

# Machine Learning

## Exercise Sheet 4

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Submission until November 21st, 13.00 via learnweb!

### Exercise 7: Discriminant Analysis (10 Points)

Scientists have discovered two different bacteria types A and B, which are present in earth's soil depending on its pH value and the concentration of nitrates.

pH value	nitrate concentration	type
5	10	A
5.2	17	A
4.9	14	A
5	19	A
5.7	11	A
4.7	24	A
5.1	10	A
5.2	21	A
5.5	11	A
8.2	52	B
6.5	55	B
9.2	53	B
7.1	54	B
9.3	52	B

- a) Estimate the parameters  $n_k, \pi_k, \mu_k, \Sigma_k$  for a discriminant analysis, with different covariance matrices per class.
- b) Compute the discriminant functions for both classes. Then, assign a prediction to the instance

$$x = (5.9 \quad 24)$$

### Exercise 8: QDA and LDA (10 Points)

In the lecture it was mentioned that when using one covariance matrix for all  $K$  classes, i.e.

$$\Sigma_k = \Sigma \quad \forall k = 1, \dots, K \quad (1)$$

the decision boundaries become linear. Show how this happens for  $K = 2$ !