Architectural layout optimization using annealed neural network

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Abstract

The facility layout problem is concerned with finding feasible locations for a set of interrelated objects that meet all design requirements and maximize design quality in terms of design preferences. The contribution of this paper is a new framework, named annealed neural network, for efficiently finding competitive solutions for the facility layout problem. This framework arises from the combination of Hopfield neural networks and simulated annealing. The first is a representation model of the layout problem and the second is a search algorithm for finding the optimum or near optimum solutions. The annealed neural network combines characteristics of the simulated annealing algorithm and the Hopfield neural network. Annealed neural network exhibits the rapid convergence of the neural network, while preserving the solution quality afforded by simulated annealing. Strategies for setting reasonable penalty factor in objective function and temperature in simulated annealing procedure were proposed. A case study of a hospital building with 28 facilities was employed to demonstrate that this model is rather efficient to solve the architectural layout problem, and it is amenable to fast computation for large layout problems.

Keyword：Architecture; Layout; Annealed neural network, Simulated annealing, Combinatorial optimization.