

2001 Paper 8 Question 9

Neural Computing

- (a) (i) A competitive Kohonen neural network forms feature maps which can be regarded as performing dimensionality reduction. Explain this. [4 marks]
- (ii) Is training time normally faster, or slower, in a supervised neural network compared with an unsupervised one? What is the major disadvantage inherent in the use of supervised neural networks? [2 marks]
- (iii) What class of neural network can be used to overcome the mathematical difficulties caused by the use of non-orthogonal sensory and motor representations? [2 marks]
- (b) (i) Give *three* examples of biological sensory or motor control systems that seem to rely on the use of non-orthogonal coordinates. [3 marks]
- (ii) Explain why this creates a problem in the computational evaluation and simulation of such systems, and discuss whether or not you think this issue matters in the function of the actual neurobiological systems. [2 marks]
- (c) (i) Give *four* examples of neural activity having a fundamentally quantal structure, in the sense that signals or events are quantised into discrete packages rather than being continuous. [4 marks]
- (ii) For purposes of understanding neurobiological computation, what can be learned from studying the brain's failures, either as the consequences of specific forms of trauma or in normal function as revealed in the systematic visual illusions? [3 marks]