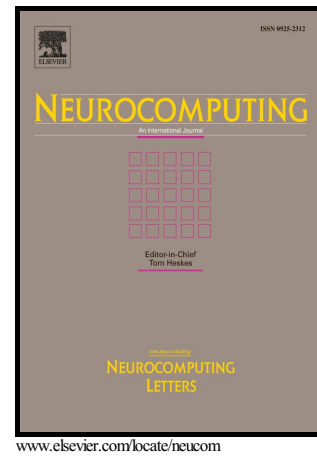


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Kernel-based dimensionality reduction using Renyi's α -entropy measures of similarity

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Abstract

Dimensionality reduction (DR) aims to reveal salient properties of high-dimensional (HD) data in a low-dimensional (LD) representation space. Two elements stipulate success of a DR approach: definition of a notion of pairwise relations in the HD and LD spaces, and measuring the mismatch between these relationships in the HD and LD representations of data. This paper introduces a new DR method, termed Kernel-based entropy dimensionality reduction (KEDR), to measure the embedding quality that is based on stochastic neighborhood preservation, involving a Gram matrix estimation of Renyi's α -entropy. The proposed approach is a data-driven framework for information theoretic learning, based on infinitely divisible matrices. Instead of relying upon regular Renyi's entropies, KEDR also computes the embedding mismatch through a parameterized mixture of divergences, resulting in an improved the preservation of both the local and global data structures. Our approach is validated on both synthetic and real-world datasets and compared to several state-of-the-art algorithms, including the Stochastic Neighbor Embedding-like techniques for which DR approach is a data-driven extension (from the perspective of kernel-based Gram matrices). In terms of visual inspection and quantitative evaluation of neighborhood preservation, the obtained results show that KEDR is competitive and promising DR method.

Keywords: Dimensionality reduction, kernel methods, Renyi's α -entropy.

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