

lab7

December 11, 2023

```
[1]: import numpy as np
import tensorflow as tf
import keras.optimizers as opt
from keras.models import Sequential
from keras.layers import Dense
from copy import deepcopy

x = [[1,2],[2,4],[3,6],[4,8]]
y = [[2,4],[4,8],[6,12],[8,16]]

model = Sequential()
model.add(Dense(2, activation='tanh', input_shape=(2,)))
model.add(Dense(1, activation='tanh'))
model.summary()
```

WARNING:tensorflow:From
C:\Users\micha\AppData\Local\Programs\Python\Python311\Lib\site-
packages\keras\src\losses.py:2976: The name
tf.losses.sparse_softmax_cross_entropy is deprecated. Please use
tf.compat.v1.losses.sparse_softmax_cross_entropy instead.

WARNING:tensorflow:From
C:\Users\micha\AppData\Local\Programs\Python\Python311\Lib\site-
packages\keras\src\backend.py:873: The name tf.get_default_graph is deprecated.
Please use tf.compat.v1.get_default_graph instead.

Model: "sequential"

Layer (type)	Output Shape	Param #
dense (Dense)	(None, 2)	6
dense_1 (Dense)	(None, 1)	3

Total params: 9 (36.00 Byte)
Trainable params: 9 (36.00 Byte)
Non-trainable params: 0 (0.00 Byte)

```

[2]: print(model.get_weights())

sgd = opt.legacy.SGD(0.01)
model.compile(optimizer=sgd,loss='mean_squared_error',metrics=['accuracy'])

from copy import deepcopy
w = deepcopy(model.get_weights())
print(w)

```

```

[array([[0.39697492, 0.8289324 ],
        [0.55012786, 0.06192279]], dtype=float32), array([0., 0.],
dtype=float32), array([[0.95566595],
        [0.42584562]], dtype=float32), array([0.], dtype=float32)]
[array([[0.39697492, 0.8289324 ],
        [0.55012786, 0.06192279]], dtype=float32), array([0., 0.],
dtype=float32), array([[0.95566595],
        [0.42584562]], dtype=float32), array([0.], dtype=float32)]

```

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[3]: def feed_forward(inputs, outputs, weights):
    hidden = np.dot(inputs,weights[0])
    out = hidden+weights[1]
    squared_error = (np.square(out - outputs))
    return squared_error

def update_weights(inputs, outputs, weights, epochs):
    for epoch in range(epochs):
        org_loss = feed_forward(inputs, outputs, weights)
        wts_tmp = deepcopy(weights)
        wts_tmp2 = deepcopy(weights)
        for ix, wt in enumerate(weights):
            wts_tmp[-(ix+1)] += 0.0001
            # print('wts_tmp:', wts_tmp)
            loss = feed_forward(inputs, outputs, wts_tmp)
            # print('loss', loss)
            del_loss = np.sum(org_loss - loss)/(0.0001*len(inputs))
            wts_tmp2[-(ix+1)] += del_loss*0.01
            wts_tmp = deepcopy(weights)

        weights = deepcopy(wts_tmp2)
    return wts_tmp2

w = [2000, 0]
update_weights(x,y,w,1)

w_val = []
b_val = []

```

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for k in range(100):
    w_new, b_new = update_weights(x,y,w,(k+1))
    w_val.append(w_new)
    b_val.append(b_new)

```

```
[5]: import matplotlib.pyplot as plt
```

```

print(w_val)

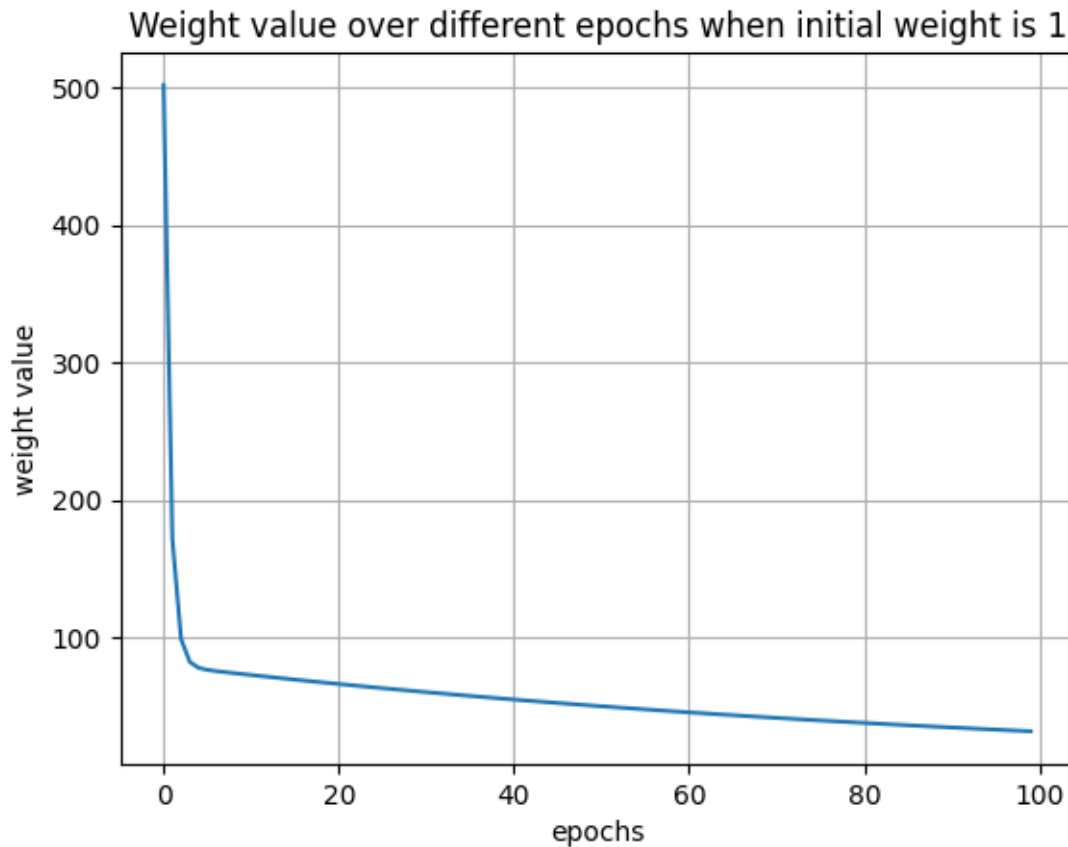
%matplotlib inline
plt.plot(w_val)
plt.title('Weight value over different epochs when initial weight is 1')
plt.xlabel('epochs')
plt.ylabel('weight value')
plt.grid('off')

```

```

[501.4999628183432, 171.82995344992378, 98.85300054193067, 82.25411458183771,
78.04194982745685, 76.55548817012914, 75.67301539852451, 74.92852875536755,
74.21963774522737, 73.52380546719814, 72.836032205646, 72.15517007991821,
71.4809175926348, 70.813159594627, 70.1518223326957, 69.49684161136247,
68.84815579251153, 68.20570425868482, 67.56942706840618, 66.93926487603221,
66.31515891299387, 65.69705097390397, 65.0848834148519, 64.4785991451954,
63.878141623627016, 63.28345485032969, 62.694483365999076, 62.11117224311238,
61.533467082063, 60.96131400654485, 60.39465965764066, 59.83345118913803,
59.27763626363003, 58.727163045762154, 58.181980197809935, 57.642036876836755,
57.1072827281796, 56.57766788057188, 56.05314294238042, 55.53365899626215,
55.01916759544656, 54.509620759199606, 54.00497096645722, 53.50517115441562,
53.01017471172145, 52.51993547503844, 52.03440772504564, 51.553546181435195,
51.077305999206146, 50.605642764890035, 50.13851249028676, 49.67587161206666,
49.21767698384656, 48.76388587492784, 48.31445596475987, 47.869345339358915,
47.42851248842044, 46.99191629977122, 46.55951605636801, 46.131271433034726,
45.707142491562536, 45.28708967812918, 44.87107381862643, 44.45905611554508,
44.05099814426876, 43.64686184947573, 43.24660954137016, 42.85020389278884,
42.45760793501745, 42.06878505477789, 41.68369899031745, 41.30231382885654,
40.92459400251869, 40.55050428531217, 40.18000978964551, 39.81307596336592,
39.44966858651924, 39.08975376755279, 38.73329794124061, 38.3802678644372,
38.03063061366743, 37.684353582170615, 37.34140447575669, 37.00175131165793,
36.66536241364042, 36.332206410219214, 36.00225223130451, 35.67546910566648,
35.351826557564436, 35.03129440416615, 34.713842752779556, 34.39944199779461,
34.088062818750586, 33.7796761761183, 33.474253310026825, 33.171765736824455,
32.872185246623076, 32.57548390058673, 32.28163402864084, 31.990608226163886]

```



```
[6]: w = list(model.get_weights().copy())
      print(w)

      update_weights(x,y,w,100)

      model.fit(np.array(x), np.array(y), epochs=100, batch_size = 4, verbose=1)

      model.get_weights()

[array([[0.39697492, 0.8289324 ],
        [0.55012786, 0.06192279]], dtype=float32), array([0., 0.],
dtype=float32), array([[0.95566595],
        [0.42584562]], dtype=float32), array([0.], dtype=float32)]
Epoch 1/100
WARNING:tensorflow:From
C:\Users\micha\AppData\Local\Programs\Python\Python311\Lib\site-
packages\keras\src\utils\tf_utils.py:492: The name tf.ragged.RaggedTensorValue
is deprecated. Please use tf.compat.v1.ragged.RaggedTensorValue instead.

WARNING:tensorflow:From
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```
C:\Users\micha\AppData\Local\Programs\Python\Python311\Lib\site-  
packages\keras\src\engine\base_layer_utils.py:384: The name  
tf.executing_eagerly_outside_functions is deprecated. Please use  
tf.compat.v1.executing_eagerly_outside_functions instead.
```

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1/1 [=====] - 1s 652ms/step - loss: 62.6319 - accuracy:  
0.0000e+00  
Epoch 2/100  
1/1 [=====] - 0s 12ms/step - loss: 62.3747 - accuracy:  
0.0000e+00  
Epoch 3/100  
1/1 [=====] - 0s 9ms/step - loss: 62.1869 - accuracy:  
0.0000e+00  
Epoch 4/100  
1/1 [=====] - 0s 9ms/step - loss: 62.0438 - accuracy:  
0.0000e+00  
Epoch 5/100  
1/1 [=====] - 0s 10ms/step - loss: 61.9314 - accuracy:  
0.0000e+00  
Epoch 6/100  
1/1 [=====] - 0s 8ms/step - loss: 61.8406 - accuracy:  
0.0000e+00  
Epoch 7/100  
1/1 [=====] - 0s 10ms/step - loss: 61.7659 - accuracy:  
0.0000e+00  
Epoch 8/100  
1/1 [=====] - 0s 8ms/step - loss: 61.7033 - accuracy:  
0.0000e+00  
Epoch 9/100  
1/1 [=====] - 0s 9ms/step - loss: 61.6501 - accuracy:  
0.0000e+00  
Epoch 10/100  
1/1 [=====] - 0s 8ms/step - loss: 61.6044 - accuracy:  
0.0000e+00  
Epoch 11/100  
1/1 [=====] - 0s 8ms/step - loss: 61.5646 - accuracy:  
0.0000e+00  
Epoch 12/100  
1/1 [=====] - 0s 7ms/step - loss: 61.5298 - accuracy:  
0.0000e+00  
Epoch 13/100  
1/1 [=====] - 0s 7ms/step - loss: 61.4989 - accuracy:  
0.0000e+00  
Epoch 14/100  
1/1 [=====] - 0s 7ms/step - loss: 61.4715 - accuracy:  
0.0000e+00  
Epoch 15/100  
1/1 [=====] - 0s 5ms/step - loss: 61.4469 - accuracy:
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0.0000e+00
Epoch 16/100
1/1 [=====] - 0s 7ms/step - loss: 61.4247 - accuracy:
0.0000e+00
Epoch 17/100
1/1 [=====] - 0s 6ms/step - loss: 61.4046 - accuracy:
0.0000e+00
Epoch 18/100
1/1 [=====] - 0s 7ms/step - loss: 61.3864 - accuracy:
0.0000e+00
Epoch 19/100
1/1 [=====] - 0s 6ms/step - loss: 61.3697 - accuracy:
0.0000e+00
Epoch 20/100
1/1 [=====] - 0s 7ms/step - loss: 61.3544 - accuracy:
0.0000e+00
Epoch 21/100
1/1 [=====] - 0s 6ms/step - loss: 61.3402 - accuracy:
0.0000e+00
Epoch 22/100
1/1 [=====] - 0s 9ms/step - loss: 61.3272 - accuracy:
0.0000e+00
Epoch 23/100
1/1 [=====] - 0s 7ms/step - loss: 61.3152 - accuracy:
0.0000e+00
Epoch 24/100
1/1 [=====] - 0s 7ms/step - loss: 61.3039 - accuracy:
0.0000e+00
Epoch 25/100
1/1 [=====] - 0s 15ms/step - loss: 61.2935 - accuracy:
0.0000e+00
Epoch 26/100
1/1 [=====] - 0s 26ms/step - loss: 61.2837 - accuracy:
0.0000e+00
Epoch 27/100
1/1 [=====] - 0s 7ms/step - loss: 61.2746 - accuracy:
0.0000e+00
Epoch 28/100
1/1 [=====] - 0s 18ms/step - loss: 61.2661 - accuracy:
0.0000e+00
Epoch 29/100
1/1 [=====] - 0s 15ms/step - loss: 61.2580 - accuracy:
0.0000e+00
Epoch 30/100
1/1 [=====] - 0s 7ms/step - loss: 61.2504 - accuracy:
0.0000e+00
Epoch 31/100
1/1 [=====] - 0s 7ms/step - loss: 61.2433 - accuracy:

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0.0000e+00
Epoch 32/100
1/1 [=====] - 0s 8ms/step - loss: 61.2365 - accuracy:
0.0000e+00
Epoch 33/100
1/1 [=====] - 0s 8ms/step - loss: 61.2302 - accuracy:
0.0000e+00
Epoch 34/100
1/1 [=====] - 0s 6ms/step - loss: 61.2241 - accuracy:
0.0000e+00
Epoch 35/100
1/1 [=====] - 0s 7ms/step - loss: 61.2184 - accuracy:
0.0000e+00
Epoch 36/100
1/1 [=====] - 0s 7ms/step - loss: 61.2129 - accuracy:
0.0000e+00
Epoch 37/100
1/1 [=====] - 0s 7ms/step - loss: 61.2077 - accuracy:
0.0000e+00
Epoch 38/100
1/1 [=====] - 0s 5ms/step - loss: 61.2028 - accuracy:
0.0000e+00
Epoch 39/100
1/1 [=====] - 0s 8ms/step - loss: 61.1981 - accuracy:
0.0000e+00
Epoch 40/100
1/1 [=====] - 0s 5ms/step - loss: 61.1936 - accuracy:
0.0000e+00
Epoch 41/100
1/1 [=====] - 0s 6ms/step - loss: 61.1893 - accuracy:
0.0000e+00
Epoch 42/100
1/1 [=====] - 0s 5ms/step - loss: 61.1852 - accuracy:
0.0000e+00
Epoch 43/100
1/1 [=====] - 0s 6ms/step - loss: 61.1812 - accuracy:
0.0000e+00
Epoch 44/100
1/1 [=====] - 0s 6ms/step - loss: 61.1774 - accuracy:
0.0000e+00
Epoch 45/100
1/1 [=====] - 0s 6ms/step - loss: 61.1738 - accuracy:
0.0000e+00
Epoch 46/100
1/1 [=====] - 0s 5ms/step - loss: 61.1703 - accuracy:
0.0000e+00
Epoch 47/100
1/1 [=====] - 0s 5ms/step - loss: 61.1670 - accuracy:

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0.0000e+00
Epoch 48/100
1/1 [=====] - 0s 7ms/step - loss: 61.1638 - accuracy:
0.0000e+00
Epoch 49/100
1/1 [=====] - 0s 7ms/step - loss: 61.1607 - accuracy:
0.0000e+00
Epoch 50/100
1/1 [=====] - 0s 5ms/step - loss: 61.1577 - accuracy:
0.0000e+00
Epoch 51/100
1/1 [=====] - 0s 7ms/step - loss: 61.1548 - accuracy:
0.0000e+00
Epoch 52/100
1/1 [=====] - 0s 5ms/step - loss: 61.1521 - accuracy:
0.0000e+00
Epoch 53/100
1/1 [=====] - 0s 6ms/step - loss: 61.1494 - accuracy:
0.0000e+00
Epoch 54/100
1/1 [=====] - 0s 5ms/step - loss: 61.1468 - accuracy:
0.0000e+00
Epoch 55/100
1/1 [=====] - 0s 7ms/step - loss: 61.1443 - accuracy:
0.0000e+00
Epoch 56/100
1/1 [=====] - 0s 7ms/step - loss: 61.1419 - accuracy:
0.0000e+00
Epoch 57/100
1/1 [=====] - 0s 7ms/step - loss: 61.1396 - accuracy:
0.0000e+00
Epoch 58/100
1/1 [=====] - 0s 5ms/step - loss: 61.1373 - accuracy:
0.0000e+00
Epoch 59/100
1/1 [=====] - 0s 5ms/step - loss: 61.1352 - accuracy:
0.0000e+00
Epoch 60/100
1/1 [=====] - 0s 5ms/step - loss: 61.1330 - accuracy:
0.0000e+00
Epoch 61/100
1/1 [=====] - 0s 5ms/step - loss: 61.1310 - accuracy:
0.0000e+00
Epoch 62/100
1/1 [=====] - 0s 5ms/step - loss: 61.1290 - accuracy:
0.0000e+00
Epoch 63/100
1/1 [=====] - 0s 7ms/step - loss: 61.1271 - accuracy:

```



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0.0000e+00
Epoch 64/100
1/1 [=====] - 0s 5ms/step - loss: 61.1252 - accuracy:
0.0000e+00
Epoch 65/100
1/1 [=====] - 0s 5ms/step - loss: 61.1234 - accuracy:
0.0000e+00
Epoch 66/100
1/1 [=====] - 0s 7ms/step - loss: 61.1216 - accuracy:
0.0000e+00
Epoch 67/100
1/1 [=====] - 0s 7ms/step - loss: 61.1199 - accuracy:
0.0000e+00
Epoch 68/100
1/1 [=====] - 0s 6ms/step - loss: 61.1182 - accuracy:
0.0000e+00
Epoch 69/100
1/1 [=====] - 0s 8ms/step - loss: 61.1166 - accuracy:
0.0000e+00
Epoch 70/100
1/1 [=====] - 0s 6ms/step - loss: 61.1150 - accuracy:
0.0000e+00
Epoch 71/100
1/1 [=====] - 0s 6ms/step - loss: 61.1135 - accuracy:
0.0000e+00
Epoch 72/100
1/1 [=====] - 0s 6ms/step - loss: 61.1120 - accuracy:
0.0000e+00
Epoch 73/100
1/1 [=====] - 0s 7ms/step - loss: 61.1105 - accuracy:
0.0000e+00
Epoch 74/100
1/1 [=====] - 0s 7ms/step - loss: 61.1091 - accuracy:
0.0000e+00
Epoch 75/100
1/1 [=====] - 0s 6ms/step - loss: 61.1077 - accuracy:
0.0000e+00
Epoch 76/100
1/1 [=====] - 0s 6ms/step - loss: 61.1064 - accuracy:
0.0000e+00
Epoch 77/100
1/1 [=====] - 0s 8ms/step - loss: 61.1051 - accuracy:
0.0000e+00
Epoch 78/100
1/1 [=====] - 0s 6ms/step - loss: 61.1038 - accuracy:
0.0000e+00
Epoch 79/100
1/1 [=====] - 0s 7ms/step - loss: 61.1025 - accuracy:

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0.0000e+00
Epoch 80/100
1/1 [=====] - 0s 7ms/step - loss: 61.1013 - accuracy:
0.0000e+00
Epoch 81/100
1/1 [=====] - 0s 7ms/step - loss: 61.1001 - accuracy:
0.0000e+00
Epoch 82/100
1/1 [=====] - 0s 8ms/step - loss: 61.0990 - accuracy:
0.0000e+00
Epoch 83/100
1/1 [=====] - 0s 7ms/step - loss: 61.0978 - accuracy:
0.0000e+00
Epoch 84/100
1/1 [=====] - 0s 8ms/step - loss: 61.0967 - accuracy:
0.0000e+00
Epoch 85/100
1/1 [=====] - 0s 7ms/step - loss: 61.0956 - accuracy:
0.0000e+00
Epoch 86/100
1/1 [=====] - 0s 7ms/step - loss: 61.0946 - accuracy:
0.0000e+00
Epoch 87/100
1/1 [=====] - 0s 8ms/step - loss: 61.0935 - accuracy:
0.0000e+00
Epoch 88/100
1/1 [=====] - 0s 7ms/step - loss: 61.0925 - accuracy:
0.0000e+00
Epoch 89/100
1/1 [=====] - 0s 7ms/step - loss: 61.0915 - accuracy:
0.0000e+00
Epoch 90/100
1/1 [=====] - 0s 6ms/step - loss: 61.0905 - accuracy:
0.0000e+00
Epoch 91/100
1/1 [=====] - 0s 6ms/step - loss: 61.0896 - accuracy:
0.0000e+00
Epoch 92/100
1/1 [=====] - 0s 6ms/step - loss: 61.0886 - accuracy:
0.0000e+00
Epoch 93/100
1/1 [=====] - 0s 15ms/step - loss: 61.0877 - accuracy:
0.0000e+00
Epoch 94/100
1/1 [=====] - 0s 16ms/step - loss: 61.0868 - accuracy:
0.0000e+00
Epoch 95/100
1/1 [=====] - 0s 6ms/step - loss: 61.0859 - accuracy:

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0.0000e+00
Epoch 96/100
1/1 [=====] - 0s 5ms/step - loss: 61.0851 - accuracy:
0.0000e+00
Epoch 97/100
1/1 [=====] - 0s 5ms/step - loss: 61.0842 - accuracy:
0.0000e+00
Epoch 98/100
1/1 [=====] - 0s 5ms/step - loss: 61.0834 - accuracy:
0.0000e+00
Epoch 99/100
1/1 [=====] - 0s 5ms/step - loss: 61.0826 - accuracy:
0.0000e+00
Epoch 100/100
1/1 [=====] - 0s 5ms/step - loss: 61.0818 - accuracy:
0.0000e+00
```

```
[6]: [array([[0.4120812 , 0.8574911 ],
          [0.58034045, 0.11904001]], dtype=float32),
      array([0.01392321, 0.02214704], dtype=float32),
      array([[1.4708331],
          [0.9285902]], dtype=float32),
      array([0.5211832], dtype=float32)]
```

```
[ ]:
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