_loss: 0.7012  
Epoch 441/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6096 - loss: 0.6976 - val\_accuracy: 0.6094 - val\_loss: 0.7012  
Epoch 442/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6063 - loss: 0.7015 - val\_accuracy: 0.6094 - val\_loss: 0.7011  
Epoch 443/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6595 - loss: 0.6768 - val\_accuracy: 0.6094 - val\_loss: 0.7010  
Epoch 444/500


18/18 ————— 0s 6ms/step - accuracy: 0.6418 - loss: 0.6881 - val\_accuracy: 0.6094 - val\_loss: 0.7010  
Epoch 445/500  
18/18 ————— 0s 7ms/step - accuracy: 0.5918 - loss: 0.6993 - val\_accuracy: 0.6094 - val\_loss: 0.7009  
Epoch 446/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6239 - loss: 0.6894 - val\_accuracy: 0.6094 - val\_loss: 0.7008  
Epoch 447/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6400 - loss: 0.6852 - val\_accuracy: 0.6094 - val\_loss: 0.7007  
Epoch 448/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6698 - loss: 0.6689 - val\_accuracy: 0.6094 - val\_loss: 0.7007  
Epoch 449/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6360 - loss: 0.6826 - val\_accuracy: 0.6094 - val\_loss: 0.7006  
Epoch 450/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6414 - loss: 0.6811 - val\_accuracy: 0.6094 - val\_loss: 0.7005  
Epoch 451/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6151 - loss: 0.6903 - val\_accuracy: 0.6094 - val\_loss: 0.7005  
Epoch 452/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6124 - loss: 0.6887 - val\_accuracy: 0.6094 - val\_loss: 0.7004  
Epoch 453/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6094 - loss: 0.6962 - val\_accuracy: 0.6094 - val\_loss: 0.7003  
Epoch 454/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6120 - loss: 0.6958 - val\_accuracy: 0.6094 - val\_loss: 0.7002  
Epoch 455/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6178 - loss: 0.6913 - val\_accuracy: 0.6094 - val\_loss: 0.7002  
Epoch 456/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6513 - loss: 0.6747 - val\_accuracy: 0.6094 - val\_loss: 0.7001  
Epoch 457/500  
18/18 ————— 0s 10ms/step - accuracy: 0.6207 - loss: 0.6876 - val\_accuracy: 0.6094 - val\_loss: 0.7000  
Epoch 458/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6521 - loss: 0.6752 - val\_accuracy: 0.6094 - val\_loss: 0.7000  
Epoch 459/500  
18/18 ————— 0s 9ms/step - accuracy: 0.6243 - loss: 0.6836 - val\_accuracy: 0.6094 - val\_loss: 0.6999  
Epoch 460/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6162 - loss: 0.6863 - val\_accuracy: 0.6094 - val\_loss: 0.6998  
Epoch 461/500  
18/18 ————— 0s 12ms/step - accuracy: 0.6180 - loss: 0.6907 - val\_accuracy: 0.6094 - val\_loss: 0.6997  
Epoch 462/500  
18/18 ————— 0s 10ms/step - accuracy: 0.6352 - loss: 0.6868 - val\_accuracy: 0.6094 - val\_loss: 0.6997  
Epoch 463/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6250 - loss: 0.6776 - val\_accuracy: 0.6094 - val\_loss: 0.6996  
Epoch 464/500  
18/18 ————— 0s 10ms/step - accuracy: 0.6154 - loss: 0.6950 - val\_accuracy: 0.6094 - val\_loss: 0.6995  
Epoch 465/500  
18/18 ————— 0s 11ms/step - accuracy: 0.6244 - loss: 0.6905 - val\_accuracy: 0.6094 - val\_loss: 0.6995  
Epoch 466/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6210 - loss: 0.6857 - val\_accuracy: 0.6094 - val\_loss: 0.6994  
Epoch 467/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5914 - loss: 0.6957 - val\_accuracy: 0.6094 - val\_loss:


0.6993  
Epoch 468/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6353 - loss: 0.6762 - val\_accuracy: 0.6094 - val\_loss: 0.6993  
Epoch 469/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6178 - loss: 0.6873 - val\_accuracy: 0.6094 - val\_loss: 0.6992  
Epoch 470/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6237 - loss: 0.6842 - val\_accuracy: 0.6094 - val\_loss: 0.6991  
Epoch 471/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6370 - loss: 0.6864 - val\_accuracy: 0.6094 - val\_loss: 0.6990  
Epoch 472/500  
18/18 ————— 0s 7ms/step - accuracy: 0.5942 - loss: 0.6951 - val\_accuracy: 0.6094 - val\_loss: 0.6990  
Epoch 473/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6350 - loss: 0.6862 - val\_accuracy: 0.6094 - val\_loss: 0.6989  
Epoch 474/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6195 - loss: 0.6880 - val\_accuracy: 0.6094 - val\_loss: 0.6988  
Epoch 475/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6284 - loss: 0.6888 - val\_accuracy: 0.6094 - val\_loss: 0.6988  
Epoch 476/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6449 - loss: 0.6793 - val\_accuracy: 0.6094 - val\_loss: 0.6987  
Epoch 477/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6220 - loss: 0.6810 - val\_accuracy: 0.6094 - val\_loss: 0.6986  
Epoch 478/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6138 - loss: 0.6876 - val\_accuracy: 0.6094 - val\_loss: 0.6986  
Epoch 479/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6488 - loss: 0.6743 - val\_accuracy: 0.6094 - val\_loss: 0.6985  
Epoch 480/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6144 - loss: 0.6877 - val\_accuracy: 0.6094 - val\_loss: 0.6984  
Epoch 481/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6034 - loss: 0.6854 - val\_accuracy: 0.6094 - val\_loss: 0.6984  
Epoch 482/500  
18/18 ————— 0s 6ms/step - accuracy: 0.5923 - loss: 0.6950 - val\_accuracy: 0.6094 - val\_loss: 0.6983  
Epoch 483/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6372 - loss: 0.6746 - val\_accuracy: 0.6094 - val\_loss: 0.6982  
Epoch 484/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6347 - loss: 0.6848 - val\_accuracy: 0.6094 - val\_loss: 0.6981  
Epoch 485/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6255 - loss: 0.6876 - val\_accuracy: 0.6094 - val\_loss: 0.6981  
Epoch 486/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6102 - loss: 0.6902 - val\_accuracy: 0.6094 - val\_loss: 0.6980  
Epoch 487/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6452 - loss: 0.6785 - val\_accuracy: 0.6094 - val\_loss: 0.6979  
Epoch 488/500  
18/18 ————— 0s 7ms/step - accuracy: 0.6133 - loss: 0.6831 - val\_accuracy: 0.6094 - val\_loss: 0.6979  
Epoch 489/500  
18/18 ————— 0s 8ms/step - accuracy: 0.6299 - loss: 0.6863 - val\_accuracy: 0.6094 - val\_loss: 0.6978  
Epoch 490/500  
18/18 ————— 0s 6ms/step - accuracy: 0.6382 - loss: 0.6731 - val\_accuracy: 0.6094 - val\_loss: 0.6977





Epoch 491/500  
**18/18**  0s 6ms/step - accuracy: 0.6028 - loss: 0.6895 - val\_accuracy: 0.6094 - val\_loss: 0.6977  
Epoch 492/500  
**18/18**  0s 7ms/step - accuracy: 0.6317 - loss: 0.6797 - val\_accuracy: 0.6094 - val\_loss: 0.6976  
Epoch 493/500  
**18/18**  0s 6ms/step - accuracy: 0.6365 - loss: 0.6780 - val\_accuracy: 0.6094 - val\_loss: 0.6975  
Epoch 494/500  
**18/18**  0s 7ms/step - accuracy: 0.6263 - loss: 0.6843 - val\_accuracy: 0.6094 - val\_loss: 0.6975  
Epoch 495/500  
**18/18**  0s 6ms/step - accuracy: 0.6376 - loss: 0.6718 - val\_accuracy: 0.6094 - val\_loss: 0.6974  
Epoch 496/500  
**18/18**  0s 7ms/step - accuracy: 0.6376 - loss: 0.6806 - val\_accuracy: 0.6094 - val\_loss: 0.6973  
Epoch 497/500  
**18/18**  0s 6ms/step - accuracy: 0.6259 - loss: 0.6866 - val\_accuracy: 0.6094 - val\_loss: 0.6972  
Epoch 498/500  
**18/18**  0s 7ms/step - accuracy: 0.6472 - loss: 0.6739 - val\_accuracy: 0.6094 - val\_loss: 0.6972  
Epoch 499/500  
**18/18**  0s 6ms/step - accuracy: 0.6435 - loss: 0.6782 - val\_accuracy: 0.6094 - val\_loss: 0.6971  
Epoch 500/500  
**18/18**  0s 8ms/step - accuracy: 0.5992 - loss: 0.6917 - val\_accuracy: 0.6094 - val\_loss: 0.6970


```
In [ ]: #Model 2: Learning rate = 0.01, Epochs = 300, 1 hidden Layer with 5 nodes
model_2 = Sequential([
    Dense(5, input_shape=(8,), activation="relu"),
    Dense(1, activation="sigmoid")
])
model_2.compile(SGD(learning_rate = .01), "binary_crossentropy", metrics=["accuracy"])
history_2 = model_2.fit(X_train_norm, y_train, validation_data=(X_test_norm, y_test), epochs=300)
```


Epoch 1/300  
18/18  1s 15ms/step - accuracy: 0.6290 - loss: 0.9107 - val\_accuracy: 0.5990 - val\_loss: 0.9709


Epoch 2/300  
18/18  0s 8ms/step - accuracy: 0.6052 - loss: 0.8906 - val\_accuracy: 0.6042 - val\_loss: 0.9258


Epoch 3/300  
18/18  0s 6ms/step - accuracy: 0.6467 - loss: 0.7821 - val\_accuracy: 0.5938 - val\_loss: 0.8866


Epoch 4/300  
18/18  0s 7ms/step - accuracy: 0.6663 - loss: 0.7374 - val\_accuracy: 0.5885 - val\_loss: 0.8526


Epoch 5/300  
18/18  0s 5ms/step - accuracy: 0.6101 - loss: 0.7627 - val\_accuracy: 0.5885 - val\_loss: 0.8225


Epoch 6/300  
18/18  0s 6ms/step - accuracy: 0.6782 - loss: 0.6786 - val\_accuracy: 0.5938 - val\_loss: 0.7962


Epoch 7/300  
18/18  0s 6ms/step - accuracy: 0.6389 - loss: 0.6969 - val\_accuracy: 0.5938 - val\_loss: 0.7738


Epoch 8/300  
18/18  0s 6ms/step - accuracy: 0.6767 - loss: 0.6227 - val\_accuracy: 0.5990 - val\_loss: 0.7541


Epoch 9/300  
18/18  0s 6ms/step - accuracy: 0.6164 - loss: 0.6696 - val\_accuracy: 0.6042 - val\_loss: 0.7366


Epoch 10/300  
18/18  0s 6ms/step - accuracy: 0.6258 - loss: 0.6521 - val\_accuracy: 0.6042 - val\_loss: 0.7212


Epoch 11/300  
18/18  0s 6ms/step - accuracy: 0.6572 - loss: 0.6426 - val\_accuracy: 0.6094 - val\_loss: 0.7074


Epoch 12/300  
18/18  0s 6ms/step - accuracy: 0.6566 - loss: 0.6182 - val\_accuracy: 0.6198 - val\_loss: 0.6952


Epoch 13/300  
18/18  0s 6ms/step - accuracy: 0.6287 - loss: 0.6426 - val\_accuracy: 0.6198 - val\_loss: 0.6844


Epoch 14/300  
18/18  0s 7ms/step - accuracy: 0.6427 - loss: 0.6140 - val\_accuracy: 0.6198 - val\_loss: 0.6744


Epoch 15/300  
18/18  0s 6ms/step - accuracy: 0.6197 - loss: 0.6185 - val\_accuracy: 0.6198 - val\_loss: 0.6656


Epoch 16/300  
18/18  0s 5ms/step - accuracy: 0.6901 - loss: 0.5659 - val\_accuracy: 0.6198 - val\_loss: 0.6574


Epoch 17/300  
18/18  0s 20ms/step - accuracy: 0.6845 - loss: 0.5789 - val\_accuracy: 0.6302 - val\_loss: 0.6500


Epoch 18/300  
18/18  0s 6ms/step - accuracy: 0.6784 - loss: 0.5780 - val\_accuracy: 0.6406 - val\_loss: 0.6434

Epoch 19/300  
18/18  0s 8ms/step - accuracy: 0.6501 - loss: 0.5706 - val\_accuracy: 0.6354 - val\_loss: 0.6375

Epoch 20/300  
18/18  0s 10ms/step - accuracy: 0.6715 - loss: 0.5372 - val\_accuracy: 0.6354 - val\_loss: 0.6321
























Epoch 21/300  
18/18  0s 8ms/step - accuracy: 0.6844 - loss: 0.5559 - val\_accuracy: 0.6302 - val\_loss: 0.6271


Epoch 22/300  
18/18  0s 8ms/step - accuracy: 0.6849 - loss: 0.5511 - val\_accuracy: 0.6406 - val\_loss: 0.6224


Epoch 23/300  
18/18  0s 9ms/step - accuracy: 0.6703 - loss: 0.5537 - val\_accuracy: 0.6354 - val\_loss: 0.6181


Epoch 24/300


18/18 ————— 0s 10ms/step - accuracy: 0.6762 - loss: 0.5282 - val\_accuracy: 0.6354 - val\_loss: 0.6141  
Epoch 25/300  
18/18 ————— 0s 12ms/step - accuracy: 0.7136 - loss: 0.5108 - val\_accuracy: 0.6354 - val\_loss: 0.6104  
Epoch 26/300  
18/18 ————— 0s 9ms/step - accuracy: 0.7041 - loss: 0.5127 - val\_accuracy: 0.6406 - val\_loss: 0.6071  
Epoch 27/300  
18/18 ————— 0s 9ms/step - accuracy: 0.6608 - loss: 0.5556 - val\_accuracy: 0.6510 - val\_loss: 0.6040  
Epoch 28/300  
18/18 ————— 0s 9ms/step - accuracy: 0.7043 - loss: 0.5260 - val\_accuracy: 0.6562 - val\_loss: 0.6011  
Epoch 29/300  
18/18 ————— 0s 9ms/step - accuracy: 0.6844 - loss: 0.5314 - val\_accuracy: 0.6562 - val\_loss: 0.5984  
Epoch 30/300  
18/18 ————— 0s 5ms/step - accuracy: 0.7023 - loss: 0.5342 - val\_accuracy: 0.6667 - val\_loss: 0.5958  
Epoch 31/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7012 - loss: 0.5301 - val\_accuracy: 0.6771 - val\_loss: 0.5934  
Epoch 32/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7001 - loss: 0.5189 - val\_accuracy: 0.6823 - val\_loss: 0.5910  
Epoch 33/300  
18/18 ————— 0s 7ms/step - accuracy: 0.7249 - loss: 0.5023 - val\_accuracy: 0.6875 - val\_loss: 0.5887  
Epoch 34/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7219 - loss: 0.5116 - val\_accuracy: 0.6875 - val\_loss: 0.5866  
Epoch 35/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7295 - loss: 0.4952 - val\_accuracy: 0.6823 - val\_loss: 0.5846  
Epoch 36/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7312 - loss: 0.4851 - val\_accuracy: 0.6667 - val\_loss: 0.5827  
Epoch 37/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7540 - loss: 0.4938 - val\_accuracy: 0.6615 - val\_loss: 0.5810  
Epoch 38/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7324 - loss: 0.5051 - val\_accuracy: 0.6615 - val\_loss: 0.5793  
Epoch 39/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7479 - loss: 0.4936 - val\_accuracy: 0.6615 - val\_loss: 0.5778  
Epoch 40/300  
18/18 ————— 0s 7ms/step - accuracy: 0.7160 - loss: 0.5083 - val\_accuracy: 0.6667 - val\_loss: 0.5763  
Epoch 41/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7519 - loss: 0.4776 - val\_accuracy: 0.6667 - val\_loss: 0.5749  
Epoch 42/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7108 - loss: 0.5252 - val\_accuracy: 0.6771 - val\_loss: 0.5736  
Epoch 43/300  
18/18 ————— 0s 5ms/step - accuracy: 0.7499 - loss: 0.4870 - val\_accuracy: 0.6771 - val\_loss: 0.5724  
Epoch 44/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7423 - loss: 0.4852 - val\_accuracy: 0.6823 - val\_loss: 0.5712  
Epoch 45/300  
18/18 ————— 0s 5ms/step - accuracy: 0.7390 - loss: 0.5185 - val\_accuracy: 0.6875 - val\_loss: 0.5701  
Epoch 46/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7491 - loss: 0.4926 - val\_accuracy: 0.6771 - val\_loss: 0.5691  
Epoch 47/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7442 - loss: 0.4873 - val\_accuracy: 0.6823 - val\_loss:


0.5682  
Epoch 48/300  
18/18  0s 6ms/step - accuracy: 0.7349 - loss: 0.4855 - val\_accuracy: 0.6771 - val\_loss: 0.5672  
Epoch 49/300  
18/18  0s 6ms/step - accuracy: 0.7193 - loss: 0.4952 - val\_accuracy: 0.6771 - val\_loss: 0.5664  
Epoch 50/300  
18/18  0s 6ms/step - accuracy: 0.7568 - loss: 0.4936 - val\_accuracy: 0.6771 - val\_loss: 0.5655  
Epoch 51/300  
18/18  0s 6ms/step - accuracy: 0.7134 - loss: 0.5131 - val\_accuracy: 0.6823 - val\_loss: 0.5648  
Epoch 52/300  
18/18  0s 5ms/step - accuracy: 0.7311 - loss: 0.4824 - val\_accuracy: 0.6771 - val\_loss: 0.5640  
Epoch 53/300  
18/18  0s 7ms/step - accuracy: 0.7570 - loss: 0.4646 - val\_accuracy: 0.6771 - val\_loss: 0.5633  
Epoch 54/300  
18/18  0s 6ms/step - accuracy: 0.7463 - loss: 0.4887 - val\_accuracy: 0.6875 - val\_loss: 0.5627  
Epoch 55/300  
18/18  0s 6ms/step - accuracy: 0.7335 - loss: 0.4911 - val\_accuracy: 0.6875 - val\_loss: 0.5621  
Epoch 56/300  
18/18  0s 6ms/step - accuracy: 0.7807 - loss: 0.4551 - val\_accuracy: 0.6875 - val\_loss: 0.5616  
Epoch 57/300  
18/18  0s 6ms/step - accuracy: 0.7444 - loss: 0.4966 - val\_accuracy: 0.6875 - val\_loss: 0.5610  
Epoch 58/300  
18/18  0s 6ms/step - accuracy: 0.7608 - loss: 0.4853 - val\_accuracy: 0.6875 - val\_loss: 0.5605  
Epoch 59/300  
18/18  0s 7ms/step - accuracy: 0.7659 - loss: 0.4944 - val\_accuracy: 0.6927 - val\_loss: 0.5600  
Epoch 60/300  
18/18  0s 6ms/step - accuracy: 0.7506 - loss: 0.4872 - val\_accuracy: 0.6875 - val\_loss: 0.5595  
Epoch 61/300  
18/18  0s 5ms/step - accuracy: 0.7733 - loss: 0.4542 - val\_accuracy: 0.6823 - val\_loss: 0.5590  
Epoch 62/300  
18/18  0s 8ms/step - accuracy: 0.7501 - loss: 0.4799 - val\_accuracy: 0.6823 - val\_loss: 0.5586  
Epoch 63/300  
18/18  0s 8ms/step - accuracy: 0.7703 - loss: 0.4615 - val\_accuracy: 0.6823 - val\_loss: 0.5581  
Epoch 64/300  
18/18  0s 6ms/step - accuracy: 0.7638 - loss: 0.4905 - val\_accuracy: 0.6823 - val\_loss: 0.5577  
Epoch 65/300  
18/18  0s 6ms/step - accuracy: 0.7708 - loss: 0.4789 - val\_accuracy: 0.6771 - val\_loss: 0.5573  
Epoch 66/300  
18/18  0s 6ms/step - accuracy: 0.7523 - loss: 0.4690 - val\_accuracy: 0.6771 - val\_loss: 0.5570  
Epoch 67/300  
18/18  0s 6ms/step - accuracy: 0.7615 - loss: 0.4821 - val\_accuracy: 0.6771 - val\_loss: 0.5566  
Epoch 68/300  
18/18  0s 6ms/step - accuracy: 0.7605 - loss: 0.4826 - val\_accuracy: 0.6771 - val\_loss: 0.5563  
Epoch 69/300  
18/18  0s 6ms/step - accuracy: 0.7599 - loss: 0.4803 - val\_accuracy: 0.6875 - val\_loss: 0.5560  
Epoch 70/300  
18/18  0s 8ms/step - accuracy: 0.7704 - loss: 0.4612 - val\_accuracy: 0.6875 - val\_loss: 0.5556


Epoch 71/300  
18/18  0s 6ms/step - accuracy: 0.7802 - loss: 0.4853 - val\_accuracy: 0.6875 - val\_loss: 0.5553


Epoch 72/300  
18/18  0s 6ms/step - accuracy: 0.7707 - loss: 0.4877 - val\_accuracy: 0.6875 - val\_loss: 0.5550


Epoch 73/300  
18/18  0s 6ms/step - accuracy: 0.7765 - loss: 0.4622 - val\_accuracy: 0.6875 - val\_loss: 0.5548


Epoch 74/300  
18/18  0s 8ms/step - accuracy: 0.7461 - loss: 0.4705 - val\_accuracy: 0.6927 - val\_loss: 0.5545


Epoch 75/300  
18/18  0s 6ms/step - accuracy: 0.7602 - loss: 0.4725 - val\_accuracy: 0.6875 - val\_loss: 0.5543


Epoch 76/300  
18/18  0s 6ms/step - accuracy: 0.7995 - loss: 0.4424 - val\_accuracy: 0.6927 - val\_loss: 0.5540


Epoch 77/300  
18/18  0s 6ms/step - accuracy: 0.7673 - loss: 0.4601 - val\_accuracy: 0.6927 - val\_loss: 0.5538


Epoch 78/300  
18/18  0s 6ms/step - accuracy: 0.7880 - loss: 0.4532 - val\_accuracy: 0.6927 - val\_loss: 0.5536


Epoch 79/300  
18/18  0s 7ms/step - accuracy: 0.7946 - loss: 0.4561 - val\_accuracy: 0.6927 - val\_loss: 0.5533


Epoch 80/300  
18/18  0s 6ms/step - accuracy: 0.7512 - loss: 0.4882 - val\_accuracy: 0.6927 - val\_loss: 0.5531


Epoch 81/300  
18/18  0s 6ms/step - accuracy: 0.7720 - loss: 0.4690 - val\_accuracy: 0.6927 - val\_loss: 0.5530


Epoch 82/300  
18/18  0s 6ms/step - accuracy: 0.7722 - loss: 0.4721 - val\_accuracy: 0.6979 - val\_loss: 0.5528


Epoch 83/300  
18/18  0s 6ms/step - accuracy: 0.7751 - loss: 0.4727 - val\_accuracy: 0.6979 - val\_loss: 0.5526


Epoch 84/300  
18/18  0s 5ms/step - accuracy: 0.7686 - loss: 0.4751 - val\_accuracy: 0.6979 - val\_loss: 0.5525


Epoch 85/300  
18/18  0s 6ms/step - accuracy: 0.7500 - loss: 0.5002 - val\_accuracy: 0.7031 - val\_loss: 0.5523


Epoch 86/300  
18/18  0s 8ms/step - accuracy: 0.7648 - loss: 0.4590 - val\_accuracy: 0.7031 - val\_loss: 0.5522


Epoch 87/300  
18/18  0s 7ms/step - accuracy: 0.7565 - loss: 0.4620 - val\_accuracy: 0.7031 - val\_loss: 0.5520


Epoch 88/300  
18/18  0s 6ms/step - accuracy: 0.7507 - loss: 0.4978 - val\_accuracy: 0.7031 - val\_loss: 0.5519

Epoch 89/300  
18/18  0s 10ms/step - accuracy: 0.7446 - loss: 0.4913 - val\_accuracy: 0.7031 - val\_loss: 0.5518

Epoch 90/300  
18/18  0s 10ms/step - accuracy: 0.7693 - loss: 0.4576 - val\_accuracy: 0.7083 - val\_loss: 0.5517

Epoch 91/300  
18/18  0s 8ms/step - accuracy: 0.7518 - loss: 0.4774 - val\_accuracy: 0.7083 - val\_loss: 0.5516

Epoch 92/300  
18/18  0s 10ms/step - accuracy: 0.7605 - loss: 0.4608 - val\_accuracy: 0.7083 - val\_loss: 0.5516

Epoch 93/300  
18/18  0s 10ms/step - accuracy: 0.7621 - loss: 0.4593 - val\_accuracy: 0.7083 - val\_loss: 0.5515

Epoch 94/300

18/18 ————— 0s 10ms/step - accuracy: 0.7871 - loss: 0.4466 - val\_accuracy: 0.7083 - val\_loss: 0.5515  
Epoch 95/300  
18/18 ————— 0s 10ms/step - accuracy: 0.7823 - loss: 0.4429 - val\_accuracy: 0.7083 - val\_loss: 0.5514  
Epoch 96/300  
18/18 ————— 0s 10ms/step - accuracy: 0.7513 - loss: 0.4755 - val\_accuracy: 0.7083 - val\_loss: 0.5514  
Epoch 97/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7794 - loss: 0.4618 - val\_accuracy: 0.7083 - val\_loss: 0.5513  
Epoch 98/300  
18/18 ————— 0s 9ms/step - accuracy: 0.7858 - loss: 0.4321 - val\_accuracy: 0.7083 - val\_loss: 0.5513  
Epoch 99/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7472 - loss: 0.4738 - val\_accuracy: 0.7083 - val\_loss: 0.5513  
Epoch 100/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7343 - loss: 0.4703 - val\_accuracy: 0.7083 - val\_loss: 0.5512  
Epoch 101/300  
18/18 ————— 0s 5ms/step - accuracy: 0.7376 - loss: 0.4835 - val\_accuracy: 0.7083 - val\_loss: 0.5512  
Epoch 102/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7496 - loss: 0.4827 - val\_accuracy: 0.7083 - val\_loss: 0.5512  
Epoch 103/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7626 - loss: 0.4525 - val\_accuracy: 0.7135 - val\_loss: 0.5512  
Epoch 104/300  
18/18 ————— 0s 7ms/step - accuracy: 0.7504 - loss: 0.4796 - val\_accuracy: 0.7135 - val\_loss: 0.5512  
Epoch 105/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7740 - loss: 0.4517 - val\_accuracy: 0.7135 - val\_loss: 0.5513  
Epoch 106/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7630 - loss: 0.4632 - val\_accuracy: 0.7135 - val\_loss: 0.5513  
Epoch 107/300  
18/18 ————— 0s 7ms/step - accuracy: 0.7726 - loss: 0.4555 - val\_accuracy: 0.7135 - val\_loss: 0.5513  
Epoch 108/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7802 - loss: 0.4515 - val\_accuracy: 0.7188 - val\_loss: 0.5513  
Epoch 109/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7422 - loss: 0.4904 - val\_accuracy: 0.7240 - val\_loss: 0.5513  
Epoch 110/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7459 - loss: 0.5006 - val\_accuracy: 0.7240 - val\_loss: 0.5513  
Epoch 111/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7643 - loss: 0.4550 - val\_accuracy: 0.7240 - val\_loss: 0.5513  
Epoch 112/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7775 - loss: 0.4716 - val\_accuracy: 0.7344 - val\_loss: 0.5513  
Epoch 113/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7822 - loss: 0.4454 - val\_accuracy: 0.7344 - val\_loss: 0.5513  
Epoch 114/300  
18/18 ————— 0s 5ms/step - accuracy: 0.7629 - loss: 0.4551 - val\_accuracy: 0.7344 - val\_loss: 0.5513  
Epoch 115/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7794 - loss: 0.4642 - val\_accuracy: 0.7396 - val\_loss: 0.5513  
Epoch 116/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7508 - loss: 0.4779 - val\_accuracy: 0.7396 - val\_loss: 0.5513  
Epoch 117/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7748 - loss: 0.4569 - val\_accuracy: 0.7396 - val\_loss: 0.5513

0.5513  
Epoch 118/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7883 - loss: 0.4528 - val\_accuracy: 0.7396 - val\_loss: 0.5513  
Epoch 119/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7637 - loss: 0.4472 - val\_accuracy: 0.7396 - val\_loss: 0.5513  
Epoch 120/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7960 - loss: 0.4559 - val\_accuracy: 0.7396 - val\_loss: 0.5514  
Epoch 121/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7691 - loss: 0.4609 - val\_accuracy: 0.7396 - val\_loss: 0.5514  
Epoch 122/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7732 - loss: 0.4608 - val\_accuracy: 0.7396 - val\_loss: 0.5514  
Epoch 123/300  
18/18 ————— 0s 7ms/step - accuracy: 0.8024 - loss: 0.4341 - val\_accuracy: 0.7396 - val\_loss: 0.5514  
Epoch 124/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7670 - loss: 0.4663 - val\_accuracy: 0.7396 - val\_loss: 0.5515  
Epoch 125/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7662 - loss: 0.4848 - val\_accuracy: 0.7344 - val\_loss: 0.5515  
Epoch 126/300  
18/18 ————— 0s 5ms/step - accuracy: 0.7542 - loss: 0.4723 - val\_accuracy: 0.7344 - val\_loss: 0.5515  
Epoch 127/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7753 - loss: 0.4683 - val\_accuracy: 0.7344 - val\_loss: 0.5516  
Epoch 128/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7818 - loss: 0.4659 - val\_accuracy: 0.7344 - val\_loss: 0.5516  
Epoch 129/300  
18/18 ————— 0s 8ms/step - accuracy: 0.8045 - loss: 0.4392 - val\_accuracy: 0.7292 - val\_loss: 0.5516  
Epoch 130/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7874 - loss: 0.4438 - val\_accuracy: 0.7292 - val\_loss: 0.5517  
Epoch 131/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7814 - loss: 0.4311 - val\_accuracy: 0.7292 - val\_loss: 0.5517  
Epoch 132/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7726 - loss: 0.4504 - val\_accuracy: 0.7292 - val\_loss: 0.5518  
Epoch 133/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7893 - loss: 0.4218 - val\_accuracy: 0.7292 - val\_loss: 0.5518  
Epoch 134/300  
18/18 ————— 0s 7ms/step - accuracy: 0.7685 - loss: 0.4734 - val\_accuracy: 0.7292 - val\_loss: 0.5519  
Epoch 135/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7416 - loss: 0.4938 - val\_accuracy: 0.7292 - val\_loss: 0.5519  
Epoch 136/300  
18/18 ————— 0s 5ms/step - accuracy: 0.7854 - loss: 0.4305 - val\_accuracy: 0.7292 - val\_loss: 0.5519  
Epoch 137/300  
18/18 ————— 0s 5ms/step - accuracy: 0.7643 - loss: 0.4533 - val\_accuracy: 0.7292 - val\_loss: 0.5519  
Epoch 138/300  
18/18 ————— 0s 5ms/step - accuracy: 0.8070 - loss: 0.4198 - val\_accuracy: 0.7240 - val\_loss: 0.5519  
Epoch 139/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8021 - loss: 0.4316 - val\_accuracy: 0.7240 - val\_loss: 0.5520  
Epoch 140/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7819 - loss: 0.4526 - val\_accuracy: 0.7240 - val\_loss: 0.5519

Epoch 141/300  
18/18 — 0s 8ms/step - accuracy: 0.7549 - loss: 0.4705 - val\_accuracy: 0.7240 - val\_loss: 0.5520

Epoch 142/300  
18/18 — 0s 6ms/step - accuracy: 0.7968 - loss: 0.4581 - val\_accuracy: 0.7240 - val\_loss: 0.5520

Epoch 143/300  
18/18 — 0s 6ms/step - accuracy: 0.7768 - loss: 0.4612 - val\_accuracy: 0.7240 - val\_loss: 0.5519

Epoch 144/300  
18/18 — 0s 6ms/step - accuracy: 0.8000 - loss: 0.4283 - val\_accuracy: 0.7240 - val\_loss: 0.5519

Epoch 145/300  
18/18 — 0s 8ms/step - accuracy: 0.7723 - loss: 0.4616 - val\_accuracy: 0.7240 - val\_loss: 0.5520

Epoch 146/300  
18/18 — 0s 6ms/step - accuracy: 0.7908 - loss: 0.4227 - val\_accuracy: 0.7240 - val\_loss: 0.5520

Epoch 147/300  
18/18 — 0s 6ms/step - accuracy: 0.7880 - loss: 0.4377 - val\_accuracy: 0.7240 - val\_loss: 0.5519

Epoch 148/300  
18/18 — 0s 6ms/step - accuracy: 0.7644 - loss: 0.4589 - val\_accuracy: 0.7240 - val\_loss: 0.5519

Epoch 149/300  
18/18 — 0s 6ms/step - accuracy: 0.7594 - loss: 0.4651 - val\_accuracy: 0.7240 - val\_loss: 0.5519

Epoch 150/300  
18/18 — 0s 6ms/step - accuracy: 0.7922 - loss: 0.4562 - val\_accuracy: 0.7188 - val\_loss: 0.5519

Epoch 151/300  
18/18 — 0s 6ms/step - accuracy: 0.8051 - loss: 0.4423 - val\_accuracy: 0.7188 - val\_loss: 0.5519

Epoch 152/300  
18/18 — 0s 6ms/step - accuracy: 0.7920 - loss: 0.4430 - val\_accuracy: 0.7188 - val\_loss: 0.5519

Epoch 153/300  
18/18 — 0s 6ms/step - accuracy: 0.7832 - loss: 0.4561 - val\_accuracy: 0.7188 - val\_loss: 0.5518

Epoch 154/300  
18/18 — 0s 5ms/step - accuracy: 0.7980 - loss: 0.4324 - val\_accuracy: 0.7188 - val\_loss: 0.5519

Epoch 155/300  
18/18 — 0s 8ms/step - accuracy: 0.7962 - loss: 0.4359 - val\_accuracy: 0.7188 - val\_loss: 0.5519

Epoch 156/300  
18/18 — 0s 5ms/step - accuracy: 0.7791 - loss: 0.4261 - val\_accuracy: 0.7188 - val\_loss: 0.5519

Epoch 157/300  
18/18 — 0s 7ms/step - accuracy: 0.7629 - loss: 0.4566 - val\_accuracy: 0.7188 - val\_loss: 0.5518

Epoch 158/300  
18/18 — 0s 10ms/step - accuracy: 0.7923 - loss: 0.4365 - val\_accuracy: 0.7188 - val\_loss: 0.5518

Epoch 159/300  
18/18 — 0s 10ms/step - accuracy: 0.7603 - loss: 0.4742 - val\_accuracy: 0.7188 - val\_loss: 0.5518

Epoch 160/300  
18/18 — 0s 10ms/step - accuracy: 0.7906 - loss: 0.4564 - val\_accuracy: 0.7188 - val\_loss: 0.5518

Epoch 161/300  
18/18 — 0s 9ms/step - accuracy: 0.7931 - loss: 0.4408 - val\_accuracy: 0.7135 - val\_loss: 0.5517

Epoch 162/300  
18/18 — 0s 10ms/step - accuracy: 0.7797 - loss: 0.4536 - val\_accuracy: 0.7135 - val\_loss: 0.5518

Epoch 163/300  
18/18 — 0s 9ms/step - accuracy: 0.7778 - loss: 0.4524 - val\_accuracy: 0.7135 - val\_loss: 0.5518

Epoch 164/300














































18/18 ————— 0s 10ms/step - accuracy: 0.8152 - loss: 0.4340 - val\_accuracy: 0.7135 - val\_loss: 0.5518  
Epoch 165/300  
18/18 ————— 0s 10ms/step - accuracy: 0.8027 - loss: 0.4235 - val\_accuracy: 0.7135 - val\_loss: 0.5517  
Epoch 166/300  
18/18 ————— 0s 10ms/step - accuracy: 0.8109 - loss: 0.4111 - val\_accuracy: 0.7135 - val\_loss: 0.5517  
Epoch 167/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7778 - loss: 0.4485 - val\_accuracy: 0.7135 - val\_loss: 0.5517  
Epoch 168/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7861 - loss: 0.4539 - val\_accuracy: 0.7135 - val\_loss: 0.5518  
Epoch 169/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7935 - loss: 0.4271 - val\_accuracy: 0.7135 - val\_loss: 0.5517  
Epoch 170/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7862 - loss: 0.4320 - val\_accuracy: 0.7135 - val\_loss: 0.5517  
Epoch 171/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7676 - loss: 0.4785 - val\_accuracy: 0.7188 - val\_loss: 0.5517  
Epoch 172/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7622 - loss: 0.4508 - val\_accuracy: 0.7188 - val\_loss: 0.5518  
Epoch 173/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7720 - loss: 0.4490 - val\_accuracy: 0.7188 - val\_loss: 0.5518  
Epoch 174/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8117 - loss: 0.4202 - val\_accuracy: 0.7188 - val\_loss: 0.5518  
Epoch 175/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7954 - loss: 0.4263 - val\_accuracy: 0.7188 - val\_loss: 0.5519  
Epoch 176/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8112 - loss: 0.4334 - val\_accuracy: 0.7188 - val\_loss: 0.5519  
Epoch 177/300  
18/18 ————— 0s 5ms/step - accuracy: 0.7867 - loss: 0.4401 - val\_accuracy: 0.7188 - val\_loss: 0.5519  
Epoch 178/300  
18/18 ————— 0s 5ms/step - accuracy: 0.8039 - loss: 0.4280 - val\_accuracy: 0.7188 - val\_loss: 0.5519  
Epoch 179/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7770 - loss: 0.4437 - val\_accuracy: 0.7188 - val\_loss: 0.5519  
Epoch 180/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7929 - loss: 0.4413 - val\_accuracy: 0.7188 - val\_loss: 0.5520  
Epoch 181/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7923 - loss: 0.4573 - val\_accuracy: 0.7188 - val\_loss: 0.5520  
Epoch 182/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7756 - loss: 0.4479 - val\_accuracy: 0.7188 - val\_loss: 0.5521  
Epoch 183/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7825 - loss: 0.4480 - val\_accuracy: 0.7188 - val\_loss: 0.5520  
Epoch 184/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7682 - loss: 0.4679 - val\_accuracy: 0.7188 - val\_loss: 0.5521  
Epoch 185/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8002 - loss: 0.4152 - val\_accuracy: 0.7188 - val\_loss: 0.5521  
Epoch 186/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7969 - loss: 0.4186 - val\_accuracy: 0.7188 - val\_loss: 0.5522  
Epoch 187/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8016 - loss: 0.4342 - val\_accuracy: 0.7188 - val\_loss:

0.5522  
Epoch 188/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7520 - loss: 0.4872 - val\_accuracy: 0.7188 - val\_loss: 0.5522  
Epoch 189/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8076 - loss: 0.4154 - val\_accuracy: 0.7188 - val\_loss: 0.5522  
Epoch 190/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7942 - loss: 0.4445 - val\_accuracy: 0.7188 - val\_loss: 0.5523  
Epoch 191/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7613 - loss: 0.4609 - val\_accuracy: 0.7188 - val\_loss: 0.5523  
Epoch 192/300  
18/18 ————— 0s 8ms/step - accuracy: 0.8043 - loss: 0.4083 - val\_accuracy: 0.7188 - val\_loss: 0.5523  
Epoch 193/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7896 - loss: 0.4434 - val\_accuracy: 0.7188 - val\_loss: 0.5523  
Epoch 194/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7798 - loss: 0.4700 - val\_accuracy: 0.7188 - val\_loss: 0.5523  
Epoch 195/300  
18/18 ————— 0s 5ms/step - accuracy: 0.7770 - loss: 0.4343 - val\_accuracy: 0.7188 - val\_loss: 0.5523  
Epoch 196/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7744 - loss: 0.4589 - val\_accuracy: 0.7188 - val\_loss: 0.5523  
Epoch 197/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7905 - loss: 0.4409 - val\_accuracy: 0.7188 - val\_loss: 0.5523  
Epoch 198/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7858 - loss: 0.4576 - val\_accuracy: 0.7240 - val\_loss: 0.5523  
Epoch 199/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7967 - loss: 0.4325 - val\_accuracy: 0.7240 - val\_loss: 0.5524  
Epoch 200/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7710 - loss: 0.4649 - val\_accuracy: 0.7188 - val\_loss: 0.5525  
Epoch 201/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8012 - loss: 0.4398 - val\_accuracy: 0.7135 - val\_loss: 0.5525  
Epoch 202/300  
18/18 ————— 0s 5ms/step - accuracy: 0.8048 - loss: 0.4390 - val\_accuracy: 0.7135 - val\_loss: 0.5525  
Epoch 203/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7753 - loss: 0.4841 - val\_accuracy: 0.7135 - val\_loss: 0.5526  
Epoch 204/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8009 - loss: 0.4352 - val\_accuracy: 0.7135 - val\_loss: 0.5525  
Epoch 205/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7603 - loss: 0.4723 - val\_accuracy: 0.7135 - val\_loss: 0.5525  
Epoch 206/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7843 - loss: 0.4321 - val\_accuracy: 0.7135 - val\_loss: 0.5525  
Epoch 207/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8098 - loss: 0.4278 - val\_accuracy: 0.7135 - val\_loss: 0.5525  
Epoch 208/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7957 - loss: 0.4537 - val\_accuracy: 0.7135 - val\_loss: 0.5526  
Epoch 209/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7636 - loss: 0.4856 - val\_accuracy: 0.7135 - val\_loss: 0.5526  
Epoch 210/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7925 - loss: 0.4515 - val\_accuracy: 0.7135 - val\_loss: 0.5526

Epoch 211/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7686 - loss: 0.4454 - val\_accuracy: 0.7135 - val\_loss: 0.5526  
Epoch 212/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8063 - loss: 0.4055 - val\_accuracy: 0.7135 - val\_loss: 0.5526  
Epoch 213/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8167 - loss: 0.4313 - val\_accuracy: 0.7135 - val\_loss: 0.5526  
Epoch 214/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7815 - loss: 0.4494 - val\_accuracy: 0.7135 - val\_loss: 0.5526  
Epoch 215/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7797 - loss: 0.4574 - val\_accuracy: 0.7135 - val\_loss: 0.5526  
Epoch 216/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7809 - loss: 0.4350 - val\_accuracy: 0.7083 - val\_loss: 0.5526  
Epoch 217/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7909 - loss: 0.4303 - val\_accuracy: 0.7083 - val\_loss: 0.5526  
Epoch 218/300  
18/18 ————— 0s 9ms/step - accuracy: 0.7915 - loss: 0.4411 - val\_accuracy: 0.7083 - val\_loss: 0.5526  
Epoch 219/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8034 - loss: 0.4293 - val\_accuracy: 0.7083 - val\_loss: 0.5527  
Epoch 220/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7874 - loss: 0.4445 - val\_accuracy: 0.7083 - val\_loss: 0.5527  
Epoch 221/300  
18/18 ————— 0s 8ms/step - accuracy: 0.8102 - loss: 0.4181 - val\_accuracy: 0.7083 - val\_loss: 0.5526  
Epoch 222/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8045 - loss: 0.4201 - val\_accuracy: 0.7083 - val\_loss: 0.5527  
Epoch 223/300  
18/18 ————— 0s 7ms/step - accuracy: 0.8062 - loss: 0.4365 - val\_accuracy: 0.7083 - val\_loss: 0.5527  
Epoch 224/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7986 - loss: 0.4102 - val\_accuracy: 0.7083 - val\_loss: 0.5527  
Epoch 225/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8003 - loss: 0.4293 - val\_accuracy: 0.7031 - val\_loss: 0.5526  
Epoch 226/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7851 - loss: 0.4505 - val\_accuracy: 0.7031 - val\_loss: 0.5527  
Epoch 227/300  
18/18 ————— 0s 8ms/step - accuracy: 0.8097 - loss: 0.4414 - val\_accuracy: 0.7031 - val\_loss: 0.5526  
Epoch 228/300  
18/18 ————— 0s 11ms/step - accuracy: 0.7815 - loss: 0.4494 - val\_accuracy: 0.7031 - val\_loss: 0.5526  
Epoch 229/300  
18/18 ————— 0s 8ms/step - accuracy: 0.8071 - loss: 0.4320 - val\_accuracy: 0.7031 - val\_loss: 0.5526  
Epoch 230/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7578 - loss: 0.4529 - val\_accuracy: 0.7031 - val\_loss: 0.5526  
Epoch 231/300  
18/18 ————— 0s 8ms/step - accuracy: 0.8002 - loss: 0.4408 - val\_accuracy: 0.7031 - val\_loss: 0.5526  
Epoch 232/300  
18/18 ————— 0s 11ms/step - accuracy: 0.7777 - loss: 0.4517 - val\_accuracy: 0.7083 - val\_loss: 0.5526  
Epoch 233/300  
18/18 ————— 0s 10ms/step - accuracy: 0.7659 - loss: 0.4678 - val\_accuracy: 0.7083 - val\_loss: 0.5526  
Epoch 234/300

18/18 ————— 0s 9ms/step - accuracy: 0.7898 - loss: 0.4458 - val\_accuracy: 0.7083 - val\_loss: 0.5526  
Epoch 235/300  
18/18 ————— 0s 9ms/step - accuracy: 0.8002 - loss: 0.4249 - val\_accuracy: 0.7083 - val\_loss: 0.5526  
Epoch 236/300  
18/18 ————— 0s 10ms/step - accuracy: 0.7855 - loss: 0.4515 - val\_accuracy: 0.7083 - val\_loss: 0.5526  
Epoch 237/300  
18/18 ————— 0s 11ms/step - accuracy: 0.8151 - loss: 0.4172 - val\_accuracy: 0.7083 - val\_loss: 0.5525  
Epoch 238/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7767 - loss: 0.4532 - val\_accuracy: 0.7083 - val\_loss: 0.5525  
Epoch 239/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7894 - loss: 0.4425 - val\_accuracy: 0.7083 - val\_loss: 0.5525  
Epoch 240/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7982 - loss: 0.4326 - val\_accuracy: 0.7083 - val\_loss: 0.5525  
Epoch 241/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8185 - loss: 0.4082 - val\_accuracy: 0.7031 - val\_loss: 0.5525  
Epoch 242/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7896 - loss: 0.4576 - val\_accuracy: 0.7083 - val\_loss: 0.5524  
Epoch 243/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7807 - loss: 0.4540 - val\_accuracy: 0.7083 - val\_loss: 0.5524  
Epoch 244/300  
18/18 ————— 0s 8ms/step - accuracy: 0.7959 - loss: 0.4289 - val\_accuracy: 0.7083 - val\_loss: 0.5524  
Epoch 245/300  
18/18 ————— 0s 7ms/step - accuracy: 0.7964 - loss: 0.4347 - val\_accuracy: 0.7083 - val\_loss: 0.5524  
Epoch 246/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8042 - loss: 0.4368 - val\_accuracy: 0.7083 - val\_loss: 0.5524  
Epoch 247/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7686 - loss: 0.4699 - val\_accuracy: 0.7083 - val\_loss: 0.5524  
Epoch 248/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8317 - loss: 0.4054 - val\_accuracy: 0.7083 - val\_loss: 0.5524  
Epoch 249/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8006 - loss: 0.4428 - val\_accuracy: 0.7083 - val\_loss: 0.5524  
Epoch 250/300  
18/18 ————— 0s 9ms/step - accuracy: 0.7937 - loss: 0.4336 - val\_accuracy: 0.7083 - val\_loss: 0.5524  
Epoch 251/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8105 - loss: 0.4333 - val\_accuracy: 0.7083 - val\_loss: 0.5524  
Epoch 252/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8018 - loss: 0.4356 - val\_accuracy: 0.7083 - val\_loss: 0.5523  
Epoch 253/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7852 - loss: 0.4292 - val\_accuracy: 0.7083 - val\_loss: 0.5523  
Epoch 254/300  
18/18 ————— 0s 6ms/step - accuracy: 0.8171 - loss: 0.4300 - val\_accuracy: 0.7083 - val\_loss: 0.5523  
Epoch 255/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7898 - loss: 0.4707 - val\_accuracy: 0.7083 - val\_loss: 0.5523  
Epoch 256/300  
18/18 ————— 0s 6ms/step - accuracy: 0.7934 - loss: 0.4512 - val\_accuracy: 0.7083 - val\_loss: 0.5523  
Epoch 257/300  
18/18 ————— 0s 9ms/step - accuracy: 0.7946 - loss: 0.4540 - val\_accuracy: 0.7083 - val\_loss: 0.5523

0.5523  
Epoch 258/300  
18/18  0s 6ms/step - accuracy: 0.7961 - loss: 0.4383 - val\_accuracy: 0.7083 - val\_loss: 0.5523  
Epoch 259/300  
18/18  0s 6ms/step - accuracy: 0.8280 - loss: 0.4303 - val\_accuracy: 0.7083 - val\_loss: 0.5524  
Epoch 260/300  
18/18  0s 6ms/step - accuracy: 0.7933 - loss: 0.4397 - val\_accuracy: 0.7083 - val\_loss: 0.5524  
Epoch 261/300  
18/18  0s 6ms/step - accuracy: 0.7655 - loss: 0.4719 - val\_accuracy: 0.7083 - val\_loss: 0.5524  
Epoch 262/300  
18/18  0s 6ms/step - accuracy: 0.8104 - loss: 0.4249 - val\_accuracy: 0.7083 - val\_loss: 0.5524  
Epoch 263/300  
18/18  0s 7ms/step - accuracy: 0.7841 - loss: 0.4684 - val\_accuracy: 0.7083 - val\_loss: 0.5525  
Epoch 264/300  
18/18  0s 8ms/step - accuracy: 0.8041 - loss: 0.4120 - val\_accuracy: 0.7083 - val\_loss: 0.5525  
Epoch 265/300  
18/18  0s 6ms/step - accuracy: 0.8163 - loss: 0.4127 - val\_accuracy: 0.7083 - val\_loss: 0.5525  
Epoch 266/300  
18/18  0s 6ms/step - accuracy: 0.7705 - loss: 0.4769 - val\_accuracy: 0.7083 - val\_loss: 0.5525  
Epoch 267/300  
18/18  0s 6ms/step - accuracy: 0.8074 - loss: 0.4123 - val\_accuracy: 0.7083 - val\_loss: 0.5525  
Epoch 268/300  
18/18  0s 6ms/step - accuracy: 0.8079 - loss: 0.4395 - val\_accuracy: 0.7083 - val\_loss: 0.5526  
Epoch 269/300  
18/18  0s 7ms/step - accuracy: 0.7785 - loss: 0.4395 - val\_accuracy: 0.7083 - val\_loss: 0.5526  
Epoch 270/300  
18/18  0s 6ms/step - accuracy: 0.8101 - loss: 0.4320 - val\_accuracy: 0.7083 - val\_loss: 0.5526  
Epoch 271/300  
18/18  0s 6ms/step - accuracy: 0.7881 - loss: 0.4503 - val\_accuracy: 0.7083 - val\_loss: 0.5526  
Epoch 272/300  
18/18  0s 6ms/step - accuracy: 0.8005 - loss: 0.4415 - val\_accuracy: 0.7083 - val\_loss: 0.5527  
Epoch 273/300  
18/18  0s 10ms/step - accuracy: 0.7958 - loss: 0.4340 - val\_accuracy: 0.7083 - val\_loss: 0.5527  
Epoch 274/300  
18/18  0s 14ms/step - accuracy: 0.7918 - loss: 0.4274 - val\_accuracy: 0.7083 - val\_loss: 0.5528  
Epoch 275/300  
18/18  0s 19ms/step - accuracy: 0.7933 - loss: 0.4563 - val\_accuracy: 0.7083 - val\_loss: 0.5528  
Epoch 276/300  
18/18  1s 23ms/step - accuracy: 0.8058 - loss: 0.4270 - val\_accuracy: 0.7083 - val\_loss: 0.5529  
Epoch 277/300  
18/18  0s 11ms/step - accuracy: 0.7989 - loss: 0.4331 - val\_accuracy: 0.7083 - val\_loss: 0.5529  
Epoch 278/300  
18/18  0s 10ms/step - accuracy: 0.8171 - loss: 0.4114 - val\_accuracy: 0.7135 - val\_loss: 0.5529  
Epoch 279/300  
18/18  0s 19ms/step - accuracy: 0.7834 - loss: 0.4453 - val\_accuracy: 0.7135 - val\_loss: 0.5530  
Epoch 280/300  
18/18  1s 15ms/step - accuracy: 0.8240 - loss: 0.4148 - val\_accuracy: 0.7135 - val\_loss: 0.5530

Epoch 281/300  
**18/18**  1s 16ms/step - accuracy: 0.7873 - loss: 0.4407 - val\_accuracy: 0.7135 - val\_loss: 0.5530  
Epoch 282/300  
**18/18**  1s 20ms/step - accuracy: 0.7985 - loss: 0.4285 - val\_accuracy: 0.7135 - val\_loss: 0.5530  
Epoch 283/300  
**18/18**  1s 34ms/step - accuracy: 0.7888 - loss: 0.4504 - val\_accuracy: 0.7135 - val\_loss: 0.5531  
Epoch 284/300  
**18/18**  1s 24ms/step - accuracy: 0.7821 - loss: 0.4330 - val\_accuracy: 0.7188 - val\_loss: 0.5531  
Epoch 285/300  
**18/18**  0s 11ms/step - accuracy: 0.7773 - loss: 0.4508 - val\_accuracy: 0.7188 - val\_loss: 0.5532  
Epoch 286/300  
**18/18**  0s 10ms/step - accuracy: 0.7861 - loss: 0.4402 - val\_accuracy: 0.7188 - val\_loss: 0.5532  
Epoch 287/300  
**18/18**  0s 12ms/step - accuracy: 0.8010 - loss: 0.4153 - val\_accuracy: 0.7188 - val\_loss: 0.5532  
Epoch 288/300  
**18/18**  0s 10ms/step - accuracy: 0.8262 - loss: 0.4041 - val\_accuracy: 0.7188 - val\_loss: 0.5532  
Epoch 289/300  
**18/18**  0s 6ms/step - accuracy: 0.8177 - loss: 0.4035 - val\_accuracy: 0.7188 - val\_loss: 0.5532  
Epoch 290/300  
**18/18**  0s 6ms/step - accuracy: 0.8253 - loss: 0.4084 - val\_accuracy: 0.7188 - val\_loss: 0.5532  
Epoch 291/300  
**18/18**  0s 6ms/step - accuracy: 0.8083 - loss: 0.4424 - val\_accuracy: 0.7188 - val\_loss: 0.5533  
Epoch 292/300  
**18/18**  0s 6ms/step - accuracy: 0.7823 - loss: 0.4362 - val\_accuracy: 0.7188 - val\_loss: 0.5533  
Epoch 293/300  
**18/18**  0s 6ms/step - accuracy: 0.8060 - loss: 0.4311 - val\_accuracy: 0.7188 - val\_loss: 0.5533  
Epoch 294/300  
**18/18**  0s 6ms/step - accuracy: 0.8130 - loss: 0.4205 - val\_accuracy: 0.7188 - val\_loss: 0.5534  
Epoch 295/300  
**18/18**  0s 6ms/step - accuracy: 0.7993 - loss: 0.4528 - val\_accuracy: 0.7188 - val\_loss: 0.5534  
Epoch 296/300  
**18/18**  0s 8ms/step - accuracy: 0.8217 - loss: 0.4211 - val\_accuracy: 0.7188 - val\_loss: 0.5534  
Epoch 297/300  
**18/18**  0s 6ms/step - accuracy: 0.8127 - loss: 0.4128 - val\_accuracy: 0.7188 - val\_loss: 0.5534  
Epoch 298/300  
**18/18**  0s 7ms/step - accuracy: 0.8124 - loss: 0.4466 - val\_accuracy: 0.7188 - val\_loss: 0.5535  
Epoch 299/300  
**18/18**  0s 6ms/step - accuracy: 0.8013 - loss: 0.4450 - val\_accuracy: 0.7188 - val\_loss: 0.5535  
Epoch 300/300  
**18/18**  0s 8ms/step - accuracy: 0.8039 - loss: 0.4152 - val\_accuracy: 0.7188 - val\_loss: 0.5535

```
In [ ]: #Model 3: Learning rate = 0.001, Epochs = 1000, 3 hidden layers with 5 nodes
model_3 = Sequential([
    Dense(5, input_shape=(8,), activation="relu"),
    Dense(5, activation="relu"),
    Dense(5, activation="relu"),
    Dense(1, activation="sigmoid")
])
model_3.compile(SGD(learning_rate = .001), loss="binary_crossentropy", metrics=["accuracy"])
history_3 = model_3.fit(X_train_norm, y_train, validation_data=(X_test_norm, y_test), epochs=1000)
```

Epoch 1/1000  
18/18 ————— 2s 73ms/step - accuracy: 0.6030 - loss: 0.6869 - val\_accuracy: 0.6719 - val\_loss: 0.6819  
Epoch 2/1000  
18/18 ————— 2s 28ms/step - accuracy: 0.6379 - loss: 0.6877 - val\_accuracy: 0.6771 - val\_loss: 0.6813  
Epoch 3/1000  
18/18 ————— 1s 31ms/step - accuracy: 0.6258 - loss: 0.6863 - val\_accuracy: 0.6771 - val\_loss: 0.6806  
Epoch 4/1000  
18/18 ————— 0s 23ms/step - accuracy: 0.6051 - loss: 0.6869 - val\_accuracy: 0.6719 - val\_loss: 0.6800  
Epoch 5/1000  
18/18 ————— 1s 23ms/step - accuracy: 0.6432 - loss: 0.6821 - val\_accuracy: 0.6719 - val\_loss: 0.6793  
Epoch 6/1000  
18/18 ————— 1s 33ms/step - accuracy: 0.6344 - loss: 0.6868 - val\_accuracy: 0.6615 - val\_loss: 0.6787  
Epoch 7/1000  
18/18 ————— 1s 17ms/step - accuracy: 0.6653 - loss: 0.6798 - val\_accuracy: 0.6615 - val\_loss: 0.6781  
Epoch 8/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6182 - loss: 0.6827 - val\_accuracy: 0.6615 - val\_loss: 0.6774  
Epoch 9/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6108 - loss: 0.6849 - val\_accuracy: 0.6667 - val\_loss: 0.6768  
Epoch 10/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6358 - loss: 0.6793 - val\_accuracy: 0.6562 - val\_loss: 0.6762  
Epoch 11/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6436 - loss: 0.6777 - val\_accuracy: 0.6562 - val\_loss: 0.6756  
Epoch 12/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6507 - loss: 0.6768 - val\_accuracy: 0.6562 - val\_loss: 0.6750  
Epoch 13/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6443 - loss: 0.6771 - val\_accuracy: 0.6562 - val\_loss: 0.6744  
Epoch 14/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6400 - loss: 0.6789 - val\_accuracy: 0.6615 - val\_loss: 0.6739  
Epoch 15/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.6349 - loss: 0.6794 - val\_accuracy: 0.6615 - val\_loss: 0.6733  
Epoch 16/1000  
18/18 ————— 0s 5ms/step - accuracy: 0.6349 - loss: 0.6788 - val\_accuracy: 0.6562 - val\_loss: 0.6727  
Epoch 17/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6766 - loss: 0.6692 - val\_accuracy: 0.6562 - val\_loss: 0.6722  
Epoch 18/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6507 - loss: 0.6709 - val\_accuracy: 0.6562 - val\_loss: 0.6716  
Epoch 19/1000  
18/18 ————— 0s 5ms/step - accuracy: 0.6434 - loss: 0.6727 - val\_accuracy: 0.6510 - val\_loss: 0.6711  
Epoch 20/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6430 - loss: 0.6711 - val\_accuracy: 0.6510 - val\_loss: 0.6705  
Epoch 21/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6226 - loss: 0.6764 - val\_accuracy: 0.6510 - val\_loss: 0.6700  
Epoch 22/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6445 - loss: 0.6711 - val\_accuracy: 0.6510 - val\_loss: 0.6695  
Epoch 23/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6397 - loss: 0.6733 - val\_accuracy: 0.6510 - val\_loss: 0.6690  
Epoch 24/1000

18/18 ————— 0s 6ms/step - accuracy: 0.6146 - loss: 0.6736 - val\_accuracy: 0.6510 - val\_loss: 0.6685  
Epoch 25/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6151 - loss: 0.6751 - val\_accuracy: 0.6510 - val\_loss: 0.6680  
Epoch 26/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6509 - loss: 0.6712 - val\_accuracy: 0.6510 - val\_loss: 0.6675  
Epoch 27/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6342 - loss: 0.6697 - val\_accuracy: 0.6510 - val\_loss: 0.6670  
Epoch 28/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6274 - loss: 0.6744 - val\_accuracy: 0.6510 - val\_loss: 0.6665  
Epoch 29/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6344 - loss: 0.6696 - val\_accuracy: 0.6458 - val\_loss: 0.6660  
Epoch 30/1000  
18/18 ————— 0s 5ms/step - accuracy: 0.6436 - loss: 0.6663 - val\_accuracy: 0.6458 - val\_loss: 0.6655  
Epoch 31/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6250 - loss: 0.6672 - val\_accuracy: 0.6458 - val\_loss: 0.6650  
Epoch 32/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6401 - loss: 0.6634 - val\_accuracy: 0.6458 - val\_loss: 0.6645  
Epoch 33/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6168 - loss: 0.6707 - val\_accuracy: 0.6510 - val\_loss: 0.6640  
Epoch 34/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6198 - loss: 0.6661 - val\_accuracy: 0.6510 - val\_loss: 0.6636  
Epoch 35/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6287 - loss: 0.6694 - val\_accuracy: 0.6510 - val\_loss: 0.6631  
Epoch 36/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6314 - loss: 0.6656 - val\_accuracy: 0.6510 - val\_loss: 0.6626  
Epoch 37/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6068 - loss: 0.6708 - val\_accuracy: 0.6510 - val\_loss: 0.6622  
Epoch 38/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6349 - loss: 0.6656 - val\_accuracy: 0.6510 - val\_loss: 0.6617  
Epoch 39/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6346 - loss: 0.6600 - val\_accuracy: 0.6562 - val\_loss: 0.6613  
Epoch 40/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6386 - loss: 0.6605 - val\_accuracy: 0.6510 - val\_loss: 0.6608  
Epoch 41/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6282 - loss: 0.6607 - val\_accuracy: 0.6458 - val\_loss: 0.6604  
Epoch 42/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6138 - loss: 0.6646 - val\_accuracy: 0.6406 - val\_loss: 0.6600  
Epoch 43/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6260 - loss: 0.6624 - val\_accuracy: 0.6406 - val\_loss: 0.6595  
Epoch 44/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6478 - loss: 0.6565 - val\_accuracy: 0.6458 - val\_loss: 0.6591  
Epoch 45/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6792 - loss: 0.6530 - val\_accuracy: 0.6458 - val\_loss: 0.6587  
Epoch 46/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6332 - loss: 0.6596 - val\_accuracy: 0.6510 - val\_loss: 0.6583  
Epoch 47/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6575 - loss: 0.6527 - val\_accuracy: 0.6510 - val\_loss:



0.6579  
Epoch 48/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6058 - loss: 0.6663 - val\_accuracy: 0.6510 - val\_loss: 0.6575  
Epoch 49/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6474 - loss: 0.6544 - val\_accuracy: 0.6510 - val\_loss: 0.6571  
Epoch 50/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6637 - loss: 0.6546 - val\_accuracy: 0.6510 - val\_loss: 0.6567  
Epoch 51/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.6553 - loss: 0.6503 - val\_accuracy: 0.6458 - val\_loss: 0.6563  
Epoch 52/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.6550 - loss: 0.6484 - val\_accuracy: 0.6458 - val\_loss: 0.6559  
Epoch 53/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.6459 - loss: 0.6565 - val\_accuracy: 0.6458 - val\_loss: 0.6555  
Epoch 54/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.6446 - loss: 0.6577 - val\_accuracy: 0.6458 - val\_loss: 0.6551  
Epoch 55/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.6644 - loss: 0.6498 - val\_accuracy: 0.6406 - val\_loss: 0.6547  
Epoch 56/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.6560 - loss: 0.6537 - val\_accuracy: 0.6406 - val\_loss: 0.6544  
Epoch 57/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.6429 - loss: 0.6536 - val\_accuracy: 0.6458 - val\_loss: 0.6540  
Epoch 58/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.6322 - loss: 0.6580 - val\_accuracy: 0.6458 - val\_loss: 0.6536  
Epoch 59/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.6582 - loss: 0.6556 - val\_accuracy: 0.6458 - val\_loss: 0.6533  
Epoch 60/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.6490 - loss: 0.6517 - val\_accuracy: 0.6458 - val\_loss: 0.6529  
Epoch 61/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6278 - loss: 0.6601 - val\_accuracy: 0.6458 - val\_loss: 0.6526  
Epoch 62/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6490 - loss: 0.6552 - val\_accuracy: 0.6458 - val\_loss: 0.6522  
Epoch 63/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6469 - loss: 0.6510 - val\_accuracy: 0.6510 - val\_loss: 0.6518  
Epoch 64/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6496 - loss: 0.6554 - val\_accuracy: 0.6562 - val\_loss: 0.6515  
Epoch 65/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6529 - loss: 0.6514 - val\_accuracy: 0.6562 - val\_loss: 0.6511  
Epoch 66/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6524 - loss: 0.6519 - val\_accuracy: 0.6562 - val\_loss: 0.6508  
Epoch 67/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6464 - loss: 0.6468 - val\_accuracy: 0.6562 - val\_loss: 0.6504  
Epoch 68/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6787 - loss: 0.6437 - val\_accuracy: 0.6562 - val\_loss: 0.6501  
Epoch 69/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6558 - loss: 0.6457 - val\_accuracy: 0.6562 - val\_loss: 0.6497  
Epoch 70/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6504 - loss: 0.6476 - val\_accuracy: 0.6562 - val\_loss: 0.6494

Epoch 71/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6718 - loss: 0.6407 - val\_accuracy: 0.6562 - val\_loss: 0.6490  
Epoch 72/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6494 - loss: 0.6532 - val\_accuracy: 0.6562 - val\_loss: 0.6487  
Epoch 73/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6462 - loss: 0.6458 - val\_accuracy: 0.6562 - val\_loss: 0.6483  
Epoch 74/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6490 - loss: 0.6509 - val\_accuracy: 0.6562 - val\_loss: 0.6480  
Epoch 75/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6596 - loss: 0.6451 - val\_accuracy: 0.6562 - val\_loss: 0.6476  
Epoch 76/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6107 - loss: 0.6541 - val\_accuracy: 0.6562 - val\_loss: 0.6473  
Epoch 77/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6195 - loss: 0.6536 - val\_accuracy: 0.6510 - val\_loss: 0.6470  
Epoch 78/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6233 - loss: 0.6564 - val\_accuracy: 0.6510 - val\_loss: 0.6466  
Epoch 79/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6762 - loss: 0.6410 - val\_accuracy: 0.6510 - val\_loss: 0.6463  
Epoch 80/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6237 - loss: 0.6587 - val\_accuracy: 0.6510 - val\_loss: 0.6460  
Epoch 81/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6574 - loss: 0.6445 - val\_accuracy: 0.6510 - val\_loss: 0.6456  
Epoch 82/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6445 - loss: 0.6442 - val\_accuracy: 0.6510 - val\_loss: 0.6453  
Epoch 83/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6707 - loss: 0.6421 - val\_accuracy: 0.6510 - val\_loss: 0.6450  
Epoch 84/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6638 - loss: 0.6427 - val\_accuracy: 0.6510 - val\_loss: 0.6447  
Epoch 85/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6465 - loss: 0.6498 - val\_accuracy: 0.6510 - val\_loss: 0.6443  
Epoch 86/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6311 - loss: 0.6559 - val\_accuracy: 0.6510 - val\_loss: 0.6440  
Epoch 87/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6591 - loss: 0.6405 - val\_accuracy: 0.6510 - val\_loss: 0.6437  
Epoch 88/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6608 - loss: 0.6385 - val\_accuracy: 0.6510 - val\_loss: 0.6434  
Epoch 89/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6465 - loss: 0.6469 - val\_accuracy: 0.6510 - val\_loss: 0.6431  
Epoch 90/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6773 - loss: 0.6336 - val\_accuracy: 0.6406 - val\_loss: 0.6428  
Epoch 91/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6113 - loss: 0.6574 - val\_accuracy: 0.6406 - val\_loss: 0.6425  
Epoch 92/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6638 - loss: 0.6371 - val\_accuracy: 0.6406 - val\_loss: 0.6422  
Epoch 93/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6535 - loss: 0.6429 - val\_accuracy: 0.6406 - val\_loss: 0.6419  
Epoch 94/1000

18/18 ————— 0s 6ms/step - accuracy: 0.6441 - loss: 0.6418 - val\_accuracy: 0.6406 - val\_loss: 0.6416  
Epoch 95/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6294 - loss: 0.6505 - val\_accuracy: 0.6406 - val\_loss: 0.6413  
Epoch 96/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6671 - loss: 0.6441 - val\_accuracy: 0.6406 - val\_loss: 0.6410  
Epoch 97/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.6610 - loss: 0.6369 - val\_accuracy: 0.6406 - val\_loss: 0.6407  
Epoch 98/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6501 - loss: 0.6462 - val\_accuracy: 0.6406 - val\_loss: 0.6404  
Epoch 99/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6723 - loss: 0.6339 - val\_accuracy: 0.6458 - val\_loss: 0.6401  
Epoch 100/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6268 - loss: 0.6466 - val\_accuracy: 0.6458 - val\_loss: 0.6398  
Epoch 101/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6454 - loss: 0.6436 - val\_accuracy: 0.6458 - val\_loss: 0.6395  
Epoch 102/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6595 - loss: 0.6299 - val\_accuracy: 0.6458 - val\_loss: 0.6392  
Epoch 103/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6582 - loss: 0.6358 - val\_accuracy: 0.6458 - val\_loss: 0.6389  
Epoch 104/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6686 - loss: 0.6282 - val\_accuracy: 0.6458 - val\_loss: 0.6386  
Epoch 105/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6269 - loss: 0.6460 - val\_accuracy: 0.6458 - val\_loss: 0.6383  
Epoch 106/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6438 - loss: 0.6419 - val\_accuracy: 0.6458 - val\_loss: 0.6380  
Epoch 107/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6609 - loss: 0.6308 - val\_accuracy: 0.6458 - val\_loss: 0.6378  
Epoch 108/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6496 - loss: 0.6403 - val\_accuracy: 0.6510 - val\_loss: 0.6375  
Epoch 109/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6748 - loss: 0.6309 - val\_accuracy: 0.6510 - val\_loss: 0.6372  
Epoch 110/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6627 - loss: 0.6323 - val\_accuracy: 0.6510 - val\_loss: 0.6369  
Epoch 111/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6773 - loss: 0.6304 - val\_accuracy: 0.6510 - val\_loss: 0.6366  
Epoch 112/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6456 - loss: 0.6391 - val\_accuracy: 0.6510 - val\_loss: 0.6363  
Epoch 113/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6569 - loss: 0.6313 - val\_accuracy: 0.6510 - val\_loss: 0.6361  
Epoch 114/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6589 - loss: 0.6355 - val\_accuracy: 0.6510 - val\_loss: 0.6358  
Epoch 115/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6707 - loss: 0.6249 - val\_accuracy: 0.6510 - val\_loss: 0.6355  
Epoch 116/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6777 - loss: 0.6263 - val\_accuracy: 0.6562 - val\_loss: 0.6352  
Epoch 117/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6138 - loss: 0.6447 - val\_accuracy: 0.6562 - val\_loss:

0.6350  
Epoch 118/1000  
18/18 — 0s 6ms/step - accuracy: 0.6438 - loss: 0.6339 - val\_accuracy: 0.6562 - val\_loss: 0.6347  
Epoch 119/1000  
18/18 — 0s 7ms/step - accuracy: 0.6368 - loss: 0.6475 - val\_accuracy: 0.6562 - val\_loss: 0.6344  
Epoch 120/1000  
18/18 — 0s 8ms/step - accuracy: 0.6377 - loss: 0.6334 - val\_accuracy: 0.6562 - val\_loss: 0.6342  
Epoch 121/1000  
18/18 — 0s 11ms/step - accuracy: 0.6260 - loss: 0.6440 - val\_accuracy: 0.6562 - val\_loss: 0.6339  
Epoch 122/1000  
18/18 — 0s 10ms/step - accuracy: 0.6574 - loss: 0.6272 - val\_accuracy: 0.6562 - val\_loss: 0.6336  
Epoch 123/1000  
18/18 — 0s 9ms/step - accuracy: 0.6912 - loss: 0.6157 - val\_accuracy: 0.6562 - val\_loss: 0.6334  
Epoch 124/1000  
18/18 — 0s 8ms/step - accuracy: 0.6774 - loss: 0.6273 - val\_accuracy: 0.6562 - val\_loss: 0.6331  
Epoch 125/1000  
18/18 — 0s 8ms/step - accuracy: 0.6551 - loss: 0.6371 - val\_accuracy: 0.6562 - val\_loss: 0.6329  
Epoch 126/1000  
18/18 — 0s 10ms/step - accuracy: 0.6642 - loss: 0.6298 - val\_accuracy: 0.6562 - val\_loss: 0.6326  
Epoch 127/1000  
18/18 — 0s 11ms/step - accuracy: 0.6627 - loss: 0.6253 - val\_accuracy: 0.6562 - val\_loss: 0.6323  
Epoch 128/1000  
18/18 — 0s 8ms/step - accuracy: 0.6653 - loss: 0.6280 - val\_accuracy: 0.6562 - val\_loss: 0.6321  
Epoch 129/1000  
18/18 — 0s 10ms/step - accuracy: 0.6541 - loss: 0.6339 - val\_accuracy: 0.6562 - val\_loss: 0.6318  
Epoch 130/1000  
18/18 — 0s 9ms/step - accuracy: 0.6489 - loss: 0.6352 - val\_accuracy: 0.6562 - val\_loss: 0.6315  
Epoch 131/1000  
18/18 — 0s 6ms/step - accuracy: 0.6428 - loss: 0.6334 - val\_accuracy: 0.6562 - val\_loss: 0.6313  
Epoch 132/1000  
18/18 — 0s 6ms/step - accuracy: 0.6738 - loss: 0.6254 - val\_accuracy: 0.6562 - val\_loss: 0.6310  
Epoch 133/1000  
18/18 — 0s 6ms/step - accuracy: 0.6585 - loss: 0.6208 - val\_accuracy: 0.6562 - val\_loss: 0.6308  
Epoch 134/1000  
18/18 — 0s 6ms/step - accuracy: 0.6420 - loss: 0.6379 - val\_accuracy: 0.6562 - val\_loss: 0.6305  
Epoch 135/1000  
18/18 — 0s 6ms/step - accuracy: 0.6799 - loss: 0.6187 - val\_accuracy: 0.6562 - val\_loss: 0.6303  
Epoch 136/1000  
18/18 — 0s 6ms/step - accuracy: 0.6479 - loss: 0.6342 - val\_accuracy: 0.6562 - val\_loss: 0.6300  
Epoch 137/1000  
18/18 — 0s 8ms/step - accuracy: 0.6543 - loss: 0.6315 - val\_accuracy: 0.6562 - val\_loss: 0.6297  
Epoch 138/1000  
18/18 — 0s 6ms/step - accuracy: 0.6503 - loss: 0.6313 - val\_accuracy: 0.6562 - val\_loss: 0.6295  
Epoch 139/1000  
18/18 — 0s 6ms/step - accuracy: 0.6580 - loss: 0.6288 - val\_accuracy: 0.6562 - val\_loss: 0.6292  
Epoch 140/1000  
18/18 — 0s 6ms/step - accuracy: 0.6493 - loss: 0.6310 - val\_accuracy: 0.6615 - val\_loss: 0.6290

Epoch 141/1000  
18/18 — 0s 6ms/step - accuracy: 0.6685 - loss: 0.6208 - val\_accuracy: 0.6615 - val\_loss: 0.6287  
Epoch 142/1000  
18/18 — 0s 6ms/step - accuracy: 0.6842 - loss: 0.6130 - val\_accuracy: 0.6615 - val\_loss: 0.6285  
Epoch 143/1000  
18/18 — 0s 6ms/step - accuracy: 0.6544 - loss: 0.6304 - val\_accuracy: 0.6615 - val\_loss: 0.6283  
Epoch 144/1000  
18/18 — 0s 6ms/step - accuracy: 0.6547 - loss: 0.6356 - val\_accuracy: 0.6615 - val\_loss: 0.6280  
Epoch 145/1000  
18/18 — 0s 6ms/step - accuracy: 0.6616 - loss: 0.6214 - val\_accuracy: 0.6615 - val\_loss: 0.6278  
Epoch 146/1000  
18/18 — 0s 6ms/step - accuracy: 0.6375 - loss: 0.6295 - val\_accuracy: 0.6615 - val\_loss: 0.6275  
Epoch 147/1000  
18/18 — 0s 6ms/step - accuracy: 0.6494 - loss: 0.6297 - val\_accuracy: 0.6615 - val\_loss: 0.6273  
Epoch 148/1000  
18/18 — 0s 6ms/step - accuracy: 0.6278 - loss: 0.6440 - val\_accuracy: 0.6667 - val\_loss: 0.6270  
Epoch 149/1000  
18/18 — 0s 8ms/step - accuracy: 0.6462 - loss: 0.6303 - val\_accuracy: 0.6667 - val\_loss: 0.6268  
Epoch 150/1000  
18/18 — 0s 6ms/step - accuracy: 0.6498 - loss: 0.6279 - val\_accuracy: 0.6667 - val\_loss: 0.6265  
Epoch 151/1000  
18/18 — 0s 6ms/step - accuracy: 0.6740 - loss: 0.6202 - val\_accuracy: 0.6667 - val\_loss: 0.6263  
Epoch 152/1000  
18/18 — 0s 8ms/step - accuracy: 0.6862 - loss: 0.6158 - val\_accuracy: 0.6667 - val\_loss: 0.6260  
Epoch 153/1000  
18/18 — 0s 6ms/step - accuracy: 0.6582 - loss: 0.6234 - val\_accuracy: 0.6667 - val\_loss: 0.6258  
Epoch 154/1000  
18/18 — 0s 6ms/step - accuracy: 0.6436 - loss: 0.6350 - val\_accuracy: 0.6667 - val\_loss: 0.6255  
Epoch 155/1000  
18/18 — 0s 6ms/step - accuracy: 0.6705 - loss: 0.6124 - val\_accuracy: 0.6667 - val\_loss: 0.6253  
Epoch 156/1000  
18/18 — 0s 7ms/step - accuracy: 0.6426 - loss: 0.6377 - val\_accuracy: 0.6667 - val\_loss: 0.6251  
Epoch 157/1000  
18/18 — 0s 6ms/step - accuracy: 0.6664 - loss: 0.6195 - val\_accuracy: 0.6667 - val\_loss: 0.6248  
Epoch 158/1000  
18/18 — 0s 8ms/step - accuracy: 0.6726 - loss: 0.6259 - val\_accuracy: 0.6667 - val\_loss: 0.6246  
Epoch 159/1000  
18/18 — 0s 6ms/step - accuracy: 0.6229 - loss: 0.6342 - val\_accuracy: 0.6667 - val\_loss: 0.6243  
Epoch 160/1000  
18/18 — 0s 6ms/step - accuracy: 0.6491 - loss: 0.6235 - val\_accuracy: 0.6667 - val\_loss: 0.6241  
Epoch 161/1000  
18/18 — 0s 8ms/step - accuracy: 0.6333 - loss: 0.6291 - val\_accuracy: 0.6667 - val\_loss: 0.6238  
Epoch 162/1000  
18/18 — 0s 6ms/step - accuracy: 0.6455 - loss: 0.6227 - val\_accuracy: 0.6667 - val\_loss: 0.6236  
Epoch 163/1000  
18/18 — 0s 6ms/step - accuracy: 0.6481 - loss: 0.6215 - val\_accuracy: 0.6667 - val\_loss: 0.6234  
Epoch 164/1000

18/18 ————— 0s 6ms/step - accuracy: 0.6606 - loss: 0.6197 - val\_accuracy: 0.6667 - val\_loss: 0.6231  
Epoch 165/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6589 - loss: 0.6198 - val\_accuracy: 0.6667 - val\_loss: 0.6229  
Epoch 166/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6627 - loss: 0.6207 - val\_accuracy: 0.6667 - val\_loss: 0.6227  
Epoch 167/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6453 - loss: 0.6211 - val\_accuracy: 0.6667 - val\_loss: 0.6225  
Epoch 168/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6594 - loss: 0.6182 - val\_accuracy: 0.6667 - val\_loss: 0.6222  
Epoch 169/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6721 - loss: 0.6126 - val\_accuracy: 0.6667 - val\_loss: 0.6220  
Epoch 170/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6618 - loss: 0.6197 - val\_accuracy: 0.6667 - val\_loss: 0.6218  
Epoch 171/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6447 - loss: 0.6282 - val\_accuracy: 0.6667 - val\_loss: 0.6215  
Epoch 172/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6556 - loss: 0.6202 - val\_accuracy: 0.6719 - val\_loss: 0.6213  
Epoch 173/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6351 - loss: 0.6245 - val\_accuracy: 0.6719 - val\_loss: 0.6210  
Epoch 174/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.6478 - loss: 0.6236 - val\_accuracy: 0.6719 - val\_loss: 0.6208  
Epoch 175/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6533 - loss: 0.6199 - val\_accuracy: 0.6719 - val\_loss: 0.6206  
Epoch 176/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.6700 - loss: 0.6099 - val\_accuracy: 0.6719 - val\_loss: 0.6203  
Epoch 177/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6443 - loss: 0.6238 - val\_accuracy: 0.6719 - val\_loss: 0.6201  
Epoch 178/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6319 - loss: 0.6351 - val\_accuracy: 0.6719 - val\_loss: 0.6198  
Epoch 179/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6379 - loss: 0.6278 - val\_accuracy: 0.6719 - val\_loss: 0.6196  
Epoch 180/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6652 - loss: 0.6069 - val\_accuracy: 0.6719 - val\_loss: 0.6194  
Epoch 181/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6631 - loss: 0.6126 - val\_accuracy: 0.6719 - val\_loss: 0.6191  
Epoch 182/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6716 - loss: 0.6066 - val\_accuracy: 0.6719 - val\_loss: 0.6189  
Epoch 183/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6803 - loss: 0.6054 - val\_accuracy: 0.6719 - val\_loss: 0.6186  
Epoch 184/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6395 - loss: 0.6217 - val\_accuracy: 0.6719 - val\_loss: 0.6184  
Epoch 185/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6693 - loss: 0.6066 - val\_accuracy: 0.6719 - val\_loss: 0.6182  
Epoch 186/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6589 - loss: 0.6050 - val\_accuracy: 0.6719 - val\_loss: 0.6179  
Epoch 187/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6597 - loss: 0.6183 - val\_accuracy: 0.6719 - val\_loss:

0.6177  
Epoch 188/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6841 - loss: 0.5984 - val\_accuracy: 0.6719 - val\_loss: 0.6175  
Epoch 189/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6497 - loss: 0.6130 - val\_accuracy: 0.6719 - val\_loss: 0.6172  
Epoch 190/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6357 - loss: 0.6221 - val\_accuracy: 0.6719 - val\_loss: 0.6170  
Epoch 191/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.6340 - loss: 0.6194 - val\_accuracy: 0.6719 - val\_loss: 0.6167  
Epoch 192/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.6291 - loss: 0.6267 - val\_accuracy: 0.6719 - val\_loss: 0.6165  
Epoch 193/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6566 - loss: 0.6083 - val\_accuracy: 0.6719 - val\_loss: 0.6163  
Epoch 194/1000  
18/18 ————— 0s 13ms/step - accuracy: 0.6713 - loss: 0.6075 - val\_accuracy: 0.6719 - val\_loss: 0.6160  
Epoch 195/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.6467 - loss: 0.6156 - val\_accuracy: 0.6719 - val\_loss: 0.6158  
Epoch 196/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.6274 - loss: 0.6265 - val\_accuracy: 0.6719 - val\_loss: 0.6156  
Epoch 197/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.6519 - loss: 0.6191 - val\_accuracy: 0.6719 - val\_loss: 0.6153  
Epoch 198/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.6225 - loss: 0.6285 - val\_accuracy: 0.6719 - val\_loss: 0.6151  
Epoch 199/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.6666 - loss: 0.6069 - val\_accuracy: 0.6719 - val\_loss: 0.6148  
Epoch 200/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.6490 - loss: 0.6143 - val\_accuracy: 0.6719 - val\_loss: 0.6146  
Epoch 201/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.6737 - loss: 0.6015 - val\_accuracy: 0.6719 - val\_loss: 0.6144  
Epoch 202/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6426 - loss: 0.6171 - val\_accuracy: 0.6719 - val\_loss: 0.6141  
Epoch 203/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6913 - loss: 0.5942 - val\_accuracy: 0.6719 - val\_loss: 0.6139  
Epoch 204/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6478 - loss: 0.6191 - val\_accuracy: 0.6719 - val\_loss: 0.6136  
Epoch 205/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6950 - loss: 0.5886 - val\_accuracy: 0.6719 - val\_loss: 0.6134  
Epoch 206/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6757 - loss: 0.5941 - val\_accuracy: 0.6719 - val\_loss: 0.6132  
Epoch 207/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6750 - loss: 0.5981 - val\_accuracy: 0.6719 - val\_loss: 0.6129  
Epoch 208/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6118 - loss: 0.6412 - val\_accuracy: 0.6719 - val\_loss: 0.6127  
Epoch 209/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7101 - loss: 0.5772 - val\_accuracy: 0.6719 - val\_loss: 0.6124  
Epoch 210/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6630 - loss: 0.6096 - val\_accuracy: 0.6719 - val\_loss: 0.6122

Epoch 211/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6523 - loss: 0.6145 - val\_accuracy: 0.6719 - val\_loss: 0.6120  
Epoch 212/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6538 - loss: 0.6080 - val\_accuracy: 0.6719 - val\_loss: 0.6117  
Epoch 213/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6515 - loss: 0.6142 - val\_accuracy: 0.6719 - val\_loss: 0.6115  
Epoch 214/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6436 - loss: 0.6210 - val\_accuracy: 0.6719 - val\_loss: 0.6113  
Epoch 215/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6560 - loss: 0.6071 - val\_accuracy: 0.6719 - val\_loss: 0.6110  
Epoch 216/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6850 - loss: 0.6019 - val\_accuracy: 0.6719 - val\_loss: 0.6108  
Epoch 217/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6254 - loss: 0.6204 - val\_accuracy: 0.6719 - val\_loss: 0.6105  
Epoch 218/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6689 - loss: 0.6026 - val\_accuracy: 0.6719 - val\_loss: 0.6103  
Epoch 219/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6353 - loss: 0.6121 - val\_accuracy: 0.6719 - val\_loss: 0.6100  
Epoch 220/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6387 - loss: 0.6166 - val\_accuracy: 0.6719 - val\_loss: 0.6098  
Epoch 221/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6659 - loss: 0.6079 - val\_accuracy: 0.6719 - val\_loss: 0.6096  
Epoch 222/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6666 - loss: 0.5907 - val\_accuracy: 0.6719 - val\_loss: 0.6093  
Epoch 223/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6841 - loss: 0.5966 - val\_accuracy: 0.6719 - val\_loss: 0.6091  
Epoch 224/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6376 - loss: 0.6053 - val\_accuracy: 0.6719 - val\_loss: 0.6089  
Epoch 225/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6359 - loss: 0.6147 - val\_accuracy: 0.6719 - val\_loss: 0.6086  
Epoch 226/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6479 - loss: 0.5962 - val\_accuracy: 0.6719 - val\_loss: 0.6084  
Epoch 227/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6844 - loss: 0.5873 - val\_accuracy: 0.6719 - val\_loss: 0.6081  
Epoch 228/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6634 - loss: 0.6010 - val\_accuracy: 0.6719 - val\_loss: 0.6079  
Epoch 229/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6317 - loss: 0.6198 - val\_accuracy: 0.6719 - val\_loss: 0.6076  
Epoch 230/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6694 - loss: 0.6031 - val\_accuracy: 0.6719 - val\_loss: 0.6074  
Epoch 231/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6336 - loss: 0.6174 - val\_accuracy: 0.6719 - val\_loss: 0.6072  
Epoch 232/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6670 - loss: 0.6016 - val\_accuracy: 0.6719 - val\_loss: 0.6069  
Epoch 233/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6533 - loss: 0.6037 - val\_accuracy: 0.6719 - val\_loss: 0.6067  
Epoch 234/1000




18/18 ————— 0s 6ms/step - accuracy: 0.6599 - loss: 0.6006 - val\_accuracy: 0.6719 - val\_loss: 0.6065  
Epoch 235/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6501 - loss: 0.6029 - val\_accuracy: 0.6719 - val\_loss: 0.6062  
Epoch 236/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6592 - loss: 0.5972 - val\_accuracy: 0.6719 - val\_loss: 0.6060  
Epoch 237/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6705 - loss: 0.5932 - val\_accuracy: 0.6719 - val\_loss: 0.6058  
Epoch 238/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6760 - loss: 0.5945 - val\_accuracy: 0.6667 - val\_loss: 0.6055  
Epoch 239/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6419 - loss: 0.6080 - val\_accuracy: 0.6667 - val\_loss: 0.6053  
Epoch 240/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6458 - loss: 0.6093 - val\_accuracy: 0.6719 - val\_loss: 0.6050  
Epoch 241/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6894 - loss: 0.5842 - val\_accuracy: 0.6719 - val\_loss: 0.6048  
Epoch 242/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6489 - loss: 0.5953 - val\_accuracy: 0.6719 - val\_loss: 0.6046  
Epoch 243/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6543 - loss: 0.6061 - val\_accuracy: 0.6719 - val\_loss: 0.6043  
Epoch 244/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6566 - loss: 0.6035 - val\_accuracy: 0.6719 - val\_loss: 0.6041  
Epoch 245/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6591 - loss: 0.6037 - val\_accuracy: 0.6719 - val\_loss: 0.6038  
Epoch 246/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6586 - loss: 0.5946 - val\_accuracy: 0.6719 - val\_loss: 0.6036  
Epoch 247/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6643 - loss: 0.5926 - val\_accuracy: 0.6771 - val\_loss: 0.6033  
Epoch 248/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6206 - loss: 0.6116 - val\_accuracy: 0.6771 - val\_loss: 0.6031  
Epoch 249/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6640 - loss: 0.5825 - val\_accuracy: 0.6771 - val\_loss: 0.6028  
Epoch 250/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6681 - loss: 0.5957 - val\_accuracy: 0.6771 - val\_loss: 0.6026  
Epoch 251/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6555 - loss: 0.6028 - val\_accuracy: 0.6771 - val\_loss: 0.6024  
Epoch 252/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6511 - loss: 0.5989 - val\_accuracy: 0.6771 - val\_loss: 0.6021  
Epoch 253/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6400 - loss: 0.6054 - val\_accuracy: 0.6771 - val\_loss: 0.6019  
Epoch 254/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6813 - loss: 0.5858 - val\_accuracy: 0.6771 - val\_loss: 0.6016  
Epoch 255/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6798 - loss: 0.5872 - val\_accuracy: 0.6771 - val\_loss: 0.6014  
Epoch 256/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6389 - loss: 0.6084 - val\_accuracy: 0.6771 - val\_loss: 0.6011  
Epoch 257/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6329 - loss: 0.6110 - val\_accuracy: 0.6771 - val\_loss:


0.6009  
Epoch 258/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6808 - loss: 0.5800 - val\_accuracy: 0.6771 - val\_loss: 0.6007  
Epoch 259/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.6772 - loss: 0.5855 - val\_accuracy: 0.6771 - val\_loss: 0.6004  
Epoch 260/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6680 - loss: 0.5922 - val\_accuracy: 0.6771 - val\_loss: 0.6002  
Epoch 261/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.6676 - loss: 0.5906 - val\_accuracy: 0.6771 - val\_loss: 0.5999  
Epoch 262/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.6523 - loss: 0.6047 - val\_accuracy: 0.6771 - val\_loss: 0.5997  
Epoch 263/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.6468 - loss: 0.6004 - val\_accuracy: 0.6771 - val\_loss: 0.5994  
Epoch 264/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.6832 - loss: 0.5831 - val\_accuracy: 0.6771 - val\_loss: 0.5992  
Epoch 265/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.6467 - loss: 0.6106 - val\_accuracy: 0.6771 - val\_loss: 0.5990  
Epoch 266/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.6700 - loss: 0.5853 - val\_accuracy: 0.6771 - val\_loss: 0.5987  
Epoch 267/1000  
18/18 ————— 0s 13ms/step - accuracy: 0.6660 - loss: 0.5873 - val\_accuracy: 0.6771 - val\_loss: 0.5985  
Epoch 268/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.6568 - loss: 0.5960 - val\_accuracy: 0.6771 - val\_loss: 0.5982  
Epoch 269/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6521 - loss: 0.5939 - val\_accuracy: 0.6771 - val\_loss: 0.5980  
Epoch 270/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6616 - loss: 0.5940 - val\_accuracy: 0.6771 - val\_loss: 0.5977  
Epoch 271/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6647 - loss: 0.5857 - val\_accuracy: 0.6771 - val\_loss: 0.5975  
Epoch 272/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6790 - loss: 0.5750 - val\_accuracy: 0.6771 - val\_loss: 0.5972  
Epoch 273/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6655 - loss: 0.5850 - val\_accuracy: 0.6771 - val\_loss: 0.5970  
Epoch 274/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6636 - loss: 0.5876 - val\_accuracy: 0.6771 - val\_loss: 0.5968  
Epoch 275/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6659 - loss: 0.5886 - val\_accuracy: 0.6771 - val\_loss: 0.5965  
Epoch 276/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6446 - loss: 0.5990 - val\_accuracy: 0.6771 - val\_loss: 0.5963  
Epoch 277/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6858 - loss: 0.5706 - val\_accuracy: 0.6771 - val\_loss: 0.5960  
Epoch 278/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6531 - loss: 0.5907 - val\_accuracy: 0.6771 - val\_loss: 0.5958  
Epoch 279/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6385 - loss: 0.6006 - val\_accuracy: 0.6771 - val\_loss: 0.5955  
Epoch 280/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6606 - loss: 0.5917 - val\_accuracy: 0.6771 - val\_loss: 0.5953


Epoch 281/1000  
18/18 — 0s 6ms/step - accuracy: 0.6538 - loss: 0.5867 - val\_accuracy: 0.6771 - val\_loss: 0.5950  
Epoch 282/1000  
18/18 — 0s 6ms/step - accuracy: 0.6730 - loss: 0.5897 - val\_accuracy: 0.6771 - val\_loss: 0.5948  
Epoch 283/1000  
18/18 — 0s 8ms/step - accuracy: 0.6787 - loss: 0.5744 - val\_accuracy: 0.6771 - val\_loss: 0.5946  
Epoch 284/1000  
18/18 — 0s 6ms/step - accuracy: 0.6613 - loss: 0.5969 - val\_accuracy: 0.6771 - val\_loss: 0.5943  
Epoch 285/1000  
18/18 — 0s 6ms/step - accuracy: 0.6552 - loss: 0.5982 - val\_accuracy: 0.6771 - val\_loss: 0.5941  
Epoch 286/1000  
18/18 — 0s 6ms/step - accuracy: 0.6615 - loss: 0.5876 - val\_accuracy: 0.6771 - val\_loss: 0.5939  
Epoch 287/1000  
18/18 — 0s 6ms/step - accuracy: 0.6243 - loss: 0.6062 - val\_accuracy: 0.6771 - val\_loss: 0.5936  
Epoch 288/1000  
18/18 — 0s 6ms/step - accuracy: 0.6460 - loss: 0.6096 - val\_accuracy: 0.6771 - val\_loss: 0.5934  
Epoch 289/1000  
18/18 — 0s 6ms/step - accuracy: 0.6470 - loss: 0.6025 - val\_accuracy: 0.6771 - val\_loss: 0.5931  
Epoch 290/1000  
18/18 — 0s 6ms/step - accuracy: 0.6394 - loss: 0.5985 - val\_accuracy: 0.6771 - val\_loss: 0.5929  
Epoch 291/1000  
18/18 — 0s 6ms/step - accuracy: 0.6737 - loss: 0.5785 - val\_accuracy: 0.6771 - val\_loss: 0.5927  
Epoch 292/1000  
18/18 — 0s 6ms/step - accuracy: 0.6678 - loss: 0.5901 - val\_accuracy: 0.6771 - val\_loss: 0.5924  
Epoch 293/1000  
18/18 — 0s 6ms/step - accuracy: 0.6727 - loss: 0.5846 - val\_accuracy: 0.6771 - val\_loss: 0.5922  
Epoch 294/1000  
18/18 — 0s 6ms/step - accuracy: 0.6606 - loss: 0.5901 - val\_accuracy: 0.6771 - val\_loss: 0.5920  
Epoch 295/1000  
18/18 — 0s 7ms/step - accuracy: 0.7093 - loss: 0.5602 - val\_accuracy: 0.6771 - val\_loss: 0.5917  
Epoch 296/1000  
18/18 — 0s 6ms/step - accuracy: 0.6918 - loss: 0.5695 - val\_accuracy: 0.6771 - val\_loss: 0.5915  
Epoch 297/1000  
18/18 — 0s 6ms/step - accuracy: 0.6611 - loss: 0.5929 - val\_accuracy: 0.6771 - val\_loss: 0.5912  
Epoch 298/1000  
18/18 — 0s 6ms/step - accuracy: 0.6400 - loss: 0.5955 - val\_accuracy: 0.6771 - val\_loss: 0.5910  
Epoch 299/1000  
18/18 — 0s 6ms/step - accuracy: 0.6810 - loss: 0.5843 - val\_accuracy: 0.6771 - val\_loss: 0.5907  
Epoch 300/1000  
18/18 — 0s 6ms/step - accuracy: 0.6503 - loss: 0.5972 - val\_accuracy: 0.6823 - val\_loss: 0.5905  
Epoch 301/1000  
18/18 — 0s 8ms/step - accuracy: 0.6538 - loss: 0.5913 - val\_accuracy: 0.6823 - val\_loss: 0.5903  
Epoch 302/1000  
18/18 — 0s 6ms/step - accuracy: 0.6548 - loss: 0.5885 - val\_accuracy: 0.6823 - val\_loss: 0.5900  
Epoch 303/1000  
18/18 — 0s 6ms/step - accuracy: 0.6655 - loss: 0.5791 - val\_accuracy: 0.6823 - val\_loss: 0.5898  
Epoch 304/1000


18/18 ————— 0s 6ms/step - accuracy: 0.6968 - loss: 0.5679 - val\_accuracy: 0.6823 - val\_loss: 0.5895  
Epoch 305/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6591 - loss: 0.5868 - val\_accuracy: 0.6823 - val\_loss: 0.5893  
Epoch 306/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6740 - loss: 0.5904 - val\_accuracy: 0.6823 - val\_loss: 0.5890  
Epoch 307/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7007 - loss: 0.5707 - val\_accuracy: 0.6823 - val\_loss: 0.5888  
Epoch 308/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6594 - loss: 0.5906 - val\_accuracy: 0.6823 - val\_loss: 0.5885  
Epoch 309/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6654 - loss: 0.5907 - val\_accuracy: 0.6823 - val\_loss: 0.5883  
Epoch 310/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6754 - loss: 0.5774 - val\_accuracy: 0.6823 - val\_loss: 0.5880  
Epoch 311/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7054 - loss: 0.5726 - val\_accuracy: 0.6823 - val\_loss: 0.5877  
Epoch 312/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6747 - loss: 0.5734 - val\_accuracy: 0.6823 - val\_loss: 0.5875  
Epoch 313/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6821 - loss: 0.5847 - val\_accuracy: 0.6823 - val\_loss: 0.5872  
Epoch 314/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6846 - loss: 0.5731 - val\_accuracy: 0.6771 - val\_loss: 0.5870  
Epoch 315/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6822 - loss: 0.5690 - val\_accuracy: 0.6771 - val\_loss: 0.5867  
Epoch 316/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6643 - loss: 0.5966 - val\_accuracy: 0.6771 - val\_loss: 0.5865  
Epoch 317/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.6644 - loss: 0.5868 - val\_accuracy: 0.6771 - val\_loss: 0.5862  
Epoch 318/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6649 - loss: 0.5877 - val\_accuracy: 0.6771 - val\_loss: 0.5859  
Epoch 319/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6818 - loss: 0.5891 - val\_accuracy: 0.6771 - val\_loss: 0.5857  
Epoch 320/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6832 - loss: 0.5703 - val\_accuracy: 0.6771 - val\_loss: 0.5854  
Epoch 321/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6713 - loss: 0.5845 - val\_accuracy: 0.6771 - val\_loss: 0.5851  
Epoch 322/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6928 - loss: 0.5737 - val\_accuracy: 0.6771 - val\_loss: 0.5849  
Epoch 323/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6606 - loss: 0.5797 - val\_accuracy: 0.6771 - val\_loss: 0.5846  
Epoch 324/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6616 - loss: 0.5973 - val\_accuracy: 0.6771 - val\_loss: 0.5843  
Epoch 325/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6506 - loss: 0.5950 - val\_accuracy: 0.6771 - val\_loss: 0.5841  
Epoch 326/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.6526 - loss: 0.6092 - val\_accuracy: 0.6771 - val\_loss: 0.5838  
Epoch 327/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.6873 - loss: 0.5763 - val\_accuracy: 0.6771 - val\_loss:


0.5835  
Epoch 328/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7217 - loss: 0.5537 - val\_accuracy: 0.6771 - val\_loss: 0.5833  
Epoch 329/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6453 - loss: 0.5997 - val\_accuracy: 0.6823 - val\_loss: 0.5830  
Epoch 330/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.6802 - loss: 0.5629 - val\_accuracy: 0.6823 - val\_loss: 0.5827  
Epoch 331/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7006 - loss: 0.5761 - val\_accuracy: 0.6823 - val\_loss: 0.5824  
Epoch 332/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.6788 - loss: 0.5632 - val\_accuracy: 0.6823 - val\_loss: 0.5822  
Epoch 333/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.6851 - loss: 0.5725 - val\_accuracy: 0.6823 - val\_loss: 0.5819  
Epoch 334/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.6841 - loss: 0.5742 - val\_accuracy: 0.6823 - val\_loss: 0.5816  
Epoch 335/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.6860 - loss: 0.5787 - val\_accuracy: 0.6823 - val\_loss: 0.5814  
Epoch 336/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.6788 - loss: 0.5848 - val\_accuracy: 0.6823 - val\_loss: 0.5811  
Epoch 337/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6902 - loss: 0.5785 - val\_accuracy: 0.6823 - val\_loss: 0.5808  
Epoch 338/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6886 - loss: 0.5721 - val\_accuracy: 0.6823 - val\_loss: 0.5806  
Epoch 339/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6984 - loss: 0.5605 - val\_accuracy: 0.6823 - val\_loss: 0.5803  
Epoch 340/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6855 - loss: 0.5685 - val\_accuracy: 0.6823 - val\_loss: 0.5800  
Epoch 341/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6449 - loss: 0.5815 - val\_accuracy: 0.6823 - val\_loss: 0.5797  
Epoch 342/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6785 - loss: 0.5774 - val\_accuracy: 0.6823 - val\_loss: 0.5795  
Epoch 343/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7017 - loss: 0.5765 - val\_accuracy: 0.6823 - val\_loss: 0.5792  
Epoch 344/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6739 - loss: 0.5734 - val\_accuracy: 0.6823 - val\_loss: 0.5789  
Epoch 345/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6498 - loss: 0.5813 - val\_accuracy: 0.6823 - val\_loss: 0.5787  
Epoch 346/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6627 - loss: 0.5868 - val\_accuracy: 0.6823 - val\_loss: 0.5784  
Epoch 347/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6900 - loss: 0.5623 - val\_accuracy: 0.6823 - val\_loss: 0.5781  
Epoch 348/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6650 - loss: 0.5754 - val\_accuracy: 0.6823 - val\_loss: 0.5779  
Epoch 349/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.6563 - loss: 0.5934 - val\_accuracy: 0.6823 - val\_loss: 0.5776  
Epoch 350/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6759 - loss: 0.5606 - val\_accuracy: 0.6823 - val\_loss: 0.5774


Epoch 351/1000  
18/18  0s 8ms/step - accuracy: 0.6952 - loss: 0.5655 - val\_accuracy: 0.6823 - val\_loss: 0.5771


Epoch 352/1000  
18/18  0s 6ms/step - accuracy: 0.7087 - loss: 0.5545 - val\_accuracy: 0.6823 - val\_loss: 0.5768


Epoch 353/1000  
18/18  0s 6ms/step - accuracy: 0.6885 - loss: 0.5732 - val\_accuracy: 0.6823 - val\_loss: 0.5766


Epoch 354/1000  
18/18  0s 7ms/step - accuracy: 0.6637 - loss: 0.5767 - val\_accuracy: 0.6823 - val\_loss: 0.5763


Epoch 355/1000  
18/18  0s 7ms/step - accuracy: 0.6794 - loss: 0.5783 - val\_accuracy: 0.6823 - val\_loss: 0.5760


Epoch 356/1000  
18/18  0s 6ms/step - accuracy: 0.6740 - loss: 0.5859 - val\_accuracy: 0.6823 - val\_loss: 0.5758


Epoch 357/1000  
18/18  0s 6ms/step - accuracy: 0.7044 - loss: 0.5493 - val\_accuracy: 0.6823 - val\_loss: 0.5755


Epoch 358/1000  
18/18  0s 6ms/step - accuracy: 0.6627 - loss: 0.5777 - val\_accuracy: 0.6823 - val\_loss: 0.5752


Epoch 359/1000  
18/18  0s 8ms/step - accuracy: 0.7122 - loss: 0.5638 - val\_accuracy: 0.6823 - val\_loss: 0.5750


Epoch 360/1000  
18/18  0s 7ms/step - accuracy: 0.6938 - loss: 0.5622 - val\_accuracy: 0.6823 - val\_loss: 0.5747


Epoch 361/1000  
18/18  0s 6ms/step - accuracy: 0.6908 - loss: 0.5644 - val\_accuracy: 0.6823 - val\_loss: 0.5745


Epoch 362/1000  
18/18  0s 6ms/step - accuracy: 0.6581 - loss: 0.5871 - val\_accuracy: 0.6823 - val\_loss: 0.5742


Epoch 363/1000  
18/18  0s 6ms/step - accuracy: 0.6884 - loss: 0.5546 - val\_accuracy: 0.6823 - val\_loss: 0.5739


Epoch 364/1000  
18/18  0s 6ms/step - accuracy: 0.6551 - loss: 0.5867 - val\_accuracy: 0.6823 - val\_loss: 0.5737


Epoch 365/1000  
18/18  0s 6ms/step - accuracy: 0.6762 - loss: 0.5726 - val\_accuracy: 0.6823 - val\_loss: 0.5734


Epoch 366/1000  
18/18  0s 8ms/step - accuracy: 0.6719 - loss: 0.5811 - val\_accuracy: 0.6823 - val\_loss: 0.5732


Epoch 367/1000  
18/18  0s 6ms/step - accuracy: 0.6676 - loss: 0.5814 - val\_accuracy: 0.6823 - val\_loss: 0.5729


Epoch 368/1000  
18/18  0s 6ms/step - accuracy: 0.7044 - loss: 0.5605 - val\_accuracy: 0.6823 - val\_loss: 0.5726

Epoch 369/1000  
18/18  0s 6ms/step - accuracy: 0.6783 - loss: 0.5664 - val\_accuracy: 0.6875 - val\_loss: 0.5724

Epoch 370/1000  
18/18  0s 8ms/step - accuracy: 0.6894 - loss: 0.5758 - val\_accuracy: 0.6875 - val\_loss: 0.5721

Epoch 371/1000  
18/18  0s 6ms/step - accuracy: 0.7062 - loss: 0.5562 - val\_accuracy: 0.6875 - val\_loss: 0.5719

Epoch 372/1000  
18/18  0s 6ms/step - accuracy: 0.6865 - loss: 0.5584 - val\_accuracy: 0.6875 - val\_loss: 0.5716

Epoch 373/1000  
18/18  0s 6ms/step - accuracy: 0.7038 - loss: 0.5602 - val\_accuracy: 0.6927 - val\_loss: 0.5714

Epoch 374/1000

18/18 ————— 0s 8ms/step - accuracy: 0.6729 - loss: 0.5801 - val\_accuracy: 0.6927 - val\_loss: 0.5711  
Epoch 375/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7009 - loss: 0.5511 - val\_accuracy: 0.6927 - val\_loss: 0.5708  
Epoch 376/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6807 - loss: 0.5673 - val\_accuracy: 0.6927 - val\_loss: 0.5706  
Epoch 377/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6991 - loss: 0.5662 - val\_accuracy: 0.6927 - val\_loss: 0.5704  
Epoch 378/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6716 - loss: 0.5653 - val\_accuracy: 0.6927 - val\_loss: 0.5701  
Epoch 379/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6797 - loss: 0.5650 - val\_accuracy: 0.6927 - val\_loss: 0.5699  
Epoch 380/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7147 - loss: 0.5462 - val\_accuracy: 0.6927 - val\_loss: 0.5696  
Epoch 381/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6829 - loss: 0.5635 - val\_accuracy: 0.6927 - val\_loss: 0.5694  
Epoch 382/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6782 - loss: 0.5690 - val\_accuracy: 0.6927 - val\_loss: 0.5691  
Epoch 383/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6895 - loss: 0.5497 - val\_accuracy: 0.6927 - val\_loss: 0.5689  
Epoch 384/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6930 - loss: 0.5430 - val\_accuracy: 0.6927 - val\_loss: 0.5686  
Epoch 385/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6850 - loss: 0.5730 - val\_accuracy: 0.6979 - val\_loss: 0.5683  
Epoch 386/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7024 - loss: 0.5540 - val\_accuracy: 0.6979 - val\_loss: 0.5681  
Epoch 387/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6949 - loss: 0.5476 - val\_accuracy: 0.6979 - val\_loss: 0.5678  
Epoch 388/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6783 - loss: 0.5690 - val\_accuracy: 0.6979 - val\_loss: 0.5676  
Epoch 389/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6942 - loss: 0.5520 - val\_accuracy: 0.6979 - val\_loss: 0.5673  
Epoch 390/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7058 - loss: 0.5509 - val\_accuracy: 0.6979 - val\_loss: 0.5671  
Epoch 391/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7097 - loss: 0.5447 - val\_accuracy: 0.6979 - val\_loss: 0.5668  
Epoch 392/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6926 - loss: 0.5487 - val\_accuracy: 0.6979 - val\_loss: 0.5666  
Epoch 393/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.6529 - loss: 0.5888 - val\_accuracy: 0.6979 - val\_loss: 0.5663  
Epoch 394/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7202 - loss: 0.5327 - val\_accuracy: 0.6979 - val\_loss: 0.5661  
Epoch 395/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.6863 - loss: 0.5506 - val\_accuracy: 0.6979 - val\_loss: 0.5658  
Epoch 396/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.6872 - loss: 0.5483 - val\_accuracy: 0.6979 - val\_loss: 0.5656  
Epoch 397/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6974 - loss: 0.5547 - val\_accuracy: 0.6979 - val\_loss:

0.5653  
Epoch 398/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.6759 - loss: 0.5766 - val\_accuracy: 0.6979 - val\_loss: 0.5651  
Epoch 399/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.6698 - loss: 0.5715 - val\_accuracy: 0.6979 - val\_loss: 0.5648  
Epoch 400/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7220 - loss: 0.5358 - val\_accuracy: 0.6979 - val\_loss: 0.5646  
Epoch 401/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.6711 - loss: 0.5755 - val\_accuracy: 0.6979 - val\_loss: 0.5643  
Epoch 402/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.6838 - loss: 0.5680 - val\_accuracy: 0.7031 - val\_loss: 0.5640  
Epoch 403/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7090 - loss: 0.5326 - val\_accuracy: 0.7031 - val\_loss: 0.5638  
Epoch 404/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6664 - loss: 0.5685 - val\_accuracy: 0.7031 - val\_loss: 0.5636  
Epoch 405/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6862 - loss: 0.5556 - val\_accuracy: 0.7031 - val\_loss: 0.5633  
Epoch 406/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7038 - loss: 0.5449 - val\_accuracy: 0.7031 - val\_loss: 0.5631  
Epoch 407/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6719 - loss: 0.5565 - val\_accuracy: 0.7083 - val\_loss: 0.5628  
Epoch 408/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6849 - loss: 0.5625 - val\_accuracy: 0.7083 - val\_loss: 0.5626  
Epoch 409/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6946 - loss: 0.5575 - val\_accuracy: 0.7031 - val\_loss: 0.5623  
Epoch 410/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7020 - loss: 0.5564 - val\_accuracy: 0.6979 - val\_loss: 0.5621  
Epoch 411/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7045 - loss: 0.5548 - val\_accuracy: 0.6979 - val\_loss: 0.5619  
Epoch 412/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7067 - loss: 0.5459 - val\_accuracy: 0.6979 - val\_loss: 0.5616  
Epoch 413/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6929 - loss: 0.5382 - val\_accuracy: 0.6979 - val\_loss: 0.5614  
Epoch 414/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7199 - loss: 0.5398 - val\_accuracy: 0.6979 - val\_loss: 0.5612  
Epoch 415/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7387 - loss: 0.5164 - val\_accuracy: 0.6979 - val\_loss: 0.5609  
Epoch 416/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6766 - loss: 0.5731 - val\_accuracy: 0.6979 - val\_loss: 0.5607  
Epoch 417/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7094 - loss: 0.5533 - val\_accuracy: 0.6979 - val\_loss: 0.5604  
Epoch 418/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7063 - loss: 0.5476 - val\_accuracy: 0.6979 - val\_loss: 0.5602  
Epoch 419/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7018 - loss: 0.5444 - val\_accuracy: 0.7031 - val\_loss: 0.5600  
Epoch 420/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7218 - loss: 0.5480 - val\_accuracy: 0.7031 - val\_loss: 0.5597



Epoch 421/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7077 - loss: 0.5514 - val\_accuracy: 0.7031 - val\_loss: 0.5595  
Epoch 422/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7277 - loss: 0.5372 - val\_accuracy: 0.7031 - val\_loss: 0.5593  
Epoch 423/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6975 - loss: 0.5474 - val\_accuracy: 0.7031 - val\_loss: 0.5590  
Epoch 424/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7196 - loss: 0.5414 - val\_accuracy: 0.7031 - val\_loss: 0.5588  
Epoch 425/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.6765 - loss: 0.5790 - val\_accuracy: 0.7031 - val\_loss: 0.5586  
Epoch 426/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7145 - loss: 0.5453 - val\_accuracy: 0.7031 - val\_loss: 0.5583  
Epoch 427/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.6905 - loss: 0.5451 - val\_accuracy: 0.7031 - val\_loss: 0.5581  
Epoch 428/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6852 - loss: 0.5593 - val\_accuracy: 0.7031 - val\_loss: 0.5579  
Epoch 429/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6982 - loss: 0.5580 - val\_accuracy: 0.7031 - val\_loss: 0.5576  
Epoch 430/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7371 - loss: 0.5222 - val\_accuracy: 0.7031 - val\_loss: 0.5574  
Epoch 431/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7222 - loss: 0.5366 - val\_accuracy: 0.7031 - val\_loss: 0.5572  
Epoch 432/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7001 - loss: 0.5490 - val\_accuracy: 0.7031 - val\_loss: 0.5569  
Epoch 433/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7180 - loss: 0.5433 - val\_accuracy: 0.7031 - val\_loss: 0.5567  
Epoch 434/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7159 - loss: 0.5362 - val\_accuracy: 0.7031 - val\_loss: 0.5565  
Epoch 435/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6917 - loss: 0.5648 - val\_accuracy: 0.7083 - val\_loss: 0.5562  
Epoch 436/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7120 - loss: 0.5658 - val\_accuracy: 0.7083 - val\_loss: 0.5560  
Epoch 437/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7227 - loss: 0.5229 - val\_accuracy: 0.7083 - val\_loss: 0.5558  
Epoch 438/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7157 - loss: 0.5577 - val\_accuracy: 0.7083 - val\_loss: 0.5556  
Epoch 439/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7241 - loss: 0.5369 - val\_accuracy: 0.7083 - val\_loss: 0.5553  
Epoch 440/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7185 - loss: 0.5285 - val\_accuracy: 0.7031 - val\_loss: 0.5551  
Epoch 441/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6914 - loss: 0.5546 - val\_accuracy: 0.7083 - val\_loss: 0.5549  
Epoch 442/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7080 - loss: 0.5584 - val\_accuracy: 0.7188 - val\_loss: 0.5547  
Epoch 443/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7234 - loss: 0.5361 - val\_accuracy: 0.7188 - val\_loss: 0.5545  
Epoch 444/1000

18/18 ————— 0s 7ms/step - accuracy: 0.7215 - loss: 0.5476 - val\_accuracy: 0.7188 - val\_loss: 0.5542  
Epoch 445/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6934 - loss: 0.5583 - val\_accuracy: 0.7188 - val\_loss: 0.5540  
Epoch 446/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7366 - loss: 0.5334 - val\_accuracy: 0.7188 - val\_loss: 0.5538  
Epoch 447/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7238 - loss: 0.5290 - val\_accuracy: 0.7135 - val\_loss: 0.5536  
Epoch 448/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7180 - loss: 0.5366 - val\_accuracy: 0.7135 - val\_loss: 0.5534  
Epoch 449/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7220 - loss: 0.5463 - val\_accuracy: 0.7135 - val\_loss: 0.5532  
Epoch 450/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7220 - loss: 0.5411 - val\_accuracy: 0.7188 - val\_loss: 0.5530  
Epoch 451/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6970 - loss: 0.5540 - val\_accuracy: 0.7188 - val\_loss: 0.5528  
Epoch 452/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7307 - loss: 0.5205 - val\_accuracy: 0.7188 - val\_loss: 0.5525  
Epoch 453/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7165 - loss: 0.5371 - val\_accuracy: 0.7188 - val\_loss: 0.5523  
Epoch 454/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7201 - loss: 0.5460 - val\_accuracy: 0.7240 - val\_loss: 0.5521  
Epoch 455/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7128 - loss: 0.5431 - val\_accuracy: 0.7240 - val\_loss: 0.5519  
Epoch 456/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.6724 - loss: 0.5688 - val\_accuracy: 0.7240 - val\_loss: 0.5517  
Epoch 457/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7094 - loss: 0.5530 - val\_accuracy: 0.7240 - val\_loss: 0.5515  
Epoch 458/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7309 - loss: 0.5363 - val\_accuracy: 0.7188 - val\_loss: 0.5513  
Epoch 459/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7077 - loss: 0.5409 - val\_accuracy: 0.7188 - val\_loss: 0.5511  
Epoch 460/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7246 - loss: 0.5356 - val\_accuracy: 0.7188 - val\_loss: 0.5509  
Epoch 461/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7444 - loss: 0.5299 - val\_accuracy: 0.7188 - val\_loss: 0.5507  
Epoch 462/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7377 - loss: 0.5157 - val\_accuracy: 0.7188 - val\_loss: 0.5504  
Epoch 463/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7211 - loss: 0.5302 - val\_accuracy: 0.7188 - val\_loss: 0.5502  
Epoch 464/1000  
18/18 ————— 0s 13ms/step - accuracy: 0.7043 - loss: 0.5470 - val\_accuracy: 0.7188 - val\_loss: 0.5500  
Epoch 465/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7313 - loss: 0.5469 - val\_accuracy: 0.7188 - val\_loss: 0.5498  
Epoch 466/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7458 - loss: 0.5376 - val\_accuracy: 0.7188 - val\_loss: 0.5496  
Epoch 467/1000  
18/18 ————— 0s 20ms/step - accuracy: 0.7211 - loss: 0.5286 - val\_accuracy: 0.7188 - val\_loss:

0.5494  
Epoch 468/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7210 - loss: 0.5355 - val\_accuracy: 0.7188 - val\_loss: 0.5492  
Epoch 469/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7421 - loss: 0.5275 - val\_accuracy: 0.7188 - val\_loss: 0.5490  
Epoch 470/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7315 - loss: 0.5459 - val\_accuracy: 0.7135 - val\_loss: 0.5488  
Epoch 471/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7574 - loss: 0.5013 - val\_accuracy: 0.7135 - val\_loss: 0.5486  
Epoch 472/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6934 - loss: 0.5507 - val\_accuracy: 0.7188 - val\_loss: 0.5484  
Epoch 473/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7161 - loss: 0.5492 - val\_accuracy: 0.7188 - val\_loss: 0.5482  
Epoch 474/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7223 - loss: 0.5257 - val\_accuracy: 0.7135 - val\_loss: 0.5480  
Epoch 475/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7258 - loss: 0.5334 - val\_accuracy: 0.7135 - val\_loss: 0.5478  
Epoch 476/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7247 - loss: 0.5237 - val\_accuracy: 0.7135 - val\_loss: 0.5476  
Epoch 477/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7141 - loss: 0.5384 - val\_accuracy: 0.7083 - val\_loss: 0.5474  
Epoch 478/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7362 - loss: 0.5261 - val\_accuracy: 0.7083 - val\_loss: 0.5472  
Epoch 479/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7400 - loss: 0.5267 - val\_accuracy: 0.7083 - val\_loss: 0.5470  
Epoch 480/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7207 - loss: 0.5349 - val\_accuracy: 0.7083 - val\_loss: 0.5468  
Epoch 481/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7449 - loss: 0.5252 - val\_accuracy: 0.7083 - val\_loss: 0.5466  
Epoch 482/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7065 - loss: 0.5442 - val\_accuracy: 0.7031 - val\_loss: 0.5464  
Epoch 483/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7445 - loss: 0.4976 - val\_accuracy: 0.7031 - val\_loss: 0.5462  
Epoch 484/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7131 - loss: 0.5359 - val\_accuracy: 0.7031 - val\_loss: 0.5460  
Epoch 485/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7297 - loss: 0.5315 - val\_accuracy: 0.7031 - val\_loss: 0.5458  
Epoch 486/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7368 - loss: 0.5230 - val\_accuracy: 0.7031 - val\_loss: 0.5456  
Epoch 487/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7598 - loss: 0.4931 - val\_accuracy: 0.6927 - val\_loss: 0.5454  
Epoch 488/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7184 - loss: 0.5484 - val\_accuracy: 0.6927 - val\_loss: 0.5452  
Epoch 489/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7155 - loss: 0.5341 - val\_accuracy: 0.6927 - val\_loss: 0.5450  
Epoch 490/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7528 - loss: 0.5076 - val\_accuracy: 0.6875 - val\_loss: 0.5448

Epoch 491/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7507 - loss: 0.4872 - val\_accuracy: 0.6875 - val\_loss: 0.5446  
Epoch 492/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7269 - loss: 0.5396 - val\_accuracy: 0.6875 - val\_loss: 0.5444  
Epoch 493/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7127 - loss: 0.5601 - val\_accuracy: 0.6875 - val\_loss: 0.5442  
Epoch 494/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7603 - loss: 0.5067 - val\_accuracy: 0.6927 - val\_loss: 0.5440  
Epoch 495/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7191 - loss: 0.5386 - val\_accuracy: 0.6927 - val\_loss: 0.5438  
Epoch 496/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7384 - loss: 0.5297 - val\_accuracy: 0.6927 - val\_loss: 0.5436  
Epoch 497/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7472 - loss: 0.5281 - val\_accuracy: 0.6927 - val\_loss: 0.5434  
Epoch 498/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7274 - loss: 0.5414 - val\_accuracy: 0.6927 - val\_loss: 0.5432  
Epoch 499/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7251 - loss: 0.5446 - val\_accuracy: 0.6927 - val\_loss: 0.5430  
Epoch 500/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7366 - loss: 0.5249 - val\_accuracy: 0.6927 - val\_loss: 0.5428  
Epoch 501/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7280 - loss: 0.5228 - val\_accuracy: 0.6927 - val\_loss: 0.5427  
Epoch 502/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7377 - loss: 0.5211 - val\_accuracy: 0.6927 - val\_loss: 0.5425  
Epoch 503/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7518 - loss: 0.5265 - val\_accuracy: 0.6927 - val\_loss: 0.5423  
Epoch 504/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7040 - loss: 0.5395 - val\_accuracy: 0.6979 - val\_loss: 0.5421  
Epoch 505/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7346 - loss: 0.5231 - val\_accuracy: 0.6979 - val\_loss: 0.5419  
Epoch 506/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7257 - loss: 0.5364 - val\_accuracy: 0.6979 - val\_loss: 0.5418  
Epoch 507/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7390 - loss: 0.5343 - val\_accuracy: 0.6979 - val\_loss: 0.5416  
Epoch 508/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7303 - loss: 0.5194 - val\_accuracy: 0.6979 - val\_loss: 0.5414  
Epoch 509/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7650 - loss: 0.4884 - val\_accuracy: 0.6979 - val\_loss: 0.5412  
Epoch 510/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7297 - loss: 0.5349 - val\_accuracy: 0.7031 - val\_loss: 0.5411  
Epoch 511/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7347 - loss: 0.5245 - val\_accuracy: 0.7031 - val\_loss: 0.5409  
Epoch 512/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7457 - loss: 0.5215 - val\_accuracy: 0.7031 - val\_loss: 0.5407  
Epoch 513/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7388 - loss: 0.5325 - val\_accuracy: 0.7031 - val\_loss: 0.5405  
Epoch 514/1000

18/18 ————— 0s 6ms/step - accuracy: 0.7270 - loss: 0.5418 - val\_accuracy: 0.7031 - val\_loss: 0.5404  
Epoch 515/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7509 - loss: 0.5152 - val\_accuracy: 0.7031 - val\_loss: 0.5402  
Epoch 516/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7378 - loss: 0.5288 - val\_accuracy: 0.7031 - val\_loss: 0.5400  
Epoch 517/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7381 - loss: 0.5324 - val\_accuracy: 0.7083 - val\_loss: 0.5399  
Epoch 518/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7407 - loss: 0.5135 - val\_accuracy: 0.7135 - val\_loss: 0.5397  
Epoch 519/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7669 - loss: 0.5078 - val\_accuracy: 0.7135 - val\_loss: 0.5395  
Epoch 520/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7460 - loss: 0.5122 - val\_accuracy: 0.7135 - val\_loss: 0.5394  
Epoch 521/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7616 - loss: 0.5224 - val\_accuracy: 0.7135 - val\_loss: 0.5392  
Epoch 522/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7778 - loss: 0.5071 - val\_accuracy: 0.7135 - val\_loss: 0.5390  
Epoch 523/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7226 - loss: 0.5315 - val\_accuracy: 0.7240 - val\_loss: 0.5389  
Epoch 524/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7468 - loss: 0.5059 - val\_accuracy: 0.7240 - val\_loss: 0.5387  
Epoch 525/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7369 - loss: 0.5348 - val\_accuracy: 0.7240 - val\_loss: 0.5385  
Epoch 526/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7305 - loss: 0.5174 - val\_accuracy: 0.7240 - val\_loss: 0.5384  
Epoch 527/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7663 - loss: 0.5122 - val\_accuracy: 0.7240 - val\_loss: 0.5382  
Epoch 528/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7480 - loss: 0.5154 - val\_accuracy: 0.7240 - val\_loss: 0.5381  
Epoch 529/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7511 - loss: 0.4962 - val\_accuracy: 0.7240 - val\_loss: 0.5379  
Epoch 530/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7283 - loss: 0.5075 - val\_accuracy: 0.7240 - val\_loss: 0.5377  
Epoch 531/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7281 - loss: 0.5334 - val\_accuracy: 0.7240 - val\_loss: 0.5376  
Epoch 532/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7658 - loss: 0.5059 - val\_accuracy: 0.7240 - val\_loss: 0.5374  
Epoch 533/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7371 - loss: 0.5134 - val\_accuracy: 0.7240 - val\_loss: 0.5373  
Epoch 534/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7617 - loss: 0.5134 - val\_accuracy: 0.7240 - val\_loss: 0.5371  
Epoch 535/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7368 - loss: 0.5299 - val\_accuracy: 0.7240 - val\_loss: 0.5369  
Epoch 536/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7439 - loss: 0.5200 - val\_accuracy: 0.7240 - val\_loss: 0.5368  
Epoch 537/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7642 - loss: 0.5101 - val\_accuracy: 0.7240 - val\_loss:

0.5366  
Epoch 538/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7188 - loss: 0.5481 - val\_accuracy: 0.7292 - val\_loss: 0.5365  
Epoch 539/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7352 - loss: 0.5172 - val\_accuracy: 0.7344 - val\_loss: 0.5364  
Epoch 540/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7417 - loss: 0.5117 - val\_accuracy: 0.7292 - val\_loss: 0.5362  
Epoch 541/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7551 - loss: 0.5305 - val\_accuracy: 0.7292 - val\_loss: 0.5361  
Epoch 542/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7062 - loss: 0.5191 - val\_accuracy: 0.7292 - val\_loss: 0.5359  
Epoch 543/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7315 - loss: 0.5207 - val\_accuracy: 0.7344 - val\_loss: 0.5358  
Epoch 544/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7497 - loss: 0.5141 - val\_accuracy: 0.7344 - val\_loss: 0.5357  
Epoch 545/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7492 - loss: 0.5056 - val\_accuracy: 0.7344 - val\_loss: 0.5355  
Epoch 546/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7408 - loss: 0.5204 - val\_accuracy: 0.7344 - val\_loss: 0.5354  
Epoch 547/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7614 - loss: 0.4946 - val\_accuracy: 0.7344 - val\_loss: 0.5352  
Epoch 548/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7708 - loss: 0.4927 - val\_accuracy: 0.7344 - val\_loss: 0.5351  
Epoch 549/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7398 - loss: 0.5263 - val\_accuracy: 0.7344 - val\_loss: 0.5350  
Epoch 550/1000  
18/18 ————— 0s 16ms/step - accuracy: 0.7594 - loss: 0.5216 - val\_accuracy: 0.7396 - val\_loss: 0.5348  
Epoch 551/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7735 - loss: 0.4925 - val\_accuracy: 0.7396 - val\_loss: 0.5347  
Epoch 552/1000  
18/18 ————— 1s 19ms/step - accuracy: 0.7172 - loss: 0.5352 - val\_accuracy: 0.7396 - val\_loss: 0.5346  
Epoch 553/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7764 - loss: 0.4974 - val\_accuracy: 0.7396 - val\_loss: 0.5345  
Epoch 554/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7550 - loss: 0.5071 - val\_accuracy: 0.7396 - val\_loss: 0.5343  
Epoch 555/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7444 - loss: 0.5228 - val\_accuracy: 0.7396 - val\_loss: 0.5342  
Epoch 556/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7422 - loss: 0.5183 - val\_accuracy: 0.7396 - val\_loss: 0.5341  
Epoch 557/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7438 - loss: 0.5095 - val\_accuracy: 0.7396 - val\_loss: 0.5340  
Epoch 558/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7457 - loss: 0.4983 - val\_accuracy: 0.7396 - val\_loss: 0.5338  
Epoch 559/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7398 - loss: 0.5270 - val\_accuracy: 0.7396 - val\_loss: 0.5337  
Epoch 560/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7661 - loss: 0.5108 - val\_accuracy: 0.7396 - val\_loss: 0.5336

Epoch 561/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7481 - loss: 0.5158 - val\_accuracy: 0.7396 - val\_loss: 0.5334

Epoch 562/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7299 - loss: 0.5146 - val\_accuracy: 0.7396 - val\_loss: 0.5333

Epoch 563/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7351 - loss: 0.5320 - val\_accuracy: 0.7396 - val\_loss: 0.5332

Epoch 564/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7164 - loss: 0.5224 - val\_accuracy: 0.7396 - val\_loss: 0.5331

Epoch 565/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7219 - loss: 0.5229 - val\_accuracy: 0.7396 - val\_loss: 0.5330

Epoch 566/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7669 - loss: 0.5020 - val\_accuracy: 0.7396 - val\_loss: 0.5329

Epoch 567/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7506 - loss: 0.4911 - val\_accuracy: 0.7396 - val\_loss: 0.5328

Epoch 568/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7440 - loss: 0.5119 - val\_accuracy: 0.7344 - val\_loss: 0.5326

Epoch 569/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7750 - loss: 0.4877 - val\_accuracy: 0.7344 - val\_loss: 0.5325

Epoch 570/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7714 - loss: 0.5081 - val\_accuracy: 0.7396 - val\_loss: 0.5324

Epoch 571/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7668 - loss: 0.4932 - val\_accuracy: 0.7396 - val\_loss: 0.5323

Epoch 572/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7456 - loss: 0.5067 - val\_accuracy: 0.7396 - val\_loss: 0.5322

Epoch 573/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7635 - loss: 0.4924 - val\_accuracy: 0.7396 - val\_loss: 0.5321

Epoch 574/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7394 - loss: 0.5166 - val\_accuracy: 0.7396 - val\_loss: 0.5320

Epoch 575/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7759 - loss: 0.4931 - val\_accuracy: 0.7448 - val\_loss: 0.5319

Epoch 576/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7381 - loss: 0.5256 - val\_accuracy: 0.7448 - val\_loss: 0.5318

Epoch 577/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7417 - loss: 0.5187 - val\_accuracy: 0.7448 - val\_loss: 0.5317

Epoch 578/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7453 - loss: 0.5190 - val\_accuracy: 0.7448 - val\_loss: 0.5316

Epoch 579/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7439 - loss: 0.5065 - val\_accuracy: 0.7448 - val\_loss: 0.5315

Epoch 580/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7557 - loss: 0.5005 - val\_accuracy: 0.7448 - val\_loss: 0.5314

Epoch 581/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7566 - loss: 0.5041 - val\_accuracy: 0.7448 - val\_loss: 0.5313

Epoch 582/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7638 - loss: 0.4828 - val\_accuracy: 0.7448 - val\_loss: 0.5312


Epoch 583/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7734 - loss: 0.4987 - val\_accuracy: 0.7448 - val\_loss: 0.5311


Epoch 584/1000


18/18 ————— 0s 8ms/step - accuracy: 0.7567 - loss: 0.4981 - val\_accuracy: 0.7448 - val\_loss: 0.5310  
Epoch 585/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7715 - loss: 0.5015 - val\_accuracy: 0.7448 - val\_loss: 0.5309  
Epoch 586/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7848 - loss: 0.4807 - val\_accuracy: 0.7448 - val\_loss: 0.5308  
Epoch 587/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7449 - loss: 0.5205 - val\_accuracy: 0.7448 - val\_loss: 0.5307  
Epoch 588/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7604 - loss: 0.4804 - val\_accuracy: 0.7448 - val\_loss: 0.5306  
Epoch 589/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6954 - loss: 0.5360 - val\_accuracy: 0.7448 - val\_loss: 0.5305  
Epoch 590/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.6982 - loss: 0.5316 - val\_accuracy: 0.7448 - val\_loss: 0.5304  
Epoch 591/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7397 - loss: 0.5096 - val\_accuracy: 0.7448 - val\_loss: 0.5303  
Epoch 592/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7611 - loss: 0.4945 - val\_accuracy: 0.7500 - val\_loss: 0.5302  
Epoch 593/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7452 - loss: 0.5117 - val\_accuracy: 0.7500 - val\_loss: 0.5301  
Epoch 594/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7321 - loss: 0.5300 - val\_accuracy: 0.7500 - val\_loss: 0.5301  
Epoch 595/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7520 - loss: 0.4994 - val\_accuracy: 0.7500 - val\_loss: 0.5300  
Epoch 596/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7393 - loss: 0.5044 - val\_accuracy: 0.7500 - val\_loss: 0.5299  
Epoch 597/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7487 - loss: 0.5072 - val\_accuracy: 0.7604 - val\_loss: 0.5298  
Epoch 598/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7424 - loss: 0.5184 - val\_accuracy: 0.7604 - val\_loss: 0.5297  
Epoch 599/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7582 - loss: 0.5109 - val\_accuracy: 0.7604 - val\_loss: 0.5296  
Epoch 600/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7536 - loss: 0.5140 - val\_accuracy: 0.7604 - val\_loss: 0.5296  
Epoch 601/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7545 - loss: 0.4774 - val\_accuracy: 0.7604 - val\_loss: 0.5295  
Epoch 602/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7689 - loss: 0.4920 - val\_accuracy: 0.7552 - val\_loss: 0.5294  
Epoch 603/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7514 - loss: 0.5078 - val\_accuracy: 0.7552 - val\_loss: 0.5293  
Epoch 604/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7460 - loss: 0.5141 - val\_accuracy: 0.7552 - val\_loss: 0.5292  
Epoch 605/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7581 - loss: 0.4859 - val\_accuracy: 0.7552 - val\_loss: 0.5291  
Epoch 606/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7666 - loss: 0.4899 - val\_accuracy: 0.7552 - val\_loss: 0.5291  
Epoch 607/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7563 - loss: 0.5001 - val\_accuracy: 0.7552 - val\_loss:





0.5290  
Epoch 608/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7367 - loss: 0.5149 - val\_accuracy: 0.7604 - val\_loss: 0.5289  
Epoch 609/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7561 - loss: 0.5033 - val\_accuracy: 0.7604 - val\_loss: 0.5288  
Epoch 610/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7712 - loss: 0.4925 - val\_accuracy: 0.7604 - val\_loss: 0.5287  
Epoch 611/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7706 - loss: 0.4860 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 612/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7553 - loss: 0.5113 - val\_accuracy: 0.7656 - val\_loss: 0.5286  
Epoch 613/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7461 - loss: 0.5079 - val\_accuracy: 0.7656 - val\_loss: 0.5285  
Epoch 614/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7306 - loss: 0.5279 - val\_accuracy: 0.7656 - val\_loss: 0.5285  
Epoch 615/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7595 - loss: 0.4913 - val\_accuracy: 0.7656 - val\_loss: 0.5284  
Epoch 616/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7519 - loss: 0.4925 - val\_accuracy: 0.7656 - val\_loss: 0.5283  
Epoch 617/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7909 - loss: 0.4794 - val\_accuracy: 0.7656 - val\_loss: 0.5283  
Epoch 618/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7480 - loss: 0.5020 - val\_accuracy: 0.7708 - val\_loss: 0.5282  
Epoch 619/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7474 - loss: 0.5136 - val\_accuracy: 0.7708 - val\_loss: 0.5281  
Epoch 620/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7707 - loss: 0.4966 - val\_accuracy: 0.7708 - val\_loss: 0.5281  
Epoch 621/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7455 - loss: 0.4910 - val\_accuracy: 0.7708 - val\_loss: 0.5280  
Epoch 622/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7599 - loss: 0.5080 - val\_accuracy: 0.7708 - val\_loss: 0.5279  
Epoch 623/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7504 - loss: 0.5102 - val\_accuracy: 0.7656 - val\_loss: 0.5279  
Epoch 624/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7578 - loss: 0.5151 - val\_accuracy: 0.7656 - val\_loss: 0.5278  
Epoch 625/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7525 - loss: 0.5025 - val\_accuracy: 0.7656 - val\_loss: 0.5278  
Epoch 626/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7608 - loss: 0.4940 - val\_accuracy: 0.7656 - val\_loss: 0.5277  
Epoch 627/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7558 - loss: 0.5191 - val\_accuracy: 0.7604 - val\_loss: 0.5276  
Epoch 628/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7399 - loss: 0.5125 - val\_accuracy: 0.7604 - val\_loss: 0.5276  
Epoch 629/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7717 - loss: 0.4694 - val\_accuracy: 0.7604 - val\_loss: 0.5275  
Epoch 630/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7531 - loss: 0.5053 - val\_accuracy: 0.7604 - val\_loss: 0.5275


Epoch 631/1000  
18/18  0s 12ms/step - accuracy: 0.7598 - loss: 0.5261 - val\_accuracy: 0.7604 - val\_loss: 0.5274


Epoch 632/1000  
18/18  0s 9ms/step - accuracy: 0.7852 - loss: 0.4710 - val\_accuracy: 0.7604 - val\_loss: 0.5274


Epoch 633/1000  
18/18  0s 12ms/step - accuracy: 0.7854 - loss: 0.4866 - val\_accuracy: 0.7604 - val\_loss: 0.5273


Epoch 634/1000  
18/18  0s 12ms/step - accuracy: 0.7645 - loss: 0.4906 - val\_accuracy: 0.7604 - val\_loss: 0.5273


Epoch 635/1000  
18/18  0s 11ms/step - accuracy: 0.7628 - loss: 0.4976 - val\_accuracy: 0.7604 - val\_loss: 0.5272


Epoch 636/1000  
18/18  0s 12ms/step - accuracy: 0.7320 - loss: 0.5193 - val\_accuracy: 0.7604 - val\_loss: 0.5272


Epoch 637/1000  
18/18  0s 11ms/step - accuracy: 0.7632 - loss: 0.4827 - val\_accuracy: 0.7604 - val\_loss: 0.5271


Epoch 638/1000  
18/18  0s 12ms/step - accuracy: 0.7940 - loss: 0.4748 - val\_accuracy: 0.7604 - val\_loss: 0.5271


Epoch 639/1000  
18/18  0s 10ms/step - accuracy: 0.7613 - loss: 0.4959 - val\_accuracy: 0.7604 - val\_loss: 0.5270


Epoch 640/1000  
18/18  0s 6ms/step - accuracy: 0.7505 - loss: 0.5194 - val\_accuracy: 0.7604 - val\_loss: 0.5270


Epoch 641/1000  
18/18  0s 6ms/step - accuracy: 0.7483 - loss: 0.5001 - val\_accuracy: 0.7604 - val\_loss: 0.5269


Epoch 642/1000  
18/18  0s 6ms/step - accuracy: 0.7640 - loss: 0.4963 - val\_accuracy: 0.7604 - val\_loss: 0.5269


Epoch 643/1000  
18/18  0s 6ms/step - accuracy: 0.7789 - loss: 0.4856 - val\_accuracy: 0.7604 - val\_loss: 0.5269


Epoch 644/1000  
18/18  0s 7ms/step - accuracy: 0.7572 - loss: 0.5073 - val\_accuracy: 0.7604 - val\_loss: 0.5268


Epoch 645/1000  
18/18  0s 6ms/step - accuracy: 0.7739 - loss: 0.4784 - val\_accuracy: 0.7656 - val\_loss: 0.5268


Epoch 646/1000  
18/18  0s 6ms/step - accuracy: 0.7656 - loss: 0.4821 - val\_accuracy: 0.7656 - val\_loss: 0.5267


Epoch 647/1000  
18/18  0s 8ms/step - accuracy: 0.7752 - loss: 0.4924 - val\_accuracy: 0.7656 - val\_loss: 0.5267


Epoch 648/1000  
18/18  0s 7ms/step - accuracy: 0.7714 - loss: 0.4999 - val\_accuracy: 0.7656 - val\_loss: 0.5266

Epoch 649/1000  
18/18  0s 6ms/step - accuracy: 0.7355 - loss: 0.5026 - val\_accuracy: 0.7656 - val\_loss: 0.5266

Epoch 650/1000  
18/18  0s 6ms/step - accuracy: 0.7640 - loss: 0.5102 - val\_accuracy: 0.7656 - val\_loss: 0.5266

Epoch 651/1000  
18/18  0s 6ms/step - accuracy: 0.7845 - loss: 0.4602 - val\_accuracy: 0.7656 - val\_loss: 0.5265

Epoch 652/1000  
18/18  0s 8ms/step - accuracy: 0.7467 - loss: 0.5021 - val\_accuracy: 0.7656 - val\_loss: 0.5265

Epoch 653/1000  
18/18  0s 6ms/step - accuracy: 0.7492 - loss: 0.5050 - val\_accuracy: 0.7656 - val\_loss: 0.5265

Epoch 654/1000

18/18 ————— 0s 6ms/step - accuracy: 0.7572 - loss: 0.5076 - val\_accuracy: 0.7656 - val\_loss: 0.5264  
Epoch 655/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7510 - loss: 0.5190 - val\_accuracy: 0.7656 - val\_loss: 0.5264  
Epoch 656/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7314 - loss: 0.5105 - val\_accuracy: 0.7656 - val\_loss: 0.5264  
Epoch 657/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7599 - loss: 0.4868 - val\_accuracy: 0.7656 - val\_loss: 0.5264  
Epoch 658/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7493 - loss: 0.5018 - val\_accuracy: 0.7656 - val\_loss: 0.5263  
Epoch 659/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7572 - loss: 0.4925 - val\_accuracy: 0.7656 - val\_loss: 0.5263  
Epoch 660/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7315 - loss: 0.5323 - val\_accuracy: 0.7604 - val\_loss: 0.5263  
Epoch 661/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7372 - loss: 0.5052 - val\_accuracy: 0.7604 - val\_loss: 0.5262  
Epoch 662/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7438 - loss: 0.5088 - val\_accuracy: 0.7604 - val\_loss: 0.5262  
Epoch 663/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7214 - loss: 0.5265 - val\_accuracy: 0.7604 - val\_loss: 0.5262  
Epoch 664/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7635 - loss: 0.4822 - val\_accuracy: 0.7604 - val\_loss: 0.5262  
Epoch 665/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7310 - loss: 0.5162 - val\_accuracy: 0.7604 - val\_loss: 0.5261  
Epoch 666/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7224 - loss: 0.5187 - val\_accuracy: 0.7604 - val\_loss: 0.5261  
Epoch 667/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7591 - loss: 0.4837 - val\_accuracy: 0.7604 - val\_loss: 0.5261  
Epoch 668/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7355 - loss: 0.5191 - val\_accuracy: 0.7604 - val\_loss: 0.5260  
Epoch 669/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7671 - loss: 0.5012 - val\_accuracy: 0.7604 - val\_loss: 0.5260  
Epoch 670/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7343 - loss: 0.5277 - val\_accuracy: 0.7604 - val\_loss: 0.5260  
Epoch 671/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7703 - loss: 0.4927 - val\_accuracy: 0.7604 - val\_loss: 0.5260  
Epoch 672/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7760 - loss: 0.4735 - val\_accuracy: 0.7552 - val\_loss: 0.5260  
Epoch 673/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7747 - loss: 0.4739 - val\_accuracy: 0.7552 - val\_loss: 0.5259  
Epoch 674/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7543 - loss: 0.4898 - val\_accuracy: 0.7552 - val\_loss: 0.5259  
Epoch 675/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7554 - loss: 0.4853 - val\_accuracy: 0.7552 - val\_loss: 0.5259  
Epoch 676/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7681 - loss: 0.4968 - val\_accuracy: 0.7552 - val\_loss: 0.5259  
Epoch 677/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7779 - loss: 0.4780 - val\_accuracy: 0.7552 - val\_loss:

0.5258  
Epoch 678/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7407 - loss: 0.4964 - val\_accuracy: 0.7552 - val\_loss: 0.5258  
Epoch 679/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7545 - loss: 0.4959 - val\_accuracy: 0.7552 - val\_loss: 0.5258  
Epoch 680/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7451 - loss: 0.4829 - val\_accuracy: 0.7500 - val\_loss: 0.5258  
Epoch 681/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7689 - loss: 0.4889 - val\_accuracy: 0.7500 - val\_loss: 0.5258  
Epoch 682/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7702 - loss: 0.4694 - val\_accuracy: 0.7500 - val\_loss: 0.5257  
Epoch 683/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7348 - loss: 0.5043 - val\_accuracy: 0.7500 - val\_loss: 0.5257  
Epoch 684/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7761 - loss: 0.4913 - val\_accuracy: 0.7500 - val\_loss: 0.5257  
Epoch 685/1000  
18/18 ————— 0s 13ms/step - accuracy: 0.7612 - loss: 0.4892 - val\_accuracy: 0.7500 - val\_loss: 0.5257  
Epoch 686/1000  
18/18 ————— 0s 13ms/step - accuracy: 0.7385 - loss: 0.4972 - val\_accuracy: 0.7500 - val\_loss: 0.5257  
Epoch 687/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7629 - loss: 0.4941 - val\_accuracy: 0.7500 - val\_loss: 0.5257  
Epoch 688/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7582 - loss: 0.5150 - val\_accuracy: 0.7500 - val\_loss: 0.5256  
Epoch 689/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7492 - loss: 0.4959 - val\_accuracy: 0.7500 - val\_loss: 0.5256  
Epoch 690/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7900 - loss: 0.4754 - val\_accuracy: 0.7500 - val\_loss: 0.5256  
Epoch 691/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7388 - loss: 0.5229 - val\_accuracy: 0.7500 - val\_loss: 0.5256  
Epoch 692/1000  
18/18 ————— 0s 13ms/step - accuracy: 0.7767 - loss: 0.4727 - val\_accuracy: 0.7500 - val\_loss: 0.5256  
Epoch 693/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7398 - loss: 0.5114 - val\_accuracy: 0.7500 - val\_loss: 0.5256  
Epoch 694/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7852 - loss: 0.4834 - val\_accuracy: 0.7500 - val\_loss: 0.5256  
Epoch 695/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7401 - loss: 0.5096 - val\_accuracy: 0.7500 - val\_loss: 0.5256  
Epoch 696/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7822 - loss: 0.4691 - val\_accuracy: 0.7500 - val\_loss: 0.5257  
Epoch 697/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7475 - loss: 0.5038 - val\_accuracy: 0.7500 - val\_loss: 0.5257  
Epoch 698/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7540 - loss: 0.4867 - val\_accuracy: 0.7500 - val\_loss: 0.5257  
Epoch 699/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7583 - loss: 0.4924 - val\_accuracy: 0.7500 - val\_loss: 0.5257  
Epoch 700/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7574 - loss: 0.5010 - val\_accuracy: 0.7500 - val\_loss: 0.5257

Epoch 701/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7675 - loss: 0.4734 - val\_accuracy: 0.7500 - val\_loss: 0.5257  
Epoch 702/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7624 - loss: 0.4667 - val\_accuracy: 0.7500 - val\_loss: 0.5257  
Epoch 703/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7607 - loss: 0.4702 - val\_accuracy: 0.7500 - val\_loss: 0.5257  
Epoch 704/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7777 - loss: 0.4927 - val\_accuracy: 0.7500 - val\_loss: 0.5257  
Epoch 705/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7738 - loss: 0.4795 - val\_accuracy: 0.7500 - val\_loss: 0.5257  
Epoch 706/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7678 - loss: 0.4535 - val\_accuracy: 0.7500 - val\_loss: 0.5257  
Epoch 707/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7793 - loss: 0.4604 - val\_accuracy: 0.7552 - val\_loss: 0.5257  
Epoch 708/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7490 - loss: 0.4937 - val\_accuracy: 0.7552 - val\_loss: 0.5257  
Epoch 709/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7640 - loss: 0.4561 - val\_accuracy: 0.7604 - val\_loss: 0.5257  
Epoch 710/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7734 - loss: 0.4596 - val\_accuracy: 0.7604 - val\_loss: 0.5257  
Epoch 711/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7539 - loss: 0.4877 - val\_accuracy: 0.7604 - val\_loss: 0.5257  
Epoch 712/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7192 - loss: 0.5019 - val\_accuracy: 0.7604 - val\_loss: 0.5257  
Epoch 713/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7538 - loss: 0.4976 - val\_accuracy: 0.7604 - val\_loss: 0.5258  
Epoch 714/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7668 - loss: 0.4844 - val\_accuracy: 0.7604 - val\_loss: 0.5258  
Epoch 715/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7975 - loss: 0.4665 - val\_accuracy: 0.7604 - val\_loss: 0.5258  
Epoch 716/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7634 - loss: 0.4961 - val\_accuracy: 0.7604 - val\_loss: 0.5258  
Epoch 717/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7802 - loss: 0.4691 - val\_accuracy: 0.7604 - val\_loss: 0.5258  
Epoch 718/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7374 - loss: 0.5060 - val\_accuracy: 0.7604 - val\_loss: 0.5258  
Epoch 719/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7393 - loss: 0.5016 - val\_accuracy: 0.7604 - val\_loss: 0.5258  
Epoch 720/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7606 - loss: 0.4867 - val\_accuracy: 0.7604 - val\_loss: 0.5258  
Epoch 721/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7568 - loss: 0.4781 - val\_accuracy: 0.7604 - val\_loss: 0.5258  
Epoch 722/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7612 - loss: 0.4830 - val\_accuracy: 0.7604 - val\_loss: 0.5258  
Epoch 723/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7492 - loss: 0.4822 - val\_accuracy: 0.7604 - val\_loss: 0.5259  
Epoch 724/1000

18/18 ————— 0s 6ms/step - accuracy: 0.7531 - loss: 0.5001 - val\_accuracy: 0.7604 - val\_loss: 0.5259  
Epoch 725/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7760 - loss: 0.4596 - val\_accuracy: 0.7604 - val\_loss: 0.5259  
Epoch 726/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7375 - loss: 0.5107 - val\_accuracy: 0.7604 - val\_loss: 0.5259  
Epoch 727/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7563 - loss: 0.4965 - val\_accuracy: 0.7604 - val\_loss: 0.5259  
Epoch 728/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7388 - loss: 0.5119 - val\_accuracy: 0.7604 - val\_loss: 0.5259  
Epoch 729/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7517 - loss: 0.5021 - val\_accuracy: 0.7604 - val\_loss: 0.5259  
Epoch 730/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7778 - loss: 0.4825 - val\_accuracy: 0.7604 - val\_loss: 0.5259  
Epoch 731/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7589 - loss: 0.4932 - val\_accuracy: 0.7604 - val\_loss: 0.5260  
Epoch 732/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7698 - loss: 0.4780 - val\_accuracy: 0.7604 - val\_loss: 0.5260  
Epoch 733/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7671 - loss: 0.4717 - val\_accuracy: 0.7604 - val\_loss: 0.5260  
Epoch 734/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7723 - loss: 0.4806 - val\_accuracy: 0.7604 - val\_loss: 0.5260  
Epoch 735/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7487 - loss: 0.4936 - val\_accuracy: 0.7604 - val\_loss: 0.5260  
Epoch 736/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7542 - loss: 0.4844 - val\_accuracy: 0.7604 - val\_loss: 0.5260  
Epoch 737/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7736 - loss: 0.4823 - val\_accuracy: 0.7604 - val\_loss: 0.5260  
Epoch 738/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7543 - loss: 0.5040 - val\_accuracy: 0.7604 - val\_loss: 0.5261  
Epoch 739/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7555 - loss: 0.4851 - val\_accuracy: 0.7604 - val\_loss: 0.5261  
Epoch 740/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7826 - loss: 0.4697 - val\_accuracy: 0.7604 - val\_loss: 0.5261  
Epoch 741/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7821 - loss: 0.4804 - val\_accuracy: 0.7604 - val\_loss: 0.5261  
Epoch 742/1000  
18/18 ————— 0s 13ms/step - accuracy: 0.7964 - loss: 0.4629 - val\_accuracy: 0.7604 - val\_loss: 0.5261  
Epoch 743/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7792 - loss: 0.4452 - val\_accuracy: 0.7604 - val\_loss: 0.5261  
Epoch 744/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7813 - loss: 0.4651 - val\_accuracy: 0.7604 - val\_loss: 0.5261  
Epoch 745/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7688 - loss: 0.4676 - val\_accuracy: 0.7604 - val\_loss: 0.5262  
Epoch 746/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7725 - loss: 0.4759 - val\_accuracy: 0.7604 - val\_loss: 0.5262  
Epoch 747/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7654 - loss: 0.4744 - val\_accuracy: 0.7604 - val\_loss: 0.5262

0.5262  
Epoch 748/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7663 - loss: 0.4971 - val\_accuracy: 0.7604 - val\_loss: 0.5262  
Epoch 749/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7865 - loss: 0.4586 - val\_accuracy: 0.7656 - val\_loss: 0.5262  
Epoch 750/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7345 - loss: 0.5150 - val\_accuracy: 0.7656 - val\_loss: 0.5263  
Epoch 751/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7842 - loss: 0.4629 - val\_accuracy: 0.7656 - val\_loss: 0.5263  
Epoch 752/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7491 - loss: 0.4960 - val\_accuracy: 0.7656 - val\_loss: 0.5263  
Epoch 753/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7349 - loss: 0.4907 - val\_accuracy: 0.7656 - val\_loss: 0.5263  
Epoch 754/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7554 - loss: 0.4862 - val\_accuracy: 0.7656 - val\_loss: 0.5263  
Epoch 755/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7545 - loss: 0.4898 - val\_accuracy: 0.7656 - val\_loss: 0.5264  
Epoch 756/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7509 - loss: 0.4917 - val\_accuracy: 0.7656 - val\_loss: 0.5264  
Epoch 757/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7541 - loss: 0.4872 - val\_accuracy: 0.7656 - val\_loss: 0.5264  
Epoch 758/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7659 - loss: 0.4861 - val\_accuracy: 0.7656 - val\_loss: 0.5264  
Epoch 759/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7978 - loss: 0.4470 - val\_accuracy: 0.7656 - val\_loss: 0.5264  
Epoch 760/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7350 - loss: 0.5017 - val\_accuracy: 0.7656 - val\_loss: 0.5265  
Epoch 761/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7537 - loss: 0.4918 - val\_accuracy: 0.7656 - val\_loss: 0.5265  
Epoch 762/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7817 - loss: 0.4559 - val\_accuracy: 0.7656 - val\_loss: 0.5265  
Epoch 763/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7810 - loss: 0.4732 - val\_accuracy: 0.7656 - val\_loss: 0.5265  
Epoch 764/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7731 - loss: 0.4812 - val\_accuracy: 0.7656 - val\_loss: 0.5265  
Epoch 765/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7735 - loss: 0.4680 - val\_accuracy: 0.7656 - val\_loss: 0.5266  
Epoch 766/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7786 - loss: 0.4858 - val\_accuracy: 0.7656 - val\_loss: 0.5266  
Epoch 767/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7766 - loss: 0.4917 - val\_accuracy: 0.7656 - val\_loss: 0.5266  
Epoch 768/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7604 - loss: 0.4933 - val\_accuracy: 0.7656 - val\_loss: 0.5266  
Epoch 769/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7885 - loss: 0.4583 - val\_accuracy: 0.7656 - val\_loss: 0.5267  
Epoch 770/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7247 - loss: 0.5128 - val\_accuracy: 0.7656 - val\_loss: 0.5267

Epoch 771/1000  
18/18 — 0s 6ms/step - accuracy: 0.7626 - loss: 0.4883 - val\_accuracy: 0.7656 - val\_loss: 0.5267  
Epoch 772/1000  
18/18 — 0s 6ms/step - accuracy: 0.7481 - loss: 0.4919 - val\_accuracy: 0.7656 - val\_loss: 0.5268  
Epoch 773/1000  
18/18 — 0s 8ms/step - accuracy: 0.7689 - loss: 0.4847 - val\_accuracy: 0.7656 - val\_loss: 0.5268  
Epoch 774/1000  
18/18 — 0s 6ms/step - accuracy: 0.7587 - loss: 0.4864 - val\_accuracy: 0.7656 - val\_loss: 0.5268  
Epoch 775/1000  
18/18 — 0s 6ms/step - accuracy: 0.7711 - loss: 0.4770 - val\_accuracy: 0.7656 - val\_loss: 0.5268  
Epoch 776/1000  
18/18 — 0s 7ms/step - accuracy: 0.7679 - loss: 0.4741 - val\_accuracy: 0.7656 - val\_loss: 0.5269  
Epoch 777/1000  
18/18 — 0s 8ms/step - accuracy: 0.7743 - loss: 0.4754 - val\_accuracy: 0.7656 - val\_loss: 0.5269  
Epoch 778/1000  
18/18 — 0s 6ms/step - accuracy: 0.7806 - loss: 0.4847 - val\_accuracy: 0.7656 - val\_loss: 0.5269  
Epoch 779/1000  
18/18 — 0s 7ms/step - accuracy: 0.7640 - loss: 0.4767 - val\_accuracy: 0.7656 - val\_loss: 0.5269  
Epoch 780/1000  
18/18 — 0s 7ms/step - accuracy: 0.7709 - loss: 0.4779 - val\_accuracy: 0.7656 - val\_loss: 0.5270  
Epoch 781/1000  
18/18 — 0s 6ms/step - accuracy: 0.7558 - loss: 0.4926 - val\_accuracy: 0.7656 - val\_loss: 0.5270  
Epoch 782/1000  
18/18 — 0s 6ms/step - accuracy: 0.7601 - loss: 0.4995 - val\_accuracy: 0.7656 - val\_loss: 0.5270  
Epoch 783/1000  
18/18 — 0s 7ms/step - accuracy: 0.7760 - loss: 0.4706 - val\_accuracy: 0.7656 - val\_loss: 0.5270  
Epoch 784/1000  
18/18 — 0s 11ms/step - accuracy: 0.7448 - loss: 0.4994 - val\_accuracy: 0.7656 - val\_loss: 0.5271  
Epoch 785/1000  
18/18 — 0s 13ms/step - accuracy: 0.7743 - loss: 0.4724 - val\_accuracy: 0.7656 - val\_loss: 0.5271  
Epoch 786/1000  
18/18 — 0s 12ms/step - accuracy: 0.7668 - loss: 0.4831 - val\_accuracy: 0.7656 - val\_loss: 0.5271  
Epoch 787/1000  
18/18 — 0s 8ms/step - accuracy: 0.7852 - loss: 0.4647 - val\_accuracy: 0.7656 - val\_loss: 0.5272  
Epoch 788/1000  
18/18 — 0s 11ms/step - accuracy: 0.7349 - loss: 0.5146 - val\_accuracy: 0.7656 - val\_loss: 0.5272  
Epoch 789/1000  
18/18 — 0s 9ms/step - accuracy: 0.8110 - loss: 0.4513 - val\_accuracy: 0.7656 - val\_loss: 0.5272  
Epoch 790/1000  
18/18 — 0s 12ms/step - accuracy: 0.7613 - loss: 0.4889 - val\_accuracy: 0.7656 - val\_loss: 0.5272  
Epoch 791/1000  
18/18 — 0s 13ms/step - accuracy: 0.7793 - loss: 0.4778 - val\_accuracy: 0.7656 - val\_loss: 0.5272  
Epoch 792/1000  
18/18 — 0s 11ms/step - accuracy: 0.7844 - loss: 0.4535 - val\_accuracy: 0.7656 - val\_loss: 0.5273  
Epoch 793/1000  
18/18 — 0s 13ms/step - accuracy: 0.7934 - loss: 0.4489 - val\_accuracy: 0.7656 - val\_loss: 0.5273  
Epoch 794/1000



18/18 ————— 0s 14ms/step - accuracy: 0.7593 - loss: 0.4893 - val\_accuracy: 0.7656 - val\_loss: 0.5273  
Epoch 795/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7712 - loss: 0.4861 - val\_accuracy: 0.7656 - val\_loss: 0.5273  
Epoch 796/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7327 - loss: 0.5013 - val\_accuracy: 0.7656 - val\_loss: 0.5273  
Epoch 797/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7807 - loss: 0.4668 - val\_accuracy: 0.7656 - val\_loss: 0.5273  
Epoch 798/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7978 - loss: 0.4747 - val\_accuracy: 0.7656 - val\_loss: 0.5273  
Epoch 799/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7461 - loss: 0.5040 - val\_accuracy: 0.7656 - val\_loss: 0.5274  
Epoch 800/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7734 - loss: 0.4734 - val\_accuracy: 0.7656 - val\_loss: 0.5274  
Epoch 801/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7859 - loss: 0.4609 - val\_accuracy: 0.7656 - val\_loss: 0.5274  
Epoch 802/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7620 - loss: 0.4764 - val\_accuracy: 0.7656 - val\_loss: 0.5274  
Epoch 803/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7719 - loss: 0.4769 - val\_accuracy: 0.7656 - val\_loss: 0.5274  
Epoch 804/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7745 - loss: 0.4723 - val\_accuracy: 0.7656 - val\_loss: 0.5274  
Epoch 805/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7795 - loss: 0.4699 - val\_accuracy: 0.7656 - val\_loss: 0.5275  
Epoch 806/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7569 - loss: 0.4870 - val\_accuracy: 0.7656 - val\_loss: 0.5275  
Epoch 807/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7385 - loss: 0.5165 - val\_accuracy: 0.7656 - val\_loss: 0.5275  
Epoch 808/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7515 - loss: 0.4887 - val\_accuracy: 0.7656 - val\_loss: 0.5275  
Epoch 809/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7764 - loss: 0.4727 - val\_accuracy: 0.7656 - val\_loss: 0.5275  
Epoch 810/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7667 - loss: 0.4838 - val\_accuracy: 0.7656 - val\_loss: 0.5275  
Epoch 811/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7741 - loss: 0.4840 - val\_accuracy: 0.7656 - val\_loss: 0.5275  
Epoch 812/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7675 - loss: 0.4781 - val\_accuracy: 0.7656 - val\_loss: 0.5276  
Epoch 813/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7657 - loss: 0.4785 - val\_accuracy: 0.7656 - val\_loss: 0.5276  
Epoch 814/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7984 - loss: 0.4496 - val\_accuracy: 0.7656 - val\_loss: 0.5276  
Epoch 815/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7670 - loss: 0.4787 - val\_accuracy: 0.7656 - val\_loss: 0.5276  
Epoch 816/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7581 - loss: 0.4761 - val\_accuracy: 0.7656 - val\_loss: 0.5276  
Epoch 817/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7817 - loss: 0.4537 - val\_accuracy: 0.7656 - val\_loss: 0.5276

0.5276  
Epoch 818/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7777 - loss: 0.4638 - val\_accuracy: 0.7656 - val\_loss: 0.5277  
Epoch 819/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7639 - loss: 0.4909 - val\_accuracy: 0.7656 - val\_loss: 0.5277  
Epoch 820/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7606 - loss: 0.4852 - val\_accuracy: 0.7656 - val\_loss: 0.5277  
Epoch 821/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7391 - loss: 0.5077 - val\_accuracy: 0.7656 - val\_loss: 0.5277  
Epoch 822/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7832 - loss: 0.4730 - val\_accuracy: 0.7656 - val\_loss: 0.5277  
Epoch 823/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7986 - loss: 0.4580 - val\_accuracy: 0.7708 - val\_loss: 0.5277  
Epoch 824/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7573 - loss: 0.4777 - val\_accuracy: 0.7708 - val\_loss: 0.5278  
Epoch 825/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7904 - loss: 0.4800 - val\_accuracy: 0.7708 - val\_loss: 0.5278  
Epoch 826/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7790 - loss: 0.4698 - val\_accuracy: 0.7708 - val\_loss: 0.5278  
Epoch 827/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7786 - loss: 0.4822 - val\_accuracy: 0.7708 - val\_loss: 0.5278  
Epoch 828/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7642 - loss: 0.4957 - val\_accuracy: 0.7708 - val\_loss: 0.5278  
Epoch 829/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7976 - loss: 0.4453 - val\_accuracy: 0.7708 - val\_loss: 0.5278  
Epoch 830/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7794 - loss: 0.4760 - val\_accuracy: 0.7708 - val\_loss: 0.5279  
Epoch 831/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7723 - loss: 0.4898 - val\_accuracy: 0.7708 - val\_loss: 0.5279  
Epoch 832/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7808 - loss: 0.4690 - val\_accuracy: 0.7708 - val\_loss: 0.5279  
Epoch 833/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7762 - loss: 0.4946 - val\_accuracy: 0.7708 - val\_loss: 0.5279  
Epoch 834/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7957 - loss: 0.4666 - val\_accuracy: 0.7708 - val\_loss: 0.5279  
Epoch 835/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7718 - loss: 0.4859 - val\_accuracy: 0.7708 - val\_loss: 0.5279  
Epoch 836/1000  
18/18 ————— 0s 18ms/step - accuracy: 0.7748 - loss: 0.4946 - val\_accuracy: 0.7708 - val\_loss: 0.5279  
Epoch 837/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7745 - loss: 0.4978 - val\_accuracy: 0.7708 - val\_loss: 0.5280  
Epoch 838/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7883 - loss: 0.4667 - val\_accuracy: 0.7708 - val\_loss: 0.5280  
Epoch 839/1000  
18/18 ————— 0s 16ms/step - accuracy: 0.7805 - loss: 0.4793 - val\_accuracy: 0.7708 - val\_loss: 0.5280  
Epoch 840/1000  
18/18 ————— 1s 13ms/step - accuracy: 0.7613 - loss: 0.4877 - val\_accuracy: 0.7708 - val\_loss: 0.5280

Epoch 841/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7839 - loss: 0.4626 - val\_accuracy: 0.7708 - val\_loss: 0.5280

Epoch 842/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7518 - loss: 0.5045 - val\_accuracy: 0.7708 - val\_loss: 0.5280

Epoch 843/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7728 - loss: 0.4785 - val\_accuracy: 0.7708 - val\_loss: 0.5280

Epoch 844/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7529 - loss: 0.5049 - val\_accuracy: 0.7708 - val\_loss: 0.5281

Epoch 845/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7648 - loss: 0.4754 - val\_accuracy: 0.7708 - val\_loss: 0.5281

Epoch 846/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7696 - loss: 0.4631 - val\_accuracy: 0.7708 - val\_loss: 0.5281

Epoch 847/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7747 - loss: 0.4854 - val\_accuracy: 0.7708 - val\_loss: 0.5281

Epoch 848/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7707 - loss: 0.4830 - val\_accuracy: 0.7708 - val\_loss: 0.5281

Epoch 849/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7575 - loss: 0.4920 - val\_accuracy: 0.7708 - val\_loss: 0.5281

Epoch 850/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7688 - loss: 0.4924 - val\_accuracy: 0.7708 - val\_loss: 0.5281

Epoch 851/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7752 - loss: 0.4888 - val\_accuracy: 0.7708 - val\_loss: 0.5281

Epoch 852/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7817 - loss: 0.4812 - val\_accuracy: 0.7708 - val\_loss: 0.5282

Epoch 853/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7597 - loss: 0.4885 - val\_accuracy: 0.7708 - val\_loss: 0.5282

Epoch 854/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.8195 - loss: 0.4338 - val\_accuracy: 0.7708 - val\_loss: 0.5282

Epoch 855/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7672 - loss: 0.4873 - val\_accuracy: 0.7708 - val\_loss: 0.5282

Epoch 856/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7739 - loss: 0.4890 - val\_accuracy: 0.7708 - val\_loss: 0.5282

Epoch 857/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7620 - loss: 0.5077 - val\_accuracy: 0.7708 - val\_loss: 0.5282

Epoch 858/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7753 - loss: 0.4659 - val\_accuracy: 0.7656 - val\_loss: 0.5282

Epoch 859/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7748 - loss: 0.4832 - val\_accuracy: 0.7604 - val\_loss: 0.5282

Epoch 860/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7882 - loss: 0.4413 - val\_accuracy: 0.7604 - val\_loss: 0.5282

Epoch 861/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7886 - loss: 0.4722 - val\_accuracy: 0.7604 - val\_loss: 0.5283

Epoch 862/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7582 - loss: 0.4801 - val\_accuracy: 0.7604 - val\_loss: 0.5283

Epoch 863/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7724 - loss: 0.4751 - val\_accuracy: 0.7604 - val\_loss: 0.5283

Epoch 864/1000

18/18 ————— 0s 6ms/step - accuracy: 0.7843 - loss: 0.4555 - val\_accuracy: 0.7604 - val\_loss: 0.5283  
Epoch 865/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7831 - loss: 0.4671 - val\_accuracy: 0.7604 - val\_loss: 0.5283  
Epoch 866/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7761 - loss: 0.4826 - val\_accuracy: 0.7604 - val\_loss: 0.5283  
Epoch 867/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7702 - loss: 0.4882 - val\_accuracy: 0.7604 - val\_loss: 0.5283  
Epoch 868/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7602 - loss: 0.4961 - val\_accuracy: 0.7604 - val\_loss: 0.5283  
Epoch 869/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7743 - loss: 0.4596 - val\_accuracy: 0.7604 - val\_loss: 0.5283  
Epoch 870/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7673 - loss: 0.4850 - val\_accuracy: 0.7552 - val\_loss: 0.5283  
Epoch 871/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.8017 - loss: 0.4605 - val\_accuracy: 0.7552 - val\_loss: 0.5283  
Epoch 872/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7509 - loss: 0.4914 - val\_accuracy: 0.7552 - val\_loss: 0.5283  
Epoch 873/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7851 - loss: 0.4631 - val\_accuracy: 0.7552 - val\_loss: 0.5284  
Epoch 874/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7766 - loss: 0.4828 - val\_accuracy: 0.7552 - val\_loss: 0.5284  
Epoch 875/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7489 - loss: 0.5146 - val\_accuracy: 0.7552 - val\_loss: 0.5284  
Epoch 876/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7911 - loss: 0.4461 - val\_accuracy: 0.7552 - val\_loss: 0.5284  
Epoch 877/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7766 - loss: 0.4708 - val\_accuracy: 0.7552 - val\_loss: 0.5284  
Epoch 878/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7542 - loss: 0.4971 - val\_accuracy: 0.7552 - val\_loss: 0.5284  
Epoch 879/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7541 - loss: 0.4914 - val\_accuracy: 0.7552 - val\_loss: 0.5284  
Epoch 880/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7670 - loss: 0.4763 - val\_accuracy: 0.7552 - val\_loss: 0.5284  
Epoch 881/1000  
18/18 ————— 0s 13ms/step - accuracy: 0.7857 - loss: 0.4586 - val\_accuracy: 0.7552 - val\_loss: 0.5284  
Epoch 882/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7623 - loss: 0.4868 - val\_accuracy: 0.7552 - val\_loss: 0.5284  
Epoch 883/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7931 - loss: 0.4687 - val\_accuracy: 0.7552 - val\_loss: 0.5284  
Epoch 884/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7615 - loss: 0.4917 - val\_accuracy: 0.7552 - val\_loss: 0.5284  
Epoch 885/1000  
18/18 ————— 0s 14ms/step - accuracy: 0.7804 - loss: 0.4583 - val\_accuracy: 0.7552 - val\_loss: 0.5285  
Epoch 886/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7841 - loss: 0.4585 - val\_accuracy: 0.7552 - val\_loss: 0.5285  
Epoch 887/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7605 - loss: 0.4992 - val\_accuracy: 0.7552 - val\_loss: 0.5285

0.5285  
Epoch 888/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7691 - loss: 0.4862 - val\_accuracy: 0.7552 - val\_loss: 0.5285  
Epoch 889/1000  
18/18 ————— 0s 15ms/step - accuracy: 0.7795 - loss: 0.4660 - val\_accuracy: 0.7552 - val\_loss: 0.5285  
Epoch 890/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7659 - loss: 0.4851 - val\_accuracy: 0.7552 - val\_loss: 0.5285  
Epoch 891/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7918 - loss: 0.4424 - val\_accuracy: 0.7552 - val\_loss: 0.5285  
Epoch 892/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7930 - loss: 0.4642 - val\_accuracy: 0.7552 - val\_loss: 0.5285  
Epoch 893/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7858 - loss: 0.4578 - val\_accuracy: 0.7552 - val\_loss: 0.5285  
Epoch 894/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7715 - loss: 0.4852 - val\_accuracy: 0.7552 - val\_loss: 0.5285  
Epoch 895/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7871 - loss: 0.4712 - val\_accuracy: 0.7552 - val\_loss: 0.5285  
Epoch 896/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7694 - loss: 0.4834 - val\_accuracy: 0.7552 - val\_loss: 0.5285  
Epoch 897/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7770 - loss: 0.4911 - val\_accuracy: 0.7552 - val\_loss: 0.5285  
Epoch 898/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7785 - loss: 0.4661 - val\_accuracy: 0.7552 - val\_loss: 0.5285  
Epoch 899/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7444 - loss: 0.5141 - val\_accuracy: 0.7552 - val\_loss: 0.5286  
Epoch 900/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7651 - loss: 0.4730 - val\_accuracy: 0.7552 - val\_loss: 0.5286  
Epoch 901/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7662 - loss: 0.4896 - val\_accuracy: 0.7552 - val\_loss: 0.5286  
Epoch 902/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7556 - loss: 0.4741 - val\_accuracy: 0.7552 - val\_loss: 0.5286  
Epoch 903/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7994 - loss: 0.4637 - val\_accuracy: 0.7552 - val\_loss: 0.5286  
Epoch 904/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7527 - loss: 0.4932 - val\_accuracy: 0.7552 - val\_loss: 0.5286  
Epoch 905/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7746 - loss: 0.4734 - val\_accuracy: 0.7552 - val\_loss: 0.5286  
Epoch 906/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7582 - loss: 0.4817 - val\_accuracy: 0.7552 - val\_loss: 0.5286  
Epoch 907/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7758 - loss: 0.4791 - val\_accuracy: 0.7552 - val\_loss: 0.5286  
Epoch 908/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7783 - loss: 0.4615 - val\_accuracy: 0.7552 - val\_loss: 0.5286  
Epoch 909/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7715 - loss: 0.4839 - val\_accuracy: 0.7552 - val\_loss: 0.5286  
Epoch 910/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7520 - loss: 0.4824 - val\_accuracy: 0.7552 - val\_loss: 0.5286

Epoch 911/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7871 - loss: 0.4615 - val\_accuracy: 0.7552 - val\_loss: 0.5286

Epoch 912/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7676 - loss: 0.4976 - val\_accuracy: 0.7552 - val\_loss: 0.5286

Epoch 913/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7658 - loss: 0.4775 - val\_accuracy: 0.7552 - val\_loss: 0.5286

Epoch 914/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7612 - loss: 0.5144 - val\_accuracy: 0.7552 - val\_loss: 0.5287

Epoch 915/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7583 - loss: 0.4710 - val\_accuracy: 0.7552 - val\_loss: 0.5287

Epoch 916/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7745 - loss: 0.4672 - val\_accuracy: 0.7552 - val\_loss: 0.5287

Epoch 917/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7543 - loss: 0.4982 - val\_accuracy: 0.7552 - val\_loss: 0.5287

Epoch 918/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7919 - loss: 0.4466 - val\_accuracy: 0.7604 - val\_loss: 0.5287

Epoch 919/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7774 - loss: 0.4861 - val\_accuracy: 0.7604 - val\_loss: 0.5287

Epoch 920/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7493 - loss: 0.4972 - val\_accuracy: 0.7604 - val\_loss: 0.5287

Epoch 921/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7518 - loss: 0.4941 - val\_accuracy: 0.7604 - val\_loss: 0.5287

Epoch 922/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7678 - loss: 0.4754 - val\_accuracy: 0.7604 - val\_loss: 0.5287

Epoch 923/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7739 - loss: 0.4678 - val\_accuracy: 0.7604 - val\_loss: 0.5287

Epoch 924/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7953 - loss: 0.4525 - val\_accuracy: 0.7604 - val\_loss: 0.5287

Epoch 925/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7708 - loss: 0.4679 - val\_accuracy: 0.7604 - val\_loss: 0.5287

Epoch 926/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7492 - loss: 0.4852 - val\_accuracy: 0.7604 - val\_loss: 0.5287

Epoch 927/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7609 - loss: 0.4719 - val\_accuracy: 0.7604 - val\_loss: 0.5287

Epoch 928/1000  
18/18 ————— 0s 13ms/step - accuracy: 0.7491 - loss: 0.5080 - val\_accuracy: 0.7604 - val\_loss: 0.5287

Epoch 929/1000  
18/18 ————— 0s 13ms/step - accuracy: 0.7599 - loss: 0.4811 - val\_accuracy: 0.7604 - val\_loss: 0.5287

Epoch 930/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7620 - loss: 0.4779 - val\_accuracy: 0.7656 - val\_loss: 0.5287

Epoch 931/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7586 - loss: 0.5023 - val\_accuracy: 0.7656 - val\_loss: 0.5287

Epoch 932/1000  
18/18 ————— 0s 11ms/step - accuracy: 0.7576 - loss: 0.4954 - val\_accuracy: 0.7656 - val\_loss: 0.5287

Epoch 933/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7695 - loss: 0.4835 - val\_accuracy: 0.7656 - val\_loss: 0.5287

Epoch 934/1000

18/18 ————— 0s 10ms/step - accuracy: 0.7830 - loss: 0.4538 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 935/1000  
18/18 ————— 0s 13ms/step - accuracy: 0.7641 - loss: 0.4929 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 936/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7706 - loss: 0.4884 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 937/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7636 - loss: 0.4805 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 938/1000  
18/18 ————— 0s 10ms/step - accuracy: 0.7881 - loss: 0.4814 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 939/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7683 - loss: 0.4358 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 940/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7608 - loss: 0.4911 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 941/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7819 - loss: 0.4893 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 942/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7741 - loss: 0.4627 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 943/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7704 - loss: 0.4608 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 944/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7839 - loss: 0.4604 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 945/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7606 - loss: 0.5030 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 946/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7616 - loss: 0.4849 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 947/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7938 - loss: 0.4528 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 948/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7825 - loss: 0.4568 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 949/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7761 - loss: 0.4855 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 950/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7907 - loss: 0.4491 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 951/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7613 - loss: 0.4881 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 952/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7870 - loss: 0.4536 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 953/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7886 - loss: 0.4540 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 954/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7751 - loss: 0.4761 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 955/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7793 - loss: 0.4720 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 956/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.8021 - loss: 0.4393 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 957/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7784 - loss: 0.4852 - val\_accuracy: 0.7656 - val\_loss: 0.5287

0.5287  
Epoch 958/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7657 - loss: 0.4710 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 959/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7612 - loss: 0.4842 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 960/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7674 - loss: 0.4763 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 961/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7594 - loss: 0.4786 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 962/1000  
18/18 ————— 0s 8ms/step - accuracy: 0.7685 - loss: 0.4869 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 963/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7596 - loss: 0.4764 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 964/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7886 - loss: 0.4591 - val\_accuracy: 0.7656 - val\_loss: 0.5287  
Epoch 965/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7729 - loss: 0.4785 - val\_accuracy: 0.7656 - val\_loss: 0.5286  
Epoch 966/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7533 - loss: 0.4780 - val\_accuracy: 0.7656 - val\_loss: 0.5286  
Epoch 967/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7699 - loss: 0.4847 - val\_accuracy: 0.7656 - val\_loss: 0.5286  
Epoch 968/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7529 - loss: 0.4951 - val\_accuracy: 0.7656 - val\_loss: 0.5286  
Epoch 969/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7639 - loss: 0.4703 - val\_accuracy: 0.7656 - val\_loss: 0.5286  
Epoch 970/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7967 - loss: 0.4389 - val\_accuracy: 0.7656 - val\_loss: 0.5286  
Epoch 971/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7613 - loss: 0.4854 - val\_accuracy: 0.7656 - val\_loss: 0.5286  
Epoch 972/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7696 - loss: 0.4652 - val\_accuracy: 0.7656 - val\_loss: 0.5286  
Epoch 973/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7695 - loss: 0.4860 - val\_accuracy: 0.7656 - val\_loss: 0.5286  
Epoch 974/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7881 - loss: 0.4548 - val\_accuracy: 0.7656 - val\_loss: 0.5286  
Epoch 975/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7465 - loss: 0.5171 - val\_accuracy: 0.7656 - val\_loss: 0.5286  
Epoch 976/1000  
18/18 ————— 0s 6ms/step - accuracy: 0.7604 - loss: 0.4779 - val\_accuracy: 0.7656 - val\_loss: 0.5286  
Epoch 977/1000  
18/18 ————— 0s 7ms/step - accuracy: 0.7745 - loss: 0.4653 - val\_accuracy: 0.7656 - val\_loss: 0.5286  
Epoch 978/1000  
18/18 ————— 0s 9ms/step - accuracy: 0.7666 - loss: 0.4753 - val\_accuracy: 0.7656 - val\_loss: 0.5286  
Epoch 979/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7416 - loss: 0.4939 - val\_accuracy: 0.7604 - val\_loss: 0.5286  
Epoch 980/1000  
18/18 ————— 0s 12ms/step - accuracy: 0.7779 - loss: 0.4616 - val\_accuracy: 0.7604 - val\_loss: 0.5286



Epoch 981/1000  
**18/18** ————— 0s 13ms/step - accuracy: 0.7902 - loss: 0.4727 - val\_accuracy: 0.7604 - val\_loss: 0.5286  
Epoch 982/1000  
**18/18** ————— 0s 12ms/step - accuracy: 0.7553 - loss: 0.4821 - val\_accuracy: 0.7604 - val\_loss: 0.5286  
Epoch 983/1000  
**18/18** ————— 0s 11ms/step - accuracy: 0.7755 - loss: 0.4671 - val\_accuracy: 0.7604 - val\_loss: 0.5286  
Epoch 984/1000  
**18/18** ————— 0s 10ms/step - accuracy: 0.7922 - loss: 0.4524 - val\_accuracy: 0.7604 - val\_loss: 0.5286  
Epoch 985/1000  
**18/18** ————— 0s 10ms/step - accuracy: 0.7650 - loss: 0.4772 - val\_accuracy: 0.7604 - val\_loss: 0.5286  
Epoch 986/1000  
**18/18** ————— 0s 13ms/step - accuracy: 0.7605 - loss: 0.4711 - val\_accuracy: 0.7604 - val\_loss: 0.5286  
Epoch 987/1000  
**18/18** ————— 0s 11ms/step - accuracy: 0.7779 - loss: 0.4568 - val\_accuracy: 0.7604 - val\_loss: 0.5286  
Epoch 988/1000  
**18/18** ————— 0s 12ms/step - accuracy: 0.7730 - loss: 0.4805 - val\_accuracy: 0.7604 - val\_loss: 0.5286  
Epoch 989/1000  
**18/18** ————— 0s 14ms/step - accuracy: 0.7636 - loss: 0.4941 - val\_accuracy: 0.7604 - val\_loss: 0.5286  
Epoch 990/1000  
**18/18** ————— 0s 12ms/step - accuracy: 0.7652 - loss: 0.4778 - val\_accuracy: 0.7604 - val\_loss: 0.5286  
Epoch 991/1000  
**18/18** ————— 0s 12ms/step - accuracy: 0.7573 - loss: 0.4974 - val\_accuracy: 0.7604 - val\_loss: 0.5286  
Epoch 992/1000  
**18/18** ————— 0s 10ms/step - accuracy: 0.7946 - loss: 0.4575 - val\_accuracy: 0.7604 - val\_loss: 0.5286  
Epoch 993/1000  
**18/18** ————— 0s 7ms/step - accuracy: 0.7644 - loss: 0.4952 - val\_accuracy: 0.7604 - val\_loss: 0.5286  
Epoch 994/1000  
**18/18** ————— 0s 6ms/step - accuracy: 0.7803 - loss: 0.4846 - val\_accuracy: 0.7604 - val\_loss: 0.5286  
Epoch 995/1000  
**18/18** ————— 0s 8ms/step - accuracy: 0.7691 - loss: 0.4892 - val\_accuracy: 0.7604 - val\_loss: 0.5285  
Epoch 996/1000  
**18/18** ————— 0s 6ms/step - accuracy: 0.7875 - loss: 0.4615 - val\_accuracy: 0.7604 - val\_loss: 0.5285  
Epoch 997/1000  
**18/18** ————— 0s 8ms/step - accuracy: 0.7774 - loss: 0.4734 - val\_accuracy: 0.7604 - val\_loss: 0.5285  
Epoch 998/1000  
**18/18** ————— 0s 6ms/step - accuracy: 0.7790 - loss: 0.4672 - val\_accuracy: 0.7604 - val\_loss: 0.5285  
Epoch 999/1000  
**18/18** ————— 0s 6ms/step - accuracy: 0.7722 - loss: 0.4758 - val\_accuracy: 0.7604 - val\_loss: 0.5285  
Epoch 1000/1000  
**18/18** ————— 0s 7ms/step - accuracy: 0.7653 - loss: 0.4631 - val\_accuracy: 0.7604 - val\_loss: 0.5285

Plot the results of training and validation loss using different learning rates, number of epochs and network structures

```
In [39]: plt.figure(figsize=(12, 8))

#Model 1 Loss
plt.subplot(3, 1, 1)
plt.plot(history_1.history['loss'], label='train loss')
plt.plot(history_1.history['val_loss'], label='val loss')
plt.title('Model 1: Learning Rate = 0.0001, Epochs = 500')
```

```

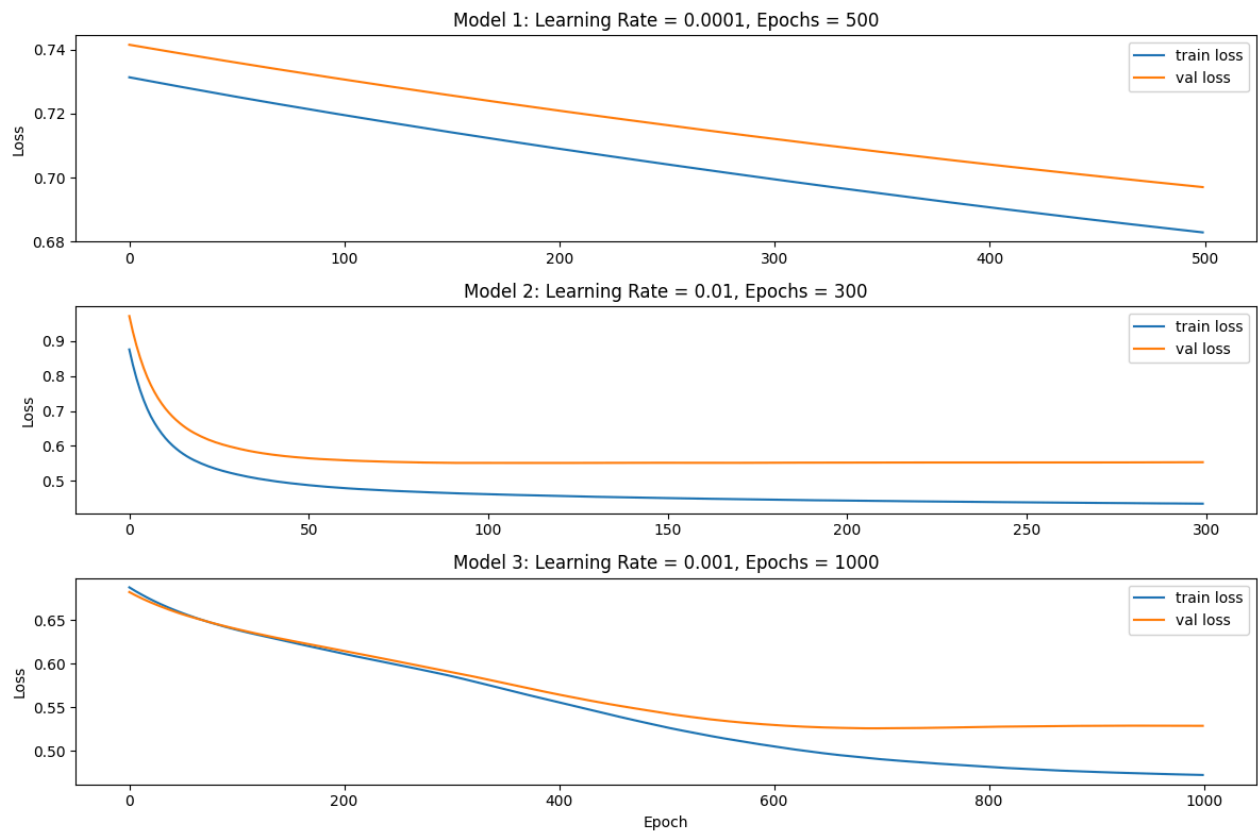
plt.ylabel('Loss')
plt.legend()

#Model 2 Loss
plt.subplot(3, 1, 2)
plt.plot(history_2.history['loss'], label='train loss')
plt.plot(history_2.history['val_loss'], label='val loss')
plt.title('Model 2: Learning Rate = 0.01, Epochs = 300')
plt.ylabel('Loss')
plt.legend()

#Model 3 Loss
plt.subplot(3, 1, 3)
plt.plot(history_3.history['loss'], label='train loss')
plt.plot(history_3.history['val_loss'], label='val loss')
plt.title('Model 3: Learning Rate = 0.001, Epochs = 1000')
plt.ylabel('Loss')
plt.legend()

plt.xlabel('Epoch')
plt.tight_layout()
plt.show()

```



The performance of the three models varies based on their learning rate, number of epochs, and network complexity. Model 1, with a low learning rate (0.0001) and moderate epochs (500), shows a gradual decrease in loss, but its validation loss plateaus, suggesting a need for further tuning. Model 2, using a higher learning rate (0.01) and fewer epochs (300), experiences rapid loss reduction but becomes unstable, indicating the learning rate may be too high. Model 3, with a moderate learning rate (0.001), a high number of epochs (1000), and a more complex architecture (three hidden layers), shows smooth training loss reduction but early validation loss increase, hinting at overfitting. Overall, a lower learning rate ensures stability but slows convergence, while a higher one speeds training but risks divergence. The number of epochs must balance underfitting and overfitting, and the network's complexity should match the dataset's intricacy to avoid unnecessary overfitting.

```

In [40]: y_pred_prob_1 = model_1.predict(X_test_norm)
y_pred_class_1 = (y_pred_prob_1 > 0.5).astype("int32")
y_pred_prob_2 = model_2.predict(X_test_norm)

```

```

y_pred_class_2 = (y_pred_prob_2 > 0.5).astype("int32")
y_pred_prob_3 = model_3.predict(X_test_norm)
y_pred_class_3 = (y_pred_prob_3 > 0.5).astype("int32")

for i, (y_pred_class, y_pred_prob) in enumerate(zip([y_pred_class_1, y_pred_class_2, y_pred_class_3],
                                                    [y_pred_prob_1, y_pred_prob_2, y_pred_prob_3])):
    print(f"Model {i+1}:")
    print(f"Accuracy: {accuracy_score(y_test, y_pred_class):.3f}")
    print(f"ROC-AUC: {roc_auc_score(y_test, y_pred_prob):.3f}")

    plot_roc(y_test, y_pred_prob, f'Model {i+1}')
    print()

```

6/6 ————— 0s 19ms/step

6/6 ————— 0s 23ms/step

6/6 ————— 0s 26ms/step

Model 1:

Accuracy: 0.609

ROC-AUC: 0.335

Model 2:

Accuracy: 0.719

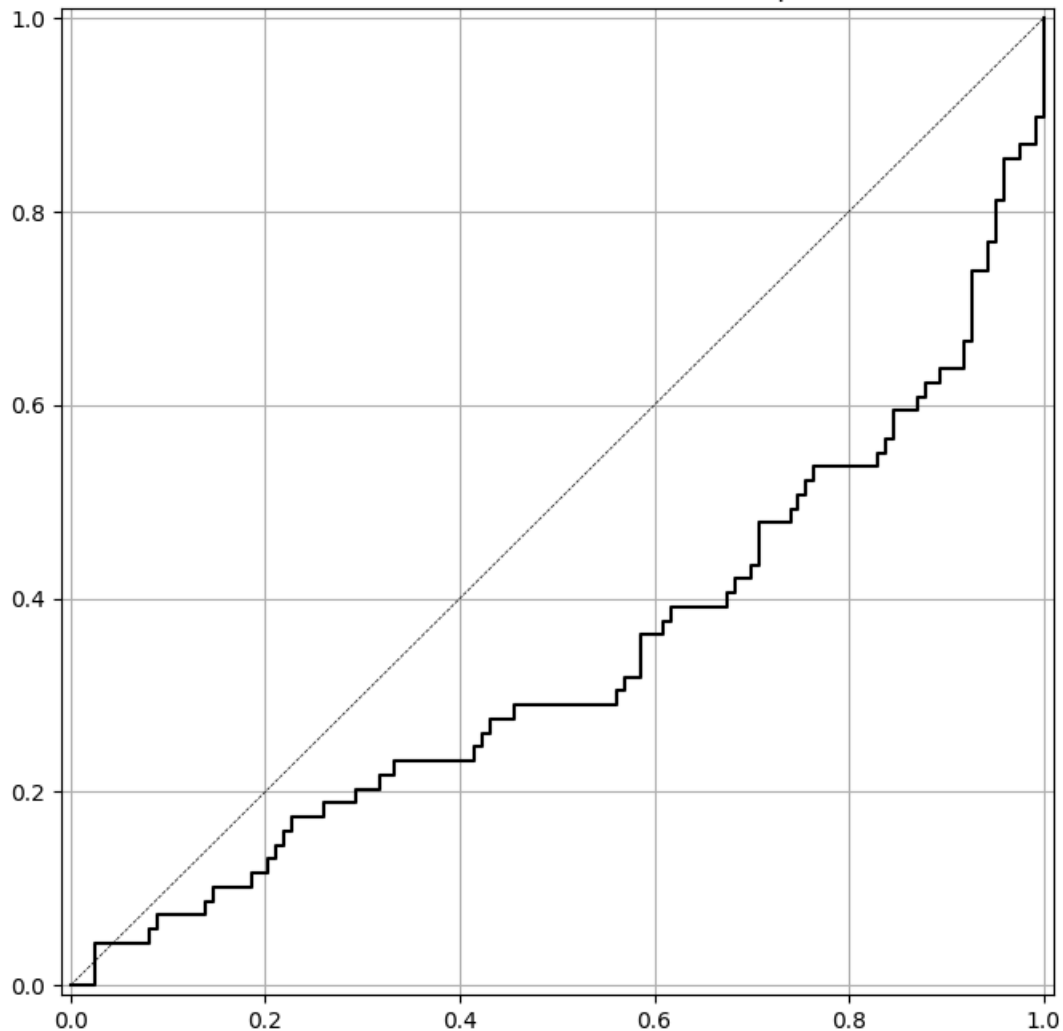
ROC-AUC: 0.791

Model 3:

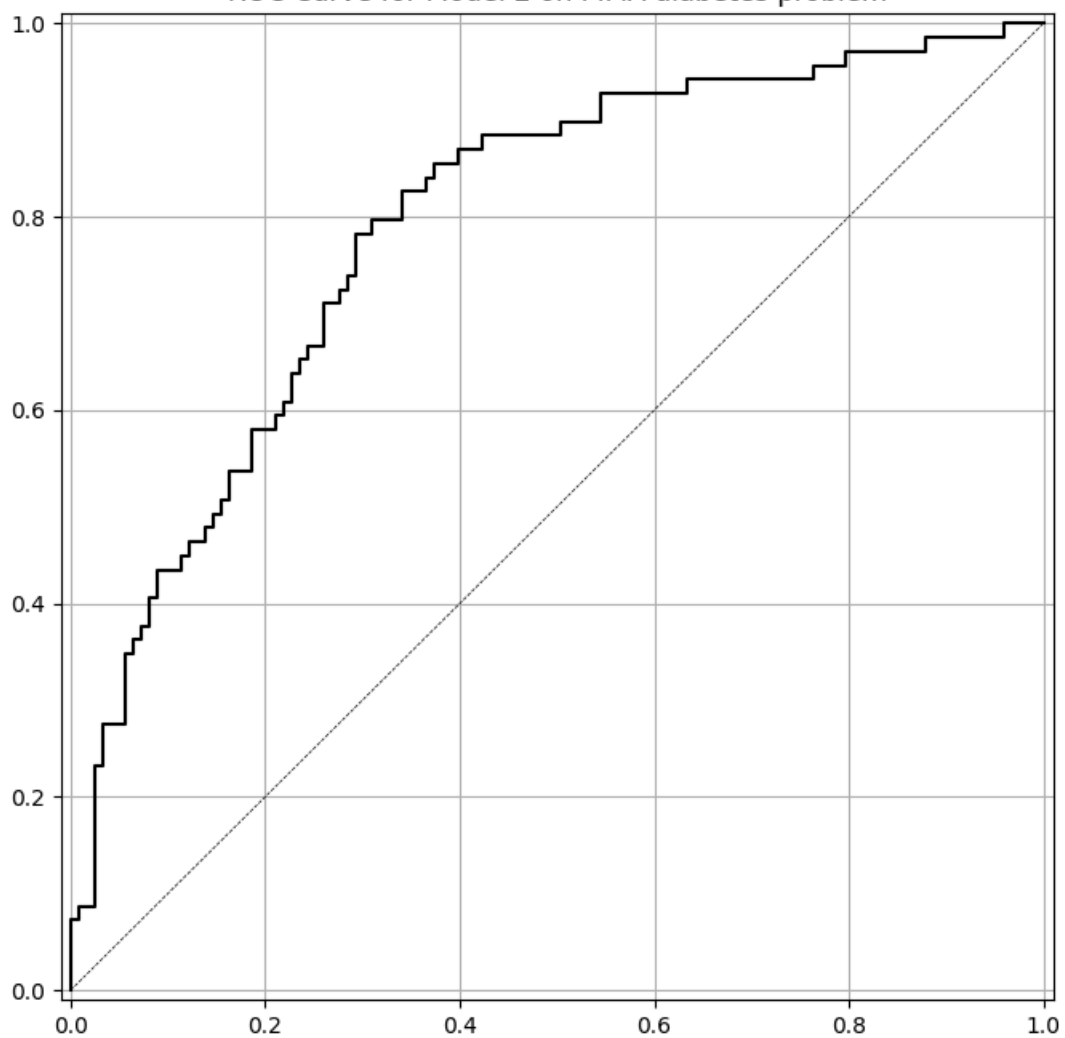
Accuracy: 0.760

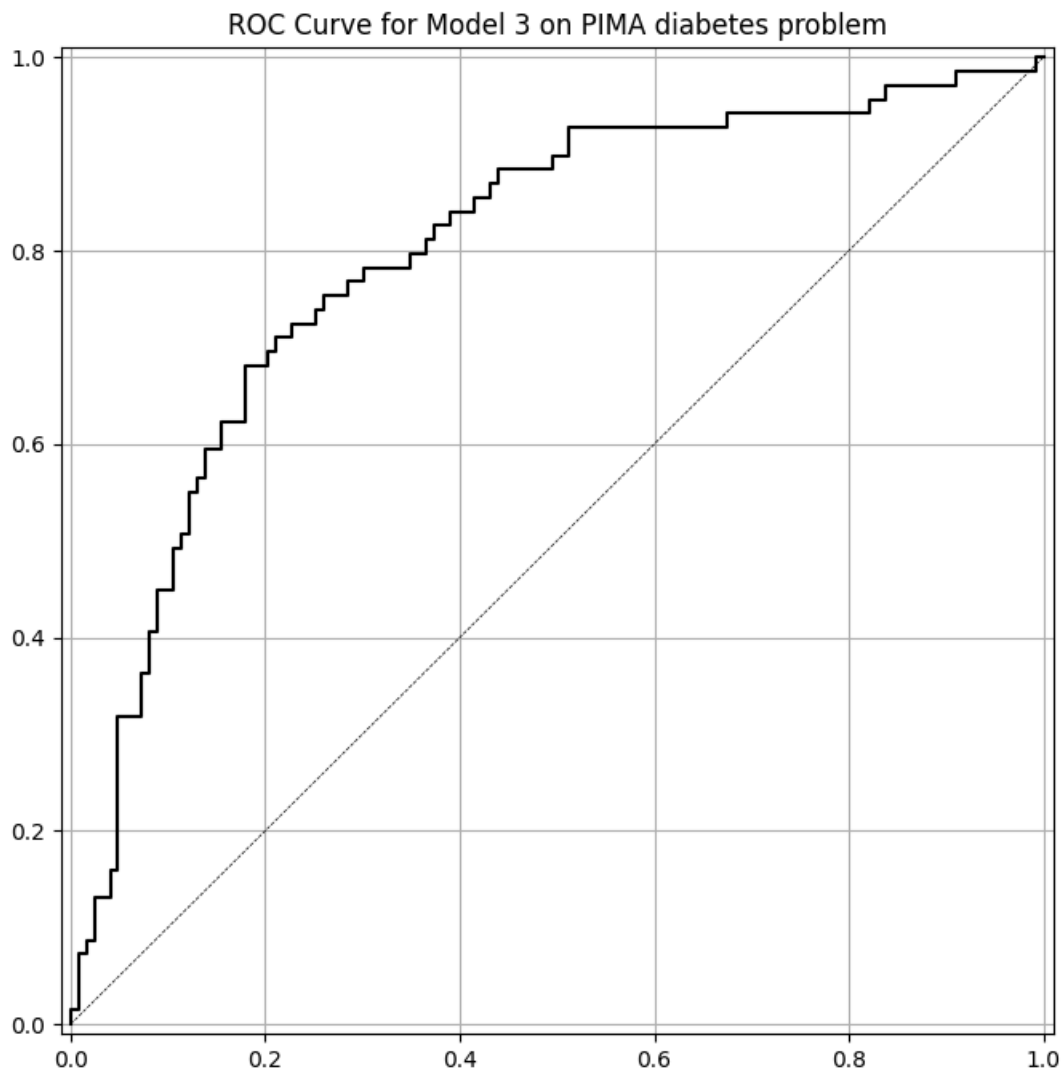
ROC-AUC: 0.798

ROC Curve for Model 1 on PIMA diabetes problem



ROC Curve for Model 2 on PIMA diabetes problem





Interpret your result

Model 1 achieves moderate accuracy (0.609) and a relatively good ROC-AUC score (0.335), indicating a fair ability to distinguish between classes. Model 2 outperforms Model 1 in accuracy (0.719) but has a slightly lower ROC-AUC score (0.791), suggesting better overall predictive performance but a slightly reduced ability to differentiate between classes. Model 3 has the highest accuracy (0.760) but the lowest ROC-AUC (0.798), meaning it correctly classifies more samples but might struggle slightly in distinguishing between classes. Overall, Model 2 has the best accuracy, making it the most effective for general predictions, while Model 1 has the highest ROC-AUC, indicating stronger class separation. The best model depends on priorities; if accuracy is key, Model 2 is preferable, but if distinguishing between classes is more important, Model 1 might be a better choice. Additional evaluation, such as confusion matrices and precision-recall curves, could provide further insights into each model's strengths and weaknesses.

## Conclusion

This notebook explored training neural networks for binary classification using the Pima Indians Diabetes dataset, examining how different network structures, learning rates, and epochs influence model performance. The results highlight that neural networks can effectively capture the relationship between input features and diabetes outcomes, but performance is highly dependent on hyperparameter choices. A single hidden layer with 12 nodes achieved reasonable accuracy (0.766) and a ROC-AUC score of 0.828, while a slightly more complex model with two hidden layers (6,6,1) improved ROC-AUC to 0.840 at a minor cost to accuracy (0.750). Further experiments demonstrated the trade-offs between accuracy, ROC-AUC, and model complexity, with Model 2 performing best in terms of accuracy (0.719) despite a slightly lower ROC-AUC (0.791), while Model 1 exhibited good class separation (ROC-AUC: 0.335) but lower accuracy.

(0.609). Model 3, with three hidden layers, achieved relatively high accuracy (0.760) but had a lower ROC-AUC score (0.798), suggesting potential overfitting or reduced discrimination ability.