An Information Measure of Temporal Structure for Multichannel Spike Trains

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One of the fundamental difficulties in neural assembly studies is the lack of an effective, high definition measure of temporal structure among spike trains obtained from a single realization. From information theoretic concepts defined around Renyi’s quadratic entropy, the cross information potential (CIP) was recently proposed as a general similarity measure between two spike trains. Furthermore, an instantaneous estimator of the CIP, called ICIP, is derived for online applications. Finally, various examples show the properties and capabilities of both CIP and ICIP estimators under single realizations, including analysis of synchronous activity in motor cortical neurons.