

Homework 5

Question 1.

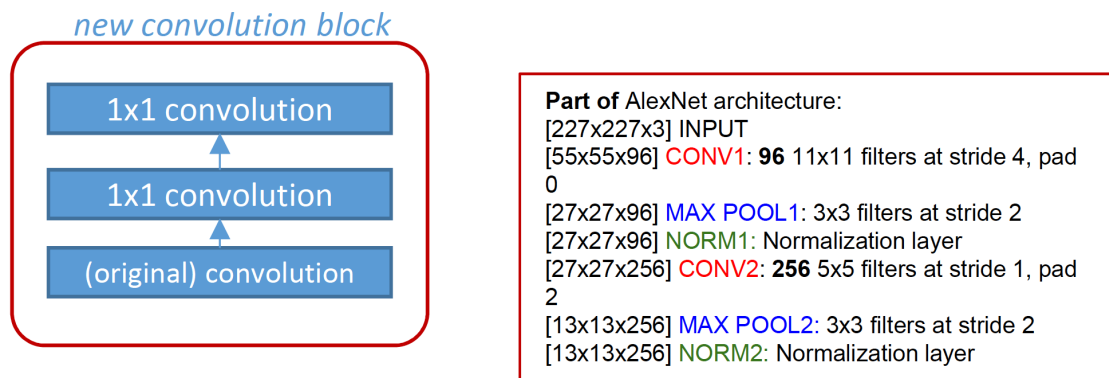
[1 mark for each subquestion]

- (1) In a character recognition task, what transformations are not acceptable?
- (2) What are some invariances for visual recognition that cannot be solved through data augmentation?

Question 2. You are given an input of $h \times w \times c_1$ to which you apply several convolutional kernels. You may assume that no padding is applied, and that $c_1 \geq h \geq w \geq 3$. What are the values of (a), (b), (c), (d)? [0.5 mark for each item]

Convolution Type	Kernel Size	Number of Kernels	Stride	Output Size
1D	(a)	(b)	1	$1 \times (w - 1) \times c_2$
2D	$3 \times 3 \times c_1$	(b)	3	(c)
3D	$3 \times 3 \times 2$	1	1	(d)

Question 3. Suppose you are given a new convolution block as given in the figure below.



Within this block, you use the same number of kernels in both 1×1 convolution layers. Now suppose you wish to substitute the CONV1 and CONV2 layers of AlexNet with this new block. Assume that the “original convolution” has the same size and number of kernels as CONV1 and CONV2. [1 mark for each subquestion]

- (1) What is the increase in the number of parameters?
- (2) What is the increase in memory?

Question 4. Determine the general impact on the bias and variance by filling out the chart with “increases”, “decreases”, or “no change”. [0.5 mark for each blank]

	bias	variance
Adding weight decay		
Increasing the number of hidden units per layer		
Using dropout during training		
Adding more training data (drawn from the same distribution as before)		