

Copulas: a useful tool for neurosciences?

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To get some hints on the nature of a neuronal network is desirable to develop tools useful to detect dependences between the spike trains. Use of correlation or of analogous indexes hides important features of such dependences. The joint distribution of random variables is the typical method to describe dependent random variables and a possible approach of this study focus on such distributions. However the joint distribution captures the dependencies but merges them with their marginal behavior. Copulas allow to separate the joint and the marginal behavior of the random variables. Sklar's Theorem plays an important role in this framework: it relates joint distribution with both copulas and marginal distributions. Hence copulas appear to be a powerful tool to catch the dependencies features of the data or to develop multivariate models. Families of Copulas have been studied in literature but their use in a neuroscience context is recent. Their distribution is used mainly to select models in finance context. Here we illustrate a set of possible applications of copulas of interest in a neuroscience framework, including their relationship with mutual information estimation, their use to detect the dependences between interspike intervals or between spike trains. We also discuss their application for modelling purposes.

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