Experience with Keras
(Theano and TensorFlow)

Michela Paganini
Yale University

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PRESENTATION OUTLINE

WHAT IS KERAS

WHY KERAS

WHAT DRIVES KERAS

WHAT'S IT LIKE TO USE KERAS

What is Keras

- Modular, powerful and intuitive Deep Learning python library built on Theano and TensorFlow
- Minimalist, user-friendly interface
- CPUs and GPUs support
- Open-source, developed and maintained by a community of contributors, and publicly hosted on GitHub
- Extremely well documented, lots of working examples
- Very shallow learning curve
—> it is by far one of the best tools for both beginners and experts
- "*Developed with a focus on enabling fast experimentation. Being able to go from idea to result with the least possible delay is key to doing good research*."

What Makes Keras Great

1. BEAUTIFUL MINIMALIST USER-FRIENDLY

2. POWERFUL ROBUST OPTIMIZED

KERAS BACKENDS

- Keras doesn't itself handle any tensor ops

- Relies on tensor manipulation libraries (Theano & TensorFlow)

- Connects with both of them via the abstract Keras backend (http://keras.io/backend/)

BACKEND ENGINES

UNIFIED FRONTEND

Theano & TF

- High level wrappers around C++ —> let you call into the C++ efficiently while using syntax of higher level programming languages

- Theano and TF are in many ways very similar
    - Both let you define arbitrary functions on tensors and compute their derivatives easily

    - Not really Deep Learning packages

- Theano has been around for longer and it's a more stable package, but it's an academic project

- TF is backed by Google and have the advantage of natively built in support for distributed systems

Theano

"Theano is a linear algebra compiler that optimizes a user's symbolically-specified mathematical computations to produce efficient low-level implementations."

"It can be used to symbolically define mathematical functions, automatically derive gradient expressions, and compile these expressions into executable functions"

Properties of Theano

- Dynamic C code generation
- Stability optimization
- Execution speed optimization
- Parallelism on CPU/GPU
- Asynchronous calls on GPU
- Lazy evaluation
- Unit tests with Travis-CI
- Symbolic differentiation

TensorFlow

- Evolution from 1st generation DistBelief (NIPS 2012)
- Meant for deployment on heterogeneous systems on a broad range of platforms including large-scale distributed systems

- Synchronous and asynchronous training on different devices
- Abstracts away underlying devices/computational hardware

TensorFlow vs Numpy

Similar syntax
+ some TF-specific entities (e.g. *session*)

Different functionality:

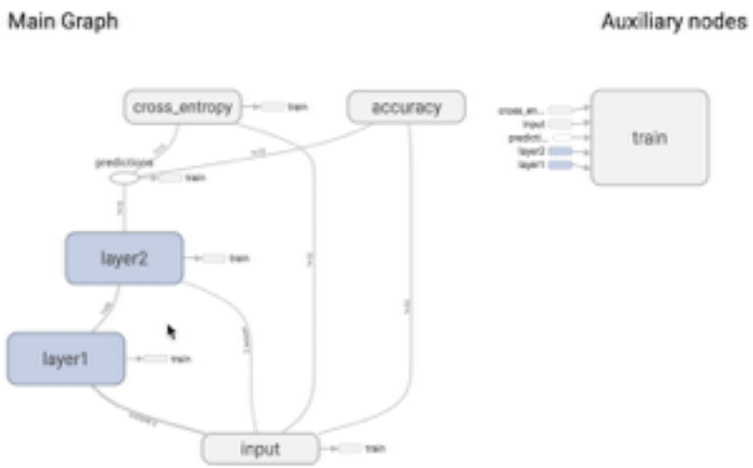
Numpy is doing operations in memory

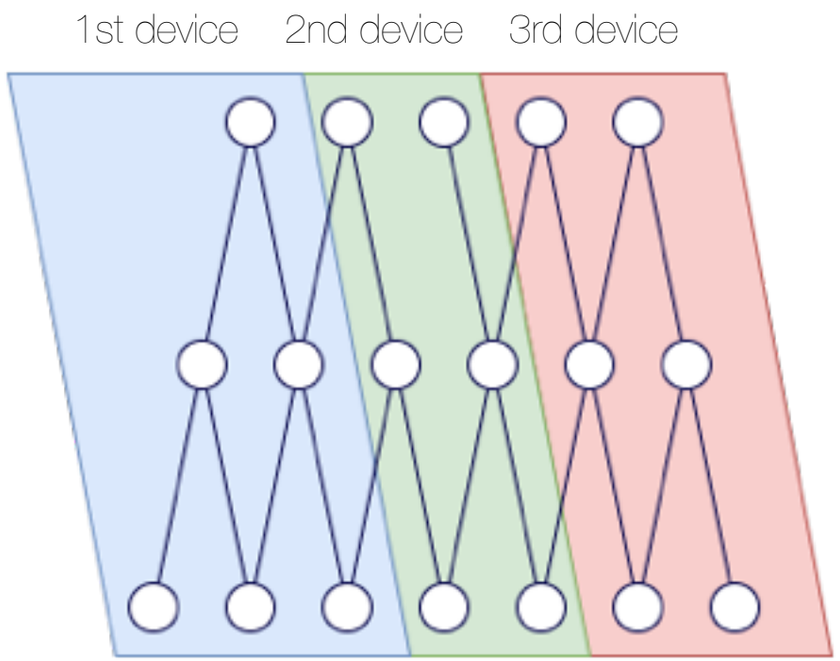
TF is symbolically describing operations, compiling and executing them in a session to get a numerical result (*feed & fetch*)

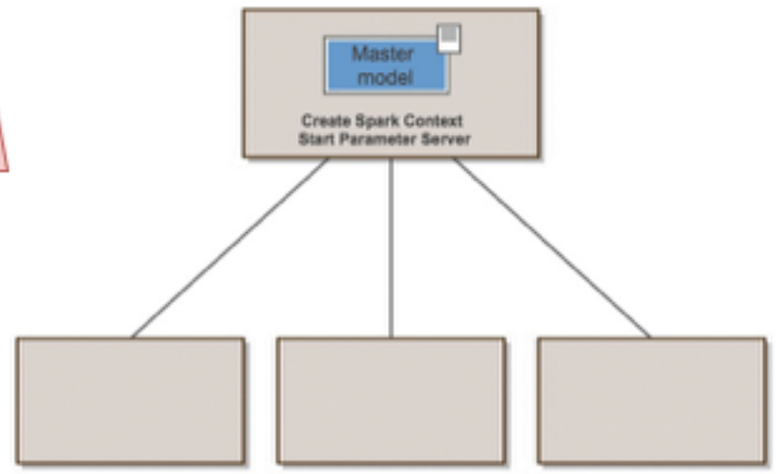
TENSORFLOW GRAPH

- Execution core directly in C++ with very low overhead
- Just like Theano, it allows us to define NNs in a programmatic way
- A TensorFlow computation is described by a directed graph, which is composed of a set on nodes
- Clients typically construct a computational graph using one of the supported front-end languages (C++ or Python)
- Each node represents the instantiation of an operation
- An operation represents an abstract computation (e.g., "matrix multiply", or "add")
- A kernel is a particular implementation of an operation that can be run on a particular type of device (e.g., CPU or GPU)
- Clients programs interact with the TensorFlow system by creating a session
- Computations represented as a dataflow graph where tensors flow along the graph edges

TensorFlow Pros







Visualization Module: TensorBoard

Model Parallelism: Subgraph Computation

Data Parallelism

What’s it like to use Keras?

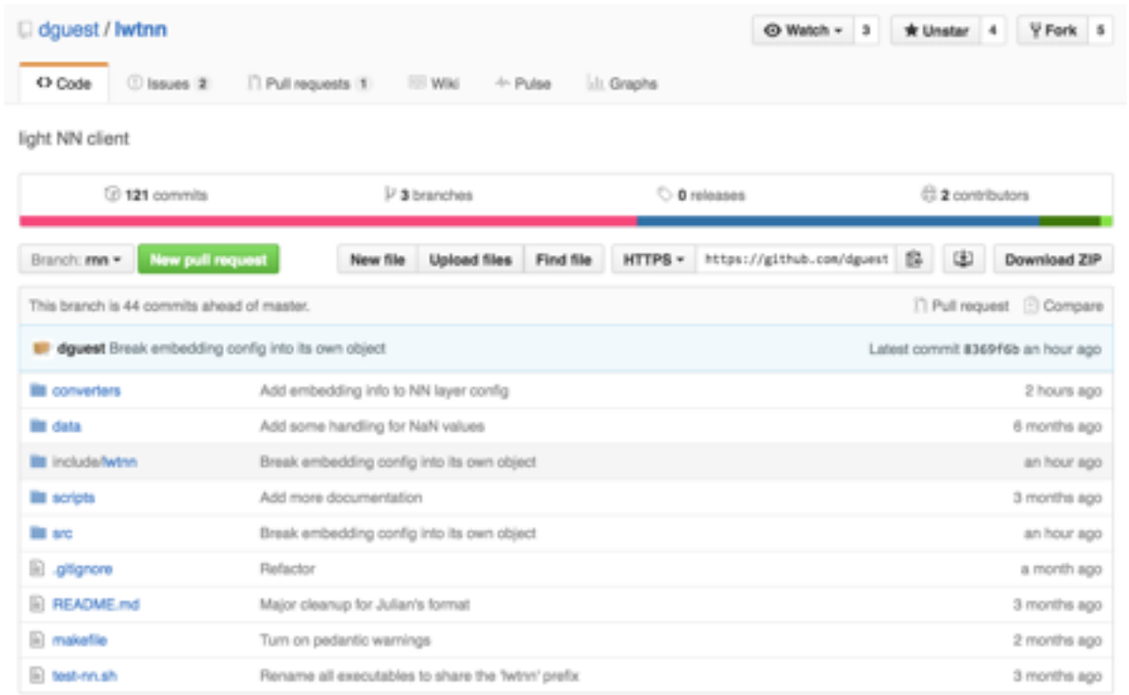
iPython Notebook

http://nbviewer.jupyter.org/github/mickypaganini/IPNN/blob/master/TF/DummyNet.ipynb

Keras Support

- Google Group: https://groups.google.com/forum/#!forum/keras-users
- Github issues: https://github.com/fchollet/keras/issues
- Slack: https://kerasteam.slack.com
- StackOverflow: http://stackoverflow.com/questions/tagged/keras

CERN INTEGRATION



NN CLASS IN ATHENA

TF C++

TENSORFLOW C++ WITH ATHENA

Questions