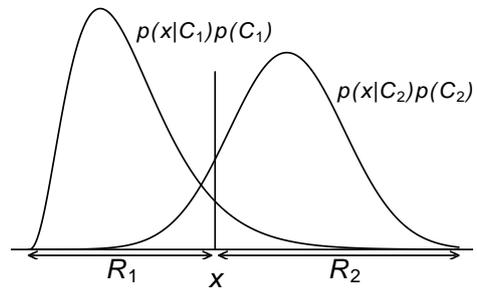


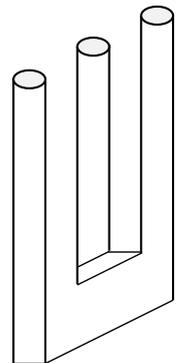
3 Computer Vision (JGD)

- (a) A Bayesian classifier uses observations x to assign visual objects to either one of two classes, C_1 or C_2 . Their baseline prior probabilities are $p(C_1)$ and $p(C_2)$, with sum $p(C_1) + p(C_2) = 1$. Observations x have unconditional probability $p(x)$, and the class-conditional probabilities of a given observation x are $p(x|C_1)$ and $p(x|C_2)$.



- (i) Using the above quantities provide an expression for $p(C_k|x)$, the likelihood of class C_k given an observation x . [2 marks]
- (ii) Provide a decision rule using $p(C_k|x)$ and $p(C_j|x)$ for assigning classes based on observations that will minimise misclassification. [2 marks]
- (iii) Now express your decision rule instead using only the quantities $p(C_k)$, $p(C_j)$, $p(x|C_k)$, $p(x|C_j)$, and relate it to the diagram above. [2 marks]
- (iv) If the classifier decision rule assigns class C_1 if $x \in R_1$, and C_2 if $x \in R_2$ as shown in the figure, what is the total probability of error? [3 marks]
- (v) If classifier decisions are made by computing functions $y_k(x)$, $y_j(x)$ of the observations x and assigning class C_k if $y_k(x) > y_j(x) \forall j \neq k$, for example $y_k(x) = p(C_k|x)$, what are such functions $y_k(x)$ called? [1 mark]
- (b) Discuss the significance of the fact that typically in mammalian visual systems, there are almost ten times more corticofugal neural fibres sent back down from the visual cortex to the thalamus, as there are ascending neural fibres bringing visual data from the retina up to the thalamus. Does this massive neural feedback projection support the thesis of “vision as graphics” and, if so, how? [5 marks]

- (c) Discuss the theory of vision as model building, hypothesis generation and testing, and knowledge-based processing, in light of the paradoxical figure on the right. What do we learn from bistable or rivalrous percepts? Discuss how top-down context information should drive the integration of low-level data into meaningful visual wholes.



[5 marks]