In [2]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

In [4]:
```
dataFrame = pd.read_excel("websites.xlsx")
dataFrame
```

Out[4]:

	Type	URL_LENGTH	NUMBER_SPECIAL_CHARACTERS	TCP_CONVERSATION_EXCHANGE	DIST_REI
0	1	23.303047	13.445560	159.066933	
1	1	26.645007	23.018073	172.149800	
2	1	25.505113	27.525833	168.393333	
3	1	14.792707	26.398893	100.491960	
4	1	26.282313	18.575080	174.999533	
...	...	...	...	...	
543	1	27.927387	29.002513	183.937333	
544	1	26.075060	36.593167	169.947733	
545	1	21.502533	36.372960	140.284600	
546	1	26.683867	37.992127	181.476200	
547	0	10.051787	31.787480	62.072373	

548 rows × 31 columns

In [5]:
```
y = dataFrame["Type"].values
x = dataFrame.drop("Type",axis=1).values
```

In [6]:
```
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x,y,test_size=0.28)
```

In [7]:
```
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler()

x_train = scaler.fit_transform(x_train)
x_test = scaler.transform(x_test)
```

In [21]:
```
import tensorflow as tf
from tensorflow.keras import models
from tensorflow.keras import layers

model1 = models.Sequential()

#kaç tane sütun (x özelliği) varsa ilk katmanda o kadar nörön olması önerilir
model1.add(layers.Dense(30,activation="relu"))

#çıkış katmanı nöron sayısı ile ilk katmandaki nöron sayısı arasında olması önerilir
model1.add(layers.Dense(15,activation="relu"))
model1.add(layers.Dense(15,activation="relu"))
```

```
#binary classification ve 0-1 arası çıktılar için sigmoid fonksiyonu
model1.add(layers.Dense(1,activation="sigmoid"))

model1.compile(optimizer="adam",loss="binary_crossentropy")
```

In [22]:

```
model1.fit(x_train,y_train,validation_data=(x_test,y_test),epochs=700)
```

```
Epoch 1/700
13/13 [==============================] - 0s 18ms/step - loss: 0.7162 - val_loss: 0.6
881
Epoch 2/700
13/13 [==============================] - 0s 6ms/step - loss: 0.6853 - val_loss: 0.66
20
Epoch 3/700
13/13 [==============================] - 0s 5ms/step - loss: 0.6597 - val_loss: 0.63
68
Epoch 4/700
13/13 [==============================] - 0s 5ms/step - loss: 0.6335 - val_loss: 0.60
96
Epoch 5/700
13/13 [==============================] - 0s 6ms/step - loss: 0.6024 - val_loss: 0.57
56
Epoch 6/700
13/13 [==============================] - 0s 5ms/step - loss: 0.5628 - val_loss: 0.52
71
Epoch 7/700
13/13 [==============================] - 0s 5ms/step - loss: 0.5085 - val_loss: 0.47
46
Epoch 8/700
13/13 [==============================] - 0s 5ms/step - loss: 0.4491 - val_loss: 0.41
95
Epoch 9/700
13/13 [==============================] - 0s 5ms/step - loss: 0.3942 - val_loss: 0.37
16
Epoch 10/700
13/13 [==============================] - 0s 5ms/step - loss: 0.3458 - val_loss: 0.33
27
Epoch 11/700
13/13 [==============================] - 0s 4ms/step - loss: 0.3105 - val_loss: 0.30
35
Epoch 12/700
13/13 [==============================] - 0s 4ms/step - loss: 0.2744 - val_loss: 0.28
05
Epoch 13/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2471 - val_loss: 0.25
97
Epoch 14/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2262 - val_loss: 0.24
37
Epoch 15/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2073 - val_loss: 0.23
01
Epoch 16/700
13/13 [==============================] - 0s 6ms/step - loss: 0.1911 - val_loss: 0.22
01
Epoch 17/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1761 - val_loss: 0.21
28
Epoch 18/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1669 - val_loss: 0.20
64
Epoch 19/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1580 - val_loss: 0.20
14
Epoch 20/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1492 - val_loss: 0.19
```

```
85
Epoch 21/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1476 - val_loss: 0.19
59
Epoch 22/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1420 - val_loss: 0.19
42
Epoch 23/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1312 - val_loss: 0.19
08
Epoch 24/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1282 - val_loss: 0.18
71
Epoch 25/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1235 - val_loss: 0.18
63
Epoch 26/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1209 - val_loss: 0.18
49
Epoch 27/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1160 - val_loss: 0.18
68
Epoch 28/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1132 - val_loss: 0.18
59
Epoch 29/700
13/13 [==============================] - 0s 6ms/step - loss: 0.1111 - val_loss: 0.18
37
Epoch 30/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1084 - val_loss: 0.18
36
Epoch 31/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1080 - val_loss: 0.18
32
Epoch 32/700
13/13 [==============================] - 0s 6ms/step - loss: 0.1042 - val_loss: 0.18
35
Epoch 33/700
13/13 [==============================] - 0s 6ms/step - loss: 0.1037 - val_loss: 0.18
67
Epoch 34/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1033 - val_loss: 0.18
37
Epoch 35/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0987 - val_loss: 0.19
00
Epoch 36/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0994 - val_loss: 0.18
50
Epoch 37/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0962 - val_loss: 0.18
42
Epoch 38/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0927 - val_loss: 0.18
44
Epoch 39/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0922 - val_loss: 0.18
38
Epoch 40/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0912 - val_loss: 0.18
50
Epoch 41/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0911 - val_loss: 0.18
37
Epoch 42/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0913 - val_loss: 0.18
71
Epoch 43/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0910 - val_loss: 0.18
```

```
29
Epoch 44/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0865 - val_loss: 0.18
73
Epoch 45/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0882 - val_loss: 0.18
71
Epoch 46/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0833 - val_loss: 0.18
76
Epoch 47/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0821 - val_loss: 0.18
62
Epoch 48/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0824 - val_loss: 0.18
74
Epoch 49/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0817 - val_loss: 0.18
94
Epoch 50/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0807 - val_loss: 0.18
96
Epoch 51/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0812 - val_loss: 0.18
93
Epoch 52/700
13/13 [==============================] - 0s 3ms/step - loss: 0.0799 - val_loss: 0.19
19
Epoch 53/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0787 - val_loss: 0.19
26
Epoch 54/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0754 - val_loss: 0.19
02
Epoch 55/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0780 - val_loss: 0.18
86
Epoch 56/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0808 - val_loss: 0.18
91
Epoch 57/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0740 - val_loss: 0.18
58
Epoch 58/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0722 - val_loss: 0.18
64
Epoch 59/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0715 - val_loss: 0.18
92
Epoch 60/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0724 - val_loss: 0.18
83
Epoch 61/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0708 - val_loss: 0.19
10
Epoch 62/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0716 - val_loss: 0.19
27
Epoch 63/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0695 - val_loss: 0.19
33
Epoch 64/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0702 - val_loss: 0.19
55
Epoch 65/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0681 - val_loss: 0.19
29
Epoch 66/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0717 - val_loss: 0.18
```

```
93
Epoch 67/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0677 - val_loss: 0.18
83
Epoch 68/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0678 - val_loss: 0.18
95
Epoch 69/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0682 - val_loss: 0.19
50
Epoch 70/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0697 - val_loss: 0.19
09
Epoch 71/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0667 - val_loss: 0.18
86
Epoch 72/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0660 - val_loss: 0.18
67
Epoch 73/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0644 - val_loss: 0.18
87
Epoch 74/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0623 - val_loss: 0.19
22
Epoch 75/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0632 - val_loss: 0.18
96
Epoch 76/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0643 - val_loss: 0.19
46
Epoch 77/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0629 - val_loss: 0.19
06
Epoch 78/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0655 - val_loss: 0.19
13
Epoch 79/700
13/13 [==============================] - 0s 3ms/step - loss: 0.0621 - val_loss: 0.18
97
Epoch 80/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0689 - val_loss: 0.19
03
Epoch 81/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0713 - val_loss: 0.19
13
Epoch 82/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0652 - val_loss: 0.18
71
Epoch 83/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0662 - val_loss: 0.18
31
Epoch 84/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0712 - val_loss: 0.19
04
Epoch 85/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0654 - val_loss: 0.18
82
Epoch 86/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0575 - val_loss: 0.18
80
Epoch 87/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0593 - val_loss: 0.18
79
Epoch 88/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0636 - val_loss: 0.19
08
Epoch 89/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0654 - val_loss: 0.18
```

```
72
Epoch 90/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0566 - val_loss: 0.19
26
Epoch 91/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0538 - val_loss: 0.18
96
Epoch 92/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0582 - val_loss: 0.19
30
Epoch 93/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0547 - val_loss: 0.18
39
Epoch 94/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0536 - val_loss: 0.18
54
Epoch 95/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0550 - val_loss: 0.18
01
Epoch 96/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0543 - val_loss: 0.18
60
Epoch 97/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0537 - val_loss: 0.18
78
Epoch 98/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0528 - val_loss: 0.18
44
Epoch 99/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0524 - val_loss: 0.18
97
Epoch 100/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0524 - val_loss: 0.18
95
Epoch 101/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0574 - val_loss: 0.19
70
Epoch 102/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0513 - val_loss: 0.19
82
Epoch 103/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0524 - val_loss: 0.19
57
Epoch 104/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0552 - val_loss: 0.19
97
Epoch 105/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0502 - val_loss: 0.19
53
Epoch 106/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0511 - val_loss: 0.19
59
Epoch 107/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0501 - val_loss: 0.19
40
Epoch 108/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0499 - val_loss: 0.19
46
Epoch 109/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0501 - val_loss: 0.18
87
Epoch 110/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0509 - val_loss: 0.20
33
Epoch 111/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0480 - val_loss: 0.20
06
Epoch 112/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0488 - val_loss: 0.19
```

```
83
Epoch 113/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0505 - val_loss: 0.19
81
Epoch 114/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0480 - val_loss: 0.19
54
Epoch 115/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0477 - val_loss: 0.19
23
Epoch 116/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0471 - val_loss: 0.19
11
Epoch 117/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0448 - val_loss: 0.19
71
Epoch 118/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0474 - val_loss: 0.19
73
Epoch 119/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0461 - val_loss: 0.20
16
Epoch 120/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0461 - val_loss: 0.19
84
Epoch 121/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0471 - val_loss: 0.19
94
Epoch 122/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0458 - val_loss: 0.20
20
Epoch 123/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0432 - val_loss: 0.19
83
Epoch 124/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0455 - val_loss: 0.20
12
Epoch 125/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0438 - val_loss: 0.19
77
Epoch 126/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0457 - val_loss: 0.19
63
Epoch 127/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0453 - val_loss: 0.20
64
Epoch 128/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0476 - val_loss: 0.19
43
Epoch 129/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0464 - val_loss: 0.19
63
Epoch 130/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0434 - val_loss: 0.20
27
Epoch 131/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0442 - val_loss: 0.19
95
Epoch 132/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0426 - val_loss: 0.19
21
Epoch 133/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0408 - val_loss: 0.19
85
Epoch 134/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0450 - val_loss: 0.20
92
Epoch 135/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0473 - val_loss: 0.20
```

```
40
Epoch 136/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0444 - val_loss: 0.19
16
Epoch 137/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0401 - val_loss: 0.19
74
Epoch 138/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0414 - val_loss: 0.19
62
Epoch 139/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0398 - val_loss: 0.20
12
Epoch 140/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0398 - val_loss: 0.20
26
Epoch 141/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0462 - val_loss: 0.19
45
Epoch 142/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0427 - val_loss: 0.19
53
Epoch 143/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0383 - val_loss: 0.19
97
Epoch 144/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0409 - val_loss: 0.20
18
Epoch 145/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0378 - val_loss: 0.20
33
Epoch 146/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0410 - val_loss: 0.20
58
Epoch 147/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0380 - val_loss: 0.20
22
Epoch 148/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0364 - val_loss: 0.20
69
Epoch 149/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0390 - val_loss: 0.20
46
Epoch 150/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0386 - val_loss: 0.20
91
Epoch 151/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0393 - val_loss: 0.20
75
Epoch 152/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0370 - val_loss: 0.20
88
Epoch 153/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0378 - val_loss: 0.21
37
Epoch 154/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0394 - val_loss: 0.20
99
Epoch 155/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0373 - val_loss: 0.20
93
Epoch 156/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0357 - val_loss: 0.20
86
Epoch 157/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0371 - val_loss: 0.20
85
Epoch 158/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0400 - val_loss: 0.20
```

```
77
Epoch 159/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0365 - val_loss: 0.21
08
Epoch 160/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0346 - val_loss: 0.20
89
Epoch 161/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0365 - val_loss: 0.21
30
Epoch 162/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0356 - val_loss: 0.21
10
Epoch 163/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0354 - val_loss: 0.19
97
Epoch 164/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0346 - val_loss: 0.20
48
Epoch 165/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0367 - val_loss: 0.20
72
Epoch 166/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0377 - val_loss: 0.19
85
Epoch 167/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0328 - val_loss: 0.20
11
Epoch 168/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0332 - val_loss: 0.20
45
Epoch 169/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0339 - val_loss: 0.20
27
Epoch 170/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0315 - val_loss: 0.21
23
Epoch 171/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0342 - val_loss: 0.21
35
Epoch 172/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0319 - val_loss: 0.21
31
Epoch 173/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0314 - val_loss: 0.21
25
Epoch 174/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0324 - val_loss: 0.20
81
Epoch 175/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0314 - val_loss: 0.20
71
Epoch 176/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0317 - val_loss: 0.21
15
Epoch 177/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0300 - val_loss: 0.21
61
Epoch 178/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0304 - val_loss: 0.21
38
Epoch 179/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0328 - val_loss: 0.21
36
Epoch 180/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0352 - val_loss: 0.21
96
Epoch 181/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0338 - val_loss: 0.21
```

```
51
Epoch 182/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0309 - val_loss: 0.21
30
Epoch 183/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0297 - val_loss: 0.21
35
Epoch 184/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0295 - val_loss: 0.21
13
Epoch 185/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0284 - val_loss: 0.21
38
Epoch 186/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0281 - val_loss: 0.21
71
Epoch 187/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0293 - val_loss: 0.21
24
Epoch 188/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0397 - val_loss: 0.23
13
Epoch 189/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0397 - val_loss: 0.23
25
Epoch 190/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0341 - val_loss: 0.22
35
Epoch 191/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0286 - val_loss: 0.21
95
Epoch 192/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0299 - val_loss: 0.22
41
Epoch 193/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0274 - val_loss: 0.22
00
Epoch 194/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0270 - val_loss: 0.21
95
Epoch 195/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0298 - val_loss: 0.23
24
Epoch 196/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0275 - val_loss: 0.22
50
Epoch 197/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0254 - val_loss: 0.21
56
Epoch 198/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0278 - val_loss: 0.22
53
Epoch 199/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0257 - val_loss: 0.22
97
Epoch 200/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0253 - val_loss: 0.22
15
Epoch 201/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0273 - val_loss: 0.22
13
Epoch 202/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0251 - val_loss: 0.21
53
Epoch 203/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0240 - val_loss: 0.22
08
Epoch 204/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0273 - val_loss: 0.22
```

```
13
Epoch 205/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0243 - val_loss: 0.21
94
Epoch 206/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0242 - val_loss: 0.21
85
Epoch 207/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0270 - val_loss: 0.22
37
Epoch 208/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0298 - val_loss: 0.22
88
Epoch 209/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0273 - val_loss: 0.22
86
Epoch 210/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0253 - val_loss: 0.22
13
Epoch 211/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0265 - val_loss: 0.21
79
Epoch 212/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0248 - val_loss: 0.21
05
Epoch 213/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0262 - val_loss: 0.21
73
Epoch 214/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0282 - val_loss: 0.22
28
Epoch 215/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0228 - val_loss: 0.21
08
Epoch 216/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0225 - val_loss: 0.20
94
Epoch 217/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0211 - val_loss: 0.21
60
Epoch 218/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0219 - val_loss: 0.21
47
Epoch 219/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0211 - val_loss: 0.21
44
Epoch 220/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0212 - val_loss: 0.21
46
Epoch 221/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0221 - val_loss: 0.21
38
Epoch 222/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0198 - val_loss: 0.22
16
Epoch 223/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0206 - val_loss: 0.21
44
Epoch 224/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0200 - val_loss: 0.21
92
Epoch 225/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0204 - val_loss: 0.21
59
Epoch 226/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0215 - val_loss: 0.22
21
Epoch 227/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0198 - val_loss: 0.22
```

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36
Epoch 228/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0215 - val_loss: 0.22
54
Epoch 229/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0192 - val_loss: 0.22
51
Epoch 230/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0200 - val_loss: 0.22
50
Epoch 231/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0189 - val_loss: 0.23
12
Epoch 232/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0248 - val_loss: 0.24
54
Epoch 233/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0193 - val_loss: 0.24
27
Epoch 234/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0208 - val_loss: 0.22
30
Epoch 235/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0182 - val_loss: 0.22
68
Epoch 236/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0174 - val_loss: 0.22
98
Epoch 237/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0187 - val_loss: 0.22
61
Epoch 238/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0183 - val_loss: 0.22
49
Epoch 239/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0170 - val_loss: 0.22
54
Epoch 240/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0177 - val_loss: 0.23
12
Epoch 241/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0169 - val_loss: 0.22
37
Epoch 242/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0162 - val_loss: 0.22
49
Epoch 243/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0168 - val_loss: 0.23
28
Epoch 244/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0157 - val_loss: 0.23
33
Epoch 245/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0191 - val_loss: 0.25
09
Epoch 246/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0165 - val_loss: 0.24
01
Epoch 247/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0161 - val_loss: 0.23
42
Epoch 248/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0152 - val_loss: 0.24
40
Epoch 249/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0161 - val_loss: 0.23
39
Epoch 250/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0155 - val_loss: 0.23
```

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36
Epoch 251/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0154 - val_loss: 0.23
60
Epoch 252/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0153 - val_loss: 0.23
45
Epoch 253/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0138 - val_loss: 0.24
48
Epoch 254/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0155 - val_loss: 0.24
38
Epoch 255/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0192 - val_loss: 0.25
24
Epoch 256/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0149 - val_loss: 0.24
43
Epoch 257/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0142 - val_loss: 0.24
42
Epoch 258/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0212 - val_loss: 0.25
92
Epoch 259/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0203 - val_loss: 0.25
96
Epoch 260/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0156 - val_loss: 0.25
88
Epoch 261/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0157 - val_loss: 0.24
18
Epoch 262/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0131 - val_loss: 0.23
99
Epoch 263/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0150 - val_loss: 0.24
81
Epoch 264/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0178 - val_loss: 0.24
36
Epoch 265/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0132 - val_loss: 0.24
62
Epoch 266/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0131 - val_loss: 0.24
97
Epoch 267/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0118 - val_loss: 0.24
68
Epoch 268/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0143 - val_loss: 0.24
44
Epoch 269/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0114 - val_loss: 0.25
03
Epoch 270/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0112 - val_loss: 0.25
30
Epoch 271/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0116 - val_loss: 0.24
78
Epoch 272/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0127 - val_loss: 0.25
31
Epoch 273/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0116 - val_loss: 0.25
```

```
72
Epoch 274/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0162 - val_loss: 0.25
92
Epoch 275/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0136 - val_loss: 0.25
10
Epoch 276/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0113 - val_loss: 0.24
62
Epoch 277/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0120 - val_loss: 0.24
94
Epoch 278/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0137 - val_loss: 0.24
80
Epoch 279/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0136 - val_loss: 0.24
54
Epoch 280/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0101 - val_loss: 0.25
01
Epoch 281/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0095 - val_loss: 0.25
64
Epoch 282/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0099 - val_loss: 0.25
00
Epoch 283/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0109 - val_loss: 0.25
17
Epoch 284/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0113 - val_loss: 0.26
78
Epoch 285/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0107 - val_loss: 0.24
98
Epoch 286/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0247 - val_loss: 0.29
36
Epoch 287/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0256 - val_loss: 0.29
08
Epoch 288/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0131 - val_loss: 0.26
30
Epoch 289/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0132 - val_loss: 0.28
01
Epoch 290/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0089 - val_loss: 0.28
06
Epoch 291/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0088 - val_loss: 0.28
16
Epoch 292/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0088 - val_loss: 0.28
17
Epoch 293/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0088 - val_loss: 0.27
93
Epoch 294/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0086 - val_loss: 0.28
38
Epoch 295/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0080 - val_loss: 0.28
31
Epoch 296/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0080 - val_loss: 0.28
```

```
92
Epoch 297/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0080 - val_loss: 0.28
61
Epoch 298/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0083 - val_loss: 0.28
74
Epoch 299/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0076 - val_loss: 0.28
38
Epoch 300/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0077 - val_loss: 0.28
02
Epoch 301/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0084 - val_loss: 0.29
01
Epoch 302/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0082 - val_loss: 0.29
23
Epoch 303/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0072 - val_loss: 0.29
02
Epoch 304/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0084 - val_loss: 0.28
70
Epoch 305/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0087 - val_loss: 0.29
14
Epoch 306/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0078 - val_loss: 0.29
11
Epoch 307/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0070 - val_loss: 0.28
71
Epoch 308/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0067 - val_loss: 0.28
99
Epoch 309/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0065 - val_loss: 0.29
30
Epoch 310/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0078 - val_loss: 0.28
33
Epoch 311/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0063 - val_loss: 0.28
25
Epoch 312/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0062 - val_loss: 0.28
80
Epoch 313/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0063 - val_loss: 0.28
86
Epoch 314/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0063 - val_loss: 0.28
65
Epoch 315/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0081 - val_loss: 0.29
44
Epoch 316/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0075 - val_loss: 0.28
96
Epoch 317/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0056 - val_loss: 0.28
88
Epoch 318/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0058 - val_loss: 0.28
62
Epoch 319/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0061 - val_loss: 0.28
```

```
96
Epoch 320/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0067 - val_loss: 0.28
92
Epoch 321/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0061 - val_loss: 0.29
60
Epoch 322/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0056 - val_loss: 0.29
06
Epoch 323/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0059 - val_loss: 0.29
17
Epoch 324/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0078 - val_loss: 0.28
83
Epoch 325/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0058 - val_loss: 0.29
34
Epoch 326/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0050 - val_loss: 0.29
23
Epoch 327/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0050 - val_loss: 0.29
06
Epoch 328/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0050 - val_loss: 0.29
51
Epoch 329/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0053 - val_loss: 0.29
14
Epoch 330/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0053 - val_loss: 0.29
39
Epoch 331/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0047 - val_loss: 0.29
59
Epoch 332/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0047 - val_loss: 0.29
61
Epoch 333/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0048 - val_loss: 0.30
08
Epoch 334/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0050 - val_loss: 0.29
76
Epoch 335/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0047 - val_loss: 0.30
46
Epoch 336/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0054 - val_loss: 0.30
27
Epoch 337/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0047 - val_loss: 0.29
70
Epoch 338/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0046 - val_loss: 0.30
02
Epoch 339/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0048 - val_loss: 0.30
09
Epoch 340/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0050 - val_loss: 0.30
52
Epoch 341/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0050 - val_loss: 0.30
51
Epoch 342/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0041 - val_loss: 0.30
```

```
29
Epoch 343/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0041 - val_loss: 0.30
35
Epoch 344/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0039 - val_loss: 0.30
51
Epoch 345/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0040 - val_loss: 0.30
77
Epoch 346/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0045 - val_loss: 0.31
20
Epoch 347/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0043 - val_loss: 0.30
77
Epoch 348/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0038 - val_loss: 0.30
83
Epoch 349/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0042 - val_loss: 0.31
20
Epoch 350/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0040 - val_loss: 0.30
66
Epoch 351/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0036 - val_loss: 0.31
07
Epoch 352/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0039 - val_loss: 0.30
86
Epoch 353/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0038 - val_loss: 0.30
97
Epoch 354/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0043 - val_loss: 0.31
89
Epoch 355/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0035 - val_loss: 0.31
38
Epoch 356/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0034 - val_loss: 0.31
53
Epoch 357/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0033 - val_loss: 0.31
90
Epoch 358/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0035 - val_loss: 0.32
21
Epoch 359/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0042 - val_loss: 0.31
75
Epoch 360/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0034 - val_loss: 0.32
47
Epoch 361/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0030 - val_loss: 0.32
71
Epoch 362/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0032 - val_loss: 0.32
43
Epoch 363/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0033 - val_loss: 0.32
37
Epoch 364/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0033 - val_loss: 0.31
96
Epoch 365/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0040 - val_loss: 0.32
```

```
74
Epoch 366/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0031 - val_loss: 0.33
59
Epoch 367/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0033 - val_loss: 0.32
44
Epoch 368/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0035 - val_loss: 0.32
49
Epoch 369/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0031 - val_loss: 0.32
42
Epoch 370/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0029 - val_loss: 0.32
75
Epoch 371/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0027 - val_loss: 0.33
03
Epoch 372/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0029 - val_loss: 0.32
80
Epoch 373/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0026 - val_loss: 0.32
92
Epoch 374/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0026 - val_loss: 0.33
19
Epoch 375/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0026 - val_loss: 0.33
09
Epoch 376/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0025 - val_loss: 0.33
04
Epoch 377/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0029 - val_loss: 0.34
09
Epoch 378/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0035 - val_loss: 0.33
48
Epoch 379/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0028 - val_loss: 0.33
18
Epoch 380/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0030 - val_loss: 0.32
77
Epoch 381/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0026 - val_loss: 0.32
90
Epoch 382/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0029 - val_loss: 0.32
66
Epoch 383/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0025 - val_loss: 0.32
34
Epoch 384/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0024 - val_loss: 0.33
88
Epoch 385/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0029 - val_loss: 0.33
89
Epoch 386/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0031 - val_loss: 0.34
65
Epoch 387/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0033 - val_loss: 0.34
35
Epoch 388/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0035 - val_loss: 0.35
```

```
25
Epoch 389/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0027 - val_loss: 0.34
57
Epoch 390/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0021 - val_loss: 0.33
99
Epoch 391/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0021 - val_loss: 0.34
04
Epoch 392/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0025 - val_loss: 0.34
13
Epoch 393/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0063 - val_loss: 0.35
97
Epoch 394/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0123 - val_loss: 0.38
52
Epoch 395/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0058 - val_loss: 0.35
56
Epoch 396/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0026 - val_loss: 0.33
53
Epoch 397/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0026 - val_loss: 0.33
50
Epoch 398/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0022 - val_loss: 0.34
03
Epoch 399/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0021 - val_loss: 0.34
28
Epoch 400/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0022 - val_loss: 0.34
69
Epoch 401/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0019 - val_loss: 0.34
57
Epoch 402/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0024 - val_loss: 0.34
41
Epoch 403/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0020 - val_loss: 0.34
31
Epoch 404/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0017 - val_loss: 0.34
42
Epoch 405/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0018 - val_loss: 0.34
49
Epoch 406/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0017 - val_loss: 0.34
62
Epoch 407/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0016 - val_loss: 0.34
81
Epoch 408/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0016 - val_loss: 0.34
49
Epoch 409/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0019 - val_loss: 0.34
58
Epoch 410/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0016 - val_loss: 0.34
70
Epoch 411/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0016 - val_loss: 0.34
```

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99
Epoch 412/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0016 - val_loss: 0.34
94
Epoch 413/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0015 - val_loss: 0.34
95
Epoch 414/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0017 - val_loss: 0.34
87
Epoch 415/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0016 - val_loss: 0.35
14
Epoch 416/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0015 - val_loss: 0.35
68
Epoch 417/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0016 - val_loss: 0.35
53
Epoch 418/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0015 - val_loss: 0.35
01
Epoch 419/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0016 - val_loss: 0.35
22
Epoch 420/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0016 - val_loss: 0.35
36
Epoch 421/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0015 - val_loss: 0.35
75
Epoch 422/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0017 - val_loss: 0.34
73
Epoch 423/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0014 - val_loss: 0.34
91
Epoch 424/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0015 - val_loss: 0.35
42
Epoch 425/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0014 - val_loss: 0.35
68
Epoch 426/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0015 - val_loss: 0.35
65
Epoch 427/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0014 - val_loss: 0.36
36
Epoch 428/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0014 - val_loss: 0.36
25
Epoch 429/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0013 - val_loss: 0.35
86
Epoch 430/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0014 - val_loss: 0.35
70
Epoch 431/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0013 - val_loss: 0.35
62
Epoch 432/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0015 - val_loss: 0.35
96
Epoch 433/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0017 - val_loss: 0.37
08
Epoch 434/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0014 - val_loss: 0.36
```

```
66
Epoch 435/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0013 - val_loss: 0.36
21
Epoch 436/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0013 - val_loss: 0.36
53
Epoch 437/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0012 - val_loss: 0.36
67
Epoch 438/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0012 - val_loss: 0.36
31
Epoch 439/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0011 - val_loss: 0.36
28
Epoch 440/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0012 - val_loss: 0.36
56
Epoch 441/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0012 - val_loss: 0.36
83
Epoch 442/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0011 - val_loss: 0.36
37
Epoch 443/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0011 - val_loss: 0.36
59
Epoch 444/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0011 - val_loss: 0.36
99
Epoch 445/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0012 - val_loss: 0.36
80
Epoch 446/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0016 - val_loss: 0.37
07
Epoch 447/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0016 - val_loss: 0.37
02
Epoch 448/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0016 - val_loss: 0.37
67
Epoch 449/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0011 - val_loss: 0.37
91
Epoch 450/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0011 - val_loss: 0.37
31
Epoch 451/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0010 - val_loss: 0.37
32
Epoch 452/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0012 - val_loss: 0.37
07
Epoch 453/700
13/13 [==============================] - 0s 5ms/step - loss: 9.5470e-04 - val_loss:
 0.3731
Epoch 454/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0013 - val_loss: 0.37
74
Epoch 455/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0011 - val_loss: 0.37
62
Epoch 456/700
13/13 [==============================] - 0s 5ms/step - loss: 9.7948e-04 - val_loss:
 0.3787
Epoch 457/700
13/13 [==============================] - 0s 5ms/step - loss: 9.9570e-04 - val_loss:
```

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 0.3822
Epoch 458/700
13/13 [==============================] - 0s 5ms/step - loss: 9.8519e-04 - val_loss:
 0.3830
Epoch 459/700
13/13 [==============================] - 0s 5ms/step - loss: 9.5141e-04 - val_loss:
 0.3833
Epoch 460/700
13/13 [==============================] - 0s 5ms/step - loss: 9.0525e-04 - val_loss:
 0.3836
Epoch 461/700
13/13 [==============================] - 0s 5ms/step - loss: 9.2331e-04 - val_loss:
 0.3815
Epoch 462/700
13/13 [==============================] - 0s 5ms/step - loss: 9.1000e-04 - val_loss:
 0.3847
Epoch 463/700
13/13 [==============================] - 0s 6ms/step - loss: 8.9482e-04 - val_loss:
 0.3830
Epoch 464/700
13/13 [==============================] - 0s 5ms/step - loss: 8.7124e-04 - val_loss:
 0.3823
Epoch 465/700
13/13 [==============================] - 0s 5ms/step - loss: 9.9012e-04 - val_loss:
 0.3825
Epoch 466/700
13/13 [==============================] - 0s 5ms/step - loss: 8.6943e-04 - val_loss:
 0.3852
Epoch 467/700
13/13 [==============================] - 0s 5ms/step - loss: 8.1273e-04 - val_loss:
 0.3882
Epoch 468/700
13/13 [==============================] - 0s 5ms/step - loss: 9.4716e-04 - val_loss:
 0.3878
Epoch 469/700
13/13 [==============================] - 0s 5ms/step - loss: 8.4155e-04 - val_loss:
 0.3885
Epoch 470/700
13/13 [==============================] - 0s 5ms/step - loss: 8.2408e-04 - val_loss:
 0.3881
Epoch 471/700
13/13 [==============================] - 0s 5ms/step - loss: 8.2043e-04 - val_loss:
 0.3873
Epoch 472/700
13/13 [==============================] - 0s 5ms/step - loss: 8.8246e-04 - val_loss:
 0.3891
Epoch 473/700
13/13 [==============================] - 0s 5ms/step - loss: 8.7448e-04 - val_loss:
 0.3901
Epoch 474/700
13/13 [==============================] - 0s 5ms/step - loss: 7.8447e-04 - val_loss:
 0.3887
Epoch 475/700
13/13 [==============================] - 0s 5ms/step - loss: 8.2547e-04 - val_loss:
 0.3905
Epoch 476/700
13/13 [==============================] - 0s 6ms/step - loss: 7.7441e-04 - val_loss:
 0.3925
Epoch 477/700
13/13 [==============================] - 0s 5ms/step - loss: 7.7628e-04 - val_loss:
 0.3944
Epoch 478/700
13/13 [==============================] - 0s 5ms/step - loss: 7.5865e-04 - val_loss:
 0.3938
Epoch 479/700
13/13 [==============================] - 0s 6ms/step - loss: 7.5411e-04 - val_loss:
 0.3977
Epoch 480/700
13/13 [==============================] - 0s 5ms/step - loss: 7.7363e-04 - val_loss:
```

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 0.3976
Epoch 481/700
13/13 [==============================] - 0s 5ms/step - loss: 7.2023e-04 - val_loss:
 0.3967
Epoch 482/700
13/13 [==============================] - 0s 5ms/step - loss: 7.3832e-04 - val_loss:
 0.3962
Epoch 483/700
13/13 [==============================] - 0s 5ms/step - loss: 7.8251e-04 - val_loss:
 0.3977
Epoch 484/700
13/13 [==============================] - 0s 6ms/step - loss: 7.4111e-04 - val_loss:
 0.3972
Epoch 485/700
13/13 [==============================] - 0s 5ms/step - loss: 7.5570e-04 - val_loss:
 0.4036
Epoch 486/700
13/13 [==============================] - 0s 4ms/step - loss: 6.9835e-04 - val_loss:
 0.4008
Epoch 487/700
13/13 [==============================] - 0s 5ms/step - loss: 6.9128e-04 - val_loss:
 0.4026
Epoch 488/700
13/13 [==============================] - 0s 5ms/step - loss: 7.0927e-04 - val_loss:
 0.4028
Epoch 489/700
13/13 [==============================] - 0s 5ms/step - loss: 7.2112e-04 - val_loss:
 0.4013
Epoch 490/700
13/13 [==============================] - 0s 5ms/step - loss: 7.2251e-04 - val_loss:
 0.4039
Epoch 491/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0010 - val_loss: 0.40
72
Epoch 492/700
13/13 [==============================] - 0s 5ms/step - loss: 7.1802e-04 - val_loss:
 0.4062
Epoch 493/700
13/13 [==============================] - 0s 6ms/step - loss: 8.7087e-04 - val_loss:
 0.4049
Epoch 494/700
13/13 [==============================] - 0s 5ms/step - loss: 8.0374e-04 - val_loss:
 0.4058
Epoch 495/700
13/13 [==============================] - 0s 5ms/step - loss: 7.2153e-04 - val_loss:
 0.4105
Epoch 496/700
13/13 [==============================] - 0s 6ms/step - loss: 6.2344e-04 - val_loss:
 0.4076
Epoch 497/700
13/13 [==============================] - 0s 5ms/step - loss: 6.7123e-04 - val_loss:
 0.4106
Epoch 498/700
13/13 [==============================] - 0s 5ms/step - loss: 6.5767e-04 - val_loss:
 0.4083
Epoch 499/700
13/13 [==============================] - 0s 5ms/step - loss: 6.3169e-04 - val_loss:
 0.4110
Epoch 500/700
13/13 [==============================] - 0s 5ms/step - loss: 6.6535e-04 - val_loss:
 0.4139
Epoch 501/700
13/13 [==============================] - 0s 5ms/step - loss: 6.8494e-04 - val_loss:
 0.4109
Epoch 502/700
13/13 [==============================] - 0s 5ms/step - loss: 6.6795e-04 - val_loss:
 0.4142
Epoch 503/700
13/13 [==============================] - 0s 5ms/step - loss: 6.2237e-04 - val_loss:
```

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 0.4125
Epoch 504/700
13/13 [==============================] - 0s 5ms/step - loss: 6.4356e-04 - val_loss:
 0.4161
Epoch 505/700
13/13 [==============================] - 0s 5ms/step - loss: 5.8273e-04 - val_loss:
 0.4151
Epoch 506/700
13/13 [==============================] - 0s 5ms/step - loss: 5.7824e-04 - val_loss:
 0.4158
Epoch 507/700
13/13 [==============================] - 0s 5ms/step - loss: 6.2697e-04 - val_loss:
 0.4174
Epoch 508/700
13/13 [==============================] - 0s 6ms/step - loss: 6.0521e-04 - val_loss:
 0.4198
Epoch 509/700
13/13 [==============================] - 0s 5ms/step - loss: 5.9987e-04 - val_loss:
 0.4208
Epoch 510/700
13/13 [==============================] - 0s 5ms/step - loss: 5.6776e-04 - val_loss:
 0.4193
Epoch 511/700
13/13 [==============================] - 0s 5ms/step - loss: 5.6205e-04 - val_loss:
 0.4204
Epoch 512/700
13/13 [==============================] - 0s 5ms/step - loss: 5.7292e-04 - val_loss:
 0.4211
Epoch 513/700
13/13 [==============================] - 0s 5ms/step - loss: 5.9418e-04 - val_loss:
 0.4213
Epoch 514/700
13/13 [==============================] - 0s 5ms/step - loss: 6.6831e-04 - val_loss:
 0.4286
Epoch 515/700
13/13 [==============================] - 0s 5ms/step - loss: 4.7265e-04 - val_loss:
 0.4244
Epoch 516/700
13/13 [==============================] - 0s 4ms/step - loss: 5.5343e-04 - val_loss:
 0.4229
Epoch 517/700
13/13 [==============================] - 0s 5ms/step - loss: 5.2252e-04 - val_loss:
 0.4234
Epoch 518/700
13/13 [==============================] - 0s 5ms/step - loss: 5.2102e-04 - val_loss:
 0.4255
Epoch 519/700
13/13 [==============================] - 0s 4ms/step - loss: 5.1037e-04 - val_loss:
 0.4225
Epoch 520/700
13/13 [==============================] - 0s 4ms/step - loss: 4.9829e-04 - val_loss:
 0.4243
Epoch 521/700
13/13 [==============================] - 0s 4ms/step - loss: 5.6201e-04 - val_loss:
 0.4236
Epoch 522/700
13/13 [==============================] - 0s 4ms/step - loss: 5.6586e-04 - val_loss:
 0.4291
Epoch 523/700
13/13 [==============================] - 0s 4ms/step - loss: 4.8880e-04 - val_loss:
 0.4265
Epoch 524/700
13/13 [==============================] - 0s 4ms/step - loss: 5.1824e-04 - val_loss:
 0.4311
Epoch 525/700
13/13 [==============================] - 0s 6ms/step - loss: 4.7785e-04 - val_loss:
 0.4315
Epoch 526/700
13/13 [==============================] - 0s 6ms/step - loss: 4.9988e-04 - val_loss:
```

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 0.4331
Epoch 527/700
13/13 [==============================] - 0s 5ms/step - loss: 4.5940e-04 - val_loss:
 0.4312
Epoch 528/700
13/13 [==============================] - 0s 5ms/step - loss: 4.7939e-04 - val_loss:
 0.4323
Epoch 529/700
13/13 [==============================] - 0s 4ms/step - loss: 4.7885e-04 - val_loss:
 0.4364
Epoch 530/700
13/13 [==============================] - 0s 6ms/step - loss: 4.5830e-04 - val_loss:
 0.4361
Epoch 531/700
13/13 [==============================] - 0s 5ms/step - loss: 4.6242e-04 - val_loss:
 0.4311
Epoch 532/700
13/13 [==============================] - 0s 5ms/step - loss: 4.6685e-04 - val_loss:
 0.4328
Epoch 533/700
13/13 [==============================] - 0s 5ms/step - loss: 4.5010e-04 - val_loss:
 0.4366
Epoch 534/700
13/13 [==============================] - 0s 5ms/step - loss: 4.4280e-04 - val_loss:
 0.4386
Epoch 535/700
13/13 [==============================] - 0s 5ms/step - loss: 4.8431e-04 - val_loss:
 0.4397
Epoch 536/700
13/13 [==============================] - 0s 5ms/step - loss: 4.2213e-04 - val_loss:
 0.4392
Epoch 537/700
13/13 [==============================] - 0s 4ms/step - loss: 4.2029e-04 - val_loss:
 0.4419
Epoch 538/700
13/13 [==============================] - 0s 5ms/step - loss: 4.1977e-04 - val_loss:
 0.4411
Epoch 539/700
13/13 [==============================] - 0s 4ms/step - loss: 4.1929e-04 - val_loss:
 0.4420
Epoch 540/700
13/13 [==============================] - 0s 6ms/step - loss: 4.0293e-04 - val_loss:
 0.4420
Epoch 541/700
13/13 [==============================] - 0s 4ms/step - loss: 4.0879e-04 - val_loss:
 0.4428
Epoch 542/700
13/13 [==============================] - 0s 5ms/step - loss: 4.2712e-04 - val_loss:
 0.4440
Epoch 543/700
13/13 [==============================] - 0s 5ms/step - loss: 4.8114e-04 - val_loss:
 0.4422
Epoch 544/700
13/13 [==============================] - 0s 4ms/step - loss: 4.8858e-04 - val_loss:
 0.4493
Epoch 545/700
13/13 [==============================] - 0s 6ms/step - loss: 4.6059e-04 - val_loss:
 0.4484
Epoch 546/700
13/13 [==============================] - 0s 5ms/step - loss: 4.2149e-04 - val_loss:
 0.4430
Epoch 547/700
13/13 [==============================] - 0s 4ms/step - loss: 4.3120e-04 - val_loss:
 0.4474
Epoch 548/700
13/13 [==============================] - 0s 6ms/step - loss: 4.3974e-04 - val_loss:
 0.4525
Epoch 549/700
13/13 [==============================] - 0s 5ms/step - loss: 3.6491e-04 - val_loss:
```

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 0.4490
Epoch 550/700
13/13 [==============================] - 0s 5ms/step - loss: 3.8822e-04 - val_loss:
 0.4473
Epoch 551/700
13/13 [==============================] - 0s 5ms/step - loss: 3.7837e-04 - val_loss:
 0.4467
Epoch 552/700
13/13 [==============================] - 0s 5ms/step - loss: 3.8453e-04 - val_loss:
 0.4503
Epoch 553/700
13/13 [==============================] - 0s 5ms/step - loss: 3.7736e-04 - val_loss:
 0.4509
Epoch 554/700
13/13 [==============================] - 0s 5ms/step - loss: 3.8380e-04 - val_loss:
 0.4548
Epoch 555/700
13/13 [==============================] - 0s 6ms/step - loss: 4.0033e-04 - val_loss:
 0.4537
Epoch 556/700
13/13 [==============================] - 0s 5ms/step - loss: 3.4489e-04 - val_loss:
 0.4524
Epoch 557/700
13/13 [==============================] - 0s 5ms/step - loss: 3.7475e-04 - val_loss:
 0.4534
Epoch 558/700
13/13 [==============================] - 0s 5ms/step - loss: 3.4030e-04 - val_loss:
 0.4530
Epoch 559/700
13/13 [==============================] - 0s 5ms/step - loss: 3.4684e-04 - val_loss:
 0.4532
Epoch 560/700
13/13 [==============================] - 0s 6ms/step - loss: 3.4184e-04 - val_loss:
 0.4558
Epoch 561/700
13/13 [==============================] - 0s 5ms/step - loss: 3.5808e-04 - val_loss:
 0.4611
Epoch 562/700
13/13 [==============================] - 0s 5ms/step - loss: 3.5377e-04 - val_loss:
 0.4591
Epoch 563/700
13/13 [==============================] - 0s 5ms/step - loss: 3.3180e-04 - val_loss:
 0.4627
Epoch 564/700
13/13 [==============================] - 0s 5ms/step - loss: 3.8577e-04 - val_loss:
 0.4641
Epoch 565/700
13/13 [==============================] - 0s 5ms/step - loss: 4.4891e-04 - val_loss:
 0.4675
Epoch 566/700
13/13 [==============================] - 0s 5ms/step - loss: 3.4642e-04 - val_loss:
 0.4610
Epoch 567/700
13/13 [==============================] - 0s 5ms/step - loss: 3.2152e-04 - val_loss:
 0.4662
Epoch 568/700
13/13 [==============================] - 0s 5ms/step - loss: 3.9239e-04 - val_loss:
 0.4677
Epoch 569/700
13/13 [==============================] - 0s 5ms/step - loss: 3.6180e-04 - val_loss:
 0.4661
Epoch 570/700
13/13 [==============================] - 0s 5ms/step - loss: 4.7841e-04 - val_loss:
 0.4683
Epoch 571/700
13/13 [==============================] - 0s 5ms/step - loss: 4.4673e-04 - val_loss:
 0.4676
Epoch 572/700
13/13 [==============================] - 0s 5ms/step - loss: 3.4658e-04 - val_loss:
```

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 0.4695
Epoch 573/700
13/13 [==============================] - 0s 5ms/step - loss: 3.0065e-04 - val_loss:
 0.4714
Epoch 574/700
13/13 [==============================] - 0s 5ms/step - loss: 2.8823e-04 - val_loss:
 0.4701
Epoch 575/700
13/13 [==============================] - 0s 5ms/step - loss: 3.0859e-04 - val_loss:
 0.4734
Epoch 576/700
13/13 [==============================] - 0s 5ms/step - loss: 2.8837e-04 - val_loss:
 0.4749
Epoch 577/700
13/13 [==============================] - 0s 5ms/step - loss: 3.0028e-04 - val_loss:
 0.4752
Epoch 578/700
13/13 [==============================] - 0s 5ms/step - loss: 2.8599e-04 - val_loss:
 0.4717
Epoch 579/700
13/13 [==============================] - 0s 5ms/step - loss: 2.8493e-04 - val_loss:
 0.4742
Epoch 580/700
13/13 [==============================] - 0s 5ms/step - loss: 3.3386e-04 - val_loss:
 0.4793
Epoch 581/700
13/13 [==============================] - 0s 4ms/step - loss: 3.2659e-04 - val_loss:
 0.4788
Epoch 582/700
13/13 [==============================] - 0s 5ms/step - loss: 2.8495e-04 - val_loss:
 0.4912
Epoch 583/700
13/13 [==============================] - 0s 5ms/step - loss: 2.9728e-04 - val_loss:
 0.4783
Epoch 584/700
13/13 [==============================] - 0s 5ms/step - loss: 3.2691e-04 - val_loss:
 0.4809
Epoch 585/700
13/13 [==============================] - 0s 5ms/step - loss: 2.8663e-04 - val_loss:
 0.4846
Epoch 586/700
13/13 [==============================] - 0s 6ms/step - loss: 2.6438e-04 - val_loss:
 0.4813
Epoch 587/700
13/13 [==============================] - 0s 6ms/step - loss: 2.7617e-04 - val_loss:
 0.4810
Epoch 588/700
13/13 [==============================] - 0s 6ms/step - loss: 3.1468e-04 - val_loss:
 0.4812
Epoch 589/700
13/13 [==============================] - 0s 4ms/step - loss: 2.5299e-04 - val_loss:
 0.4899
Epoch 590/700
13/13 [==============================] - 0s 4ms/step - loss: 2.5826e-04 - val_loss:
 0.4826
Epoch 591/700
13/13 [==============================] - 0s 5ms/step - loss: 2.7587e-04 - val_loss:
 0.4848
Epoch 592/700
13/13 [==============================] - 0s 3ms/step - loss: 2.6277e-04 - val_loss:
 0.4941
Epoch 593/700
13/13 [==============================] - 0s 5ms/step - loss: 2.8739e-04 - val_loss:
 0.4822
Epoch 594/700
13/13 [==============================] - 0s 5ms/step - loss: 3.2452e-04 - val_loss:
 0.4788
Epoch 595/700
13/13 [==============================] - 0s 5ms/step - loss: 3.1718e-04 - val_loss:
```

```
 0.4797
Epoch 596/700
13/13 [==============================] - 0s 5ms/step - loss: 2.4235e-04 - val_loss:
 0.5014
Epoch 597/700
13/13 [==============================] - 0s 5ms/step - loss: 2.9089e-04 - val_loss:
 0.4903
Epoch 598/700
13/13 [==============================] - 0s 6ms/step - loss: 2.9688e-04 - val_loss:
 0.4949
Epoch 599/700
13/13 [==============================] - 0s 5ms/step - loss: 2.4982e-04 - val_loss:
 0.4985
Epoch 600/700
13/13 [==============================] - 0s 5ms/step - loss: 2.5386e-04 - val_loss:
 0.4949
Epoch 601/700
13/13 [==============================] - 0s 5ms/step - loss: 2.4924e-04 - val_loss:
 0.4947
Epoch 602/700
13/13 [==============================] - 0s 5ms/step - loss: 2.4382e-04 - val_loss:
 0.5004
Epoch 603/700
13/13 [==============================] - 0s 5ms/step - loss: 2.1274e-04 - val_loss:
 0.4958
Epoch 604/700
13/13 [==============================] - 0s 5ms/step - loss: 2.2696e-04 - val_loss:
 0.5020
Epoch 605/700
13/13 [==============================] - 0s 5ms/step - loss: 2.2825e-04 - val_loss:
 0.5017
Epoch 606/700
13/13 [==============================] - 0s 5ms/step - loss: 2.7085e-04 - val_loss:
 0.4988
Epoch 607/700
13/13 [==============================] - 0s 5ms/step - loss: 2.5089e-04 - val_loss:
 0.5039
Epoch 608/700
13/13 [==============================] - 0s 5ms/step - loss: 2.1971e-04 - val_loss:
 0.4946
Epoch 609/700
13/13 [==============================] - 0s 5ms/step - loss: 2.7989e-04 - val_loss:
 0.5076
Epoch 610/700
13/13 [==============================] - 0s 5ms/step - loss: 2.3861e-04 - val_loss:
 0.5032
Epoch 611/700
13/13 [==============================] - 0s 5ms/step - loss: 2.5799e-04 - val_loss:
 0.5055
Epoch 612/700
13/13 [==============================] - 0s 5ms/step - loss: 2.1268e-04 - val_loss:
 0.5096
Epoch 613/700
13/13 [==============================] - 0s 5ms/step - loss: 2.1287e-04 - val_loss:
 0.5040
Epoch 614/700
13/13 [==============================] - 0s 5ms/step - loss: 2.1012e-04 - val_loss:
 0.5032
Epoch 615/700
13/13 [==============================] - 0s 5ms/step - loss: 2.2135e-04 - val_loss:
 0.5086
Epoch 616/700
13/13 [==============================] - 0s 4ms/step - loss: 2.0269e-04 - val_loss:
 0.4932
Epoch 617/700
13/13 [==============================] - 0s 5ms/step - loss: 2.2411e-04 - val_loss:
 0.5055
Epoch 618/700
13/13 [==============================] - 0s 5ms/step - loss: 2.7450e-04 - val_loss:
```

```
 0.5160
Epoch 619/700
13/13 [==============================] - 0s 5ms/step - loss: 1.7671e-04 - val_loss:
 0.5096
Epoch 620/700
13/13 [==============================] - 0s 4ms/step - loss: 2.1164e-04 - val_loss:
 0.5110
Epoch 621/700
13/13 [==============================] - 0s 6ms/step - loss: 1.9448e-04 - val_loss:
 0.5126
Epoch 622/700
13/13 [==============================] - 0s 4ms/step - loss: 1.9874e-04 - val_loss:
 0.5148
Epoch 623/700
13/13 [==============================] - 0s 4ms/step - loss: 1.8867e-04 - val_loss:
 0.5106
Epoch 624/700
13/13 [==============================] - 0s 4ms/step - loss: 1.8422e-04 - val_loss:
 0.5149
Epoch 625/700
13/13 [==============================] - 0s 4ms/step - loss: 1.8666e-04 - val_loss:
 0.5177
Epoch 626/700
13/13 [==============================] - 0s 5ms/step - loss: 1.8432e-04 - val_loss:
 0.5157
Epoch 627/700
13/13 [==============================] - 0s 4ms/step - loss: 1.9077e-04 - val_loss:
 0.5169
Epoch 628/700
13/13 [==============================] - 0s 4ms/step - loss: 1.7887e-04 - val_loss:
 0.5199
Epoch 629/700
13/13 [==============================] - 0s 4ms/step - loss: 1.8113e-04 - val_loss:
 0.5202
Epoch 630/700
13/13 [==============================] - 0s 4ms/step - loss: 1.8723e-04 - val_loss:
 0.5210
Epoch 631/700
13/13 [==============================] - 0s 4ms/step - loss: 1.8093e-04 - val_loss:
 0.5228
Epoch 632/700
13/13 [==============================] - 0s 4ms/step - loss: 1.7231e-04 - val_loss:
 0.5196
Epoch 633/700
13/13 [==============================] - 0s 5ms/step - loss: 1.7877e-04 - val_loss:
 0.5251
Epoch 634/700
13/13 [==============================] - 0s 5ms/step - loss: 1.6724e-04 - val_loss:
 0.5257
Epoch 635/700
13/13 [==============================] - 0s 5ms/step - loss: 1.7062e-04 - val_loss:
 0.5247
Epoch 636/700
13/13 [==============================] - 0s 5ms/step - loss: 1.6552e-04 - val_loss:
 0.5272
Epoch 637/700
13/13 [==============================] - 0s 5ms/step - loss: 1.6733e-04 - val_loss:
 0.5257
Epoch 638/700
13/13 [==============================] - 0s 5ms/step - loss: 1.8544e-04 - val_loss:
 0.5291
Epoch 639/700
13/13 [==============================] - 0s 5ms/step - loss: 1.7137e-04 - val_loss:
 0.5226
Epoch 640/700
13/13 [==============================] - 0s 5ms/step - loss: 1.8744e-04 - val_loss:
 0.5264
Epoch 641/700
13/13 [==============================] - 0s 5ms/step - loss: 1.7176e-04 - val_loss:
```

```
 0.5218
Epoch 642/700
13/13 [==============================] - 0s 5ms/step - loss: 1.6861e-04 - val_loss:
 0.5281
Epoch 643/700
13/13 [==============================] - 0s 5ms/step - loss: 1.5763e-04 - val_loss:
 0.5264
Epoch 644/700
13/13 [==============================] - 0s 5ms/step - loss: 1.5725e-04 - val_loss:
 0.5318
Epoch 645/700
13/13 [==============================] - 0s 5ms/step - loss: 1.6541e-04 - val_loss:
 0.5322
Epoch 646/700
13/13 [==============================] - 0s 5ms/step - loss: 1.6861e-04 - val_loss:
 0.5270
Epoch 647/700
13/13 [==============================] - 0s 5ms/step - loss: 1.5313e-04 - val_loss:
 0.5312
Epoch 648/700
13/13 [==============================] - 0s 5ms/step - loss: 2.0309e-04 - val_loss:
 0.5360
Epoch 649/700
13/13 [==============================] - 0s 5ms/step - loss: 1.5530e-04 - val_loss:
 0.5307
Epoch 650/700
13/13 [==============================] - 0s 5ms/step - loss: 1.6564e-04 - val_loss:
 0.5332
Epoch 651/700
13/13 [==============================] - 0s 5ms/step - loss: 1.5757e-04 - val_loss:
 0.5306
Epoch 652/700
13/13 [==============================] - 0s 5ms/step - loss: 1.4676e-04 - val_loss:
 0.5357
Epoch 653/700
13/13 [==============================] - 0s 5ms/step - loss: 1.6107e-04 - val_loss:
 0.5409
Epoch 654/700
13/13 [==============================] - 0s 5ms/step - loss: 1.3775e-04 - val_loss:
 0.5350
Epoch 655/700
13/13 [==============================] - 0s 5ms/step - loss: 1.4560e-04 - val_loss:
 0.5405
Epoch 656/700
13/13 [==============================] - 0s 5ms/step - loss: 1.5315e-04 - val_loss:
 0.5423
Epoch 657/700
13/13 [==============================] - 0s 5ms/step - loss: 1.4194e-04 - val_loss:
 0.5503
Epoch 658/700
13/13 [==============================] - 0s 5ms/step - loss: 1.5084e-04 - val_loss:
 0.5412
Epoch 659/700
13/13 [==============================] - 0s 5ms/step - loss: 1.4516e-04 - val_loss:
 0.5395
Epoch 660/700
13/13 [==============================] - 0s 5ms/step - loss: 1.6731e-04 - val_loss:
 0.5449
Epoch 661/700
13/13 [==============================] - 0s 5ms/step - loss: 1.9435e-04 - val_loss:
 0.5419
Epoch 662/700
13/13 [==============================] - 0s 5ms/step - loss: 1.3198e-04 - val_loss:
 0.5514
Epoch 663/700
13/13 [==============================] - 0s 5ms/step - loss: 1.5163e-04 - val_loss:
 0.5464
Epoch 664/700
13/13 [==============================] - 0s 5ms/step - loss: 1.6043e-04 - val_loss:
```

```
 0.5422
Epoch 665/700
13/13 [==============================] - 0s 5ms/step - loss: 1.6059e-04 - val_loss:
 0.5511
Epoch 666/700
13/13 [==============================] - 0s 5ms/step - loss: 2.3043e-04 - val_loss:
 0.5503
Epoch 667/700
13/13 [==============================] - 0s 5ms/step - loss: 1.7417e-04 - val_loss:
 0.5730
Epoch 668/700
13/13 [==============================] - 0s 5ms/step - loss: 1.6890e-04 - val_loss:
 0.5535
Epoch 669/700
13/13 [==============================] - 0s 5ms/step - loss: 1.6379e-04 - val_loss:
 0.5583
Epoch 670/700
13/13 [==============================] - 0s 5ms/step - loss: 1.3218e-04 - val_loss:
 0.5639
Epoch 671/700
13/13 [==============================] - 0s 6ms/step - loss: 1.1922e-04 - val_loss:
 0.5584
Epoch 672/700
13/13 [==============================] - 0s 5ms/step - loss: 1.3751e-04 - val_loss:
 0.5628
Epoch 673/700
13/13 [==============================] - 0s 5ms/step - loss: 1.2986e-04 - val_loss:
 0.5574
Epoch 674/700
13/13 [==============================] - 0s 5ms/step - loss: 1.2735e-04 - val_loss:
 0.5667
Epoch 675/700
13/13 [==============================] - 0s 5ms/step - loss: 1.2353e-04 - val_loss:
 0.5624
Epoch 676/700
13/13 [==============================] - 0s 5ms/step - loss: 1.1889e-04 - val_loss:
 0.5650
Epoch 677/700
13/13 [==============================] - 0s 5ms/step - loss: 1.1918e-04 - val_loss:
 0.5655
Epoch 678/700
13/13 [==============================] - 0s 5ms/step - loss: 1.1919e-04 - val_loss:
 0.5658
Epoch 679/700
13/13 [==============================] - 0s 5ms/step - loss: 1.3488e-04 - val_loss:
 0.5659
Epoch 680/700
13/13 [==============================] - 0s 5ms/step - loss: 1.2466e-04 - val_loss:
 0.5649
Epoch 681/700
13/13 [==============================] - 0s 5ms/step - loss: 1.1356e-04 - val_loss:
 0.5637
Epoch 682/700
13/13 [==============================] - 0s 5ms/step - loss: 1.1033e-04 - val_loss:
 0.5679
Epoch 683/700
13/13 [==============================] - 0s 5ms/step - loss: 1.1384e-04 - val_loss:
 0.5656
Epoch 684/700
13/13 [==============================] - 0s 5ms/step - loss: 1.1151e-04 - val_loss:
 0.5709
Epoch 685/700
13/13 [==============================] - 0s 5ms/step - loss: 1.0791e-04 - val_loss:
 0.5714
Epoch 686/700
13/13 [==============================] - 0s 5ms/step - loss: 1.3485e-04 - val_loss:
 0.5733
Epoch 687/700
13/13 [==============================] - 0s 6ms/step - loss: 1.0927e-04 - val_loss:
```

```
 0.5632
Epoch 688/700
13/13 [==============================] - 0s 5ms/step - loss: 1.0569e-04 - val_loss:
 0.5736
Epoch 689/700
13/13 [==============================] - 0s 6ms/step - loss: 1.1030e-04 - val_loss:
 0.5743
Epoch 690/700
13/13 [==============================] - 0s 5ms/step - loss: 1.0420e-04 - val_loss:
 0.5748
Epoch 691/700
13/13 [==============================] - 0s 5ms/step - loss: 1.0545e-04 - val_loss:
 0.5737
Epoch 692/700
13/13 [==============================] - 0s 5ms/step - loss: 1.0862e-04 - val_loss:
 0.5803
Epoch 693/700
13/13 [==============================] - 0s 4ms/step - loss: 1.1289e-04 - val_loss:
 0.5679
Epoch 694/700
13/13 [==============================] - 0s 5ms/step - loss: 1.0616e-04 - val_loss:
 0.5802
Epoch 695/700
13/13 [==============================] - 0s 5ms/step - loss: 1.0724e-04 - val_loss:
 0.5799
Epoch 696/700
13/13 [==============================] - 0s 5ms/step - loss: 1.0101e-04 - val_loss:
 0.5736
Epoch 697/700
13/13 [==============================] - 0s 5ms/step - loss: 1.0043e-04 - val_loss:
 0.5809
Epoch 698/700
13/13 [==============================] - 0s 4ms/step - loss: 1.1626e-04 - val_loss:
 0.5851
Epoch 699/700
13/13 [==============================] - 0s 5ms/step - loss: 1.0908e-04 - val_loss:
 0.5776
Epoch 700/700
13/13 [==============================] - 0s 4ms/step - loss: 1.3572e-04 - val_loss:
 0.5870
```

Out[22]: `<tensorflow.python.keras.callbacks.History at 0x1a86ec44790>`

In [23]:

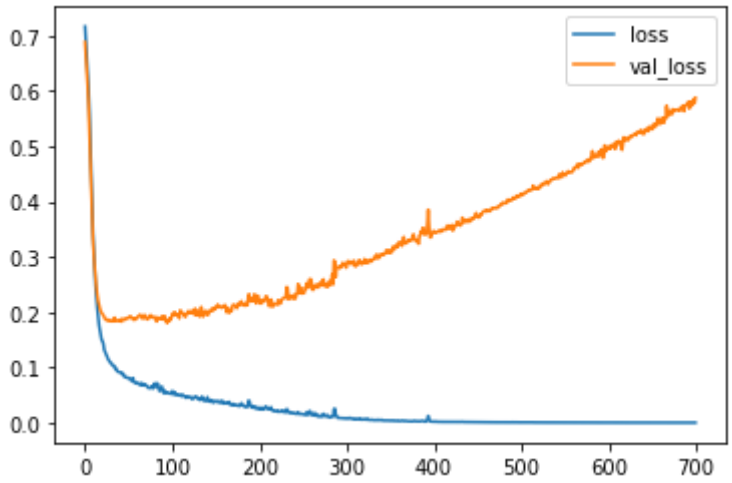
```
loss_df = model1.history.history

loss_train = loss_df["loss"]
loss_train = np.array(loss_train)
loss_test = loss_df["val_loss"]
loss_test = np.array(loss_test)

axis = range(0,700)
plt.plot(axis,loss_train, label="loss")
plt.plot(axis,loss_test, label="val_loss")
plt.legend()

# overfitting aşırı uydurma durumu (epoch fazla geldi)
```

Out[23]: `<matplotlib.legend.Legend at 0x1a86d9c4d90>`



In [25]:
```
# modeli tekrar oluşturma

model2 = models.Sequential()

model2.add(layers.Dense(30,activation="relu"))
model2.add(layers.Dense(15,activation="relu"))
model2.add(layers.Dense(15,activation="relu"))
model2.add(layers.Dense(1,activation="sigmoid"))

model2.compile(optimizer="adam",loss="binary_crossentropy")
```

In [26]:
```
# Early Stopping (Erken Durdurma) ayarlı eğitme
from tensorflow.keras import callbacks

stopping = callbacks.EarlyStopping(monitor="val_loss",mode="min",patience=25,verbose
# val_loss'u minimum olacak şekilde takip et, 25 ayarında erken durdurma yap

model2.fit(x_train, y_train, validation_data=(x_test,y_test),
          epochs=700, callbacks=[stopping])
```

```
Epoch 1/700
 1/13 [=>............................] - ETA: 0s - loss: 0.7111WARNING:tensorflow:Ca
llbacks method `on_train_batch_end` is slow compared to the batch time (batch time:
0.0000s vs `on_train_batch_end` time: 0.0040s). Check your callbacks.
13/13 [==============================] - 0s 17ms/step - loss: 0.6834 - val_loss: 0.6
714
Epoch 2/700
13/13 [==============================] - 0s 5ms/step - loss: 0.6656 - val_loss: 0.65
24
Epoch 3/700
13/13 [==============================] - 0s 5ms/step - loss: 0.6448 - val_loss: 0.62
99
Epoch 4/700
13/13 [==============================] - 0s 4ms/step - loss: 0.6181 - val_loss: 0.60
06
Epoch 5/700
13/13 [==============================] - 0s 6ms/step - loss: 0.5867 - val_loss: 0.56
56
Epoch 6/700
13/13 [==============================] - 0s 6ms/step - loss: 0.5497 - val_loss: 0.52
63
Epoch 7/700
13/13 [==============================] - 0s 4ms/step - loss: 0.5074 - val_loss: 0.48
17
Epoch 8/700
13/13 [==============================] - 0s 4ms/step - loss: 0.4621 - val_loss: 0.43
41
Epoch 9/700
```

```
13/13 [==============================] - 0s 4ms/step - loss: 0.4144 - val_loss: 0.38
60
Epoch 10/700
13/13 [==============================] - 0s 5ms/step - loss: 0.3693 - val_loss: 0.34
43
Epoch 11/700
13/13 [==============================] - 0s 5ms/step - loss: 0.3272 - val_loss: 0.30
88
Epoch 12/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2905 - val_loss: 0.27
89
Epoch 13/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2630 - val_loss: 0.25
55
Epoch 14/700
13/13 [==============================] - 0s 4ms/step - loss: 0.2387 - val_loss: 0.23
62
Epoch 15/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2124 - val_loss: 0.22
14
Epoch 16/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1934 - val_loss: 0.20
98
Epoch 17/700
13/13 [==============================] - 0s 4ms/step - loss: 0.1832 - val_loss: 0.20
56
Epoch 18/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1660 - val_loss: 0.19
63
Epoch 19/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1510 - val_loss: 0.19
37
Epoch 20/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1400 - val_loss: 0.19
08
Epoch 21/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1403 - val_loss: 0.19
44
Epoch 22/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1259 - val_loss: 0.19
12
Epoch 23/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1226 - val_loss: 0.18
85
Epoch 24/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1175 - val_loss: 0.18
79
Epoch 25/700
13/13 [==============================] - 0s 4ms/step - loss: 0.1149 - val_loss: 0.18
45
Epoch 26/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1115 - val_loss: 0.18
64
Epoch 27/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1102 - val_loss: 0.18
32
Epoch 28/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1066 - val_loss: 0.18
42
Epoch 29/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1023 - val_loss: 0.18
61
Epoch 30/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1053 - val_loss: 0.19
08
Epoch 31/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0972 - val_loss: 0.19
26
Epoch 32/700
```

```
13/13 [==============================] - 0s 4ms/step - loss: 0.0949 - val_loss: 0.19
81
Epoch 33/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0959 - val_loss: 0.20
12
Epoch 34/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0964 - val_loss: 0.19
28
Epoch 35/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0928 - val_loss: 0.19
00
Epoch 36/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0880 - val_loss: 0.18
97
Epoch 37/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0874 - val_loss: 0.18
74
Epoch 38/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0913 - val_loss: 0.18
73
Epoch 39/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0834 - val_loss: 0.18
59
Epoch 40/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0834 - val_loss: 0.18
72
Epoch 41/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0814 - val_loss: 0.19
06
Epoch 42/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0803 - val_loss: 0.19
10
Epoch 43/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0784 - val_loss: 0.19
28
Epoch 44/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0771 - val_loss: 0.19
67
Epoch 45/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0920 - val_loss: 0.20
09
Epoch 46/700
13/13 [==============================] - 0s 4ms/step - loss: 0.0910 - val_loss: 0.19
92
Epoch 47/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0813 - val_loss: 0.19
07
Epoch 48/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0741 - val_loss: 0.19
13
Epoch 49/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0722 - val_loss: 0.19
83
Epoch 50/700
13/13 [==============================] - 0s 6ms/step - loss: 0.0716 - val_loss: 0.19
76
Epoch 51/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0715 - val_loss: 0.19
86
Epoch 52/700
13/13 [==============================] - 0s 5ms/step - loss: 0.0705 - val_loss: 0.19
77
Epoch 00052: early stopping
```

Out[26]: `<tensorflow.python.keras.callbacks.History at 0x1a86f0d3ac0>`

In [28]:

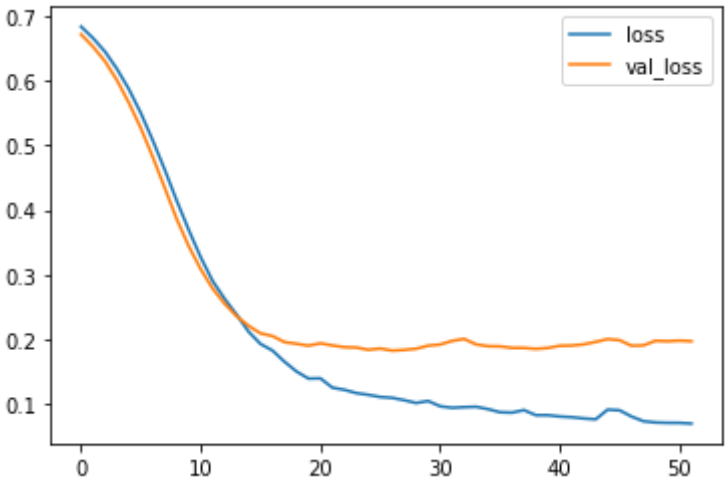
```
loss_df = model2.history.history

loss_train = loss_df["loss"]
```

```
loss_train = np.array(loss_train)
loss_test = loss_df["val_loss"]
loss_test = np.array(loss_test)

axis = range(0,52)  # 52. epoch'da erken durdurma
plt.plot(axis,loss_train, label="loss")
plt.plot(axis,loss_test, label="val_loss")
plt.legend()
```

Out[28]: <matplotlib.legend.Legend at 0x1a87048f370>



In [30]:

```
# Dropout (fazla nöronların düşürülmesi - kısa süreli unutma)
# modeli tekrar oluşturma

model3 = models.Sequential()

model3.add(layers.Dense(30,activation="relu"))
model3.add(layers.Dropout(0.4))   #rastgele nöronları düşürmeyi dene

model3.add(layers.Dense(15,activation="relu"))
model3.add(layers.Dropout(0.4))

model3.add(layers.Dense(15,activation="relu"))
model3.add(layers.Dropout(0.4))

model3.add(layers.Dense(1,activation="sigmoid"))

model3.compile(optimizer="adam",loss="binary_crossentropy")
```

In [31]:

```
model3.fit(x_train, y_train, validation_data=(x_test,y_test),
          epochs=700, callbacks=[stopping])
```

```
Epoch 1/700
13/13 [==============================] - 0s 20ms/step - loss: 0.6933 - val_loss: 0.6
890
Epoch 2/700
13/13 [==============================] - 0s 5ms/step - loss: 0.6897 - val_loss: 0.68
41
Epoch 3/700
13/13 [==============================] - 0s 6ms/step - loss: 0.6894 - val_loss: 0.67
81
Epoch 4/700
13/13 [==============================] - 0s 5ms/step - loss: 0.6856 - val_loss: 0.67
31
Epoch 5/700
13/13 [==============================] - 0s 5ms/step - loss: 0.6739 - val_loss: 0.66
53
```

```
Epoch 6/700
13/13 [==============================] - 0s 5ms/step - loss: 0.6696 - val_loss: 0.65
46
Epoch 7/700
13/13 [==============================] - 0s 5ms/step - loss: 0.6541 - val_loss: 0.64
31
Epoch 8/700
13/13 [==============================] - 0s 4ms/step - loss: 0.6540 - val_loss: 0.63
11
Epoch 9/700
13/13 [==============================] - 0s 5ms/step - loss: 0.6426 - val_loss: 0.61
69
Epoch 10/700
13/13 [==============================] - 0s 4ms/step - loss: 0.6183 - val_loss: 0.59
83
Epoch 11/700
13/13 [==============================] - 0s 5ms/step - loss: 0.6239 - val_loss: 0.57
84
Epoch 12/700
13/13 [==============================] - 0s 6ms/step - loss: 0.5906 - val_loss: 0.55
24
Epoch 13/700
13/13 [==============================] - 0s 5ms/step - loss: 0.5696 - val_loss: 0.52
04
Epoch 14/700
13/13 [==============================] - 0s 5ms/step - loss: 0.5580 - val_loss: 0.48
72
Epoch 15/700
13/13 [==============================] - 0s 5ms/step - loss: 0.5077 - val_loss: 0.45
44
Epoch 16/700
13/13 [==============================] - 0s 5ms/step - loss: 0.5072 - val_loss: 0.41
84
Epoch 17/700
13/13 [==============================] - 0s 5ms/step - loss: 0.4766 - val_loss: 0.38
69
Epoch 18/700
13/13 [==============================] - 0s 5ms/step - loss: 0.4561 - val_loss: 0.36
04
Epoch 19/700
13/13 [==============================] - 0s 5ms/step - loss: 0.4270 - val_loss: 0.33
72
Epoch 20/700
13/13 [==============================] - 0s 5ms/step - loss: 0.4253 - val_loss: 0.32
09
Epoch 21/700
13/13 [==============================] - 0s 5ms/step - loss: 0.3789 - val_loss: 0.30
47
Epoch 22/700
13/13 [==============================] - 0s 6ms/step - loss: 0.3525 - val_loss: 0.28
57
Epoch 23/700
13/13 [==============================] - 0s 5ms/step - loss: 0.3553 - val_loss: 0.27
03
Epoch 24/700
13/13 [==============================] - 0s 5ms/step - loss: 0.3535 - val_loss: 0.25
91
Epoch 25/700
13/13 [==============================] - 0s 6ms/step - loss: 0.3103 - val_loss: 0.25
12
Epoch 26/700
13/13 [==============================] - 0s 5ms/step - loss: 0.3308 - val_loss: 0.24
89
Epoch 27/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2931 - val_loss: 0.24
30
Epoch 28/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2731 - val_loss: 0.23
79
```

```
Epoch 29/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2868 - val_loss: 0.23
60
Epoch 30/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2486 - val_loss: 0.23
00
Epoch 31/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2807 - val_loss: 0.22
49
Epoch 32/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2643 - val_loss: 0.22
53
Epoch 33/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2479 - val_loss: 0.22
19
Epoch 34/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2395 - val_loss: 0.22
59
Epoch 35/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2425 - val_loss: 0.21
70
Epoch 36/700
13/13 [==============================] - 0s 6ms/step - loss: 0.2206 - val_loss: 0.21
45
Epoch 37/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2612 - val_loss: 0.21
78
Epoch 38/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2302 - val_loss: 0.21
98
Epoch 39/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2054 - val_loss: 0.22
00
Epoch 40/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2351 - val_loss: 0.22
21
Epoch 41/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2123 - val_loss: 0.21
61
Epoch 42/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2012 - val_loss: 0.21
46
Epoch 43/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2114 - val_loss: 0.21
17
Epoch 44/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1879 - val_loss: 0.21
07
Epoch 45/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2090 - val_loss: 0.20
70
Epoch 46/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1982 - val_loss: 0.20
83
Epoch 47/700
13/13 [==============================] - 0s 5ms/step - loss: 0.2126 - val_loss: 0.21
10
Epoch 48/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1855 - val_loss: 0.21
01
Epoch 49/700
13/13 [==============================] - 0s 6ms/step - loss: 0.1515 - val_loss: 0.21
23
Epoch 50/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1857 - val_loss: 0.21
40
Epoch 51/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1935 - val_loss: 0.21
40
```

```
Epoch 52/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1980 - val_loss: 0.21
14
Epoch 53/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1784 - val_loss: 0.21
23
Epoch 54/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1742 - val_loss: 0.21
61
Epoch 55/700
13/13 [==============================] - 0s 6ms/step - loss: 0.2011 - val_loss: 0.21
26
Epoch 56/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1472 - val_loss: 0.21
62
Epoch 57/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1703 - val_loss: 0.21
19
Epoch 58/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1546 - val_loss: 0.21
24
Epoch 59/700
13/13 [==============================] - 0s 4ms/step - loss: 0.1581 - val_loss: 0.21
58
Epoch 60/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1889 - val_loss: 0.21
79
Epoch 61/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1817 - val_loss: 0.22
19
Epoch 62/700
13/13 [==============================] - 0s 4ms/step - loss: 0.1718 - val_loss: 0.21
73
Epoch 63/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1632 - val_loss: 0.22
02
Epoch 64/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1385 - val_loss: 0.22
18
Epoch 65/700
13/13 [==============================] - 0s 6ms/step - loss: 0.1606 - val_loss: 0.22
63
Epoch 66/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1686 - val_loss: 0.22
28
Epoch 67/700
13/13 [==============================] - 0s 4ms/step - loss: 0.1680 - val_loss: 0.22
00
Epoch 68/700
13/13 [==============================] - 0s 4ms/step - loss: 0.1595 - val_loss: 0.21
74
Epoch 69/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1770 - val_loss: 0.21
67
Epoch 70/700
13/13 [==============================] - 0s 5ms/step - loss: 0.1516 - val_loss: 0.21
62
Epoch 00070: early stopping
```

Out[31]: `<tensorflow.python.keras.callbacks.History at 0x1a870507d30>`

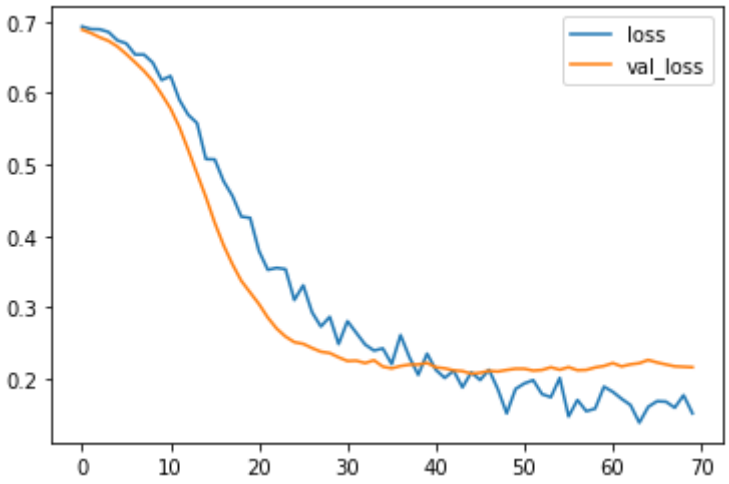
In [32]:

```
loss_df = model3.history.history

loss_train = loss_df["loss"]
loss_train = np.array(loss_train)
loss_test = loss_df["val_loss"]
loss_test = np.array(loss_test)
```

```
axis = range(0,70)  # 70. epoch
plt.plot(axis,loss_train, label="loss")
plt.plot(axis,loss_test, label="val_loss")
plt.legend()
```

Out[32]: <matplotlib.legend.Legend at 0x1a87075c040>



In [36]:

```
# sınıflandırma sonuçlarını tahmin et

tahminler = model3.predict_classes(x_test)
tahminler
```

Out[36]:

```
array([[0],
       [0],
       [0],
       [0],
       [1],
       [1],
       [1],
       [0],
       [1],
       [0],
       [0],
       [1],
       [0],
       [1],
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       [0],
       [1],
       [0],
       [0],
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       [1],
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       [1],
       [0],
       [0],
       [0],
       [1],
       [1],
       [0],
       [0],
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       [1],
       [1],
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       [0],
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       [0],
       [1],
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       [1],
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       [1],
       [1],
       [0],
       [0],
       [0],
       [1],
       [0],
       [0],
       [0],
       [1],
       [0]])
```

In [37]:

```
sayı = tahminler.shape[0]
tahminler = pd.Series(tahminler.reshape(sayı,))

resultFrame = pd.DataFrame(y_test,columns=["Gerçek Tür"])
resultFrame["Tahmin"] = tahminler
resultFrame
```

Out[37]:

	Gerçek Tür	Tahmin
0	0	0
1	0	0
2	0	0
3	0	0
4	1	1
...	...	...

	Gerçek Tür	Tahmin
149	0	0
150	0	0
151	0	0
152	1	1
153	0	0

154 rows × 2 columns

In [40]:
```
# sınıflandırma sonuçlarını değerlendirme

from sklearn.metrics import classification_report
from sklearn.metrics import confusion_matrix

print(classification_report(y_test,tahminler))
# %93 accuracy score
```

```
              precision    recall  f1-score   support

           0       0.94      0.95      0.94        95
           1       0.91      0.90      0.91        59

    accuracy                           0.93       154
   macro avg       0.93      0.92      0.92       154
weighted avg       0.93      0.93      0.93       154
```

In [41]:
```
print(confusion_matrix(y_test,tahminler))
```

```
[[90  5]
 [ 6 53]]
```

In [42]:
```
# 0'lar (virüs siteleri tahmininde) 90 doğru, 5 yanlış / %94 doğruluk
# 1'lar (güvenli siteleri tahmininde) 53 doğru, 6 yanlış / %91 doğruluk
```

In [ ]:
```

```