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Estimation of individual firing frequencies from superposed spike train

When monitoring neurons with single extracellular electrode the action potentials from different neurons are commonly recorded. One of the problems is to identify the active neurons. The analysis of the pooled record of several independent spike trains with refractory period leads to identification of specific groups of the spikes appearing in time intervals shorter than the refractory period (these are usually called doublets, triplets, etc.). In (Meunier et al., 2003), this problem was solved for two independent spike trains and the result is generalized for any number of independent records here.

How the firing frequencies of individual neurons are related to the relative frequencies of occurrence of doublets, triplets, etc. in the superposed spike train is shown. The closed form-relations between the respective firing frequencies and properties of the superposed record are derived. A method for estimation of respective firing frequencies of any number of neurons, producing indistinguishable spikes, from the knowledge of the superposed record, number of recorded neurons and the refractory period is presented. The task is similar to the problem of coincidence detection (Grün et al., 1999; Krips & Furst, 2009).

References

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