UNIVERSITY of SALZBURG

Adaptive road network assessment for context-sensitive bicycle routing

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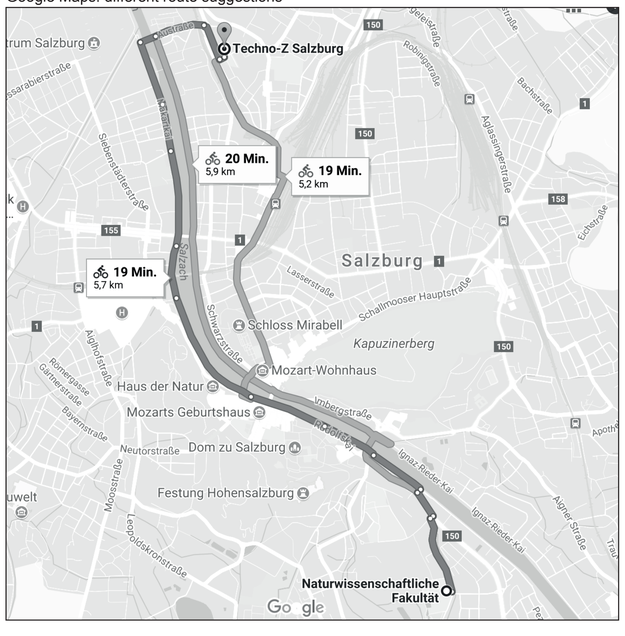
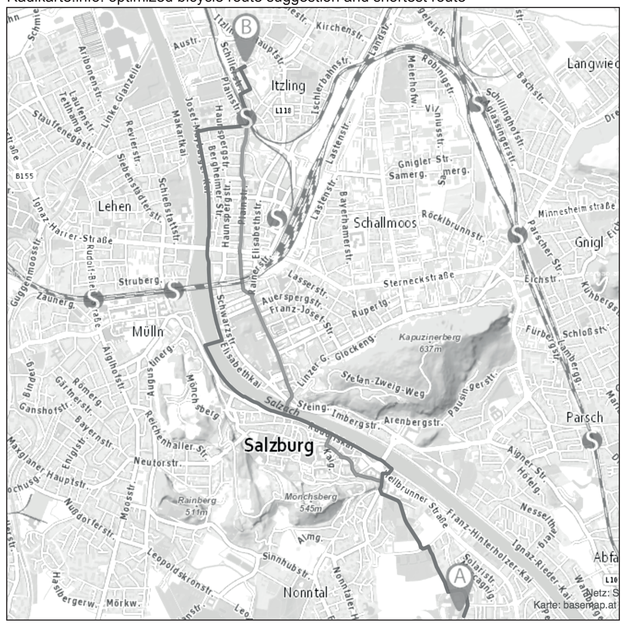
Conventional bicycle routing

Routes are optimized for average bicyclists according to predefined criteria.

Google Maps: different route suggestions



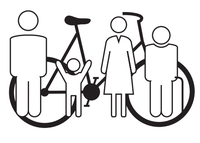
Radlkarte.info: optimized bicycle route suggestion and shortest route



Background

Routing and navigation applications are well established for automobiles. Although preferences of drivers (fastest, shortest or most scenic route, toll avoidance etc.) can vary, their individuality is levelled out to a certain degree by the fact that they drive a machine: driving up a mountain is equally possible for young and elderly, obese and impaired, sporty or risk-averse drivers.

The situation is different for bicyclists. Depending on capabilities, opportunities, preferences and trip purpose, optimal routes might differ significantly from each other. Nonetheless, many routing applications for bicyclists are designed from a »machine perspective«. And even in cases, where routing criteria for bicyclists specifically exist, two major drawbacks remain:



(1) Routes are optimized for an average bicyclist, who does not exist. Consequently, specific needs of individuals or user groups, such as school kids, elderly people or commuters, are widely ignored.
(2) Time-sensitive, dynamic information, which is crucially important for bicyclists, is hardly ever considered in route recommendations. This holds especially true for precipitation prognosis and traffic volume.

Research gap

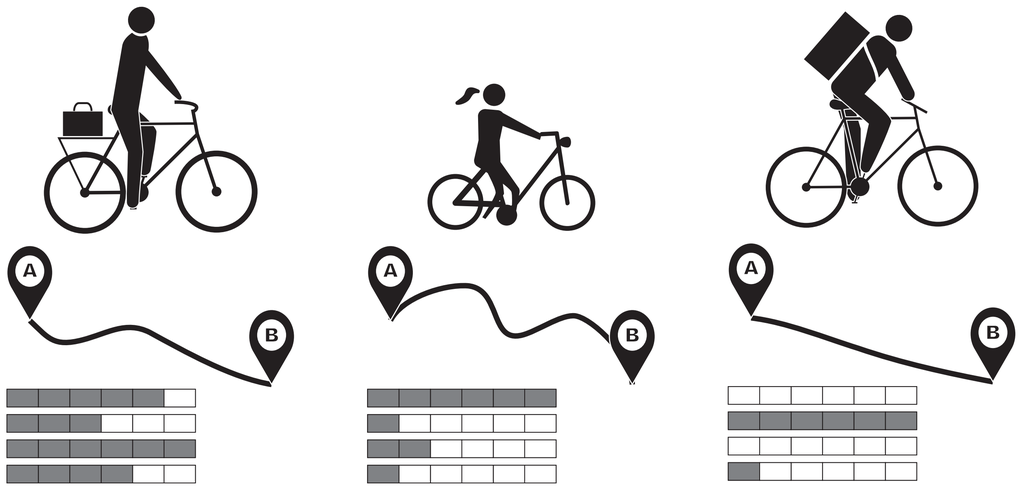
Since the particularities and complexities of bicycling cannot be adequately addressed in car-centric routing and navigation applications (»machine perspective«), new approaches are required in order to provide relevant and suitable routing information to bicyclists.
Thus, a routing optimization model that is capable to represent user‘s specific preferences as routing impedance needs to be developed.
Addressing the second drawback, ways to integrate dynamic information in route optimization are to be investigated. Additionally, methods to overlay routes with dynamic information need to be conceptualized.

Approach

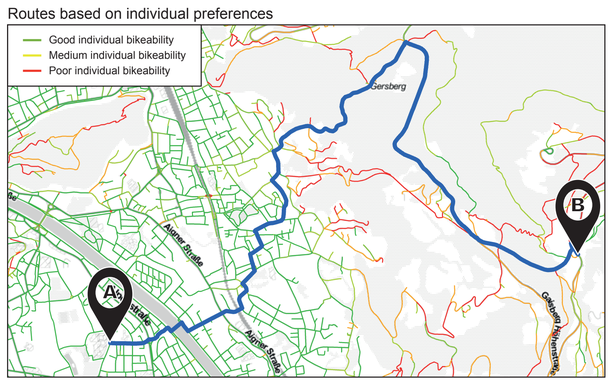
We propose to expand an existing network assessment model (Loidl & Zagel 2014) with individual indicator weights, and use this model to calculate an user-specific impedance value for each road segment.
In order to adequately incorporate dynamic information in the route recommendation, calculated routes are overlayed. This overlay considers the spatial and temporal dynamics of the information (e.g. precipitation prognosis data) and the travelling bicyclist. This approach facilitates context-senstive rrecommendations for the specific route and preferable departure time.

Adaptive assessment model

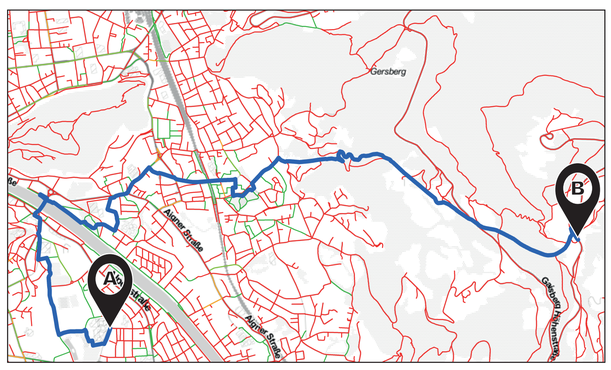
Considering individual preferences in the calculation of the routing impedance value.



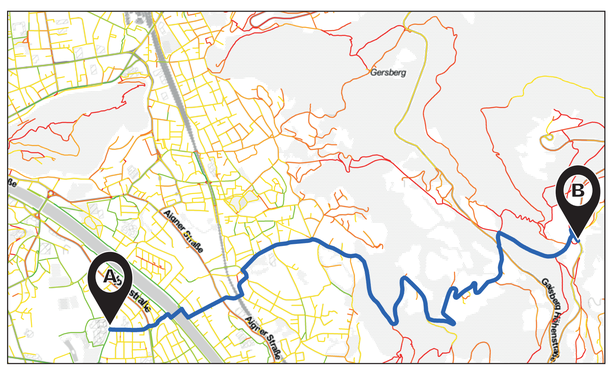
Routes based on individual preferences



Bicycle Infrastructure:
Designated Route:
Road Category:
Gradient:



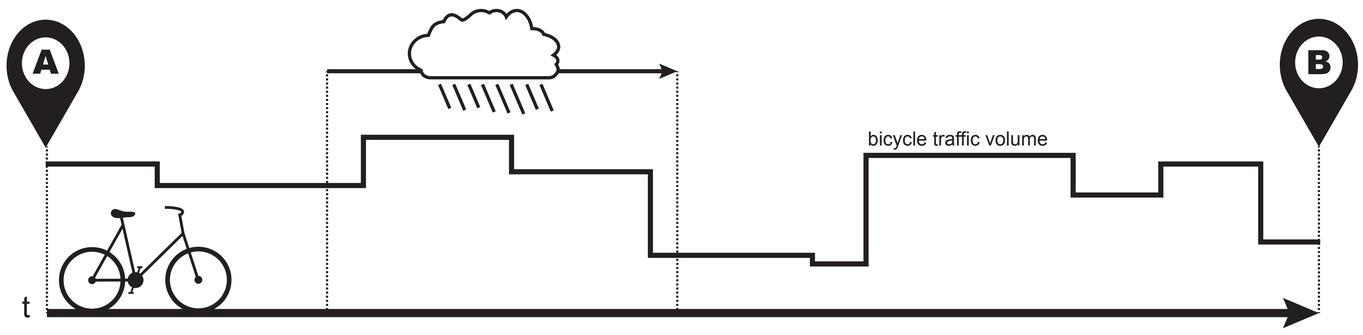
Bicycle Infrastructure:
Designated Route:
Road Category:
Gradient:



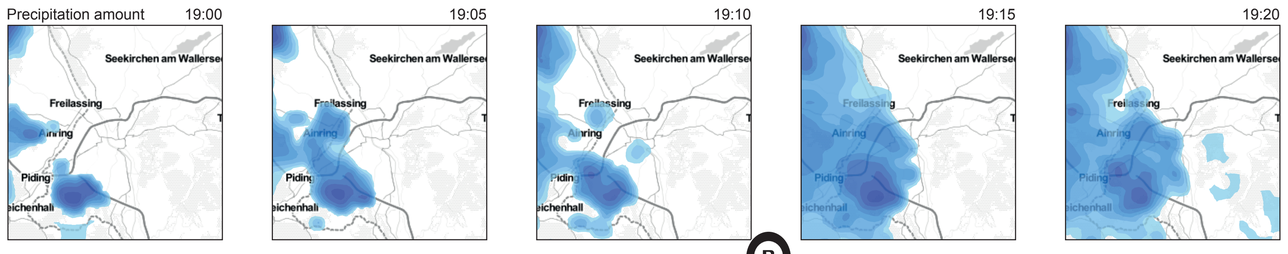
Bicycle Infrastructure:
Designated Route:
Road Category:
Gradient:

Context-sensitive optimization

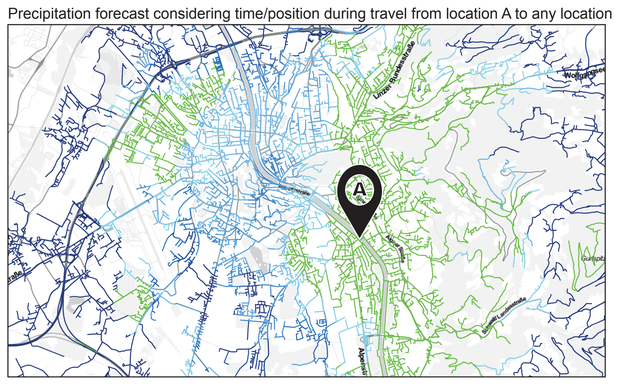
Integrating dynamic information.



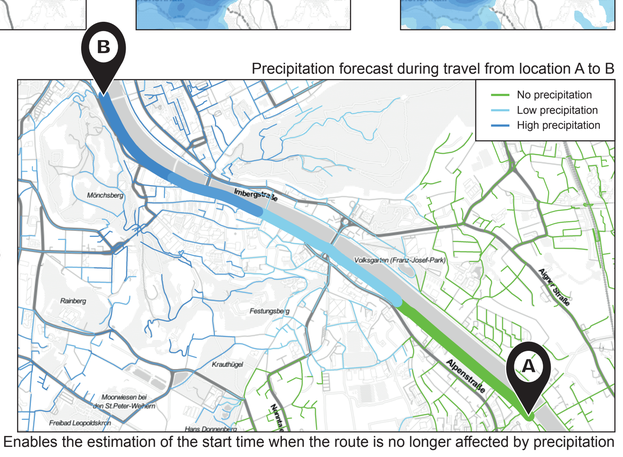
Precipitation amount



Precipitation forecast considering time/position during travel from location A to any location



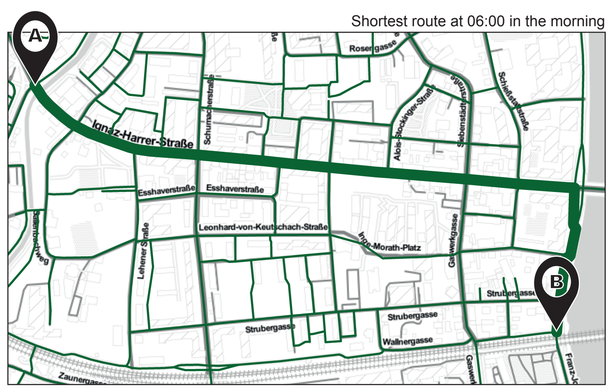
Precipitation forecast during travel from location A to B



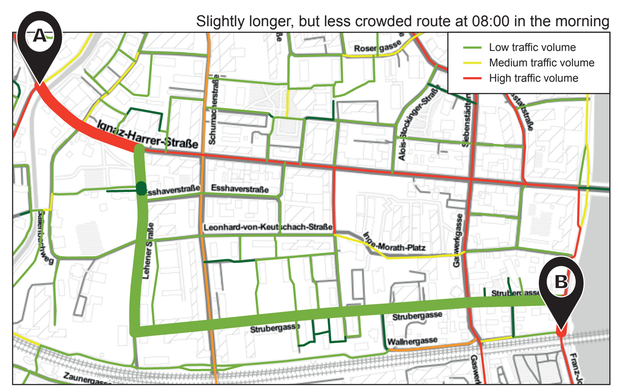
Enables the estimation of the start time when the route is no longer affected by precipitation

Bicycle traffic volume

Shortest route at 06:00 in the morning



Slightly longer, but less crowded route at 08:00 in the morning



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