Latent variable models

10 January 2024

Exercise 1

A sample of 2236 children (9-15 years old) practicing one (or more) sports for at least 2 years and selected for a national gathering organized by CONI underwent a series of sports tests. Some of the tests performed aimed to assess manual laterality (preference for using the right or left hand): each boy was asked to perform, using only one hand ($1 = $ right, $2 = $ left), some everyday actions. Load the dataset containing information on the hand used in actions: writing (Writi), throwing (Throw), hammering (Hamme), washing (Washi), combing hair (Combi), and lifting an object (Lifti).

1. Looking at the descriptive statistics reply to the following questions.

   - How many are the possible response patterns? And the observed ones?
   - Which is the proportion of 'right' for each item?
   - Does it make sense to perform a LCA? Why?

   - Use the function poLCA to fit the models with 2,3,4,5 latent classes to the data
   - Choose the model that best fits the data motivating your choice
   - Write the LCA model analytically
   - Interpret the chosen solution
   - Compute the probability of using 'right' to all the items
   - Compute the posterior probability estimates of using 'left' to all items for the latent classes. To which class is this response pattern allocated?
   - Display the latent classes in which the individuals are allocated according to highest posterior probability.

Exercise 2

1. Illustrate the specification of the latent variable model for binary data with the Underlying Variable Approach.

2. In the normal linear factor model derive the covariance between the components and the factors.