Probabilistic Branch and Bound for Multi-Fidelity Global Optimization and Deep Learning

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Abstract: Engineers often want to optimize the performance of a complex system, that is modeled with computer simulations, both deterministic and stochastic, and may involve continuous and integer variables. A partition-based random search optimization algorithm, called Probabilistic Branch and Bound (PBnB), has been successful at approximating a set of near-optimal solutions, with finite-time probability bounds on the maximum volume of incorrectly maintained or incorrectly pruned regions. Preliminary results will be presented applying PBnB to deep learning, which is recognized as a global optimization problem, yet the stochastic gradient algorithm (one of the popular methods for training deep learning) is designed for convex functions. In addition, coupling PBnB with surrogate modeling (e.g., Kriging, Gaussian processes) is being explored to take advantage of low-fidelity models that are computationally fast to evaluate and can provide a predictive capability for the high-fidelity computer simulation function. I will also mention several applications of complex systems that I have worked on.

Bio: Dr. Zelda B. Zabinsky is a Professor in Industrial and Systems Engineering (ISE) at the University of Washington, with adjunct appointments in the departments of Electrical Engineering, Mechanical Engineering, and Civil and Environmental Engineering. She is an INFORMS Fellow and an IIE Fellow, and has published numerous journal articles. Her book, *Stochastic Adaptive Search in Global Optimization*, describes research on theory and practice of algorithms useful for solving problems with multi-modal objective functions in high dimension. The National Science Foundation (NSF), Department of Homeland Security, NASA-Langley, Federal Aviation Administration (FAA), Boeing Commercial Airplane Company, Microsoft and the Port of Tacoma have funded her research. Professor Zabinsky is currently on the editorial board of the *Journal of Global Optimization*. She teaches courses in Operations Research and has received the annual teaching award in ISE at the University of Washington several times.