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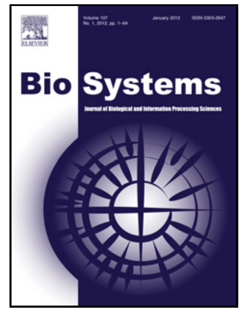

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Information reduction in a reverberatory neuronal network through convergence to complex oscillatory firing patterns

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Abstract

Dynamics of a reverberating neural net is studied by means of computer simulation. The net, which is composed of 9 leaky integrate-and-fire (LIF) neurons arranged in a square lattice, is fully connected with interneuronal communication delay proportional to the corresponding distance. The network is initially stimulated with different stimuli and then goes freely. For each stimulus, in the course of free evolution, activity either dies out completely or the network converges to a periodic trajectory, which may be different for different stimuli. The latter is observed for a set of 285290 initial stimuli which constitutes 83% of all stimuli applied. After applying each stimulus from the set, 102 different periodic end-states are found. The conclusion is made, after analyzing the trajectories, that neuronal firing is the necessary prerequisite for merging different trajectories into a single one, which eventually transforms into a periodic regime. Observed phenomena of self-organization in the time domain are discussed as a possible model for processes taking place during perception. The repetitive firing in the periodic regimes could underpin memory formation.

Keywords: reverberating network, periodic regime, attractor, stability, signal processing, perception

1. Introduction

Recordings from the inferior temporal cortex (IT) have revealed cells with unusual properties compared with cells in the primary visual cortex, [25, 34, 15]. Firstly, those cells have extremely extended receptive fields. Secondly, those cells are selective for complex features/objects, such as complex shapes. Thirdly, this

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