

IASD M2 at Paris Dauphine

# Deep Reinforcement Learning

## 3: PyTorch and Neural Nets Review Session

Eric Benhamou David Saliel



# Acknowledgement

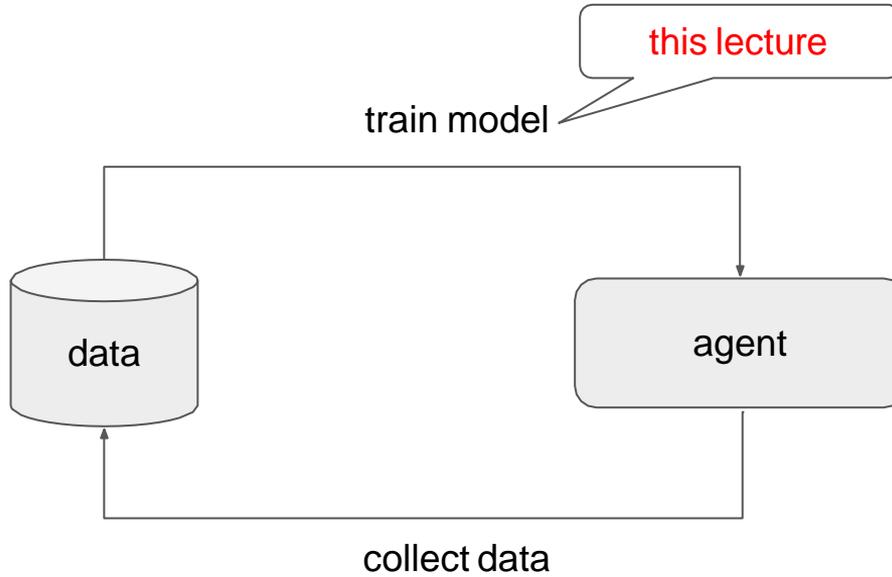
Most of the materials of this course is based on the seminal course of Sergey Levine CS285



# Goal of this course

Train an agent to perform useful tasks

# common training paradigm



How do we train a model?

$$\theta^* = \arg \min_{\theta} \sum_{(x,y) \in \mathcal{D}} \|f_{\theta}(x) - y\|_2^2$$

# How do we train a model?

$$\theta^* = \arg \min_{\theta} \sum_{(x,y) \in \mathcal{D}} \underbrace{\|f_{\theta}(x) - y\|_2^2}$$

neural network

# How do we train a model?

$$\theta^* = \arg \min_{\theta} \sum_{(x,y) \in \mathcal{D}} \|f_{\theta}(x) - y\|_2^2$$

gradient descent

neural network

# How do we train a model?

$$\theta^* = \arg \min_{\theta} \sum_{(x,y) \in \mathcal{D}} \|f_{\theta}(x) - y\|_2^2$$

gradient descent

neural network

# What is PyTorch?

Python library for...

- Defining neural networks
- Automatically computing gradients

$$\theta^* = \arg \min_{\theta} \sum_{(x,y) \in \mathcal{D}} \|f_{\theta}(x) - y\|_2^2$$

gradient descent

neural network

# What is PyTorch?

Python library for...

- Defining neural networks
- Automatically computing gradients
- And more (GPU, optimizers, etc.)

$$\theta^* = \underbrace{\arg \min_{\theta}}_{\text{gradient descent}} \sum_{(x,y) \in \mathcal{D}} \underbrace{\|f_{\theta}(x) - y\|_2^2}_{\text{neural network}}$$

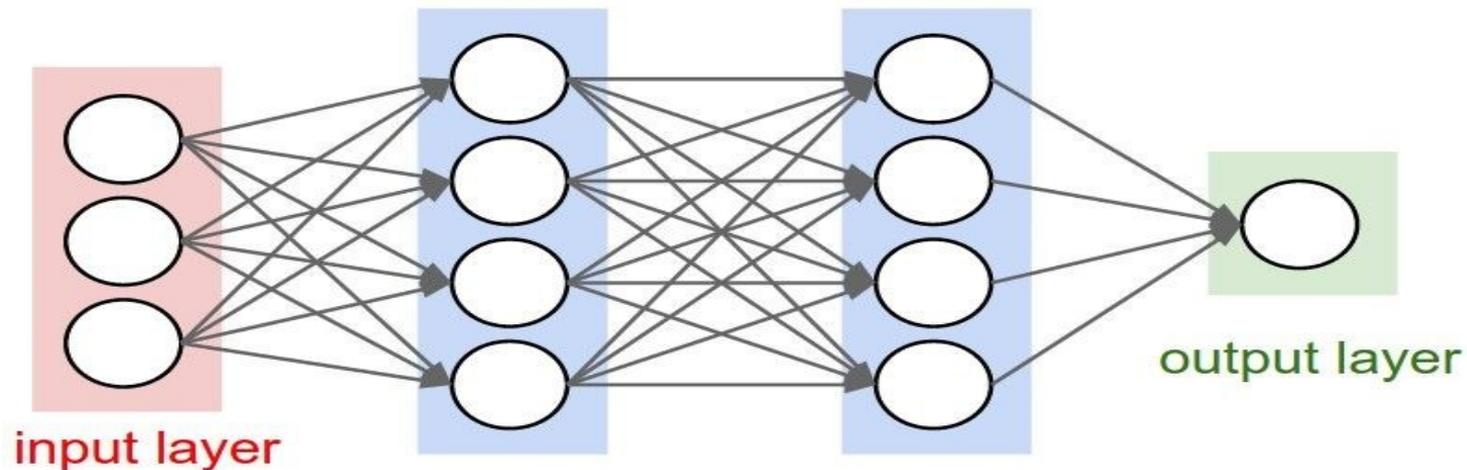
# PyTorch Alternatives

TensorFlow, JAX, Chainer, ...

Basically all do the same

How does Pytorch work?

# PyTorch: forward pass



hidden layer 1

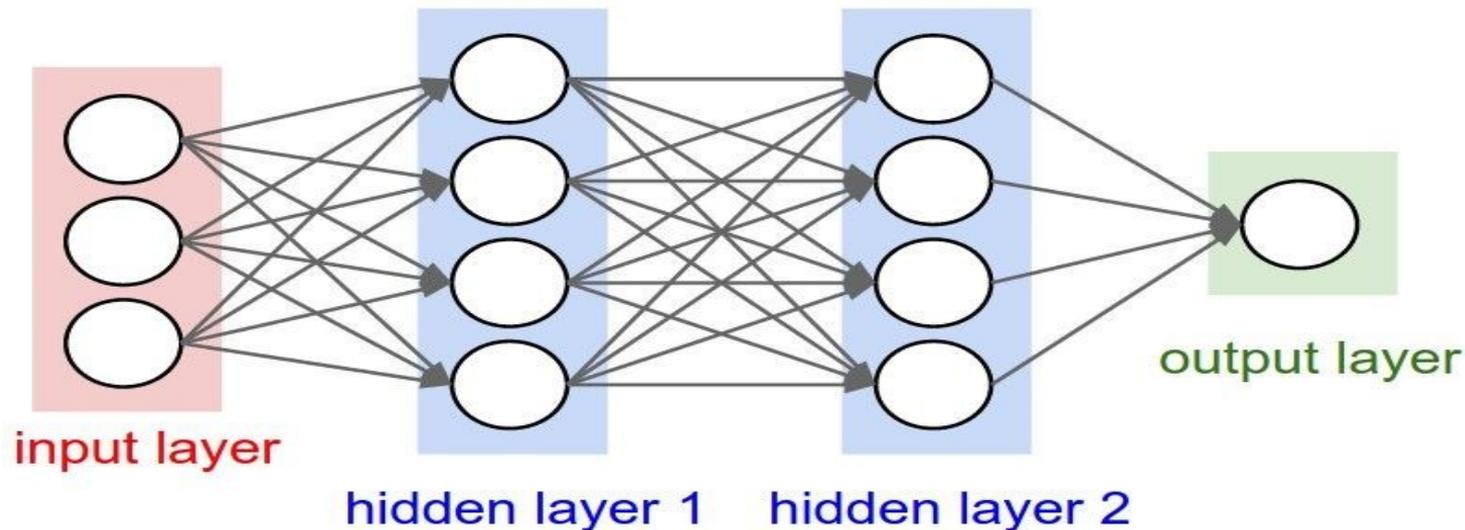
hidden layer 2

$$h_1 = \sigma(W_1x)$$

$$h_2 = \sigma(W_2h_1)$$

$$y = \sigma(W_3h_2)$$

# PyTorch: backward pass



You define	$h_1 = \sigma(W_1x)$	$h_2 = \sigma(W_2h_1)$	$y = \sigma(W_3h_2)$
PT computes	$\frac{\partial y}{\partial W_1} = \frac{\partial y}{\partial h_2} \frac{\partial h_2}{\partial h_1} \frac{\partial h_1}{\partial W_1}$	$\frac{\partial y}{\partial W_2} = \frac{\partial y}{\partial h_2} \frac{\partial h_2}{\partial W_2}$	$\frac{\partial y}{\partial W_3}$

# PyTorch Tutorial (Colab)

[Google collab link:](#)

[https://colab.research.google.com/drive/1r\\_-Ow0QYPN58cfuNjZDUy4O6HUvPDxyN?usp=sharing](https://colab.research.google.com/drive/1r_-Ow0QYPN58cfuNjZDUy4O6HUvPDxyN?usp=sharing)