

## 2000 Paper 9 Question 8

### Neural Computing

Give evidence supporting the view that the main computational load that has shaped the evolution of the human brain is “social computation”, with sexual success being the ultimate measure of the value of an algorithm or neural design feature. Say what implications this has for:

- The cognitive skills and perceptual faculties that have been selected for in brain evolution, as contrasted with the goals which are the traditional focus of AI.
- The design of face recognition algorithms, which aim to interpret facial expression, gesture, and intent, as well as gender and identity.
- The construction of the theory that other persons have minds, too.
- Models of action, planning, and interaction between self and others.

[8 marks]

Comment on whether this “social computation” view of human brain evolution implies that brain science is less relevant to the goals of computer science than is usually thought.

[2 marks]

Answer any *five* of the following seven short questions:

- (a) Roughly what is the total number of neurones in the human brain?
- (b) Roughly what is the total number of synapses in the human brain? How does this compare with the total number of stars in our galaxy, and with the total number of galaxies in the known universe?
- (c) Why is nerve impulse propagation described as “saltatory”, and what purposes are achieved by this method of signalling?
- (d) What is the approximate speed of nerve impulse propagation in warm-blooded animals, in metres/sec?
- (e) Why is “white matter” white, what cells are responsible for this, and what purpose do they serve?
- (f) Name the three principal ions involved in nerve membrane current flows, and identify which two of them transit through voltage-dependent conductances.
- (g) What causes the refractory deadtime of about 1 msec after each nerve impulse?

[2 marks each]