ABSTRACT

Constructing a multi-day travel itinerary is a notable challenge, particularly for individuals planning extended trips. This study addresses the complexity by aiming to automatically generate an optimal multi-day travel itinerary that satisfies user interest. The problem is framed as a Capacitated Vehicle Routing Problem with Time Windows (CVRPTW), and user interest is shaped by attributes such as rating and cost of points of interest (POIs), travel duration, the number of POIs in the itinerary, and penalty attributes (POI penalty and time penalty). The generated solution must adhere to constraints like daily travel duration limits and the operational hours of POIs. To ensure alignment with user interest, the Multi-Utility Attribute Theory (MAUT) is employed as the fitness function. This study proposes a VRP approach utilizing the hybrid Ant Colony System (ACS) and Brainstorm optimization (BSO) algorithm (the hybrid ACS-BSO) for multi-day travel itinerary generation, addressing the Traveling Salesman Problem (TSP) approach limitations. The hybrid ACS-BSO significantly outperforms conventional algorithms, such as Genetic Algorithm (GA), Tabu Search (TS), and Simulated Annealing (SA), across 50 sets of random POIs with an average fitness value of 0.6631. Moreover, the hybrid ACS-BSO outperforms the conventional algorithms in optimizing each attribute. Regarding travel duration attribute, the hybrid ACS-BSO generates an itinerary requiring only six days to visit 40 POIs, while the other algorithms need seven days. In terms of cost and rating attributes, the hybrid ACS-BSO achieves the best fitness values compared to the others. Furthermore, the hybrid ACS-BSO outperforms the standalone algorithms (ACS and BSO) across varying numbers of POIs, especially when the number of POIs is high. However, it faces a maximum 299 seconds running time for 87 POIs, indicating a time complexity weakness. Comparatively, ACS, BSO, and the hybrid ACS-BSO in the VRP approach significantly surpass their TSP counterparts, affirming the effectiveness of the VRP approach.

Keywords: multi-day travel itinerary, recommender system, ant colony system algorithm, hybrid ant colony and brainstorm optimization, multi-attribute utility theory