Location model minimizing distances between EV charging stations

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Abstract

In cooperation with the recent prevalence of electric vehicles (EVs), researches focus on location planning for EV charging stations are being conducted actively. Fundamental in most relevant studies is that demand is associated with population. However, alongside a viewpoint that users of a facility are vehicles, traffic flow would be a primary instance which arises demand. Given a region, we consider a road network with links and nodes associated with roads and intersections. Given an origin-destination pair, each traffic shall flow on the shortest path. In this context, there is a concept called cannibalization, reflecting multiple facilities deprive the others of demand flowing on the same single path. A model explaining this phenomenon is called the flow-capturing location-allocation model (FCLM).

Meanwhile, EVs have a significant constraint which should be taken into account in formulation; their driving distance is shorter than gasoline-powered vehicles. Thus, it is not adequate to apply the FCLM as it is to EVs. In light of this, we propose a new location-allocation model designed for EV charging stations. The model is an outgrowth of the standard FCLM, for which an out-of-battery situation does not occur. The distance between multiple facilities allocated on same path is minimized.

Keywords
Transportation; Location; Combinatorial Optimization; Flow-capturing;
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