

Abstract:

We consider a profit-maximizing service provider's competitive facility location problem where consumers' demands are endogenously influenced by the construction plan. Moreover, the attractiveness of an open facility varies among different markets. The demand of each market becomes higher when the total attractiveness from open facilities becomes higher, where the marginal effect diminishes in the total attractiveness. With these characteristics, our multi-market facility location problem for profit maximization with endogenous demand is thus formulated as a nonseparable nonlinear integer program. To obtain a near-optimal solution for this NP-hard problem, we propose approximation algorithms based on continuous relaxation and rounding incorporating a reduction on the number of fractional components in an optimal solution. The procedure may be further simplified when there is only a single market. We prove the worst-case performance guarantees of our algorithms and show that it is the best among literature under certain conditions. Through numerical experiments, we demonstrate that the average-case performance of our algorithms is much better than the theoretical lower bounds.