Homework 02 – Algorithms

Arthur J. Redfern
arthur.redfern@utdallas.edu

0 Outline

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

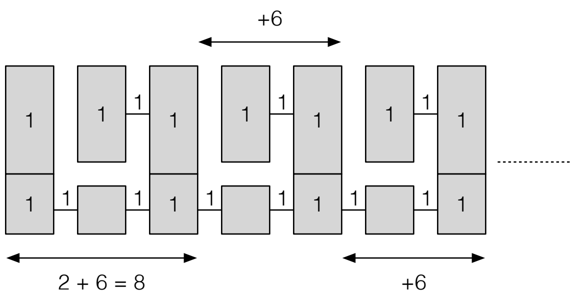
   Complete

2 Theory

2. 3x3/2 max pooling applied to an input feature map of size 3 x (2n + 1) generates an output feature map of size 1 x 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 3x3 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. 3x3/2 max pooling applied to an input feature map of size (2m + 1) x (2n + 1) generates an output feature map of size m x 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 x 32 x 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_020_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 in Keras H5 format
- Saving and loading the model in TensorFlow SavedModel format
- Getting a list of all feature maps
- Creating an encoder only model

Feel free to modify the code and experiment.

Complete