

Pattern Recognition Exercises

Sheet 3 “Feature Selection”

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1 Fundamentals of Algebra (10 Points)

Show that the matrix

$$\mathbf{A} = \begin{bmatrix} \frac{1}{\sqrt{n}} & \frac{1}{\sqrt{n}} & \frac{1}{\sqrt{n}} & \cdots & \frac{1}{\sqrt{n}} \\ \frac{-1}{\sqrt{2}} & \frac{1}{\sqrt{2}} & 0 & \cdots & 0 \\ \frac{-1}{\sqrt{6}} & \frac{-1}{\sqrt{6}} & \frac{2}{\sqrt{6}} & \cdots & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \frac{-1}{\sqrt{n(n-1)}} & \frac{-1}{\sqrt{n(n-1)}} & \frac{-1}{\sqrt{n(n-1)}} & \cdots & \frac{n-1}{\sqrt{n(n-1)}} \end{bmatrix}$$

is orthogonal, that is, $\mathbf{A}\mathbf{A}^T = \mathbf{I}$.

2 Statistical Hypothesis Testing (10P)

Let us consider an experiment with a random variable x with $N = 12$ observed values of $\sigma = 0.5$. The resulting average is $\bar{x} = 2$ and the significance level is assumed to be $\rho = 0.1$. Test if the hypothesis $\hat{\mu} = 1$ is true.

3 t -Test in Feature Selection (10P)

The sample measurements of a feature in two classes are

$$\begin{aligned} \omega_1 &\rightarrow 3.5 \ 3.7 \ 3.9 \ 4.3 \ 3.4 \ 3.2 \ 4.1 \ 3.5 \ 3.6 \ 3.7 \\ \omega_2 &\rightarrow 3.2 \ 3.6 \ 3.7 \ 3.4 \ 3.3 \ 3.4 \ 2.8 \ 3.6 \ 3.3 \ 3.6 \end{aligned}$$

Using the t -Test test whether this feature is informative enough. The significance level has to be assumed as $\rho = 0.005$.