GENERATION OF OLFACTORY NEURAL CODES BY A NETWORK OF HODGKIN-HUXLEY NEURONES

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Networks of synchronously updated McCulloch & Pitts neurones exhibit spontaneously complex spatio-temporal patterns that can be compared to the activities of biological neurones in phase with a periodic LFP, as demonstrated experimentally by Wehr & Laurent in the locust olfactory pathway (Wehr & Laurent, 1996). Modelling biological neural nets with networks of very simple formal units makes the dynamics of the model analytically tractable. It is thus possible to determine the constraints that must be satisfied by its connection matrix and inputs in order to make its neurones exhibit a given sequence of activity (for example, see Quenet et al., 2001). In the presentation, we address the following question: once a formal network has been built, that is able to reproduce quantitatively experimentally observed neuronal codes, can it serve as a guide to design a network of more realistic (Hodgkin-Huxley) formal neurones that exhibits the same dynamical behaviour? We demonstrate that such a strategy is indeed fruitful: it allowed us to design a model that reproduces the Wehr-Laurent olfactory codes, and to investigate the robustness of these codes to synaptic noise.

References

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