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# UNSUPERVISED LEARNING

## COURSE CONTENT

Course participants will be able to:

- conceptually distinguish between unsupervised and supervised learning and will know about the most important classes of unsupervised learning approaches
- frame unsupervised learning approaches in terms of manifold learning and probabilistic models and know about exemplary techniques
- phrase unsupervised learning as a deep learning task and known how to use specific tools in such a framework

The course will cover following topics:

- Clustering
- Dimension reduction
- Deep learning basic principles
- Generative models

In a hands-on approach, we will explore the clustering tools available in R. To provide a conceptual framework for dimension reduction approaches, such as PCA or t-SNE, we will discuss the task of manifold learning. Be-sides understanding algorithms as performing non-linear transformations with respect to a manifold, this will also enable a probabilistic perspective. To implement the latter, we will discuss and apply deep learning, specifical-ly variational autoencoders (VAEs).

## SCHEDULE*

- Thursday 09:00 – 17:00, Friday 09:00 – 17:00

## PRE-REQUISITE

The participants must have basis knowledge in statistics and probability theory and R programming.

The course will involve individual work and working in groups, including web searches for R packages and documentation.
The practical parts will rely on the language Julia (https://www.julialang.org ) and Jupyter notebooks (https://jupyter.org). Participants should install these on their laptops. In Julia, we will mainly rely on the packages Cairo, Clustering, DataFrames, Distances, Distributions, Flux, Gadfly, GZip, and TSne. Therefore, users should also install these on their laptops.

## REGISTRATION

- Deadline for registration is 3 weeks before.
- The fee for the course is € 470; discounted rate for affiliated with a university € 435.
- The courses may take place in parts or as a whole online (virtual conferences) if in-classroom teaching is not possible.

*subject to change

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