

Uni.lu HPC School 2018

PS13: Machine and Deep learning workflows on UL HPC platforms



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<http://hpc.uni.lu>



Latest versions available on Github:



UL HPC tutorials:

<https://github.com/ULHPC/tutorials>

UL HPC School:

<http://hpc.uni.lu/hpc-school/>

PS13 tutorial sources:

ulhpc-tutorials.rtf.d.io/en/latest/deep_learning/





Summary

- 1 Practical Session Objectives**
- 2 Deep Learning Analytics with Tensorflow
- 3 Training Neural Networks with Keras

Main Objectives of this Session

- (ultra brief) **review of Machine/Deep Learning**
 - ↪ using (excellent) material of:

<https://github.com/m2dsupsdllclass/lectures-labs>

- Preliminary installations
 - ↪ X11 forwarding and SOCKS5 proxy connection over SSH
 - ↪ Prepare **virtualenv**
 - ↪ Install Jupyter
 - ↪ Configure Jupiter Kernel and launch jupyter notebook
- **MNIST** ML and Deep ML using Tensorflow
- Training Neural Networks with Keras
 - ↪ Pretrained Models for Computer Vision

Hands-on 1: Preliminary installations

- We will rely on Python virtualenv
↳ **assumes** to have followed PS9: Advanced Prototyping with Python

Your Turn!

Hands-on 1

ulhpc-tutorials.rtf.d.io/en/latest/deep_learning/#1-preliminary-installations

- SSH Connect with X11 forwarding and SOCKS5 proxy connection
- Prepare **virtualenv**
- Installation of **Jupyter Notebook**
- Configure Jupiter Kernel and launch jupyter notebook



Summary

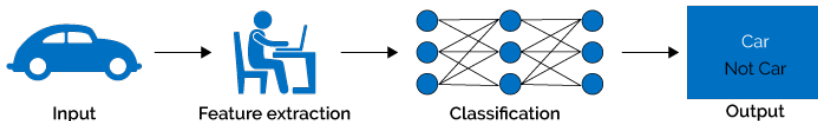
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Big data and Machine/Deep Learning

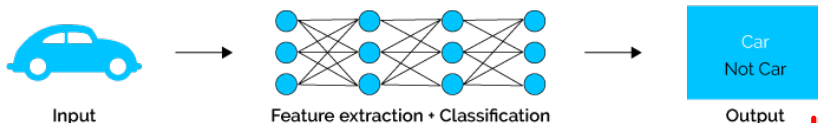
- **Out-of-scope of this tutorial:**

↪ Machine Learning (ML) / Deep Learning theoretical basis

Machine Learning



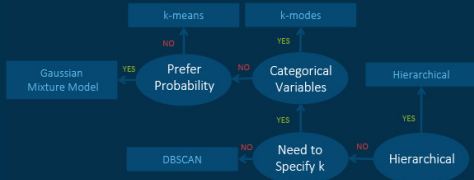
Deep Learning



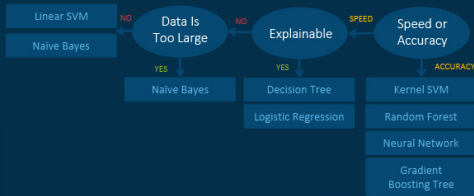
Machine Learning Cheat sheet

Machine Learning Algorithms Cheat Sheet

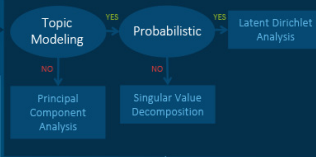
Unsupervised Learning: Clustering



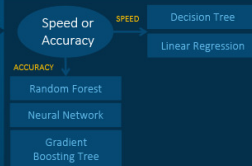
Supervised Learning: Classification



Unsupervised Learning: Dimension Reduction



Supervised Learning: Regression



Machine/Deep-Learning Frameworks I

- Pytorch

- ↪ Python version of Torch open-sourced by Facebook in 2017.
- ↪ Torch is a computational framework with an API written in Lua that supports machine-learning algorithms.
- ↪ PyTorch offers dynamic computation graphs, which let you process variable-length inputs and outputs.

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- TensorFlow

- ↪ open source software library from Google for numerical computation using data flow graphs,
- ↪ thus close to the [Deep Learning book](#) way of thinking about neural networks.

Machine/Deep-Learning Frameworks II

- Keras

- ↪ high-level neural networks API,
- ↪ written in Python and capable of running on top of TensorFlow.

Machine/Deep-Learning Frameworks II

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- Caffe

- ↪ a well-known and widely used machine-vision library
 - ✓ ported Matlabs implem. of fast convolutional nets to C & C++
- ↪ **better:** You'll also have to consider its successor, Caffe 2,
 - ✓ also open-sourced by Facebook
 - ✓ is supposed to be more scalable and light-weight

Machine/Deep-Learning Frameworks

- Offer various **Package Design Choices**
 - ↪ **Model specification:**
 - ✓ Configuration file (Caffe, DistBelief, CNTK) vs. programmatic generation (Torch, Theano, Tensorflow)
 - ↪ For programmatic models, choice of high-level language:
 - ✓ Lua (Torch)
 - ✓ vs. Python (Theano, Tensorflow)
 - ✓ vs others (Go etc.)

In this talk

- We chose to work with python because of rich community and library infrastructure.

TensorFlow vs. Theano

- Theano is another deep-learning library with pythonwrapper
 - ↳ was inspiration for Tensorflow
- Theano and TensorFlow are very similar systems.
 - ↳ TensorFlow has better support for distributed systems though,
 - ↳ development funded by Google, while Theano is an academic project.



What is TensorFlow ?

- TensorFlow is a deep learning library recently open-sourced by Google.
 - ↪ library for numerical computation using **data flow graphs**.
 - ✓ **Nodes** represent mathematical operations,
 - ✓ **edges** represent the multidimensional data arrays (**tensors**) communicated between them.
- Flexible architecture allowing to deploy computation anywhere:
 - ↪ to one or more CPUs or GPUs in a desktop, server,
 - ↪ or mobile device with a single API.
- TensorFlow was originally developed within the Google Brain Team

Hands-on 2: Tensorflow

- you are ready to play with tensorflow
- provided tutorial is self-explicit and make use of [Jupyter Notebook](#)

Hands-on 2

ulhpc-tutorials.rtf.d.io/en/latest/deep_learning/#2-mnist-machine-learning-ml-and-deep-ml-using-tensorflow

- Run a very simple **MNIST** classifier Step 1
 ↪ MNIST: computer vision dataset (images of handwritten digits)
- Run a deep MNIST classifier using convolutional layers Step 2
 ↪ compare results with **best models**

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Hands-on 3: Keras

- You are ready to play with Keras
- provided tutorial is self-explicit and make use of **Jupyter Notebook** of **EXCELLENT** labs available at

<https://github.com/m2dsupsdclass/lectures-labs>

Hands-on 3

ulhpc-tutorials.rtfld.io/en/latest/deep_learning/#3-training-neural-networks-with-keras

- Install keras
- Training Neural Networks with Keras
- Pretrained Models for Computer Vision

Questions?

<http://hpc.uni.lu>

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