The Hong Kong Polytechnic University
Department of Logistics and Maritime Studies
Research Seminar

Clustered coverage orienteering problem of unmanned surface vehicles for water sampling

by

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Venue: R407, Shirley Chan Building
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(Conducted in English)

Abstract:

We investigate a clustered coverage orienteering problem (CCOP), which is a generalization of the traditional orienteering problem (OP). The problem is widely motivated by emerging unmanned techniques (e.g., unmanned surface vehicles and drones) applied in environmental monitoring. In specific, unmanned surface vehicles (USVs) are applied to monitor reservoir water quality by collecting samples. In the CCOP, water sampling sites (i.e., nodes) are grouped into different clusters, and a minimum number of nodes should be selected in each cluster. With each node representing a certain coverage area of water quality, the objective of the CCOP is to monitor as much as possible the total coverage area in one tour of the USV, considering that the overlapped areas provide no additional information. An integer programming model is first formulated through a designed linearization procedure that captures the overlapping feature. A two-stage exact algorithm is proposed to obtain the optimal solution to the CCOP. The first stage includes selection generation, CCOP dynamic-programming-based heuristic, and CCOP cut generation. The second stage includes travelling salesman problem (TSP) greedy and 2-opt heuristics, TSP relaxation, and TSP dynamic programming. The two-stage exact algorithm shows its efficiency and effectiveness by experiments on randomly generated instances, and it can effectively solve the problem size with up to 60 sampling sites.

Bio:

ZHANG Wei is currently pursuing her Doctor of Philosophy under the supervision of Dr. WANG Shuaian (Hans). Her interested research areas include urban transport network modeling, maritime transportation and optimization algorithms.

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All are welcome!