

Vehicle Routing with Google OR Tools

Modeling and Solving Rich Vehicle Routing Problems with Google OR Tools

Graduate



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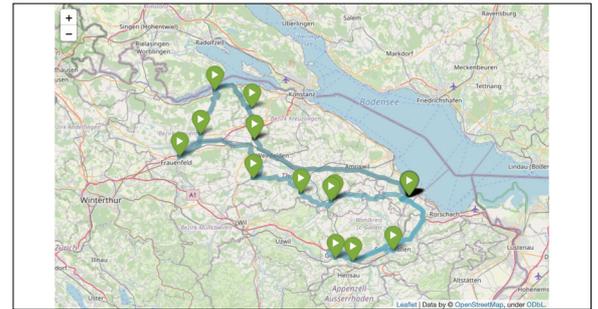
Initial Situation: In recent years, the general cargo market has been characterized by smaller shipment sizes, increased delivery requirements from customers, lower margins, high cost pressure, and higher sustainability expectations, prompting logistics providers to take action. However, despite advancing digitalization and available software tools, the important logistical task of vehicle routing is often still performed manually by humans, which means that savings in costs and CO₂ emissions from optimized routes are not fully exploited. One of the reasons why manual solutions are still preferred is that available tools often use highly simplified models that do not do justice to the complexity of the task. Another reason is that digital transformation is still in its infancy at many companies. As a result, data management has not yet reached a stage where the data required for software-based route planning is available.

Problem: Vehicle routing problems are anything but easy to solve optimally, as the computation time for a brute-force approach explodes at problem sizes as small as 20 to 30 locations. In the last 70 years, however, a lot of research has been done in this field and nowadays various exact and heuristic methods can be used to solve such problems.

Approach: In this thesis, it is shown how such routing problems can be modeled and solved using Google's open source library for operations research. Google OR tools provide access to a variety of construction and metaheuristics, which can be used to solve various vehicle routing problems in a short time. The focus of this work is on solving real-world Rich VRPs of two Swiss companies. In addition to the determination of the shortest routes, for these rich VRPs the capacity constraints of the vehicles, the time windows at the different stations and pickup and delivery orders are taken into account all at once. This results in solutions that better address the complexity of the planning task and thus can better support companies in their vehicle routing.

Solution to a Rich Vehicle Routing Problem

Own Creation. Data by © OpenStreetMap, under ODbL.



Examiners

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Subject Area

Innovation in Products, Processes and Materials - Business Engineering and Productions