COS 470 Image Processing and Computer Vision

2024 Fall

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Assignment 4, by hand and code it

Task 1: Calculate output feature map of convolutional layer.

Input feature map = (5\*5\*4), two kernels (3\*3\*4), stride = 1, zero padding = 1

A1:

Output Feature Map:

[[[ 4.9725 6.9513 6.1706 5.7381 3.4951]

[ 6.8526 10.5711 10.2292 9.7639 5.5365]

[ 5.5251 10.2092 8.9023 8.5254 5.5636]

[ 5.7728 9.6222 9.3598 9.8063 5.1873]

[ 4.5553 5.2176 5.8535 6.0835 3.4729]]

[[ 5.4377 7.9858 7.8342 6.861 4.5219]

[ 7.3113 11.0963 10.3422 9.8995 5.9103]

[ 6.3227 8.7658 9.6644 9.7349 5.6939]

[ 6.8362 9.3026 9.4238 10.1539 5.4661]

[ 4.3696 5.396 4.1176 4.084 3.3017]]]

Task 2: Calculate output feature map of pooling layers for average and max pooling.

Input feature map = 9\*9\*1, filter size = 3, stride = 3

A2:

Max Pooling:

[[0.86 0.99 0.99]

[0.97 0.88 0.98]

[0.89 0.78 1. ]]

Average Pooling:

[[0.508 0.511 0.589]

[0.417 0.404 0.628]

[0.564 0.412 0.679]]

Task 3: Calculate output vector of fully connected layers. Do not consider activation function.

A3:

Intermediate Vector:

[3.1, 4.2, 5.8, 0.1]

Output Vector:

[5.68, 2.32]

Task 4: Calculate output dimensions and number of parameters

Q4.1: convolutional layer, input 64\*64\*10, 100 kernels, kernel size 7\*7, stride = 1, zero padding = 1. Find size of output feature map and calculate the number of parameters in the layer.

A4.1:

input map: W1, H1, D1

output map: W2, H2, D2

number of kernels, K

kernel size, F\*F

stride, S

amount of zero padding, P

W2 = ((W1 - F + 2P) / S) + 1, H2 = ((H1 - F + 2P) / S) + 1, D2 = K

W2 = ((64 - 7 + 2\*1) / 1) + 1, H2 = ((64 - 7 + 2\*1) / 1) + 1, D2 = 100

output map size: (60, 60, 100)

(F\*F\*D1 + 1) \* K

(7\*7\*10 + 1) \* 100

49,100 total parameters

Q4.2: fully connected layer, input 1\*1024, 512 neurons. Find size of output vector and calculate the number of parameters in the layer.

A4.2:

output vector = 1 \* # neurons

output vector: (1\*512)

number of parameters = inputs \* neurons + bias

bias = total # neurons

number of parameters: 1024 \* 512 + 512 = 524,800 parameters