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Vitali variation error bounds for expected value functions

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In this paper we derive error bounds for one and two-dimensional expected value functions that depend on the Vitali variation of the joint probability density function of the corresponding random vector. Contrary to bounds from the literature, our bounds are not restricted to underlying functions that are one-dimensional and periodic. Moreover, we show that our new bounds are tighter when the components of the random vector are independent and have marginal densities with total variation less than one. In our proof, we first derive the bounds in a discrete setting, where we show that the extreme points in this setting are the set of all matrices that have zero-sum rows and columns and have an L_1-norm bounded by one. This result may be of independent interest. Finally, we numerically illustrate the performance of our new bounds by applying them to convex approximations of stochastic integer programs from the literature.

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