

Introduction to deep learning

– Pytorch

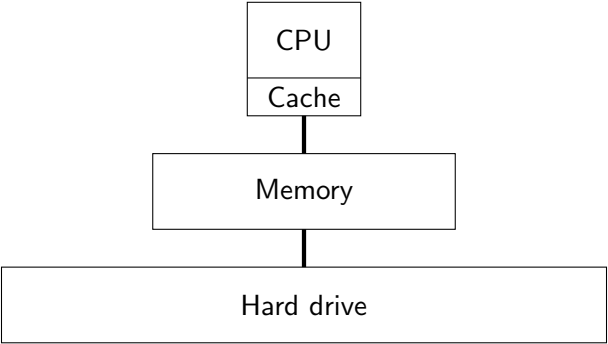
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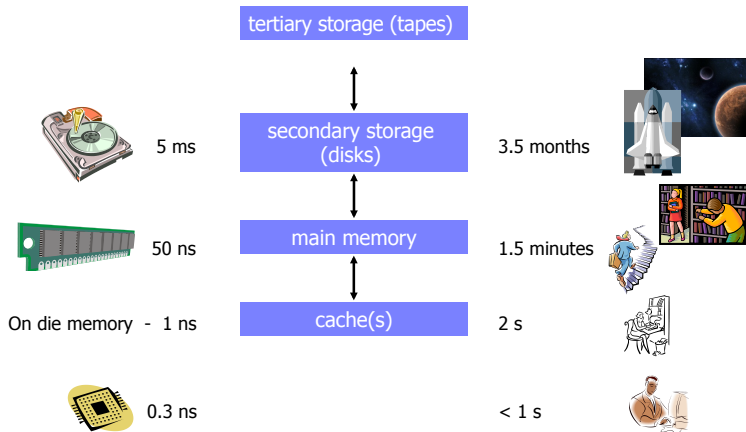
MIEVU 4020

Computer resources

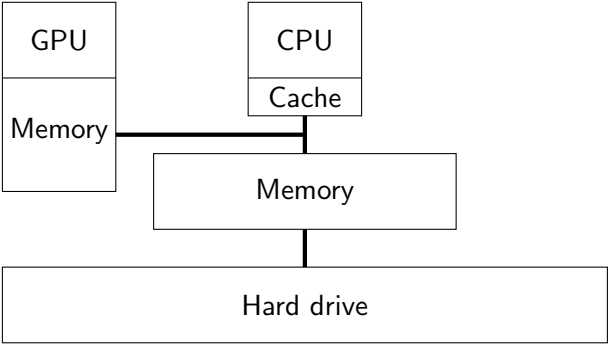


Memory Hierarchies

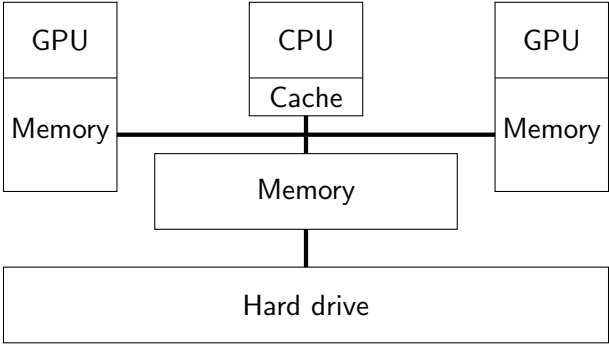
For handouts



Computer resources



Computer resources



Programming frameworks for deep learning

Many frameworks exist. Tensorflow (Google) and PyTorch (Meta) are among the most popular frameworks.

Tensorflow and PyTorch have more or less the same functionality.

Why use a deep learning framework?

- ▶ **(Easy)** Allows us to define the models in an abstract way, without worrying to much of the details.
- ▶ **(Fast)** Behind the scenes, we can use highly optimized code for different hardware.
- ▶ **(Automatic differentiation and optimization)**. We don't need to worry about computing gradients and developing optimization algorithms.
- ▶ **(Less error)** The less code you write yourself, the less error you introduce.

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Why use PyTorch?

- ▶ **(Pythonic)** Flexible, clean and easy to debug.
- ▶ **(Numpy)** Quite similar to numpy.

Precision

In scientific computing it is standard to use **double precision**, i.e., 64-bits. (Largest positive number $\approx 10^{308}$, smallest positive number $\approx 10^{-324}$)

In deep learning it is common to use **single precision**, i.e., 32-bits. (Largest positive number $\approx 10^{38}$, smallest positive number $\approx 10^{-45}$)

Sometimes even **half precision** is used, i.e., 16-bits.

Lower precision is mainly used because it **speeds** up the learning and because **high precision** is not needed.