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Discrete Beckner Inequalities via a Bochner–Bakry–Emery Method for Markov Chains

Abstract

Discrete Beckner inequalities, which interpolate between the modified logarithmic Sobolev inequality and the Poincaré inequality, are derived for time-continuous Markov chains on countable state spaces. The proof is based on the Bakry–Emery approach and on discrete Bochner-type inequalities established by Caputo, Dai Pra, and Posta and recently extended by Fathi and Maas. The abstract result is applied to several Markov chains, including birth-death processes, zero-range processes, Bernoulli–Laplace models, and random transportation models, and to a finite-volume discretization of a one-dimensional Fokker–Planck equation, applying results by Mielke.