The Effect of Inhomogeneous Connectivity on Higher-Order Correlations

Yasuhiko Igarashi\textsuperscript{1} and Masato Okada\textsuperscript{1,2}

\textsuperscript{1}Graduate School of Frontier Sciences, The University of Tokyo, Japan.
\textsuperscript{2}RIKEN Brain Science Institute, Japan.

It is widely acknowledged that dependencies among cells determine the detailed nature of a neural population code, namely, the manner in which information is represented by specific patterns of spiking and silence over a group of neurons. Ko \textit{et al.} have reported that connectivity between neighbouring neurons is specifically structured, which affected the firing rates and neural correlations \cite{Ko2011}. It would appear that these structured neural connectivities in V1 also affects the structure of higher-order correlations in neuronal firing.

Here, we expanded the previous theoretical framework to higher-order correlations in a parsimonious structured network with common inputs and spiking non-linearities as a model of orientation selectivity \cite{Macke2011}. We found that the inhomogeneous mean inputs modulate the spiking nonlinearity to result in the structured higher-order correlations and heterogeneous structure of the network can dynamically control the structure of 3rd-order correlations and can generate both sparse and synchronized neural activity\cite{Ohiorhenuan2010, Ohiorhenuan2011}, and proposed a decisive experiment to test the effect of inhomogeneous connectivity on higher-order correlations.