6^{th} practice sheet multivariate methods II

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21. We are using the inversely proportional cost function

$$C_p(k,\hat{k}) = \begin{cases} 0 & \text{für} \quad k = \hat{k} \\ \frac{c}{p(k)} & \text{für} \quad k \neq \hat{k} \end{cases}$$

Show: The optimal cost decision rule with this cost function is the ML-decision rule.

22. Show: With classical discriminant analysis and class-wise identical covariance matrices in the special case $g = 2$ the Bayes decision rule is: object ω is assigned to class 1 if

$$(x - \frac{1}{2}(\bar{x}_1 + \bar{x}_2))^T a > \ln(\frac{p(2)}{p(1)})$$

where $a = S^{-1}(\bar{x}_1 - \bar{x}_2)$.

23. Show: For $\|a\| = 1$ the linear combination $a^T x$ is the die projection of the data x on a straight line with direction a.

24. 6 students complete 4 tests: natural sciences x_1, literature x_2, concentrativeness x_3 and ability to reason x_4. The first two students are taught with method a, the remaining 4 with method b. The result of the tests are summarized in the following data matrix:

$$X = \begin{pmatrix} 7 & 9 & 10 & 8 \\ 9 & 8 & 8 & 10 \\ 4 & 3 & 1 & 2 \\ 2 & 3 & 2 & 2 \\ 3 & 1 & 2 & 4 \\ 1 & 1 & 1 & 4 \end{pmatrix}$$

Perform a classical discriminant anlysis with the SAS-procedure DISCRIM and compute the discriminant function. To which teaching method is a student with test results $\begin{pmatrix} 4 & 3 & 7 & 6 \end{pmatrix}$ assigned?