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Neural Network Models of Temporal Pattern Generation.

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Abstract

Most contemporary neural network models deal with essentially static, perceptual problems of classification and transformation. Models such as multi-layer feedforward perceptrons generally do not incorporate time as an essential dimension, whereas biological neural networks are inherently temporal systems. In modeling motor behaviour, however, it is essential to have models that are able to produce temporal patterns of varying duration and complexity. Several representations of time are dealt with, i.e., spatialized (topological) time models, temporal flow models, and recurrent networks. An alternative model is proposed, based on a network of pulse oscillators consisting of neuron/interneuron (NIN) pairs. Due to the inherent temporal properties, a simple NIN net, taught by a Hebbian learning scheme, is able to display repetitive behaviour that is much harder to teach to static non-pulse models. Several network models are compared, using the simulation of pen-tip movement in handwriting as a common reference.