COMP 2019 Workbook Exercises Week 9 – Neural Nets and Computer Vision Answers

Question 1

Suppose that you have a neural net that consists of a sole *ReLu* unit that has threshold 0. The unit receives three inputs, x1,x2,x3, with corresponding weights 1.0, 0.4, -1.0.

Compute the output of the unit for each of the following inputs?

X1	X2	X3	Output
1	0	0	1.0
1	0.5	1	0.2
0.5	1	1	-0.1

Question 2

Suppose that you have a CNN that consists of a sole convolution unit of size 3x3 with weights as given below:

1	-1	0
2	1	-1
0	2	1

Compute the output that this unit generates given the following input. Assume that the filter is shifted one cell (stride=1). (We ignore any scaling factor, activation function, etc that the unit may apply):

1	0	1	1
2	1	0	0
0	1	3	2
1	0	0	0

11	9
-1	4

Question 3

Compute the output that a 2x2 MaxPooling unit would generate given this input:

1	0	1	1
2	1	0	0
0	1	3	2
1	0	0	0

Assume that the pooling filter moves 2 cells at each step (stride=2; that is, there is no overlap among the pooled areas in the input). Since the input shape is 4x4 and the filter is 2x2, you can fit two copies of the filter along each dimension. Hence, you should obtain a 2x2 output shape.

2	1
1	3

Question 4

Suppose a CNN has input shape n x 32 x 32 x 1. (That is, n 32-by-32 monochrome images.)

Suppose further that in the first layer of the CNN, 16 3x3 convolution filters are applied to that input (with stride=1).

What is the shape of the output of that layer?

n x 30 x 30 x 16

(Here it is assumed that channels are the last dimension.)

Question 5

Suppose you have a neural net that has 4 output units, each of which is an indicator for one of 4 classes of a classification task (such as distinguishing samples of classes dog, cat, flower, and car).

You are given the training set below:

X1	...	Xn	Class
Small		Black	Dog
Small	...	Black	Cat
Small	...	Yellow	Flower
Large		Blue	Car

X1,…,Xn represent features of the samples, and Class is the target.

Convert this training set into a form suitable for training the neural net with 4 output units.

We must one-hot-encode the class:

X1	...	Xn	ClassDog	ClassCat	ClassFlower	ClassCar
Small		Black	1	0	0	0
Small	...	Black	0	1	0	0
Small	...	Yellow	0	0	1	0
Large		Blue	0	0	0	1