COMP9444 Neural Networks and Deep Learning
Term 3, 2020

Exercises 4: PyTorch

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Download the zip file `Ex4code.zip` and unzip it. This will create a directory `Ex4code` with two very simple PyTorch programs, `slope.py` and `xor.py`.

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1. **Adjusting the Learning Rate and Momentum**

   The program `slope.py` solves the simplest possible machine learning task:

   solve `F(x) = A*x` such that `F(1)=1`

   a. Run the program by typing

   ```
   python3 slope.py --lr 0.1
   ```

   Try running the code using each of the following values for learning rate:

   `0.01, 0.1, 0.5, 1.0, 1.5, 1.9, 2.0, 2.1`

   Describe what happens in each case, in terms of the success and speed of the algorithm.

   b. Now add momentum, by typing:

   ```
   python3 slope.py --mom 0.1
   ```

   Try running the code with learning rate kept at the default value of `1.9` but with momentum equal to `0.1, 0.2,` etc. up to `0.9`. For which value of momentum is the task solved in the fewest epochs? What happens when the momentum is `1.0`? What happens when it is `1.1`?

2. **Learning the XOR Task**

   The program `xor.py` trains a 2-layer neural network on the XOR task.

   a. Run the code ten times by typing

   ```
   python3 xor.py
   ```

   For how many runs does it reach the global minimum? For how many runs does it reach a local minimum?

   b. Keeping the learning rate fixed at `0.1`, can you find values of momentum (`--mom`) and initial weight size (`--init`) for which the code converges relatively quickly to the global minimum on virtually every run?

Make sure you attempt the questions yourself, before looking at the Sample Solutions.