EE-559 – Deep Learning

You can find here the materials for the EPFL course EE-559 “Deep Learning”, taught by François Fleuret.

Info sheet: dlc-info-sheet.pdf

We will use the PyTorch framework for implementations. You can find below a Linux virtual machine for the practical sessions.

Thanks to Adam Paszke, Alexandre Nanchen, Xavier Glorot, Matus Telgarsky, and Diederik Kingma, for their help, comments, or remarks.

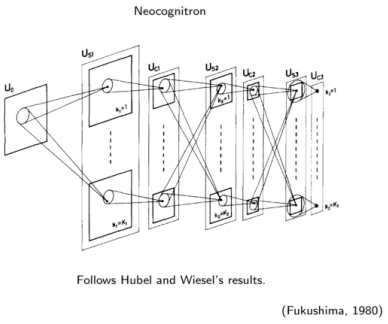
Course material

You will find here the slides which are full of “animations” and not convenient to use as notes, handouts with two slides per pages, and for some of the lectures videos of voice-over.

Practical session prologue

Helper python prologue for the practical sessions: dlc_practical_prologue.py

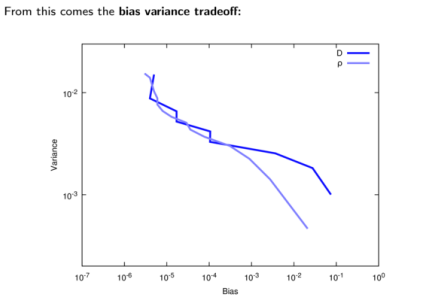
Lecture 1 (Feb 21, 2018) – Introduction and tensors



What is deep learning, some history, what are the current applications. torch.Tensor, linear regression.

- slides / handout / video (part a)
- slides / handout / video (part b)
- practical

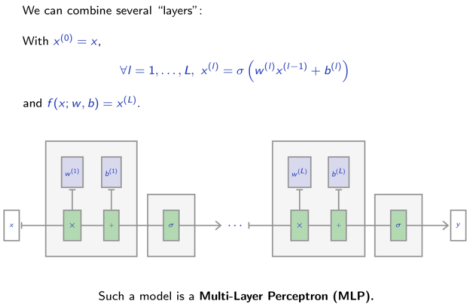
Lecture 2 (Feb 28, 2018) – Machine learning fundamentals



Empirical risk minimization, capacity, bias-variance dilemma, polynomial regression, k-means and PCA.

- slides / handout
- practical

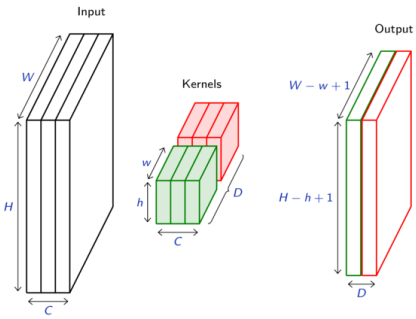
Lecture 3 (Mar 07, 2018) – Multi-layer perceptrons



Linear classifiers, perceptron, linear separability and feature extraction, Multi-Layer Perceptron, gradient descent, back-propagation.

- slides / handout (part a)
- slides / handout (part b)
- practical

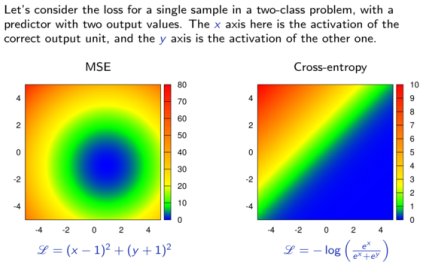
Lecture 4 (Mar 14, 2018) – Convolutional networks and autograd



Generalized acyclic graph networks, torch.autograd, batch processing, convolutional layers and pooling, torch.nn.Module.

- slides / handout (part a)
- slides / handout (part b)
- practical
- dlc_practical_4_embryo.py

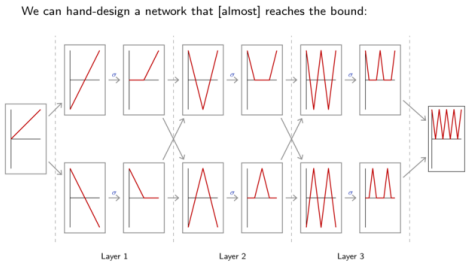
Lecture 5 (Mar 21, 2018) – Optimization



Cross-entropy, L1 and L2 penalty. Weight initialization, Xavier's rule, loss monitoring. torch.autograd.Function.

- slides / handout
- practical

Lecture 6 (Mar 28, 2018) – Going deeper

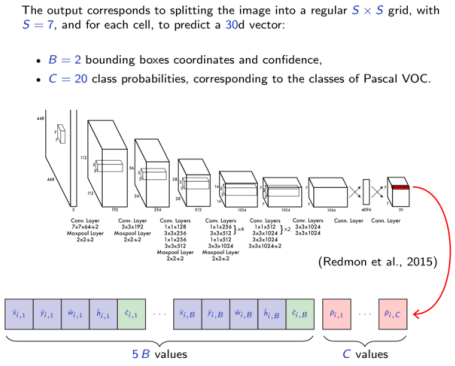


Theoretical advantages of depth, rectifiers, drop-out, batch normalization, residual networks, advanced weight initialization. GPUs and torch.cuda.

- slides / handout
- mini-project

No lecture (Apr 4, 2018) – Easter holidays

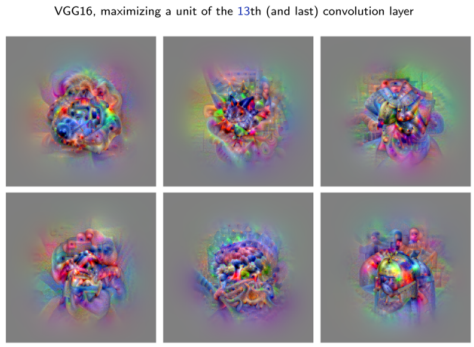
Lecture 7 (Apr 11, 2018) – Computer vision



Deep networks for image classification (AlexNet, VGGNet), object detection (YOLO), and semantic segmentation (FCN). Data-loaders, neuro-surgery, and fine-tuning.

- slides / handout
- mini-project

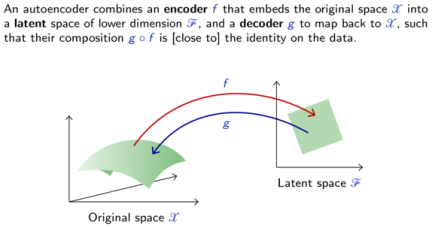
Lecture 8 (Apr 18, 2018) – Under the hood



Visualizing filters and activations, smoothgrad, deconvolution, guided back-propagation. Optimizing samples from scratch, adversarial examples.

- slides / handout
- mini-project

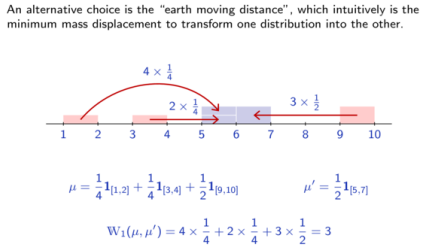
Lecture 9 (Apr 25, 2018) – Autoencoders and generative models



Transposed convolution layers, autoencoders, variational autoencoders, non volume-preserving networks.

- slides / handout
- mini-project

Lecture 10 (May 2, 2018) – Generative Adversarial Networks



GAN, Wasserstein GAN, Deep Convolutional GAN, Image-to-Image translations, model persistence.

- slides / handout
- mini-project

Lecture 11 (May 9, 2018) – Recurrent networks and NLP

TBD

Lecture 12 (May 16, 2018) – TBD (guest speaker: Soumith Chintala, Facebook)

TBD

Lecture 13 (May 23, 2018) – TBD (guest speaker: Andreas Steiner, Google)

TBD

Lecture 14 (May 30, 2018) – TBD (guest speaker: Andreas Steiner, Google)

TBD

Virtual machine for the practicals

A Virtual Machine (VM) is a software that simulates a complete computer. The one we provide here includes a Linux operating system and all the tools needed to use PyTorch from a web browser (firefox or chrome).

To use it, first download and install Oracle's VirtualBox on your machine, then download the image file:

Deep Learning VM.ova (3.4Gb)