SUTD 50.039 Theory and Practice of Deep Learning (2024)
HW2 – Part 2
Last update: 26-Feb, 2024

Answer all questions.

Q1: Filtering

Given the following 5x5 image and the 3x3 filter kernel (both are two channels), calculate the output of the filtering in the following settings:

- horizontal stride = vertical stride = 1
- horizontal stride = vertical stride = 2

Assume no boundary padding is used.

Image:

Channel 1:

2	3	4	5	6
14	15	16	1	1
6	7	8	0	0
8	10	12	1	2
22	24	26	3	3

Channel 2:

22	23	24	12	14
14	15	16	0	0
6	7	8	0	0
8	10	12	1	2
22	24	26	5	5

Filter kernel:

Channel 1:

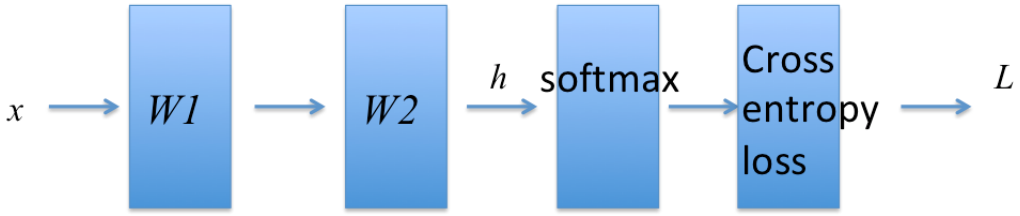
1	0	0
1	0	0
1	0	0

Channel 2:

0	0	0
1	0	0
0	0	0

Q2: Softmax and cross entropy loss

Given the following deep neural network classification system (three classes):



For a training sample x, the activation h before the softmax layer is given by:
$h = [-0.5, 0.3, 0.2]^T$

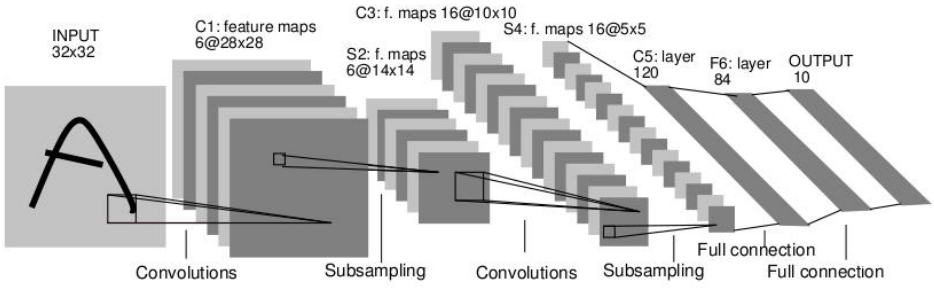
Suppose the ground-truth class of this training sample is the second class.

Compute L.

(Note: Use natural logarithm, i.e., logarithm to the base of e)

Q3: CNN architecture

In the following CNN, 5x5 convolutions are used throughout the network, with horizontal stride = vertical stride =1 and no padding.



Calculate the number of parameters in this CNN.