Convex Optimization Techniques for Unequal-Areas Facility Layout Problems

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The unequal-areas facility layout problem aims to find the optimal arrangement of a given number of non-overlapping indivisible departments with unequal area requirements within a facility. The problem is to minimize the sum of the weighted distances between pairs of departments that have a positive connection cost. The area of each rectangular department is assumed to be fixed while its dimensions (height and width) are allowed to vary subject to aspect ratio constraints. We present an improved two-stage convex-optimization-based framework for efficiently finding solutions for this problem. In the first stage, an improved attractor-repeller convex optimization model is adopted. Based on the relative locations of the departments obtained in the first stage, the distances between pairs of departments are optimized in the second stage by sizing them using second-order cone optimization. Aspect ratio constraints, frequently used in facility layout methods to restrict the occurrence of overly long and narrow departments in the computed layouts, are taken into account by both models. The computational results show that the proposed framework consistently produces competitive layouts compared with other models.