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CHANCE-CONSTRAINED PROBLEMS AND RARE EVENTS: AN IMPORTANCE SAMPLING APPROACH

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We study chance-constrained problems in which the constraints involve the probability of a rare event. We discuss the relevance of such problems and show that the existing sampling-based algorithms cannot be applied directly in this case, since they require an impractical number of samples to yield reasonable solutions. Using a **Sample Average Approximation (SAA)** approach combined with **importance sampling (IS)** techniques, we show how variance can be reduced uniformly over a suitable approximation of the feasibility set, and as a result the problem can be solved with much fewer samples. We provide sufficient conditions to obtain such uniform variance reduction and prove asymptotic convergence of the combined SAA-IS approach. We apply our methodology to a **telecommunications problem**, find IS distributions that satisfy the conditions laid out for uniform variance reduction in that context and present numerical results to illustrate the ideas.

This is a joint work with T. Homem-de-mello, E. Moreno, B. Pagnoncelli & G. Canessa.