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Pattern Recognition and Neural Networks (521497S, 5 cp / 3 cu)
Examination 2.12.2014

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

1. *Structure of Pattern Recognition Systems*

   In general, a pattern recognition system can be partitioned into several components. Describe what kinds of components there usually are and what the tasks of these components are! (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 classes c_1 and c_2 are

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

   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. *Feature Selection*

   Describe the operating principle of the *Sequential forward floating search* feature selection method! Why is this kind of technique used? (6p)

4. *Perceptrons*

   Figure 1 below shows a two-dimensional feature space that is divided into two disjoint areas for classes C1 and C2. Using Perceptrons, construct a classifier that classifies each point in the feature space to the correct class. The classification of the points outside the specified areas is arbitrary. Justify your choices and prove that the resulting classifier works! (6p)

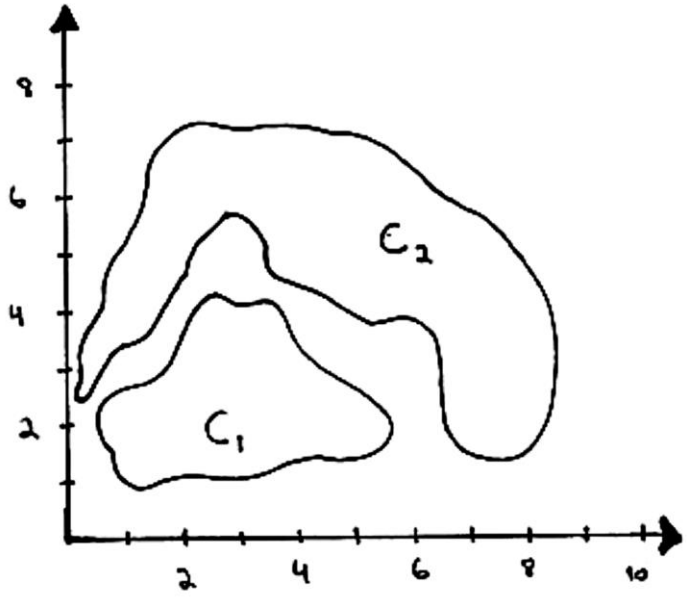

Figure 1. Feature space division for Question 4.