

# *Discrete latent variable models*

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## **Learning objectives:**

The Ph.D. course on “Discrete latent variable models” introduces the theory latent variables models for the analysis of cross-sectional and longitudinal data arising from different fields. The lectures will be devoted to summarizing the most important aspect of this modelling framework: assumptions, advanced parameterizations, and inferential procedures also considering the computational issues. During the course, case studies and applications are presented mainly by using different R libraries.

## **Schedule of the main arguments:**

- ❖ Introduction to latent variable models and a focus on discrete latent variables.
- ❖ Basic features of the finite mixture and latent class model with reference to the estimation methods and to the Expectation-Maximization (EM) algorithm.
- ❖ Basic features of the hidden Markov (HM) models for continuous and categorical longitudinal data. Introduction to the R package LMest [Latent Markov models for longitudinal continuous and categorical data](#).
- ❖ Recent HM model formulations and extensions with multivariate data, covariates and more complex data. Recent case studies and applications.
- ❖ Introduction to Stochastic Block (SB) models for complex and network data and to the maximum likelihood estimation with the genetic algorithm.

## **Teaching methods:**

Lectures: Theory and applications.

## **Main reading materials:**

Pennoni F. (2014). *Issues on the estimation of latent variable and latent class models, with applications in the social sciences*. Scholars' Press, Saarbücken. [Website](#).

Bartolucci F., Farcomeni A., Pennoni F. (2013). [Latent Markov models for longitudinal data](#), Chapman and Hall/CRC, Boca Raton.

Bartolucci, F., Pandolfi, S., Pennoni, F. (2022). Discrete latent variable models. *Annual Review of Statistics*, **9**, 425-452.