

Homework 02 – Algorithms

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0 Outline

- 1 Reading
- 2 Theory
- 3 Practice

1 Reading

1. Algorithms

Motivation: a xNN related algorithms refresher

https://github.com/arthurredfern/UT-Dallas-CS-6301-CNNs/blob/master/Lectures/xNNs_020_Algorithms.pdf

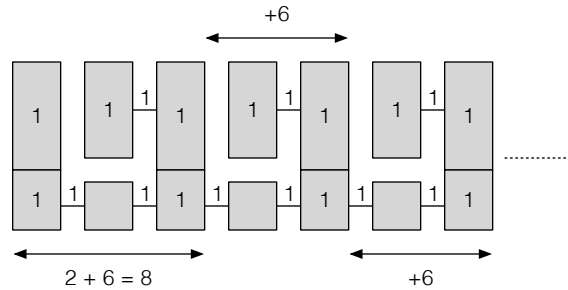
Complete

2 Theory

2. $3 \times 3/2$ max pooling applied to an input feature map of size $3 \times (2n + 1)$ generates an output feature map of size $1 \times n$. What is the minimum number of comparisons required to generate the output feature map? Draw a picture showing your pattern of comparisons (hand drawing is ok).

8 comparisons for the 1st 3×3 tile and 6 comparisons for each subsequent tile for a total of $8 + (n - 1)6 = 6n + 2$ comparisons

As a new tile adds 6 values that need to be compared to at least 1 previous, this appears to be a minimum



3. $3 \times 3/2$ max pooling applied to an input feature map of size $(2m + 1) \times (2n + 1)$ generates an output feature map of size $m \times n$. What is the minimum number of comparisons required to generate the output feature map? Draw a picture showing your pattern of comparisons (hand drawing is ok).

Applying the above strategy to each of the block rows of tiles yields $m(6n + 2) = 6mn + 2m$ comparisons

It wasn't immediately obvious that there's a way to reduce this number via sharing computations in both the row and column directions

3 Practice

4. This coding example will use CIFAR-10 (50k training and 10k testing $3 \times 32 \times 32$ images of 10 different classes) with a simple few layer sequential CNN for image classification. Understand all lines of code in the following example (https://github.com/arthurredfern/UT-Dallas-CS-6301-CNNs/blob/master/Code/xNNs_Code_021_CIFAR.py) and run it in Google Colab. Note the following examples in the code:

- Computing the dataset mean and std dev
- Restarting training after a crash from the last saved checkpoint
- Saving and loading the model

Feel free to modify the code and experiment, again, this is how you gain confidence and intuition.

Complete