Exercise 8

MANOVA

Samples of Romano-British pottery were taken at four sites in the United Kingdom. A chemical analysis of the pottery was performed to measure the percentage of five metal oxides present in each sample. The purpose of the analysis was to determine if different sites produced pottery with different chemical compositions.

Since we have five different measures of chemical composition, we should perform a multivariate analysis of variance (MANOVA) analysis to determine if there is a significant difference between sites considering all five variables simultaneously. The dependent variables for the MANOVA are the four chemical variables (we leave out one of the five), where:

Al: Percentage of aluminum oxide in sample

Fe: Percentage of iron oxide in sample

Ca: Percentage of calcium oxide in sample

Na: Percentage of sodium oxide in sample

The fixed factor is 'Site'. The sites are

1: Llanederyn

2: Caldicot

3: Island Thorns

4: Ashley Rails

(source: *The Data and Story Library*, see http://lib.stat.cmu.edu/DASL/)

Download the table pottery.sav from: http://www.let.rug.nl/~heeringa/statistics/stat03_2013/ and load the table in SPSS.

1. Test the multivariate normality of the four dependent variables. Perform the Mahalanobis test. What is the degrees of freedom for alpha=.001? Find the critical chi-square value at the Vassarstats website. What do you conclude?

2. Perform the ANOVA test simultaneously with Levene's test and Box's test.

3. Consider the results of Levene's test. What would you expect?

4. Consider the results of Box's test. Are the covariance matrices of the groups according to the fixed factor 'Site' equal?

5. Is there an effect for 'Site' when taking the dependent variables together? Look at the table 'Multivariate tests'.

6. Does 'Site' have an effect for each of the four dependent variables? Consult the table 'Tests of Between-Subjects Effects'. Report the effect size (use the adjusted R squared!) for each dependent variable.

7. Perform a linear discrimant analysis. Create also a summary table and the linear discriminant plot.

8. Look at the table 'Wilk's Lambda'. Which (groups of) functions are significantly discriminating the sites?

9. Look at the linear discrimant plot. What does the plot show?

10. Look at the table 'Functions at Group Centroids'. Which groups are discriminated by a variate?

11. Look at the classification table. How well did the LDA procedure classify the sites?