Synchronization in Neural Nets

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Abstract:

The paper presents an artificial neural network concept (the Synchronizable Oscillator Networks) where the instants of individual firings in the

form of point processes constitute the only form of information transmitted between joining neurons. This type of communication contrasts with

that which is assumed in most other models which typically are continuous or discrete value-passing networks. Limiting the messages received

by each processing unit to time markers that signal the firing of other units presents significant implemen tation advantages. In

our model, neurons fire spontaneously and regularly in the absence of perturbation. When interaction is present, the scheduled firings are

advanced or delayed by the firing of neighboring neurons. Networks of such neurons become global oscillators which exhibit multiple synchronizing

attractors. From arbitrary initial states, energy minimization learning procedures can make the network converge to oscillatory modes that satisfy multi-dimensional

constraints Such networks can directly represent routing and scheduling problems that conSist of ordering sequences of events.