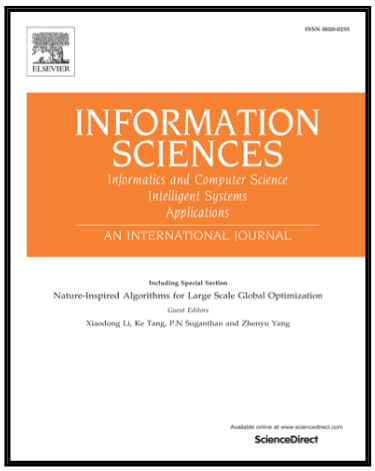

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Spike-time encoding as a data compression technique for the pattern recognition of temporal data

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Abstract

The human brain's ability to efficiently detect patterns from the continuous streaming sensory stimuli has been a source of constant intrigue for naturalists, and has set the course for the development of research into artificial intelligence. Efficient encoding of such input stimuli into discrete timing of events play a decisive role in the ability of the spiking neurons inside the human brain to compress, transmit and recognise information presented by the external environment. In this article, we introduce the spike-time or temporal encoding paradigm as an efficient general approach to data compression for the purpose of pattern recognition. The data compression through spike-time encoding not only dramatically reduces the volume of data required to capture discriminatory information leading to economical storage and transmission, but can also be used for pattern recognition in streaming data domain. We experimentally show that the spike-time data produced by the temporal encoding techniques achieve comparable (superior in some cases) performance of pattern recognition in comparison to the use of the whole raw data. This article also introduces a generalised background knowledge driven optimisation based temporal encoding framework for encoding time series data and further formulates a temporal encoding algorithm, namely GAGamma, designed to efficiently compress fMRI data using discrete spike-times. We have evaluated the temporal encoding algorithms on the benchmark Starplus fMRI dataset, and the results demonstrate the temporal encoding algorithm's ability to achieve significant data compression without sacrificing the performance of the pattern recognition in the

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