

NEITHER PROGRAMMABLE/GRAPHICAL CALCULATORS NOR COURSE MATERIAL
ARE ALLOWED IN THE EXAM!

1. *The Design of Pattern Recognition Systems*

The design cycle of a pattern recognition system can be partitioned into several rather distinguishable steps. Describe what these steps typically are, what they consist of, and how they link to each other! (6p)

2. *Bayes Decision Rule*

You have one real-valued feature x that can attain values in the range $[0,4]$. Within this range, the class-conditional density functions for the classes c_1 and c_2 are

$$p(x|c_1) = \frac{1}{2} - \frac{1}{8}x \quad \text{and} \quad p(x|c_2) = \begin{cases} \frac{2}{9}x & \text{when } x \leq 3 \\ 0 & \text{when } x > 3 \end{cases}.$$

In accordance with the Bayes decision rule, derive a classifier when the a priori probabilities for the classes are $P(c_1) = \frac{2}{5}$, and $P(c_2) = \frac{3}{5}$! (6p)

3. *Bayesian networks*

What are Bayesian networks? What for and how are they used in pattern recognition?
[Maximum answer length 2 pages] (6p)

4. *Perceptrons and Artificial Neural Networks*

Describe the so-called *XOR*-problem and construct a multilayer Perceptron capable of solving it! Justify the choices you make and validate the resulting network! (6p)