Exercise 7.3

02409 Multivariate Statistics

Principal Component Analysis on Beef characterization

In this exercise you will work on data reflecting different aspects of meat, both chemical, physical and sensory attributes. The example comes from the paper [G. Destefanis, M.T. Barge A. Brugiapaglia and S.Tassone (2000): The use of principal component analysis (PCA) to characterize beef. Meat Science 56(2000), pp 255-259.]. The aim is to study the relationship between chemical, physical and sensory variables measured on meat from young bulls of five different breeds. Those were:

- Hypertrophied Piemontese n=23
- Normal Piemontese n=12
- Hypertrophied Piemontese x Friesian Crossbreed n=10
- Friesian n=11
- Belgian blue and white n=23

18 different measurements were taken on each animal. The chemical measurements are:

1. pH (pH-value)
2. Water
3. Protein
4. EtherExt (ether extract - related to fat content)
5. Hydroxy (hydroxyproline content, i.e. cartilage)
6. CollaSol (heat-solubility of collagen)

The physical parameters are:

7. Lightn (lightness)
8. Hue (relates to the color of the meat)
9. Driploss
10. CookLoss (cooking loss)
11. WBshear (Warner-Bratzler shear, which gives an indication of the tenderness of the meat)

And finally seven different sensory parameters (A, Te, Tf, Tr, Ji, Js, Oa) were assesed using a trained panel.

12. Appear (appearance)
13. EaseSink (ease of sinking)
14. Friabil (friability)

15. Residue (after chewing)
16. InJuice (initial juiciness)
17. SusJuice (sustained juiciness)
18. OvAcc (overall acceptability)

The correlation matrix based on the 79 observations is available online in the file Beef.csv.

Read in the data in R.

1. How much variation in the data does the first four PCs explain?

2. Look at the principle components. What kind of parameters dominate the first two PCs?

3. In what way can this be related to the correlation matrix?

4. It may be expensive to measure all these variables. If some of them are redundant, we might want to exclude some of them from future studies. Give a suggestion/strategy for exclusion of variables.