Regularized estimation of probability density: likelihoods, penalties, and algorithms

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Abstract

We review the evolution of regularization approaches to probability density estimation—starting from classical formulations involving penalized maximum likelihood in conjunction with L^2 penalties, later modified to shaped-constrained prescriptions and proposals with L^1, total-variation based penalties, and most recently to dual formulations, leading to alternative likelihood concepts in connection with maximum entropy/minimum divergence paradigm. We discuss various aspects regarding this intriguing array of new possibilities: computational aspects (using achievements of contemporary mathematical programming), multidimensional potential, and flexibility in various applied contexts—in particular in estimating probability densities under shape constraints.

Joint work with Roger Koenker.