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Fast Kernel Entropy Estimation and Optimization

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Abstract

Differential entropy is a quantity used in many signal processing problems. Often we need to calculate not only the entropy itself, but also its gradient with respect to various parameters, for efficient optimization, sensitivity analysis, etc. Entropy estimation can be based on an estimate of the probability density function (PDF), which is computationally costly. For this reason, some of existing algorithms have assumed rough parametric models for the PDFs, which can lead to poor performance in some scenarios. To counter these obstacles, we consider non-parametric kernel entropy estimation, which is usually computationally costly, especially for the gradient evaluation. We present two different accelerated kernel algorithms. The first of them accelerates the entropy gradient calculation based on a *back propagation* technique, which allows the calculation of a gradient of a function with the same complexity of calculating the function itself. The second algorithm accelerates the estimation of both entropy and its gradient, exploiting fast convolution over a uniform grid. We apply both algorithms to blind source separation (BSS).

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