Intro to PYTORCH

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What is PyTorch?

- PyTorch was created to serve as the prototyping framework of choice for researchers in FAIR (Facebook's AI Research)
- In addition to PyTorch, Facebook also owns Caffe2, which is considered their production framework of choice
- ONNX - New project to transfer models from PyTorch to Caffe2
- More on Caffe2 could be the subject of another talk
- Per PyTorch's github repository, PyTorch is:
  - Tensor computation (like NumPy) with strong GPU acceleration
  - Deep neural networks built on a tape-based autograd system

PyTorch vs TensorFlow

Subject	PyTorch	TensorFlow	Verdict	Discussion
Adoption	Beta	Most Popular	TensorFlow	TensorFlow has been around longer and there is a lot of support, but PyTorch has gained a lot of steam recently
Syntax	Pythonic	Its own monster	PyTorch	PyTorch makes writing neural networks and GPU enabled programs straight forward and easy
Graph Definition	Dynamic	Static	PyTorch	Dynamic graphs allow for easier syntax and recursive and tree-RNNs (TensorFlow has TFFold)
Debugging	Pythonic	tfdbg	PyTorch	Use native python debugging software, not something specific to the framework
Visualization	Crayon	TensorBoard	TensorFlow	Tensorboard wins here, crayon is a port of tensorboard to be framework-agnostic. Point visualizations easier in PT
Deployment	?	Tensorflow Serving	TensorFlow	Tensorflow serving is currently better than PyTorch's nothing
Framework or Library	Library	Framework	?	Up to you. PyTorch is very integrated to python if you know how to do python, you can pick up PyTorch. TensorFlow sometimes feels like its own language

PyTorch vs TensorFlow Syntax Example

		TensorFlow	PyTorch

1.	Define Tensor on CPU	```import tensorflow as tf```
		
		```with tf.device('/cpu:0'):```
		    ```x = tf.constant([1,2,3])```
		    ```print(x)```
			```import torch```
			
			```x = torch.Tensor([1, 2, 3]).cpu()```

2.	Define Tensor on GPU	```with tf.device('/gpu:0'):```
		    ```y = tf.constant([1,2,3])```
		    ```print(y)```
			```y = torch.Tensor([1, 2, 3]).cuda()```

3.	Move both to Numpy for more processing	```sess = tf.Session()```
		```with sess.as_default():```
		    ```x_numpy = x.eval()``` **Yuck!**
		    ```y_numpy = y.eval()```
			```x_numpy = x.numpy()```
			```y_numpy = y.cpu().numpy()```

An Example of Tensor computation with GPU Acceleration

- Per PyTorch's github repository, PyTorch is:
    - **Tensor computation (like NumPy) with strong GPU acceleration**
    - Deep neural networks built on a tape-based autograd system
- Let's look at an example of a compute-intensive basic Gaussian Process
- Gaussian Processes are out of the scope of this talk, to learn more look at Nando de Freitas' lecture notes. The numpy code is based off a code snippet on his website.
- Gaussian Processes tl;dr: Each point approximates a function where the function has a mean and a variance, not a single point.
- On to the examples...

GPU Acceleration Cont.

- Overall speedups without converting to numpy and graphing are on the order of 25X
- Provides a clean numpy-like syntax to perform GPU computation on almost any algorithm
- Main lags come from device placement from cpu to gpu and back to cpu

PyTorch as a Deep Learning Architecture

- Per PyTorch's github repository, PyTorch is:
  - Tensor computation (like NumPy) with strong GPU acceleration
  - **Deep neural networks built on a tape-based autograd system**
- Saw speedup of ~ 5% on the model that I was working with versus TensorFlow
- The code took 153 lines of code versus ~280 lines of code

Questions