

Neural Networks for Data Science

Master's Degree in Data Science

Lecture 0: About the course

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- ▶ **Master's Degree in Data Science**, code 10589627, 2nd year, optional group D.
- ▶ **Timetable and exam dates**: announced in September.
- ▶ **Office hours**: by appointment, remotely or in person.

<https://www.sscardapane.it/teaching/nnds-2026/>

Register for **Google Classroom** from the website: it is mandatory for receiving announcements.

Default exam is an **oral examination** on the course material (2 questions).

A **research project** can replace the oral only when it is agreed in advance and it serves one of two purposes:

- ▶ pursuing a mark of **30 e lode**;
- ▶ preparing for a follow-up **thesis**.

It is intended for interested students and is generally **more demanding** than the oral examination.

1. **Fundamentals**

Arrays, optimization, supervised learning, MLPs, automatic differentiation, and PyTorch (maybe JAX).

2. **Architectures**

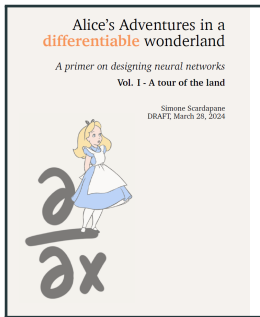
Images, sequences, text, and graphs; convolutions, recurrence, attention, and message passing.

3. **Applications**

Tokenization, pre- and post-training, self-supervised learning, possibly agents.

Alice in a **differentiable** wonderland

Slides are self-contained, but most of the material is expanded in a textbook:



The book is available for free as a PDF or as a printed copy:

<https://sscardapane.it/alice-book/>

You can also find additional lab sessions and chapters (e.g., more on post-training of models and automatic differentiation).

Structured Neural Intelligence Lab



STRUCTURED NEURAL INTELLIGENCE LAB

Efficient, explainable, and structured neural networks in science and technology, from high-energy physics to telecommunications, medicine, and earth observation.

Research Join us

A research group at Sapienza University of Rome, led by Simone Scardapane.

Explore the group: www.sscardapane.it/snail