Venue
The course will take place in Heidelberg at the University Campus ‘Im Neuenheimer Feld’.

Registration
Deadline for registration is February 11, 2021.

Course fee
The fee for the course is € 470; discounted rate for affiliated with a university € 310.

Cancellation
The cancellation policy is as follows: 100% refund for cancellations till February 17; 75% refund for cancellations between February 18 and February 24; no refund for cancellations after February 25, 2021.

Attendee substitutes may be made at any time.

Public Transport
Costs and schedule: www.vrn.de

Information
http://www.biometrie.uni-heidelberg.de/datascience

Concept and Contents
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Unsupervised Learning
4. – 5. March 2021
Aims
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

Course content
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. Besides 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, specifically variational autoencoders (VAEs).

Pre-requisites
The participants must have

- Basic knowledge of statistics and probability theory
- Basic knowledge in R

Schedule

**Thursday (4th of March)**
9:00 – 10:30 Clustering
11:00 – 12:30 Principles of Unsupervised Learning
13:30 – 15:00 Manifold Learning
15:30 – 17:00 t-SNE

**Friday (5th of March)**
9:00 – 10:30 Variational Autoencoders (VAEs)
11:00 – 12:30 VAEs (continued)
13:30 – 15:00 Exercise
15:30 – 17:00 Exercise (continued)

Number of Participants
The number of participants is limited to 20 per course.

Course instructors
Prof. Dr. Harald Binder and Dr. Moritz Hess
Institute of Medical Biometry and Statistics
Faculty of Medicine and Medical Center
University of Freiburg

Further information
The course will involve individual work and working in groups, including web searches for R packages and documentation. Therefore, it is advised that participants bring their own laptops.

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.