

Deep Learning Frameworks

A short tutorial

Requirements and Recommendations

- **Which OS to use?**
- **Windows vs Linux**

Pre-Requisites

Introduction

- **Why?**
- **Automatic Differentiation**

Introduction

- **The elements of a good framework**
- **Popular Frameworks:**
 - Caffe
 - Tensorflow
 - Theano
 - PyTorch
 - CNTK

Frameworks we will be discussing

- **Caffe**
- **Tensorflow**

Caffe

- **Developed by UC Berkeley Machine Learning Lab**
- **github repository:**
<https://github.com/BVLC/caffe>

Diving in...

- **Installation**
- **Working Principle**

TIP : Always execute commands from Caffe's root directory.

Installing Caffè be like ...



**He said: "I will just install Caffè
and I will come back"**



I'm still waiting for him

Continued ...

- **Setting up Data pipeline**
 - Beginners Nightmare
 - Tips to get around

Basic Structure of a Caffe Model

Caffe uses protocol buffers for the definition of the required files,

- **Solver**
- **Network Definition**
 - The relationship between momentum, learning rate and the weight update can be defined as,

$$V_{t+1} = \mu V_t - \alpha \nabla L(W_t)$$

Putting it all together ...

- **Start Training**

Basic Structure of a Caffe Model

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 - The relationship between momentum, learning rate and the weight update can be defined as,
$$V_{t+1} = \mu V_t - \alpha \nabla L(W_t)$$
 - μ is the momentum.
 - α is the learning rate.

Debugging ...

- **Visualizing Architectures**

- From, \$CAFFE_ROOT execute,
- *python draw_net.py /path/to/architecture /path/to/output.png*

- **Babysit training**

Tensorflow

- **What's different?**
- **Caffe vs Tensorflow**
- **Design Philosophy**

Introduction

- **Installation**

- Way easier than caffe.
- Create a virtual environment
- Pip install tensorflow
- For the gpu version,
 - Pip install tensorflow-gpu

Goals ...

- **Tensors**
- **Graphs**
- **Sessions**

Tensors

- **A generalization of vectors and matrices**
- **Tensors can have any number of dimensions**
 - `tf.rank(tensor)`
- **Tensors can be evaluated for debugging**
 - `tf.eval`
 - Usage: `nameoftensor.eval()`

Graphs

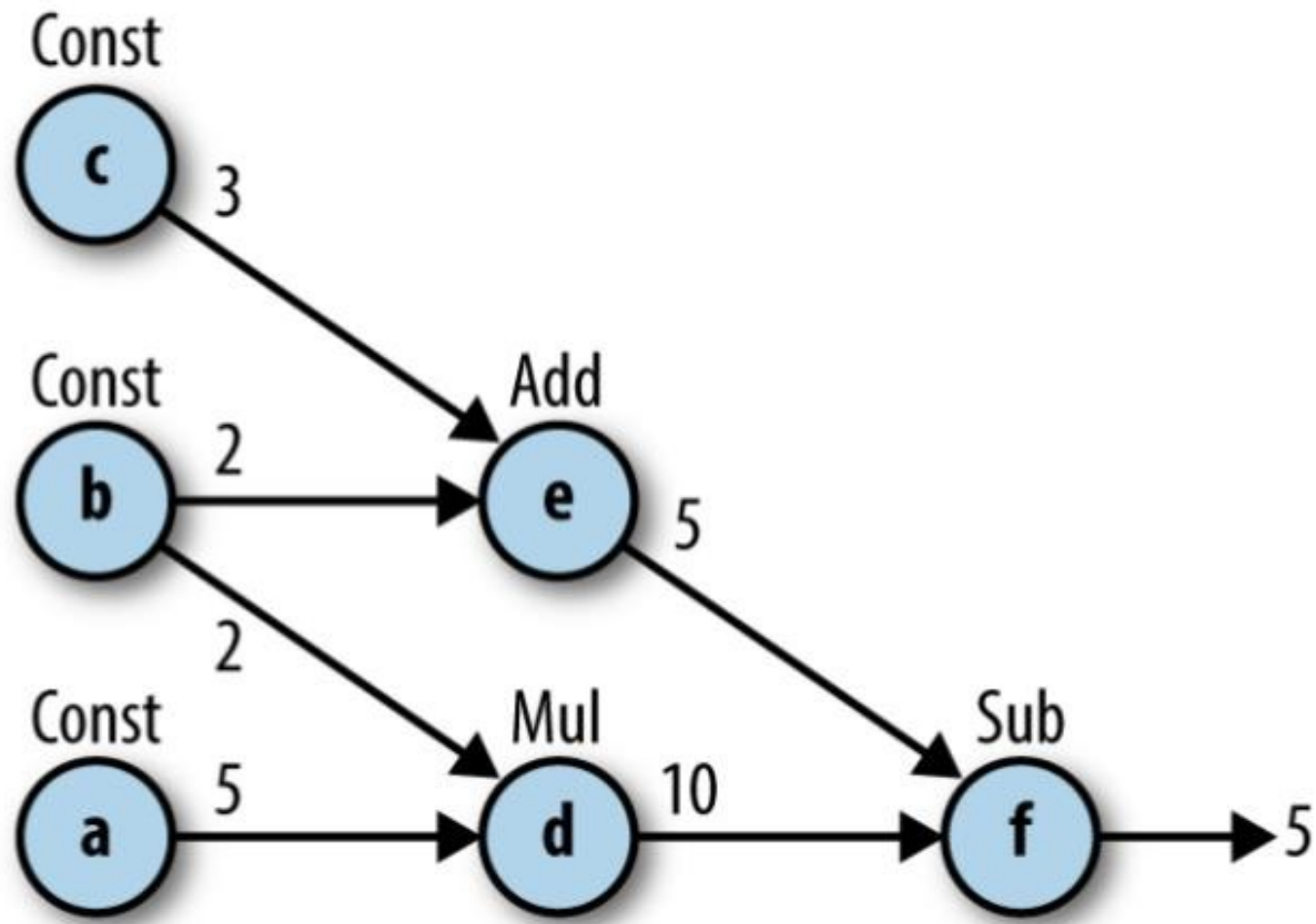
- **Nodes**

- An operation is essentially a node

- **Defining a node**

- `a = tf.constant(5)`
- `b = tf.constant(2)`
- `c = tf.constant(3)`
- `d = tf.multiply(a,b)`
- `e = tf.add(c,b)`
- `f = tf.subtract(d,e)`

Graphs



Sessions

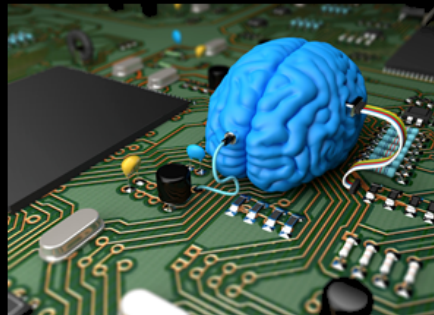
- **Session is basically a runtime context**
- **A graph is static and just lies there in the memory until we execute it**
 - `sess = tf.Session()`
 - `outs = sess.run(f)`
 - `sess.close()`

See you after break ...

Deep Learning



What society thinks I do



What my friends think I do



What other computer scientists think I do



What mathematicians think I do



What I think I do

```
In [1]:  
import keras  
Using TensorFlow backend.
```

What I actually do