Robust vehicle routing under travel time uncertainty

We present a solution framework for the robust vehicle routing problem under travel time uncertainty. In this talk, we first introduce the use of requirements violation (RV) index in the context of vehicle routing with deadlines and soft time windows. Then, we present an extension of that framework to the case of simultaneous routes and time window assignments. In this problem, the routing and time window decisions are simultaneously determined such that the expected travel time and the risk of violating the time windows are minimized. This problem arises in several applications including attended home deliveries, online grocery, internet installation, and repair and maintenance services. In the robust framework, the exact distributions of the uncertain travel time is not known whereas some statistics including the mean, minimum and maximum travel time are available. We extend the robust framework based on the RV index and derive new subgradient cuts for the reformulation, which is solved by a branch-and-cut algorithm. Computational experiments were performed to demonstrate the performance of our approach and present the trade-off between expected travel time and risk of violating the time windows.