BENEFIT MAXIMIZING NETWORK DESIGN IN THE PUBLIC SECTOR

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ABSTRACT

Governments around the globe are actively involved in providing essential services, such as healthcare, transportation, education, and utilities. In contrast with the private sectors' mission to maximize profit, governments' mandate is to maximize the societal benefit by acting as *public agents*. When designing service systems, many models in public sector focus on maximizing accessibility to public services to increase societal benefit. The idea is to (re)design the public service to maximize the number of people who will benefit from the program given a limited budget, thus using accessibility as a proxy for benefit. Such models fail to capture the *marginal benefits* -- savings in costs to taxpayers by adding an extra unit of service capacity.

In this work, we study the problem of determining the optimal number, locations, and capacities of a network of facilities to maximize the public's *overall benefit*. We define the overall benefit as the difference in savings for the public by participating in services and the cost of the provided service capacity. In our work, the consumers would like to maximize their utility (minimize their disutility) when choosing which facility to patronize. Therefore, we consider a user-equilibrium problem, whereat equilibrium, consumers have no incentive to change their choices. We formulate this benefit maximization problem as a nonlinear mixed-integer program and discuss linearization techniques to solve the problem efficiently. We demonstrate how this problem can also be extended to the private sector. Through a simple illustrative example and a realistic case study of assigning facilities to serve the residents of San Diego, we provide further insight into our modeling approach and various model parameters.