

# Introduction to Deep Neural Networks

## GPU computing perspective

### Getting Started

Yuhuang Hu    Chu Kiong Loo

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

# Outline

- 1 Introduction
- 2 System Setup
- 3 Scientific computing in Python
- 4 Machine Learning Basics
  - Linear Algebra
  - Basic concepts
- 5 Dataset Preparation
- 6 Preprocessing
  - Data Standardization
  - Principle Components Analysis
  - ZCA Whitening
- 7 Gradient-based Optimization
- 8 Summary

# Introduction

# 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)

# Software and Tools

- ★ Ubuntu 14.04
- ★ CUDA Toolkit 6.5
- ★ Python 2.7.9 (Why not 3.\*?)
- ★ Theano
- ★ numpy, scipy, etc
- ★ Eclipse+PyDev

# Ubuntu 14.04 Installation

# Nvidia Graphics Driver

# CUDA Toolkit



# Anaconda

# Anaconda: post installation

# Eclipse and PyDev

# 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

# Summary