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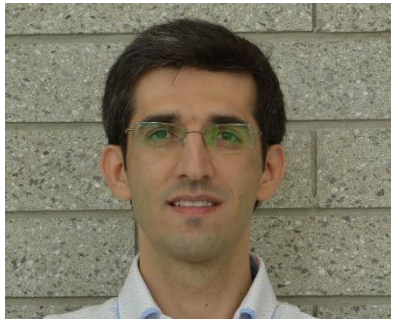

Danial Khorasanian
Ph.D. in Operations Research for Healthcare

Université Laval
Faculté des sciences de l'administration
Département d'opérations
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Dynamic Home Care Routing and Scheduling with Uncertain Number of Visits per Referral

Summary: Despite the rapid growth of the home care industry, research on the scheduling and routing of home care visits in the presence of uncertainty is still limited. This paper investigates a dynamic version of this problem in which the number of referrals and their required number of visits are uncertain. We develop a Markov decision process (MDP) model for the single-nurse problem to minimize the expected weighted sum of the rejection, diversion, overtime, and travel time costs. Since optimally solving the MDP is intractable, we employ an approximate linear program (ALP) to obtain a feasible policy. The typical ALP approach can only solve very small-scale instances of the problem. We derive an intuitively explainable closed-form solution for the optimal ALP parameters in a special case of the problem. Inspired by this form, we provide two heuristic reduction techniques for the ALP model in the general problem to solve large-scale instances in an acceptable time.

Numerical results show that the ALP policy outperforms a myopic policy that reflects current practice and is better than a scenario-based policy in most instances considered, specifically in the most general case of our problem involving multiple service types, overtime, and an uncertain number of visits per referral. The ALP policy circumscribes three regions around a nurse's starting location. The outer region indicates "always reject", the inner region denotes "always accept", and the middle region represents client locations that may be accepted depending on the state of the nurse's current workload. This results in a significantly smaller travel time for this policy compared with the benchmark policies. While tuning the ALP and deriving the ALP parameters are time-consuming for instances with numerous service types, they only need to be performed once and then actions can be generated very fast daily using the resulting ALP policy (e.g., in less than one second for instances with 10 service types and significantly faster than the benchmark policies considered).

Lundi 20 mai 2024
14h00

Université Laval
Pavillon Palasis-Prince
Salle 2327

Ouvert à tous
Café et viennoiseries

Responsable :
Jacques Renaud

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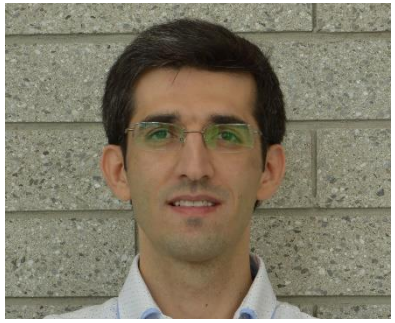

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Biography: Danial Khorasanian obtained a bachelor's degree in Industrial Engineering, a master's degree in Scheduling, and a Ph.D. in Operations Research for Healthcare with several honors from the Isfahan University of Technology in Iran. During his Ph.D., he spent six months as a visiting researcher at the KU Leuven in Belgium. He pursued Postdoctoral studies at the University of Ottawa in Sequential Decision-making with Uncertain Parameters and at the University of Toronto in Reinforcement Learning and Deep Learning. Currently, he is investigating the field of Creative AI for Scientific and Artistic Discovery.

His research contributions have been published in leading journals such as Transportation Science, Computers and Operations Research, Computers and Industrial Engineering, and International Journal of Production Research. He has developed state-of-the-art solution methods for highly competitive decision-making problems.

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