Practical Deep Neural Networks

GPU computing perspective
Introduction

Yuhuang Hu   Chu Kiong Loo

Advanced Robotic Lab
Department of Artificial Intelligence
Faculty of Computer Science & IT
University of Malaya

Outline

Objectives

➢ Light introduction of numerical computation.

➢ Fundamentals of Machine Learning.

➢ Support Vector Machine, Softmax Regression.

➢ Feed-forward Neural Network.

➢ Convolutional Networks.

➢ Recurrent Neural Networks.

Prerequisites

⋆ Basic training in Calculus
⋆ Basic training in Linear Algebra
- Matrix operations
- Matrix properties: transform, rank, norm, determinant, etc
- Eigendecomposition, Singular Value Decomposition.
⋆ Basic programming skills
- If-else conditioning
- Loops
- Function, class, library
- Source code control: Git (optional)

References

♦ Deep Learning: An MIT Press book in preparation
Main reference in this workshop, still in development, awesome structure, awesome contents.

♦ Machine Learning: A probabilistic perspective
One of the best Machine Learning books on the market.

♦ CS231n Convolutional Neural Networks for Visual Recognition Notes
Nice structured, well written, loads of pictures.

♦ CS229 Machine Learning Course Materials
For basic knowledge, well written, easy-to-read.

Software and Tools

* ⋆ Ubuntu 14.04
* ⋆ CUDA Toolkit 7
* ⋆ Python 2.7.9 (Why not 3.*?)
* ⋆ Theano
* ⋆ numpy, scipy, etc
* ⋆ Eclipse+PyDev

Reading List

A reading list is prepared for this workshop, all reading materials can be found at:

`http://rt.dgyblog.com/ref/ref-learning-deep-learning.html`

The list keeps expanding!!

Scalar, Vector, Matrix and Tensor

Matrix Operations

Matrix Properties

Singular Value Decomposition (SVD)

Optimization Problem: Hypothesis

Optimization Problem: Cost function

Dataset: How to split the data?

Dataset: Cross validation

MNIST

CIFAR-10

Mean subtraction
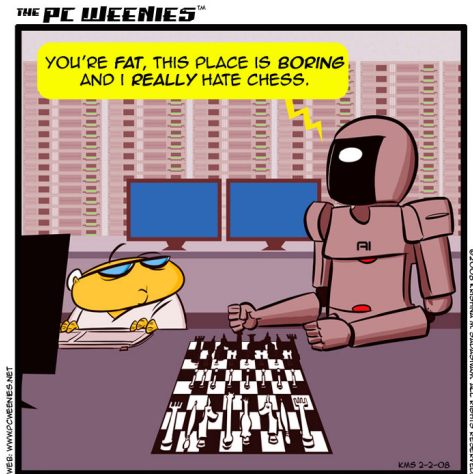
Unit variance

PCA

ZCA Whitening

SGD

Jacobian

Hessian

Q%A