

In this exercise you'll try to build a neural network that predicts the price of a house according to a simple formula.

So, imagine if house pricing was as easy as a house costs 50k + 50k per bedroom, so that a 1 bedroom house costs 100k, a 2 bedroom house costs 150k etc.

How would you create a neural network that learns this relationship so that it would predict a 7 bedroom house as costing close to 400k etc.

Hint: Your network might work better if you scale the house price down. You don't have to give the answer 400...it might be better to create something that predicts the number 4, and then your answer is in the 'hundreds of thousands' etc.

In [1]:

```
import tensorflow as tf
import numpy as np
from tensorflow import keras
```

In [4]:

```
# GRADED FUNCTION: house_model
def house_model(y_new):
    xs = np.array([1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 8.0, 9.0, 10.0])
    ys = np.array([1, 1.5, 2.0, 2.5, 3.0, 3.5, 4.5, 5.0, 5.5,], dtype=float)
    model = keras.Sequential([keras.layers.Dense(units=1, input_shape=[1])])
    model.compile(optimizer='sgd', loss='mean_squared_error')
    model.fit(xs, ys, epochs=500)
    return model.predict(y_new)[0]
```

In [5]:

```
prediction = house_model([7.0])
print(prediction)
```

```
Epoch 1/500
9/9 [=====] - 0s 23ms/sample - loss: 141.7990
Epoch 2/500
9/9 [=====] - 0s 220us/sample - loss: 8.0433
Epoch 3/500
9/9 [=====] - 0s 225us/sample - loss: 0.4668
Epoch 4/500
9/9 [=====] - 0s 5ms/sample - loss: 0.0375
Epoch 5/500
9/9 [=====] - 0s 210us/sample - loss: 0.0131
Epoch 6/500
9/9 [=====] - 0s 674us/sample - loss: 0.0116
Epoch 7/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0115
Epoch 8/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0113
Epoch 9/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0112
Epoch 10/500
9/9 [=====] - 0s 6ms/sample - loss: 0.0111
Epoch 11/500
9/9 [=====] - 0s 243us/sample - loss: 0.0110
Epoch 12/500
9/9 [=====] - 0s 202us/sample - loss: 0.0109
Epoch 13/500
9/9 [=====] - 0s 318us/sample - loss: 0.0108
Epoch 14/500
9/9 [=====] - 0s 293us/sample - loss: 0.0107
Epoch 15/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0106
Epoch 16/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0105
Epoch 17/500
9/9 [=====] - 0s 6ms/sample - loss: 0.0104
Epoch 18/500
9/9 [=====] - 0s 297us/sample - loss: 0.0103
Epoch 19/500
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9/9 [=====] - 0s 664us/sample - loss: 0.0102
Epoch 20/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0101
Epoch 21/500
9/9 [=====] - 0s 3ms/sample - loss: 0.0100
Epoch 22/500
9/9 [=====] - 0s 174us/sample - loss: 0.0099
Epoch 23/500
9/9 [=====] - 0s 5ms/sample - loss: 0.0099
Epoch 24/500
9/9 [=====] - 0s 240us/sample - loss: 0.0098
Epoch 25/500
9/9 [=====] - 0s 153us/sample - loss: 0.0097
Epoch 26/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0096
Epoch 27/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0095
Epoch 28/500
9/9 [=====] - 0s 838us/sample - loss: 0.0094
Epoch 29/500
9/9 [=====] - 0s 7ms/sample - loss: 0.0093
Epoch 30/500
9/9 [=====] - 0s 257us/sample - loss: 0.0092
Epoch 31/500
9/9 [=====] - 0s 304us/sample - loss: 0.0091
Epoch 32/500
9/9 [=====] - 0s 272us/sample - loss: 0.0091
Epoch 33/500
9/9 [=====] - 0s 253us/sample - loss: 0.0090
Epoch 34/500
9/9 [=====] - 0s 372us/sample - loss: 0.0089
Epoch 35/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0088
Epoch 36/500
9/9 [=====] - 0s 8ms/sample - loss: 0.0087
Epoch 37/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0086
Epoch 38/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0086
Epoch 39/500
9/9 [=====] - 0s 358us/sample - loss: 0.0085
Epoch 40/500
9/9 [=====] - 0s 215us/sample - loss: 0.0084
Epoch 41/500
9/9 [=====] - 0s 164us/sample - loss: 0.0083
Epoch 42/500
9/9 [=====] - 0s 6ms/sample - loss: 0.0083
Epoch 43/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0082
Epoch 44/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0081
Epoch 45/500
9/9 [=====] - 0s 302us/sample - loss: 0.0080
Epoch 46/500
9/9 [=====] - 0s 218us/sample - loss: 0.0079
Epoch 47/500
9/9 [=====] - 0s 194us/sample - loss: 0.0079
Epoch 48/500
9/9 [=====] - 0s 171us/sample - loss: 0.0078
Epoch 49/500
9/9 [=====] - 0s 8ms/sample - loss: 0.0077
Epoch 50/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0077
Epoch 51/500
9/9 [=====] - 0s 388us/sample - loss: 0.0076
Epoch 52/500
9/9 [=====] - 0s 856us/sample - loss: 0.0075
Epoch 53/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0074
Epoch 54/500
9/9 [=====] - 0s 6ms/sample - loss: 0.0074
Epoch 55/500
9/9 [=====] - 0s 336us/sample - loss: 0.0073
Epoch 56/500
9/9 [=====] - 0s 698us/sample - loss: 0.0072
Epoch 57/500
9/9 [=====] - 0s 223us/sample - loss: 0.0072
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Epoch 58/500  
9/9 [=====] - 0s 217us/sample - loss: 0.0071  
Epoch 59/500  
9/9 [=====] - 0s 2ms/sample - loss: 0.0070  
Epoch 60/500  
9/9 [=====] - 0s 6ms/sample - loss: 0.0070  
Epoch 61/500  
9/9 [=====] - 0s 698us/sample - loss: 0.0069  
Epoch 62/500  
9/9 [=====] - 0s 1ms/sample - loss: 0.0068  
Epoch 63/500  
9/9 [=====] - 0s 594us/sample - loss: 0.0068  
Epoch 64/500  
9/9 [=====] - 0s 1ms/sample - loss: 0.0067  
Epoch 65/500  
9/9 [=====] - 0s 2ms/sample - loss: 0.0067  
Epoch 66/500  
9/9 [=====] - 0s 5ms/sample - loss: 0.0066  
Epoch 67/500  
9/9 [=====] - 0s 278us/sample - loss: 0.0065  
Epoch 68/500  
9/9 [=====] - 0s 258us/sample - loss: 0.0065  
Epoch 69/500  
9/9 [=====] - 0s 1ms/sample - loss: 0.0064  
Epoch 70/500  
9/9 [=====] - 0s 2ms/sample - loss: 0.0064  
Epoch 71/500  
9/9 [=====] - 0s 1ms/sample - loss: 0.0063  
Epoch 72/500  
9/9 [=====] - 0s 7ms/sample - loss: 0.0062  
Epoch 73/500  
9/9 [=====] - 0s 2ms/sample - loss: 0.0062  
Epoch 74/500  
9/9 [=====] - 0s 949us/sample - loss: 0.0061  
Epoch 75/500  
9/9 [=====] - 0s 234us/sample - loss: 0.0061  
Epoch 76/500  
9/9 [=====] - 0s 423us/sample - loss: 0.0060  
Epoch 77/500  
9/9 [=====] - 0s 246us/sample - loss: 0.0059  
Epoch 78/500  
9/9 [=====] - 0s 6ms/sample - loss: 0.0059  
Epoch 79/500  
9/9 [=====] - 0s 2ms/sample - loss: 0.0058  
Epoch 80/500  
9/9 [=====] - 0s 1ms/sample - loss: 0.0058  
Epoch 81/500  
9/9 [=====] - 0s 241us/sample - loss: 0.0057  
Epoch 82/500  
9/9 [=====] - 0s 678us/sample - loss: 0.0057  
Epoch 83/500  
9/9 [=====] - 0s 1ms/sample - loss: 0.0056  
Epoch 84/500  
9/9 [=====] - 0s 7ms/sample - loss: 0.0056  
Epoch 85/500  
9/9 [=====] - 0s 828us/sample - loss: 0.0055  
Epoch 86/500  
9/9 [=====] - 0s 631us/sample - loss: 0.0055  
Epoch 87/500  
9/9 [=====] - 0s 2ms/sample - loss: 0.0054  
Epoch 88/500  
9/9 [=====] - 0s 2ms/sample - loss: 0.0054  
Epoch 89/500  
9/9 [=====] - 0s 451us/sample - loss: 0.0053  
Epoch 90/500  
9/9 [=====] - 0s 5ms/sample - loss: 0.0053  
Epoch 91/500  
9/9 [=====] - 0s 923us/sample - loss: 0.0052  
Epoch 92/500  
9/9 [=====] - 0s 1ms/sample - loss: 0.0052  
Epoch 93/500  
9/9 [=====] - 0s 923us/sample - loss: 0.0051  
Epoch 94/500  
9/9 [=====] - 0s 1ms/sample - loss: 0.0051  
Epoch 95/500  
9/9 [=====] - 0s 2ms/sample - loss: 0.0050  
Epoch 96/500

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9/9 [=====] - 0s 1ms/sample - loss: 0.0050
Epoch 97/500
9/9 [=====] - 0s 277us/sample - loss: 0.0049
Epoch 98/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0049
Epoch 99/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0048
Epoch 100/500
9/9 [=====] - 0s 413us/sample - loss: 0.0048
Epoch 101/500
9/9 [=====] - 0s 186us/sample - loss: 0.0048
Epoch 102/500
9/9 [=====] - 0s 132us/sample - loss: 0.0047
Epoch 103/500
9/9 [=====] - 0s 201us/sample - loss: 0.0047
Epoch 104/500
9/9 [=====] - 0s 204us/sample - loss: 0.0046
Epoch 105/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0046
Epoch 106/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0045
Epoch 107/500
9/9 [=====] - 0s 947us/sample - loss: 0.0045
Epoch 108/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0045
Epoch 109/500
9/9 [=====] - 0s 6ms/sample - loss: 0.0044
Epoch 110/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0044
Epoch 111/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0043
Epoch 112/500
9/9 [=====] - 0s 233us/sample - loss: 0.0043
Epoch 113/500
9/9 [=====] - 0s 224us/sample - loss: 0.0042
Epoch 114/500
9/9 [=====] - 0s 359us/sample - loss: 0.0042
Epoch 115/500
9/9 [=====] - 0s 302us/sample - loss: 0.0042
Epoch 116/500
9/9 [=====] - 0s 7ms/sample - loss: 0.0041
Epoch 117/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0041
Epoch 118/500
9/9 [=====] - 0s 399us/sample - loss: 0.0041
Epoch 119/500
9/9 [=====] - 0s 366us/sample - loss: 0.0040
Epoch 120/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0040
Epoch 121/500
9/9 [=====] - 0s 6ms/sample - loss: 0.0039
Epoch 122/500
9/9 [=====] - 0s 3ms/sample - loss: 0.0039
Epoch 123/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0039
Epoch 124/500
9/9 [=====] - 0s 172us/sample - loss: 0.0038
Epoch 125/500
9/9 [=====] - 0s 216us/sample - loss: 0.0038
Epoch 126/500
9/9 [=====] - 0s 345us/sample - loss: 0.0038
Epoch 127/500
9/9 [=====] - 0s 7ms/sample - loss: 0.0037
Epoch 128/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0037
Epoch 129/500
9/9 [=====] - 0s 865us/sample - loss: 0.0037
Epoch 130/500
9/9 [=====] - 0s 206us/sample - loss: 0.0036
Epoch 131/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0036
Epoch 132/500
9/9 [=====] - 0s 860us/sample - loss: 0.0036
Epoch 133/500
9/9 [=====] - 0s 7ms/sample - loss: 0.0035
Epoch 134/500
9/9 [=====] - 0s 861us/sample - loss: 0.0035
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Epoch 135/500
9/9 [=====] - 0s 955us/sample - loss: 0.0035
Epoch 136/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0034
Epoch 137/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0034
Epoch 138/500
9/9 [=====] - 0s 357us/sample - loss: 0.0034
Epoch 139/500
9/9 [=====] - 0s 4ms/sample - loss: 0.0033
Epoch 140/500
9/9 [=====] - 0s 269us/sample - loss: 0.0033
Epoch 141/500
9/9 [=====] - 0s 435us/sample - loss: 0.0033
Epoch 142/500
9/9 [=====] - 0s 287us/sample - loss: 0.0032
Epoch 143/500
9/9 [=====] - 0s 278us/sample - loss: 0.0032
Epoch 144/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0032
Epoch 145/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0031
Epoch 146/500
9/9 [=====] - 0s 6ms/sample - loss: 0.0031
Epoch 147/500
9/9 [=====] - 0s 259us/sample - loss: 0.0031
Epoch 148/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0031
Epoch 149/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0030
Epoch 150/500
9/9 [=====] - 0s 217us/sample - loss: 0.0030
Epoch 151/500
9/9 [=====] - 0s 268us/sample - loss: 0.0030
Epoch 152/500
9/9 [=====] - 0s 182us/sample - loss: 0.0029
Epoch 153/500
9/9 [=====] - 0s 248us/sample - loss: 0.0029
Epoch 154/500
9/9 [=====] - 0s 257us/sample - loss: 0.0029
Epoch 155/500
9/9 [=====] - 0s 6ms/sample - loss: 0.0029
Epoch 156/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0028
Epoch 157/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0028
Epoch 158/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0028
Epoch 159/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0028
Epoch 160/500
9/9 [=====] - 0s 4ms/sample - loss: 0.0027
Epoch 161/500
9/9 [=====] - 0s 809us/sample - loss: 0.0027
Epoch 162/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0027
Epoch 163/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0027
Epoch 164/500
9/9 [=====] - 0s 830us/sample - loss: 0.0026
Epoch 165/500
9/9 [=====] - 0s 6ms/sample - loss: 0.0026
Epoch 166/500
9/9 [=====] - 0s 428us/sample - loss: 0.0026
Epoch 167/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0026
Epoch 168/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0025
Epoch 169/500
9/9 [=====] - 0s 267us/sample - loss: 0.0025
Epoch 170/500
9/9 [=====] - 0s 197us/sample - loss: 0.0025
Epoch 171/500
9/9 [=====] - 0s 157us/sample - loss: 0.0025
Epoch 172/500
9/9 [=====] - 0s 191us/sample - loss: 0.0024
Epoch 173/500
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9/9 [=====] - 0s 243us/sample - loss: 0.0024  
Epoch 174/500  
9/9 [=====] - 0s 6ms/sample - loss: 0.0024  
Epoch 175/500  
9/9 [=====] - 0s 2ms/sample - loss: 0.0024  
Epoch 176/500  
9/9 [=====] - 0s 1ms/sample - loss: 0.0024  
Epoch 177/500  
9/9 [=====] - 0s 755us/sample - loss: 0.0023  
Epoch 178/500  
9/9 [=====] - 0s 840us/sample - loss: 0.0023  
Epoch 179/500  
9/9 [=====] - 0s 7ms/sample - loss: 0.0023  
Epoch 180/500  
9/9 [=====] - 0s 451us/sample - loss: 0.0023  
Epoch 181/500  
9/9 [=====] - 0s 309us/sample - loss: 0.0022  
Epoch 182/500  
9/9 [=====] - 0s 383us/sample - loss: 0.0022  
Epoch 183/500  
9/9 [=====] - 0s 223us/sample - loss: 0.0022  
Epoch 184/500  
9/9 [=====] - 0s 590us/sample - loss: 0.0022  
Epoch 185/500  
9/9 [=====] - 0s 2ms/sample - loss: 0.0022  
Epoch 186/500  
9/9 [=====] - 0s 982us/sample - loss: 0.0021  
Epoch 187/500  
9/9 [=====] - 0s 291us/sample - loss: 0.0021  
Epoch 188/500  
9/9 [=====] - 0s 772us/sample - loss: 0.0021  
Epoch 189/500  
9/9 [=====] - 0s 1ms/sample - loss: 0.0021  
Epoch 190/500  
9/9 [=====] - 0s 1ms/sample - loss: 0.0021  
Epoch 191/500  
9/9 [=====] - 0s 471us/sample - loss: 0.0020  
Epoch 192/500  
9/9 [=====] - 0s 6ms/sample - loss: 0.0020  
Epoch 193/500  
9/9 [=====] - 0s 299us/sample - loss: 0.0020  
Epoch 194/500  
9/9 [=====] - 0s 212us/sample - loss: 0.0020  
Epoch 195/500  
9/9 [=====] - 0s 269us/sample - loss: 0.0020  
Epoch 196/500  
9/9 [=====] - 0s 501us/sample - loss: 0.0020  
Epoch 197/500  
9/9 [=====] - 0s 2ms/sample - loss: 0.0019  
Epoch 198/500  
9/9 [=====] - 0s 2ms/sample - loss: 0.0019  
Epoch 199/500  
9/9 [=====] - 0s 290us/sample - loss: 0.0019  
Epoch 200/500  
9/9 [=====] - 0s 162us/sample - loss: 0.0019  
Epoch 201/500  
9/9 [=====] - 0s 5ms/sample - loss: 0.0019  
Epoch 202/500  
9/9 [=====] - 0s 1ms/sample - loss: 0.0018  
Epoch 203/500  
9/9 [=====] - 0s 3ms/sample - loss: 0.0018  
Epoch 204/500  
9/9 [=====] - 0s 1ms/sample - loss: 0.0018  
Epoch 205/500  
9/9 [=====] - 0s 316us/sample - loss: 0.0018  
Epoch 206/500  
9/9 [=====] - 0s 217us/sample - loss: 0.0018  
Epoch 207/500  
9/9 [=====] - 0s 5ms/sample - loss: 0.0018  
Epoch 208/500  
9/9 [=====] - 0s 754us/sample - loss: 0.0017  
Epoch 209/500  
9/9 [=====] - 0s 1ms/sample - loss: 0.0017  
Epoch 210/500  
9/9 [=====] - 0s 907us/sample - loss: 0.0017  
Epoch 211/500  
9/9 [=====] - 0s 3ms/sample - loss: 0.0017

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Epoch 212/500
9/9 [=====] - 0s 743us/sample - loss: 0.0017
Epoch 213/500
9/9 [=====] - 0s 4ms/sample - loss: 0.0017
Epoch 214/500
9/9 [=====] - 0s 387us/sample - loss: 0.0017
Epoch 215/500
9/9 [=====] - 0s 329us/sample - loss: 0.0016
Epoch 216/500
9/9 [=====] - 0s 280us/sample - loss: 0.0016
Epoch 217/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0016
Epoch 218/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0016
Epoch 219/500
9/9 [=====] - 0s 381us/sample - loss: 0.0016
Epoch 220/500
9/9 [=====] - 0s 393us/sample - loss: 0.0016
Epoch 221/500
9/9 [=====] - 0s 5ms/sample - loss: 0.0015
Epoch 222/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0015
Epoch 223/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0015
Epoch 224/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0015
Epoch 225/500
9/9 [=====] - 0s 230us/sample - loss: 0.0015
Epoch 226/500
9/9 [=====] - 0s 193us/sample - loss: 0.0015
Epoch 227/500
9/9 [=====] - 0s 6ms/sample - loss: 0.0015
Epoch 228/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0014
Epoch 229/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0014
Epoch 230/500
9/9 [=====] - 0s 755us/sample - loss: 0.0014
Epoch 231/500
9/9 [=====] - 0s 203us/sample - loss: 0.0014
Epoch 232/500
9/9 [=====] - 0s 182us/sample - loss: 0.0014
Epoch 233/500
9/9 [=====] - 0s 206us/sample - loss: 0.0014
Epoch 234/500
9/9 [=====] - 0s 5ms/sample - loss: 0.0014
Epoch 235/500
9/9 [=====] - 0s 924us/sample - loss: 0.0014
Epoch 236/500
9/9 [=====] - 0s 929us/sample - loss: 0.0013
Epoch 237/500
9/9 [=====] - 0s 808us/sample - loss: 0.0013
Epoch 238/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0013
Epoch 239/500
9/9 [=====] - 0s 6ms/sample - loss: 0.0013
Epoch 240/500
9/9 [=====] - 0s 273us/sample - loss: 0.0013
Epoch 241/500
9/9 [=====] - 0s 318us/sample - loss: 0.0013
Epoch 242/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0013
Epoch 243/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0013
Epoch 244/500
9/9 [=====] - 0s 893us/sample - loss: 0.0012
Epoch 245/500
9/9 [=====] - 0s 7ms/sample - loss: 0.0012
Epoch 246/500
9/9 [=====] - 0s 511us/sample - loss: 0.0012
Epoch 247/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0012
Epoch 248/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0012
Epoch 249/500
9/9 [=====] - 0s 186us/sample - loss: 0.0012
Epoch 250/500
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9/9 [=====] - 0s 161us/sample - loss: 0.0012
Epoch 251/500
9/9 [=====] - 0s 171us/sample - loss: 0.0012
Epoch 252/500
9/9 [=====] - 0s 5ms/sample - loss: 0.0012
Epoch 253/500
9/9 [=====] - 0s 198us/sample - loss: 0.0011
Epoch 254/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0011
Epoch 255/500
9/9 [=====] - 0s 862us/sample - loss: 0.0011
Epoch 256/500
9/9 [=====] - 0s 883us/sample - loss: 0.0011
Epoch 257/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0011
Epoch 258/500
9/9 [=====] - 0s 2ms/sample - loss: 0.0011
Epoch 259/500
9/9 [=====] - 0s 5ms/sample - loss: 0.0011
Epoch 260/500
9/9 [=====] - 0s 304us/sample - loss: 0.0011
Epoch 261/500
9/9 [=====] - 0s 270us/sample - loss: 0.0011
Epoch 262/500
9/9 [=====] - 0s 298us/sample - loss: 0.0011
Epoch 263/500
9/9 [=====] - 0s 262us/sample - loss: 0.0010
Epoch 264/500
9/9 [=====] - 0s 769us/sample - loss: 0.0010
Epoch 265/500
9/9 [=====] - 0s 1ms/sample - loss: 0.0010
Epoch 266/500
9/9 [=====] - 0s 7ms/sample - loss: 0.0010
Epoch 267/500
9/9 [=====] - 0s 691us/sample - loss: 0.0010
Epoch 268/500
9/9 [=====] - 0s 270us/sample - loss: 9.9644e-04
Epoch 269/500
9/9 [=====] - 0s 243us/sample - loss: 9.8717e-04
Epoch 270/500
9/9 [=====] - 0s 377us/sample - loss: 9.7797e-04
Epoch 271/500
9/9 [=====] - 0s 572us/sample - loss: 9.6886e-04
Epoch 272/500
9/9 [=====] - 0s 2ms/sample - loss: 9.5985e-04
Epoch 273/500
9/9 [=====] - 0s 6ms/sample - loss: 9.5090e-04
Epoch 274/500
9/9 [=====] - 0s 917us/sample - loss: 9.4205e-04
Epoch 275/500
9/9 [=====] - 0s 969us/sample - loss: 9.3329e-04
Epoch 276/500
9/9 [=====] - 0s 2ms/sample - loss: 9.2460e-04
Epoch 277/500
9/9 [=====] - 0s 1ms/sample - loss: 9.1599e-04
Epoch 278/500
9/9 [=====] - 0s 219us/sample - loss: 9.0746e-04
Epoch 279/500
9/9 [=====] - 0s 194us/sample - loss: 8.9901e-04
Epoch 280/500
9/9 [=====] - 0s 5ms/sample - loss: 8.9064e-04
Epoch 281/500
9/9 [=====] - 0s 220us/sample - loss: 8.8235e-04
Epoch 282/500
9/9 [=====] - 0s 1ms/sample - loss: 8.7413e-04
Epoch 283/500
9/9 [=====] - 0s 2ms/sample - loss: 8.6599e-04
Epoch 284/500
9/9 [=====] - 0s 1ms/sample - loss: 8.5793e-04
Epoch 285/500
9/9 [=====] - 0s 6ms/sample - loss: 8.4994e-04
Epoch 286/500
9/9 [=====] - 0s 751us/sample - loss: 8.4203e-04
Epoch 287/500
9/9 [=====] - 0s 744us/sample - loss: 8.3419e-04
Epoch 288/500
9/9 [=====] - 0s 210us/sample - loss: 8.2642e-04
```



```
Epoch 289/500
9/9 [=====] - 0s 216us/sample - loss: 8.1873e-04
Epoch 290/500
9/9 [=====] - 0s 2ms/sample - loss: 8.1110e-04
Epoch 291/500
9/9 [=====] - 0s 7ms/sample - loss: 8.0356e-04
Epoch 292/500
9/9 [=====] - 0s 871us/sample - loss: 7.9607e-04
Epoch 293/500
9/9 [=====] - 0s 992us/sample - loss: 7.8866e-04
Epoch 294/500
9/9 [=====] - 0s 1ms/sample - loss: 7.8132e-04
Epoch 295/500
9/9 [=====] - 0s 2ms/sample - loss: 7.7404e-04
Epoch 296/500
9/9 [=====] - 0s 167us/sample - loss: 7.6683e-04
Epoch 297/500
9/9 [=====] - 0s 279us/sample - loss: 7.5970e-04
Epoch 298/500
9/9 [=====] - 0s 790us/sample - loss: 7.5262e-04
Epoch 299/500
9/9 [=====] - 0s 1ms/sample - loss: 7.4562e-04
Epoch 300/500
9/9 [=====] - 0s 1ms/sample - loss: 7.3867e-04
Epoch 301/500
9/9 [=====] - 0s 1ms/sample - loss: 7.3180e-04
Epoch 302/500
9/9 [=====] - 0s 406us/sample - loss: 7.2498e-04
Epoch 303/500
9/9 [=====] - 0s 6ms/sample - loss: 7.1823e-04
Epoch 304/500
9/9 [=====] - 0s 2ms/sample - loss: 7.1155e-04
Epoch 305/500
9/9 [=====] - 0s 1ms/sample - loss: 7.0492e-04
Epoch 306/500
9/9 [=====] - 0s 202us/sample - loss: 6.9836e-04
Epoch 307/500
9/9 [=====] - 0s 223us/sample - loss: 6.9186e-04
Epoch 308/500
9/9 [=====] - 0s 435us/sample - loss: 6.8542e-04
Epoch 309/500
9/9 [=====] - 0s 7ms/sample - loss: 6.7904e-04
Epoch 310/500
9/9 [=====] - 0s 2ms/sample - loss: 6.7271e-04
Epoch 311/500
9/9 [=====] - 0s 597us/sample - loss: 6.6645e-04
Epoch 312/500
9/9 [=====] - 0s 280us/sample - loss: 6.6024e-04
Epoch 313/500
9/9 [=====] - 0s 693us/sample - loss: 6.5410e-04
Epoch 314/500
9/9 [=====] - 0s 1ms/sample - loss: 6.4801e-04
Epoch 315/500
9/9 [=====] - 0s 1ms/sample - loss: 6.4198e-04
Epoch 316/500
9/9 [=====] - 0s 5ms/sample - loss: 6.3600e-04
Epoch 317/500
9/9 [=====] - 0s 3ms/sample - loss: 6.3008e-04
Epoch 318/500
9/9 [=====] - 0s 2ms/sample - loss: 6.2421e-04
Epoch 319/500
9/9 [=====] - 0s 337us/sample - loss: 6.1840e-04
Epoch 320/500
9/9 [=====] - 0s 811us/sample - loss: 6.1264e-04
Epoch 321/500
9/9 [=====] - 0s 889us/sample - loss: 6.0694e-04
Epoch 322/500
9/9 [=====] - 0s 662us/sample - loss: 6.0128e-04
Epoch 323/500
9/9 [=====] - 0s 896us/sample - loss: 5.9569e-04
Epoch 324/500
9/9 [=====] - 0s 2ms/sample - loss: 5.9014e-04
Epoch 325/500
9/9 [=====] - 0s 1ms/sample - loss: 5.8464e-04
Epoch 326/500
9/9 [=====] - 0s 562us/sample - loss: 5.7920e-04
Epoch 327/500
```

```
9/9 [=====] - 0s 262us/sample - loss: 5.7381e-04
Epoch 328/500
9/9 [=====] - 0s 349us/sample - loss: 5.6847e-04
Epoch 329/500
9/9 [=====] - 0s 6ms/sample - loss: 5.6317e-04
Epoch 330/500
9/9 [=====] - 0s 1ms/sample - loss: 5.5793e-04
Epoch 331/500
9/9 [=====] - 0s 739us/sample - loss: 5.5274e-04
Epoch 332/500
9/9 [=====] - 0s 244us/sample - loss: 5.4759e-04
Epoch 333/500
9/9 [=====] - 0s 743us/sample - loss: 5.4249e-04
Epoch 334/500
9/9 [=====] - 0s 1ms/sample - loss: 5.3744e-04
Epoch 335/500
9/9 [=====] - 0s 6ms/sample - loss: 5.3244e-04
Epoch 336/500
9/9 [=====] - 0s 2ms/sample - loss: 5.2748e-04
Epoch 337/500
9/9 [=====] - 0s 273us/sample - loss: 5.2257e-04
Epoch 338/500
9/9 [=====] - 0s 267us/sample - loss: 5.1770e-04
Epoch 339/500
9/9 [=====] - 0s 342us/sample - loss: 5.1288e-04
Epoch 340/500
9/9 [=====] - 0s 275us/sample - loss: 5.0811e-04
Epoch 341/500
9/9 [=====] - 0s 2ms/sample - loss: 5.0338e-04
Epoch 342/500
9/9 [=====] - 0s 5ms/sample - loss: 4.9869e-04
Epoch 343/500
9/9 [=====] - 0s 1ms/sample - loss: 4.9405e-04
Epoch 344/500
9/9 [=====] - 0s 1ms/sample - loss: 4.8945e-04
Epoch 345/500
9/9 [=====] - 0s 512us/sample - loss: 4.8489e-04
Epoch 346/500
9/9 [=====] - 0s 1ms/sample - loss: 4.8038e-04
Epoch 347/500
9/9 [=====] - 0s 6ms/sample - loss: 4.7591e-04
Epoch 348/500
9/9 [=====] - 0s 245us/sample - loss: 4.7147e-04
Epoch 349/500
9/9 [=====] - 0s 172us/sample - loss: 4.6708e-04
Epoch 350/500
9/9 [=====] - 0s 218us/sample - loss: 4.6274e-04
Epoch 351/500
9/9 [=====] - 0s 394us/sample - loss: 4.5843e-04
Epoch 352/500
9/9 [=====] - 0s 841us/sample - loss: 4.5416e-04
Epoch 353/500
9/9 [=====] - 0s 2ms/sample - loss: 4.4993e-04
Epoch 354/500
9/9 [=====] - 0s 1ms/sample - loss: 4.4574e-04
Epoch 355/500
9/9 [=====] - 0s 6ms/sample - loss: 4.4159e-04
Epoch 356/500
9/9 [=====] - 0s 1ms/sample - loss: 4.3748e-04
Epoch 357/500
9/9 [=====] - 0s 922us/sample - loss: 4.3341e-04
Epoch 358/500
9/9 [=====] - 0s 2ms/sample - loss: 4.2937e-04
Epoch 359/500
9/9 [=====] - 0s 1ms/sample - loss: 4.2538e-04
Epoch 360/500
9/9 [=====] - 0s 222us/sample - loss: 4.2141e-04
Epoch 361/500
9/9 [=====] - 0s 5ms/sample - loss: 4.1749e-04
Epoch 362/500
9/9 [=====] - 0s 228us/sample - loss: 4.1360e-04
Epoch 363/500
9/9 [=====] - 0s 187us/sample - loss: 4.0975e-04
Epoch 364/500
9/9 [=====] - 0s 1ms/sample - loss: 4.0594e-04
Epoch 365/500
9/9 [=====] - 0s 1ms/sample - loss: 4.0216e-04
```

```
Epoch 366/500
9/9 [=====] - 0s 630us/sample - loss: 3.9841e-04
Epoch 367/500
9/9 [=====] - 0s 8ms/sample - loss: 3.9471e-04
Epoch 368/500
9/9 [=====] - 0s 2ms/sample - loss: 3.9103e-04
Epoch 369/500
9/9 [=====] - 0s 482us/sample - loss: 3.8739e-04
Epoch 370/500
9/9 [=====] - 0s 230us/sample - loss: 3.8378e-04
Epoch 371/500
9/9 [=====] - 0s 372us/sample - loss: 3.8021e-04
Epoch 372/500
9/9 [=====] - 0s 246us/sample - loss: 3.7667e-04
Epoch 373/500
9/9 [=====] - 0s 351us/sample - loss: 3.7316e-04
Epoch 374/500
9/9 [=====] - 0s 6ms/sample - loss: 3.6969e-04
Epoch 375/500
9/9 [=====] - 0s 2ms/sample - loss: 3.6624e-04
Epoch 376/500
9/9 [=====] - 0s 352us/sample - loss: 3.6284e-04
Epoch 377/500
9/9 [=====] - 0s 529us/sample - loss: 3.5946e-04
Epoch 378/500
9/9 [=====] - 0s 445us/sample - loss: 3.5611e-04
Epoch 379/500
9/9 [=====] - 0s 1ms/sample - loss: 3.5280e-04
Epoch 380/500
9/9 [=====] - 0s 6ms/sample - loss: 3.4951e-04
Epoch 381/500
9/9 [=====] - 0s 2ms/sample - loss: 3.4626e-04
Epoch 382/500
9/9 [=====] - 0s 938us/sample - loss: 3.4303e-04
Epoch 383/500
9/9 [=====] - 0s 232us/sample - loss: 3.3984e-04
Epoch 384/500
9/9 [=====] - 0s 237us/sample - loss: 3.3667e-04
Epoch 385/500
9/9 [=====] - 0s 286us/sample - loss: 3.3354e-04
Epoch 386/500
9/9 [=====] - 0s 515us/sample - loss: 3.3044e-04
Epoch 387/500
9/9 [=====] - 0s 7ms/sample - loss: 3.2736e-04
Epoch 388/500
9/9 [=====] - 0s 2ms/sample - loss: 3.2431e-04
Epoch 389/500
9/9 [=====] - 0s 2ms/sample - loss: 3.2129e-04
Epoch 390/500
9/9 [=====] - 0s 941us/sample - loss: 3.1830e-04
Epoch 391/500
9/9 [=====] - 0s 1ms/sample - loss: 3.1534e-04
Epoch 392/500
9/9 [=====] - 0s 5ms/sample - loss: 3.1240e-04
Epoch 393/500
9/9 [=====] - 0s 924us/sample - loss: 3.0950e-04
Epoch 394/500
9/9 [=====] - 0s 168us/sample - loss: 3.0661e-04
Epoch 395/500
9/9 [=====] - 0s 238us/sample - loss: 3.0376e-04
Epoch 396/500
9/9 [=====] - 0s 401us/sample - loss: 3.0093e-04
Epoch 397/500
9/9 [=====] - 0s 255us/sample - loss: 2.9813e-04
Epoch 398/500
9/9 [=====] - 0s 900us/sample - loss: 2.9535e-04
Epoch 399/500
9/9 [=====] - 0s 2ms/sample - loss: 2.9260e-04
Epoch 400/500
9/9 [=====] - 0s 6ms/sample - loss: 2.8988e-04
Epoch 401/500
9/9 [=====] - 0s 694us/sample - loss: 2.8718e-04
Epoch 402/500
9/9 [=====] - 0s 322us/sample - loss: 2.8450e-04
Epoch 403/500
9/9 [=====] - 0s 2ms/sample - loss: 2.8186e-04
Epoch 404/500
```

```
Epoch 404/500
9/9 [=====] - 0s 2ms/sample - loss: 2.7923e-04
Epoch 405/500
9/9 [=====] - 0s 176us/sample - loss: 2.7663e-04
Epoch 406/500
9/9 [=====] - 0s 410us/sample - loss: 2.7406e-04
Epoch 407/500
9/9 [=====] - 0s 1ms/sample - loss: 2.7151e-04
Epoch 408/500
9/9 [=====] - 0s 675us/sample - loss: 2.6898e-04
Epoch 409/500
9/9 [=====] - 0s 893us/sample - loss: 2.6647e-04
Epoch 410/500
9/9 [=====] - 0s 2ms/sample - loss: 2.6399e-04
Epoch 411/500
9/9 [=====] - 0s 622us/sample - loss: 2.6153e-04
Epoch 412/500
9/9 [=====] - 0s 2ms/sample - loss: 2.5910e-04
Epoch 413/500
9/9 [=====] - 0s 2ms/sample - loss: 2.5669e-04
Epoch 414/500
9/9 [=====] - 0s 234us/sample - loss: 2.5429e-04
Epoch 415/500
9/9 [=====] - 0s 395us/sample - loss: 2.5193e-04
Epoch 416/500
9/9 [=====] - 0s 196us/sample - loss: 2.4958e-04
Epoch 417/500
9/9 [=====] - 0s 257us/sample - loss: 2.4726e-04
Epoch 418/500
9/9 [=====] - 0s 343us/sample - loss: 2.4496e-04
Epoch 419/500
9/9 [=====] - 0s 6ms/sample - loss: 2.4267e-04
Epoch 420/500
9/9 [=====] - 0s 630us/sample - loss: 2.4042e-04
Epoch 421/500
9/9 [=====] - 0s 1ms/sample - loss: 2.3818e-04
Epoch 422/500
9/9 [=====] - 0s 1ms/sample - loss: 2.3596e-04
Epoch 423/500
9/9 [=====] - 0s 1ms/sample - loss: 2.3376e-04
Epoch 424/500
9/9 [=====] - 0s 967us/sample - loss: 2.3159e-04
Epoch 425/500
9/9 [=====] - 0s 7ms/sample - loss: 2.2943e-04
Epoch 426/500
9/9 [=====] - 0s 1ms/sample - loss: 2.2729e-04
Epoch 427/500
9/9 [=====] - 0s 155us/sample - loss: 2.2518e-04
Epoch 428/500
9/9 [=====] - 0s 711us/sample - loss: 2.2308e-04
Epoch 429/500
9/9 [=====] - 0s 276us/sample - loss: 2.2101e-04
Epoch 430/500
9/9 [=====] - 0s 754us/sample - loss: 2.1895e-04
Epoch 431/500
9/9 [=====] - 0s 6ms/sample - loss: 2.1691e-04
Epoch 432/500
9/9 [=====] - 0s 951us/sample - loss: 2.1489e-04
Epoch 433/500
9/9 [=====] - 0s 1ms/sample - loss: 2.1289e-04
Epoch 434/500
9/9 [=====] - 0s 363us/sample - loss: 2.1091e-04
Epoch 435/500
9/9 [=====] - 0s 269us/sample - loss: 2.0894e-04
Epoch 436/500
9/9 [=====] - 0s 449us/sample - loss: 2.0700e-04
Epoch 437/500
9/9 [=====] - 0s 766us/sample - loss: 2.0507e-04
Epoch 438/500
9/9 [=====] - 0s 515us/sample - loss: 2.0316e-04
Epoch 439/500
9/9 [=====] - 0s 7ms/sample - loss: 2.0127e-04
Epoch 440/500
9/9 [=====] - 0s 278us/sample - loss: 1.9940e-04
Epoch 441/500
9/9 [=====] - 0s 307us/sample - loss: 1.9754e-04
Epoch 442/500
9/9 [=====] - 0s 417us/sample - loss: 1.9570e-04
```

```
9/9 [=====] - 0s 417us/sample - loss: 1.9370e-04
Epoch 443/500
9/9 [=====] - 0s 291us/sample - loss: 1.9388e-04
Epoch 444/500
9/9 [=====] - 0s 1ms/sample - loss: 1.9207e-04
Epoch 445/500
9/9 [=====] - 0s 1ms/sample - loss: 1.9028e-04
Epoch 446/500
9/9 [=====] - 0s 7ms/sample - loss: 1.8851e-04
Epoch 447/500
9/9 [=====] - 0s 309us/sample - loss: 1.8676e-04
Epoch 448/500
9/9 [=====] - 0s 212us/sample - loss: 1.8502e-04
Epoch 449/500
9/9 [=====] - 0s 807us/sample - loss: 1.8330e-04
Epoch 450/500
9/9 [=====] - 0s 1ms/sample - loss: 1.8159e-04
Epoch 451/500
9/9 [=====] - 0s 258us/sample - loss: 1.7990e-04
Epoch 452/500
9/9 [=====] - 0s 197us/sample - loss: 1.7823e-04
Epoch 453/500
9/9 [=====] - 0s 341us/sample - loss: 1.7656e-04
Epoch 454/500
9/9 [=====] - 0s 211us/sample - loss: 1.7492e-04
Epoch 455/500
9/9 [=====] - 0s 7ms/sample - loss: 1.7329e-04
Epoch 456/500
9/9 [=====] - 0s 813us/sample - loss: 1.7168e-04
Epoch 457/500
9/9 [=====] - 0s 237us/sample - loss: 1.7008e-04
Epoch 458/500
9/9 [=====] - 0s 259us/sample - loss: 1.6850e-04
Epoch 459/500
9/9 [=====] - 0s 351us/sample - loss: 1.6693e-04
Epoch 460/500
9/9 [=====] - 0s 233us/sample - loss: 1.6538e-04
Epoch 461/500
9/9 [=====] - 0s 8ms/sample - loss: 1.6383e-04
Epoch 462/500
9/9 [=====] - 0s 1ms/sample - loss: 1.6231e-04
Epoch 463/500
9/9 [=====] - 0s 3ms/sample - loss: 1.6080e-04
Epoch 464/500
9/9 [=====] - 0s 460us/sample - loss: 1.5930e-04
Epoch 465/500
9/9 [=====] - 0s 1ms/sample - loss: 1.5782e-04
Epoch 466/500
9/9 [=====] - 0s 2ms/sample - loss: 1.5635e-04
Epoch 467/500
9/9 [=====] - 0s 252us/sample - loss: 1.5489e-04
Epoch 468/500
9/9 [=====] - 0s 2ms/sample - loss: 1.5345e-04
Epoch 469/500
9/9 [=====] - 0s 301us/sample - loss: 1.5202e-04
Epoch 470/500
9/9 [=====] - 0s 809us/sample - loss: 1.5061e-04
Epoch 471/500
9/9 [=====] - 0s 450us/sample - loss: 1.4920e-04
Epoch 472/500
9/9 [=====] - 0s 2ms/sample - loss: 1.4782e-04
Epoch 473/500
9/9 [=====] - 0s 5ms/sample - loss: 1.4644e-04
Epoch 474/500
9/9 [=====] - 0s 1ms/sample - loss: 1.4508e-04
Epoch 475/500
9/9 [=====] - 0s 1ms/sample - loss: 1.4373e-04
Epoch 476/500
9/9 [=====] - 0s 257us/sample - loss: 1.4239e-04
Epoch 477/500
9/9 [=====] - 0s 907us/sample - loss: 1.4106e-04
Epoch 478/500
9/9 [=====] - 0s 2ms/sample - loss: 1.3975e-04
Epoch 479/500
9/9 [=====] - 0s 6ms/sample - loss: 1.3845e-04
Epoch 480/500
9/9 [=====] - 0s 209us/sample - loss: 1.3716e-04
Epoch 481/500
```

```
Epoch 481/500
9/9 [=====] - 0s 450us/sample - loss: 1.3588e-04
Epoch 482/500
9/9 [=====] - 0s 326us/sample - loss: 1.3462e-04
Epoch 483/500
9/9 [=====] - 0s 253us/sample - loss: 1.3336e-04
Epoch 484/500
9/9 [=====] - 0s 418us/sample - loss: 1.3212e-04
Epoch 485/500
9/9 [=====] - 0s 1ms/sample - loss: 1.3089e-04
Epoch 486/500
9/9 [=====] - 0s 1ms/sample - loss: 1.2967e-04
Epoch 487/500
9/9 [=====] - 0s 6ms/sample - loss: 1.2847e-04
Epoch 488/500
9/9 [=====] - 0s 748us/sample - loss: 1.2727e-04
Epoch 489/500
9/9 [=====] - 0s 2ms/sample - loss: 1.2608e-04
Epoch 490/500
9/9 [=====] - 0s 1ms/sample - loss: 1.2491e-04
Epoch 491/500
9/9 [=====] - 0s 390us/sample - loss: 1.2375e-04
Epoch 492/500
9/9 [=====] - 0s 180us/sample - loss: 1.2259e-04
Epoch 493/500
9/9 [=====] - 0s 215us/sample - loss: 1.2145e-04
Epoch 494/500
9/9 [=====] - 0s 262us/sample - loss: 1.2032e-04
Epoch 495/500
9/9 [=====] - 0s 7ms/sample - loss: 1.1920e-04
Epoch 496/500
9/9 [=====] - 0s 2ms/sample - loss: 1.1809e-04
Epoch 497/500
9/9 [=====] - 0s 662us/sample - loss: 1.1699e-04
Epoch 498/500
9/9 [=====] - 0s 181us/sample - loss: 1.1590e-04
Epoch 499/500
9/9 [=====] - 0s 635us/sample - loss: 1.1482e-04
Epoch 500/500
9/9 [=====] - 0s 1ms/sample - loss: 1.1376e-04
[4.0001373]
```

In [6]:

```
# Now click the 'Submit Assignment' button above.
# Once that is complete, please run the following two cells to save your work and close the notebo
ok
```

In [7]:

```
%%javascript
<!-- Save the notebook -->
IPython.notebook.save_checkpoint();
```

In [ ]:

```
%%javascript
IPython.notebook.session.delete();
window.onbeforeunload = null
setTimeout(function() { window.close(); }, 1000);
```

In [ ]: