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A New Smart Decomposition of the Optimization Problem for Dynamic Ride-Sharing

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The growing pressure on urban transportation systems needs innovative solutions that can increase its efficiency [4]. In recent years, new mobility services and intelligent transportation systems have shown the potential to be a part of the solution. Among these services, dynamic ride-sharing is becoming popular [1]. The first issue in ride-sharing is the fleet management problem. Effective and efficient optimization technology that matches drivers and riders in real-time is one of the necessary components for a successful dynamic ride-share system [2]. Clustering methods enhance the scalability of matching methods by reducing the search space, making it possible to parallelize and balance the computing workload, and speeding up the matching computations.

In this paper, we propose a clustering method based on a “Shareability Function” (SF) that considers all the trips’ possible matching situations. Two trips can be shared either in parallel or in sequence [3]. The shareability function computes the extra travel time that the vehicle has to spend to service each matching situation, compared to the situation where each trip is serviced independently without sharing. Then the shareability function for each two trips is the minimum computed value among the three different situations (parallel, sequence and independence). We propose a clustering method based on this new function to put the most shareable trips in separate clusters. We propose a heuristic method to solve the matching problem inside each cluster.

To evaluate the method, we employed the proposed method on the network of Lyon city in France with half-million requests [5]. The results showed that the proposed clustering method produces high-quality solutions close to the optimal situation while reducing the computation time significantly.

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