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POSTER PRESENTATION

The impact of pooling and shared inputs on correlations in neuronal networks

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A cortical neuron receives inputs from thousands of afferents. Experiments suggest that the activity of these afferent cells is often correlated, although such correlations may be weak. Similarly, recordings of field potentials or data obtained using voltage sensitive dyes represents the pooled activity of large populations of cells, which can be correlated. It is therefore important to understand how correlations between cells in a population affect the statistics of the pooled activity of cells taken from the population.

It is well known that even weak correlations within an input pool can increase the variability of the pooled signal. This phenomenon and its implications for the response and coding capabilities of a downstream cell were investigated in [1][2][3].

Here we address a related phenomenon: weak correlations within and between *two* populations of neurons lead to significant correlations between the two pooled signals [4]. This phenomenon has been observed in the context of correlations between two VSD [5] and MUA [6] signals. We focus primarily on the effect pooling in input populations has on the covariation of the membrane potentials of two downstream cells. We use simple probabilistic formulae to provide an intuitive explanation for this phenomenon, and show that the contribution of overlap in input populations to the development of correlations is minor relative to the contribution of pooling.

In addition, we apply our results to provide insight on development of correlations and synchrony in feed-forward networks. We show that pooling, and not overlap in input populations, contributes most to the development of very high correlations observed in feed-forward networks. We exhibit via simulations that not only cor-

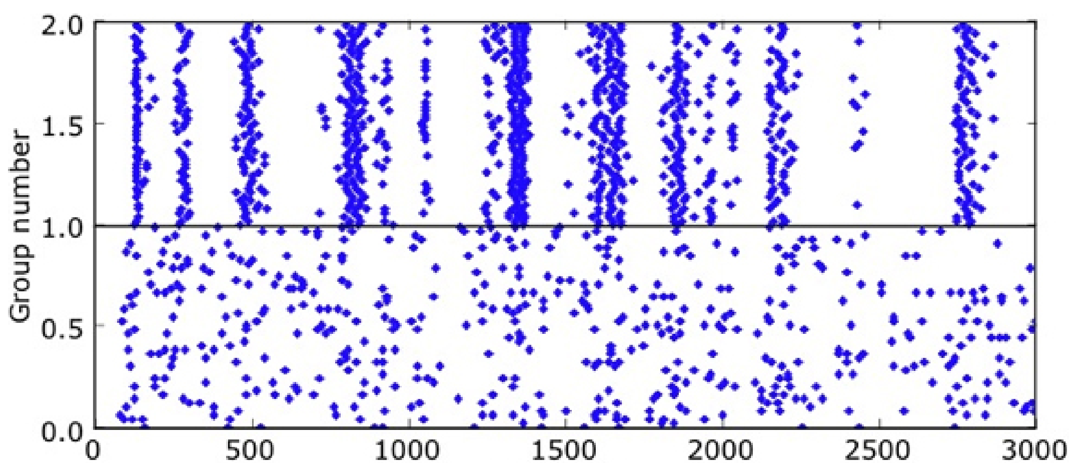

Figure 1 Development of synchrony in a feed-forward network with no overlap.

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relations, but also synchrony, develop in the absence of overlap in the input populations. (Figure 1) In a related example, we show that in more structured feed-forward networks including local disynpatic inhibitory circuits, moderate synchrony (i.e., correlations over short time windows) is a strong requirement for the propagation of inputs.

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