Bianca Pascariu
Università Roma Tre

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Improving train punctuality by optimized train route selection in decision support systems

The real-time Rail Traffic Management Problem (rtRTMP) is responsible for detecting and solving time-overlapping conflicting requests made by multiple trains on the same track sections. This problem consists in retiming, reordering and rerouting trains in such a way that the propagation of delays in the railway network is minimized. Recent approaches show that limiting in a smart way the number of routing variables available for each train further improves the rtRTMP solutions. This pre-process requires solving the Train Routing Selection Problem (TRSP) and consists of selecting a feasible and optimized subset of alternative routes for each train. This research proposes the enhancement of real-time traffic management solvers with an optimised artificial intelligence-based TRSP method. First, the correlation between the TRSP and rtRTMP models is increased and multiple objective functions are implemented to fit different rtRTMP solvers. The purpose is to identify the best routes to be used by the rtRTMP solver, in order to find the highest quality solutions. Then, a parallel ACO-TRSP algorithm is developed to speed-up the search space exploration and find better quality solutions in the available computation time. The TRSP is applied to supply routing alternatives to the well-established rtRTMP solvers: AGLibrary and RECIFE-MILP. A thorough campaign of experiments was carried out, referencing two areas in N France as cases of disturbed timetables: the lines around Rouen and the station area of Lille Flanders. As a result, our TRSP approach defines a good search space for the rtRTMP, with significantly better solutions than the state-of-the-art.