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Definition and classification of parameters for daily activity chain optimization

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Abstract

A growing trend is observable towards flexible mobility solutions, especially regarding the flexibility in times and locations of the activities. This indicates a complex optimization problem, where many parameters have to be considered. Our paper deals with the optimization of daily activity chains, which is the optimization of series of activities during a certain time period for several parameters. In order to build the optimization framework a roadmap was elaborated. First the optimization parameters have to be defined and ideal target groups have to be identified. Then an optimization algorithm has to be implemented, where different transportation modes and personal preferences have to be taken into account. This results in a personalized and optimized activity chain for urban citizens. As the first point of the roadmap, the parameters were defined, which are connected to the user, to the chosen transportation mode or to the location type of the activity. Then a general utility function was defined to provide a calculation method for the optimization of activity chains.

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1. Introduction

A growing trend (especially in urban environments) is observable towards the flexibility in times and locations of the activities. Accordingly, the optimization of daily activity chain is one of the main focuses of transportation research. Daily activity chain problems deal with the optimization of series of activities along a certain time period (usually a day). For the optimization of activities many models have been developed that take into account duration of travel, time windows and multimodal journey planning.

Concerning daily activity planning some other parameters may play a more important role, which are connected to the user, to the chosen transportation mode or to the location type of the activity. The user preferences for choosing the best set of activities lies upon practical quantifiable factors. We have established the goal of developing a model for optimization of flexible daily activity chains, taking also into account user preferences.

The first steps of the roadmap for achieving this goal are elaborated in this paper (Fig 1): the definition and classification of optimization parameters (optimization parameters), the elaboration of a general weighting of the optimization parameters (utility function).

This will be followed by the remaining steps of the roadmap: identification of target groups and their personal preferences (target group preferences), implementation of the optimization algorithm using several optimization parameters (optimization algorithm), running the optimization algorithm for different scenarios (scenario analysis), learning personal and group weights of the target groups and fine tuning of the preferences (learning weights).

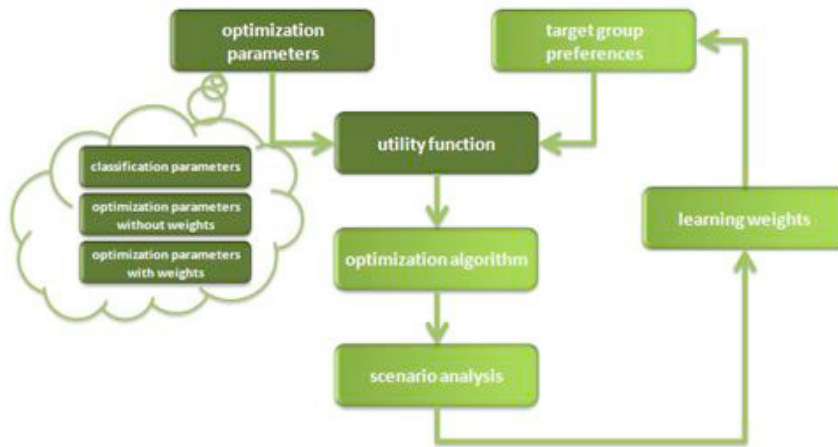


Figure 1. Roadmap of the daily activity chain optimization

2. Literature review

Recent academic literature regarding daily activity chain optimization is related to topics like (activity-based) trip chaining, mode choice, travel demand management and flexible mobility options. Although in 2008 it was stated that trip chaining was a rarely investigated topic due to difficulties in definition, extraction of information from surveys and analysis of potential trip chain types (Primerano et al. 2008), some aspects have been studied in detail in the past 30 years. Islam and Habib (2012) classified the literature on trip chaining behavior in 1) prediction of the frequency of stops in the trip chain and 2) the definition of trip chaining patterns and the investigation of the effect of socio-demographic characteristics, the present brief review focuses on the latter.

A synthesized definition of trip chain (or activity schedule) is provided by a research project (Primerano et al., 2008): it is a schedule that individuals follow or create, as they proceed through the day, i.e. the linking of secondary activities to a primary activity through travel that is made from when an individual leaves home to when they return home. This is the stop-based concept of trip chaining behaviour according to a paper on the relation of household type and trip chaining behaviour (Lee et al, 2007). On the other hand, there is the tour-based concept, which studies trip chaining as a series of activity episodes. Three types of these activities have been identified (Wen and Koppelman, 2000, Lee et al., 2007): subsistence activities (related with work), maintenance activities (to satisfy household or personal needs), discretionary activities (motivated by cultural and psychological needs).

Many aspects of chained trips have been studied: comparison of trip-chaining behaviour of men and women (McGuckin and Murakami, 1999), study of chained trips in specific regions (e.g. Subbarao and Krishna Rao, 2013), its assessment by age groups (Golob and Hensher, 2007). In the specific field of activity-based trip chaining, in spite

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