Solving Dynamic Delivery Services Using Ant Colony Optimization

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Abstract. This article presents a model for courier services designed to guide a fleet of vehicles over a dynamic set of requests. Motivation for this problem comes from a real-world scenario in an ever-changing environment, where the time to solve such optimization problem is constrained instead of endlessly searching for the optimal solution. First, a hybrid method combining Ant Colony Optimization with Local Search is proposed, which is used to solve a given static instance. Then, a framework to handle and adapt to dynamic changes over time is defined. A new method pairing nearest neighbourhood search with subtractive clustering is proposed to improve initial solutions and accelerate the convergence of the optimization algorithm. Overall, the proposed strategy presents good results for the dynamic environment and is suitable to be applied on real-world scenarios.

Keywords: Pickup delivery problem · Ant Colony Optimization · Local Search · Time windows · Dynamic requests

1 Introduction

According to data on *The World's Cities in 2018* United Nations (2018), it is clear that big cities are bound to grow both in size and number. This brings many concerns regarding the already problematic vehicle saturation on urban settlements. Small efficiency increases can have a big impact all-around when applied at a larger scale. This is especially relevant for transportation companies, whose main activity often involves driving and thus requires careful planning not to travel on heavy traffic situations.