

Lab 02

"Artificial Intelligence" Course

Hamed Hemati, Joëlle Hanna - 04.03.2024

What is this lab about?

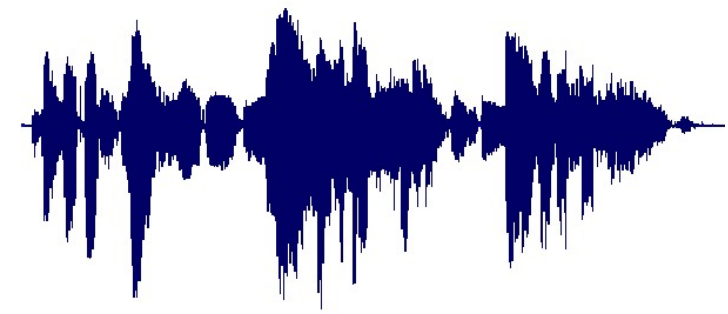
- This lab has two parts:
- Part 1: NumPy and basic image manipulation.
- Part 2: An introduction PyTorch.

Why NumPy?

- In AI, particularly in machine learning, ***Tensors*** or ***N-D arrays*** are used for representing almost "everything".

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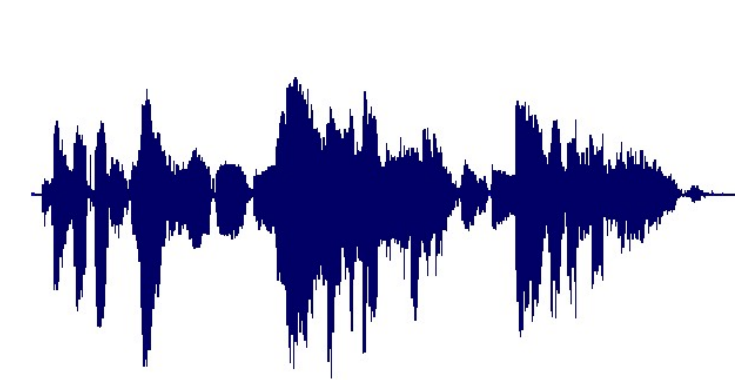


0.0	0.1	0.2	0.1	...	0.0
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T

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0.0	0.1	0.2	0.1	...	0.0
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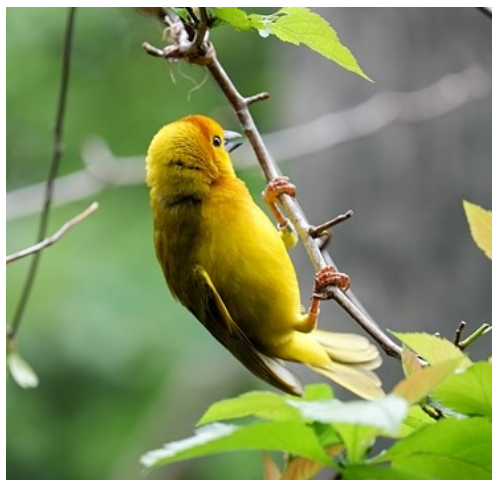
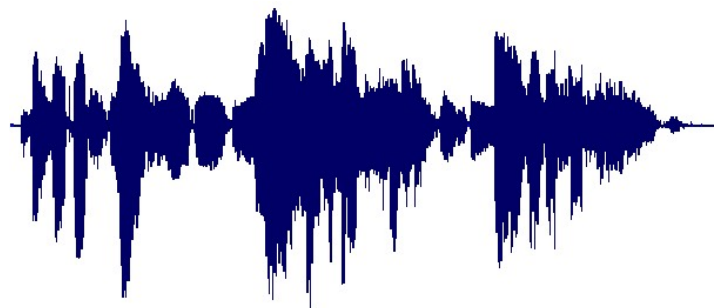
T

0.0	0.0	0.1	0.1	...	0.0
0.0	0.41	0.52	0.28	...	0.0
0.0	0.2	0.58	0.39	...	0.0
0.0	0.3	0.2	0.21	...	0.11
⋮	⋮	⋮	⋮	↘	⋮
0.0	0.12	0.1	0.11	...	0.0

$H \times W$

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$$T$$

0.0	0.0	0.1	0.1	...	0.0
0.0	0.41	0.52	0.28	...	0.0
0.0	0.2	0.58	0.39	...	0.0
0.0	0.3	0.2	0.21	...	0.11
⋮	⋮	⋮	⋮	⋮	⋮
0.0	0.12	0.1	0.11	...	0.0

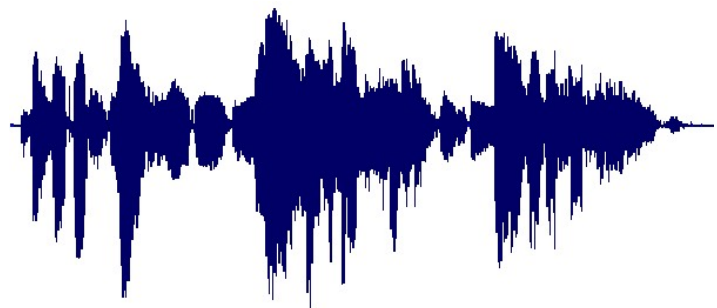
$$H \times W$$

0.0	0.0	0.1	0.1	...	0.0
0.0	0.41	0.52	0.28	...	0.0
0.0	0.2	0.58	0.39	...	0.0
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⋮	⋮	⋮	⋮	⋮	⋮
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$$C \times H \times W$$

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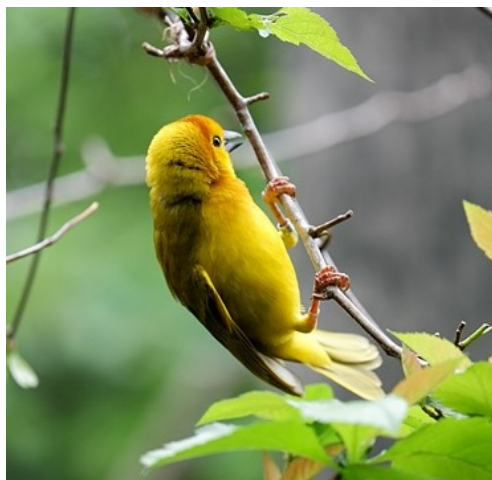
0.0	0.1	0.2	0.1	...	0.0
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T



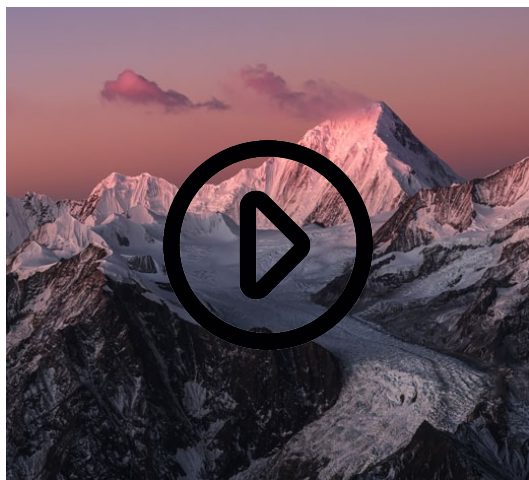
0.0	0.0	0.1	0.1	...	0.0
0.0	0.41	0.52	0.28	...	0.0
0.0	0.2	0.58	0.39	...	0.0
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⋮	⋮	⋮	⋮	⋮	⋮
0.0	0.12	0.1	0.11	...	0.0

$H \times W$



0.0	0.0	0.1	0.1	...	0.0
0.0	0.41	0.52	0.28	...	0.0
0.0	0.2	0.58	0.39	...	0.0
0.0	0.3	0.2	0.21	...	0.11
⋮	⋮	⋮	⋮	⋮	⋮
0.0	0.12	0.1	0.11	...	0.0

$C \times H \times W$

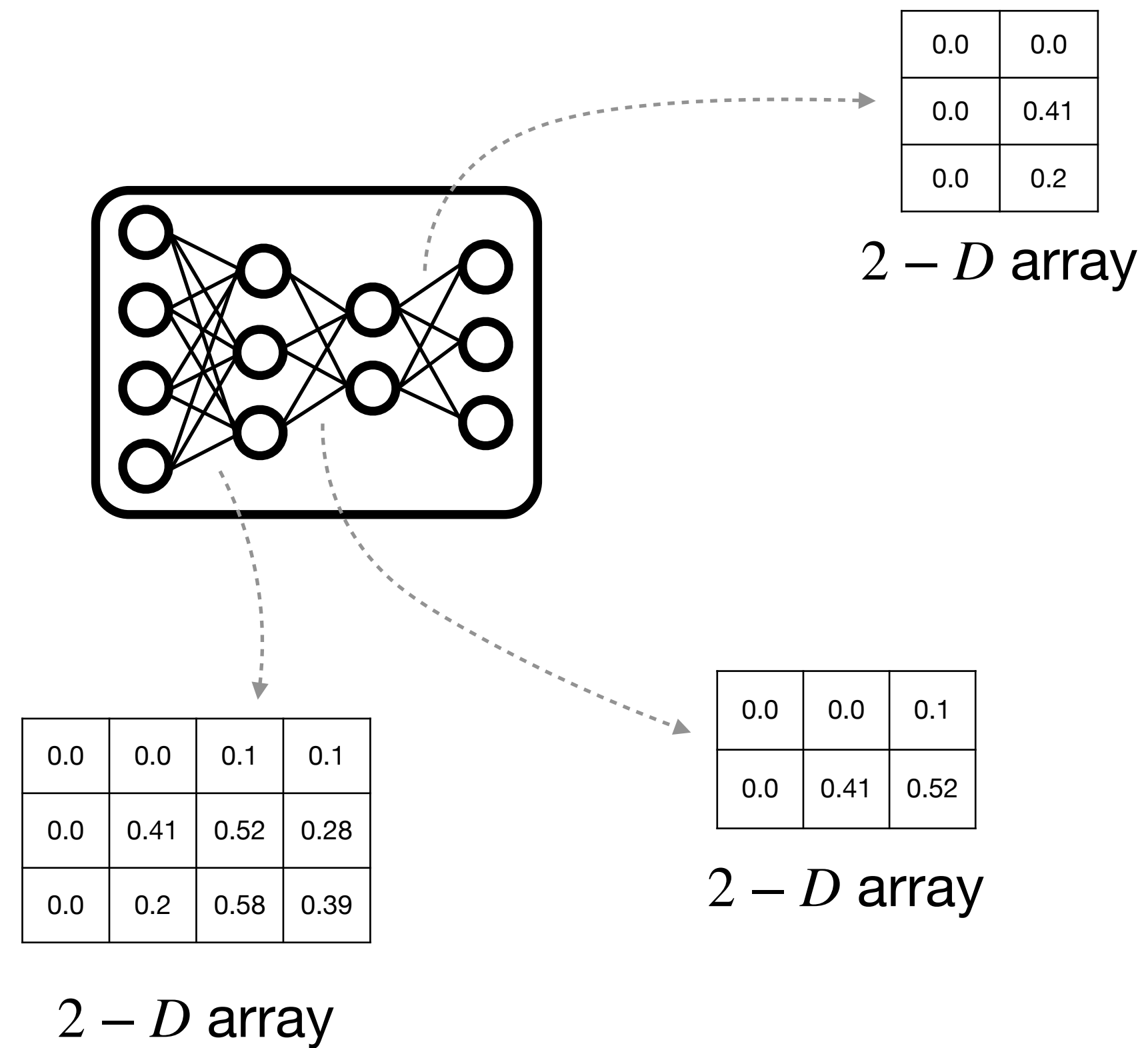


0.0	0.0	0.4	0.2	...	0.0
0.0	0.0	0.1	0.1	...	0.0
0.0	0.41	0.52	0.28	...	0.0
0.0	0.2	0.58	0.39	...	0.0
0.0	0.3	0.2	0.21	...	0.11
⋮	⋮	⋮	⋮	⋮	⋮
0.0	0.12	0.1	0.11	...	0.0

$T \times C \times H \times W$

Why NumPy?

- Tensors are also used to store the "knowledge" of a neural network and its configuration.



Topics - NumPy

- Vectorization
- Basic vector and matrix operations
- Basic image manipulation

Why PyTorch?

- NumPy is good, but we need more!
- Parallelization using GPUs or TPUs
- Automatic differentiation
- And more ...

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User-friendly

Pythonic

Dynamic graphs

Great community ...

Topics - PyTorch

- Tensor processing
- Computational graphs
- Automatic differentiation