Deep Learning with Computation Graphs in PyTorch

Lecture 02

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What is PyTorch

- A wrapper of **NumPy** that enables the use of GPUs.
  - **Tensors** similar to NumPy’s ndarray, but can also be used on GPU.

- A flexible deep learning platform:
  - Deep Neural Networks built on a tape-based **autograd** system:
    - Building neural networks using and replaying a tape recorder.
    - **Reverse-mode auto-differentiation** allows changing the network at runtime:
      - The computation graph is created on the fly.
      - Backpropagation is done on the dynamically built graph.

http://pytorch.org/about/
Tensors

• PyTorch **tensors** support the same operations as NumPy.
  – Arithmetic.
  – Slicing and Indexing.
  – Broadcasting.
  – Reshaping.
  – Sum, Max, Argmax, …

• PyTorch tensors can be converted to NumPy tensors.
• NumPy tensors can be converted to PyTorch tensors.

http://pytorch.org/tutorials/beginner/blitz/tensor_tutorial.html
Autograd

- The **autograd** package provides automatic differentiation for all operations on Tensors.
  - It is a *define-by-run* framework, which means that the gradient is defined by how your code is run:
    - Every single **backprop** iteration can be different.

- **autograd.Variable** is the central class of the package.
  - Variable wraps a Tensor, and supports nearly all of operations defined on it.
  - Once you finish your computation you can call `.backward()` and have all the gradients computed automatically.

http://pytorch.org/tutorials/beginner/blitz/autograd_tutorial.html
Variable and Function

- A **Variable** $v$ has three important attributes:
  - $v$.data holds the raw tensor value.
  - $v$.grad is another Variable which accumulates the gradient w.r.t. $v$:
    - The gradient of what?
      - The gradient of any variable $u$ that uses $v$ on which we call $u$.backward().
    - $v$.grad_fn stores the **Function** that has created the Variable $v$:
      - [http://pytorch.org/docs/master/autograd.html#variable](http://pytorch.org/docs/master/autograd.html#variable)
      - [http://pytorch.org/docs/master/autograd.html#function](http://pytorch.org/docs/master/autograd.html#function)
PyTorch

- Install using Anaconda:
  - conda install pytorch torchvision -c pytorch
  - http://pytorch.org

- Install from sources:
  - https://github.com/pytorch/pytorch#from-source

- Tutorials:
  - http://pytorch.org/tutorials/
  - http://pytorch.org/tutorials/beginner/pytorch_with_examples.html