

**(6) Linear discriminant analysis**

## STUDY QUESTIONS

1. Write down the definition of the PDF of a Gaussian distribution and discuss its components.
2. Write down the definition of the PMF of a Bernoulli distribution and discuss its components.
3. Write down the definition of a linear discriminant analysis (LDA) model  $p(x, y)$  and name its components.
4. Let  $p(x, y)$  denote an LDA model with parameters  $\mu, \mu_1, \mu_0$  and  $\Sigma$ . Write down the conditional probability  $p(y = 1|x)$ .
5. Let  $p(x, y)$  denote an LDA model and let

$$\delta : \mathbb{R}^m \rightarrow \{0, 1\}, x \mapsto \delta(x) := \begin{cases} 0 & \text{if } p(y = 0|x) \geq p(y = 1|x) \\ 1 & \text{if } p(y = 0|x) < p(y = 1|x) \end{cases} \quad (3)$$

denote the LDA decision rule. Write down the linear discriminant function corresponding to  $\delta$ .

6. Let  $p(x, y)$  denote an LDA model with parameters  $\mu, \mu_0, \mu_1$  and  $\Sigma$ . Write down and discuss the maximum likelihood estimators for  $\mu, \mu_0, \mu_1$ , and  $\Sigma$ .

## EXERCISES

1. Create a training set of  $n = 100$  training data points from an LDA model with  $m = 3$  and recover the simulation parameters.
2. Implement the LDA cross-validation example discussed in the lecture for  $m = 3$ .