

COMP4702/COMP7703 - Machine Learning

Homework 7 - Deep Learning

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Core Questions

1. Given the following matrices:

$$H = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 1 \end{pmatrix}, K = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$$

where H is the 5×5 input data (e.g. pixel values) and K is a 2×1 kernel, perform a convolution operation on H using K (stride of 1).

2. Given the following matrices:

$$X = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 \end{pmatrix}, K = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$$

where X is the 5×5 input data (e.g. pixel values) and K is a 2×2 kernel, perform a convolution operation on X using K (stride of 1).

3. Repeat Question 2 but use a stride of 2 and use padding (zero values): add a row to the bottom and a column to the right of X (making it a 6×6 matrix).
4. Perform 3×3 average pooling on matrix H from Question 1 (stride of 1).

Extension Questions

5. Examine Figures 6.6 and 6.7 in the Deep Learning book:
(<http://www.deeplearningbook.org/contents/mlp.html>).

In your own words (no more than half a page), explain what the experimental results presented are intended to demonstrate?