perceptron become multi-layer. In this case, the simple delta rule has to be changed. The internal representation is not known, so there must be error-back propagation to change each layer of the network using a generalised delta rule.

The neurons can use a continuous transfer function instead of the threshold logic function. In this case, changing a connection weight from any active neuron anywhere in the network will change the output firing rate slightly. If the output value is closer to the target value then the change is good. The effect of changing a connection weight depends on the values of the errors, the different connections and the activations upstream.

Discuss the biological plausibility of the learning algorithms employed by artificial neural networks (7 marks).

Kohonen's feature map- Biologically speaking, the neighbourhood function occur by physical spread of chemical neurotransmitters or messengers.

Perceptrons- probably not very biologically plausible. Training sets may have distributions of data to actual sets of data, the linear decision boundary generated by perceptrons would be too rigid. In real life, pattern classification is probably quite fluid.

Error-back propagation- very unlikely to be used in real life. The connection weights are changed using nonlocal information. Unlike Hebbian learning which is based on one synapse and its presynaptic and postsynaptic firing rates. There are no known ways of detecting information several synapses away in the brain.

Unsupervised learning- Hebb's law. This is quite biologically plausible as **Trend Lie** have been observed in neurons. However, it does not take into the temporal factor, the been shown that if the post-synaptic neuron fires after pre-synaptic neuron, there is LTP. Intervise synaptic neuron fires before pre-synaptic neuron, there is LTP.

Competitive learning- place centinay use this learning algorithm.

Hopfield's (1982) associative memory network wes unsupervised learning, but the symmetrically connected recurrent networks and limited storage capacity makes it less biologically plausible.

Supervised learning: this include evolution/genetic algorithms, reinforcement learning and fully supervised learning. Error propagation in supervised learning is not biologically plausible because the connection weights are changed using non-local information. The brain has no mechanisms of knowing the connection weight or target value of neurons that are 2 or three synapses away from the starting neuron.

2. Describe how the competitive learning algorithm works and how it can be modified to model the development of topographical representations in the brain (6 marks).

Competitive learning is an example of unsupervised learning. It is built on the Hebbian learning principle, but the network uses a 'winner-takes-all' output, where the output neurons uses lateral inhibition (Rummelhart and Zipser 1986).

Algorithm sequence:

- 1. Random initial connection weights in the network
- 2. Present input pattern
- 3. Winner is generated
- 4. Hebbian learning occurs where the connection weight between the output neuron and the input neuron that fired together increases.

2012

cortex. So the neurons gives off activity to indicate which line is being drawn. Even before the primate starts to move, the different representations of activity have an order, with the first action is the most active.

Preview from Notesale.co.uk Page 17 of 17