2000 Paper 8 Question 8

Neural Computing

(*a*) (*i*) Define *generalisation* in neural networks that learn from training data, and then are tested on new data. Why should not *all* the available data be used in the training set? [4 marks]

(*ii*) Draw a simple connectivity diagram that illustrates the idea of lateral inhibition in a competitive neural network. [2 marks]

(*iii*) With another diagram showing plots for input and output, illustrate how lateral inhibition in such a competitive network sharpens any input signal by effectively amplifying its first derivative. [2 marks]

(*iv*) What class of multi-layer neural network can be used to overcome the mathematical difficulties caused by intrinsic non-orthogonality of representation in many sensory and control systems? [2 marks]

(*b*) The study of neurological trauma to the brain gives clues about its modular organisation and specialisations of function, which may reveal some computational principles.

(*i*) What two fundamental principles of brain function did Karl Lashley's neurological research seem to reveal? [2 marks]

(*ii*) What are generally the differences between recovery prospects after a sudden brain trauma (in which all the damage is done at once), *versus* the same damage done more gradually (e.g. by a growing tumour)? [2 marks]

(*iii*) What mechanism might explain this difference? [2 marks]

(*iv*) Comment on its possible computational significance in terms of fault-tolerance, circuit adaptability and flexibility. [2 marks]

(*v*) Describe *two* different types of language-related disorders that can result from trauma to Broca's area or Wernicke's area, and comment on the computational inferences we might draw concerning language processing and linguistic representation. [2 marks]