The Collaborative Team Orienteering Problem

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Research Context

Existing Routing algorithms
- A single company
- A single market environment
- A single strategy

Collaborative Routing
- Multiple companies
- Multiple market environments
- Different strategies

Research Questions

- How to define this problem in a collaborative way? Can we construct a collaborative framework?
  - Single-objective problem:
    - Pool partners together as if they act as one single company
    - Solve the non-collaborative problem
    - Integrate an appropriate allocation mechanism

- How to give the right incentives by means of a good cost (or profit) allocation mechanism?
  - Incorporate the cost (profit) allocation into the algorithm
  - Flexibility of a partner needs to be rewarded

  Flexibility = a low CND (no priority for your clients)

Research Methodology

- Development of a metaheuristic that solves the orienteering problem for the grand and the sub-coalition(s)
- Study of the behaviour of different allocation mechanisms for alternating flexibility
- Proposal of an alternative cost allocation method for the collaborative team orienteering problem, taking into account the flexibility of a partner in terms of his ‘CND – policy’

Results

- A multi-start variable neighbourhood metaheuristic for solving the instances
- An alternative cost allocation mechanism based on
  - The marginal cost of each client in the tour
  - The CND of the clients that were chosen

\[
a_i = M_i + \frac{\text{CND}_i}{\text{CND}_{\text{total}}} \left( \text{TotalCost} - \sum_i M_i \right)
\]

- By requiring stability, the flexibility benefits will drop by increasing dissimilarities between collaborating partners.
  - Stand-alone cost / stand-alone efficiency
  - CND – policy in collaboration
- The partner choice has a large impact on the properties of a collaboration

Further Research

- Translation of the results in useful guidelines for companies that consider a horizontal collaboration
- Include the collaborative element in other routing problems by using the same framework