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Discrete stochastic optimization with continuous auxiliary variables

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Abstract:

In this talk, we will consider stochastic discrete optimization algorithms in a unified, versatile, framework: it consists in alternating the sampling of a probability density function, p(x), evaluating the objective functions of the created points, the x's, and updating the density. Algorithms such as Monte Carlo Markov Chains, Simulated Annealing, Estimation of Density Algorithms, Bayesian optimization and Evolutionary algorithms can fall under this description. Then, taking a model identification perspective, we will argue that the simpler the structure of p(), the least objective function evaluations are necessary to learn it. However, a minimum degree of complexity of p() is needed to optimize coupled functions. We propose to create coupled densities at no extra cost in terms of calls to the objective function by using another definition of the optimization variables, the auxiliary variables. Examples will be given in optimum design of composite structures where the primary optimization variables are fibers orientations and the auxiliary variables are the structural stiffnesses.