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Efficient Technologies and Systems for Mobility

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Using a GIS-based Framework to Analyze the Impact of a *Mobility as a Service* Offer

Technological advances, infrastructural limits and the demands for more ecologically sustainable transport lead to a rapid change in the ways we perceive and use mobility. A potential pillar for future mobility is *Mobility as a Service (MaaS)* [1], where multiple modes of transport are integrated and made available as an easily accessible, packaged offer. With *Green Class*, the Swiss Federal Railways (SBB CFF FFS) offered such a service as part of a pilot study in 2017 to a limited number of people. We here present the geographic information system (GIS)-based framework used to analyze the effects of this offer on the mobility behavior and greenhouse gas (GHG) emissions of the involved users. The results show that people change their mobility behavior depending on the transport modes available to them before their use of MaaS. Additionally, the electric car (part of the MaaS offer) led to a noticeable reduction in GHG emissions.

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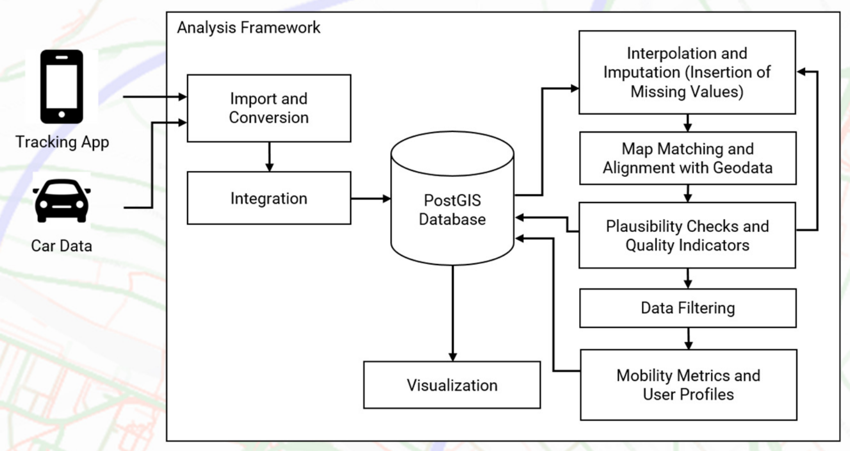
Introduction

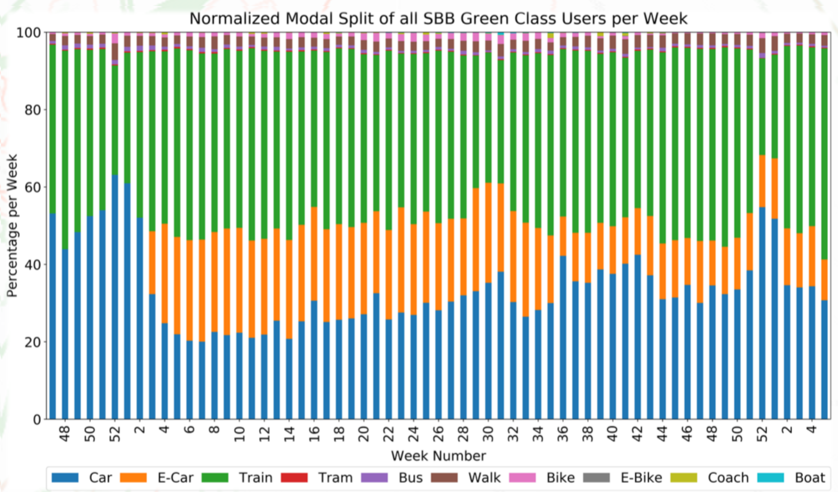
Mobility as a Service recently saw an increased interest due to new technological possibilities (e.g., given by smartphones of people or sensors that track vehicles). Preliminary studies such as UbiGo [2] analyzed the challenges and potentials of MaaS in an urban context. In a collaboration with the Swiss Federal Railways (SBB CFF FFS), we studied the effects of a MaaS offer with respect to the way that people change their mobility behavior and how this influences the greenhouse gas emissions of the involved persons. To analyze the large amounts of data we developed a GIS-based framework, which is presented here alongside some of the key insights gained by applying the framework to data from around 140 users. **One can see that people's adaption of their mobility behavior depends on the available transport modes and their behavior before their use of MaaS.**

Analysis Framework



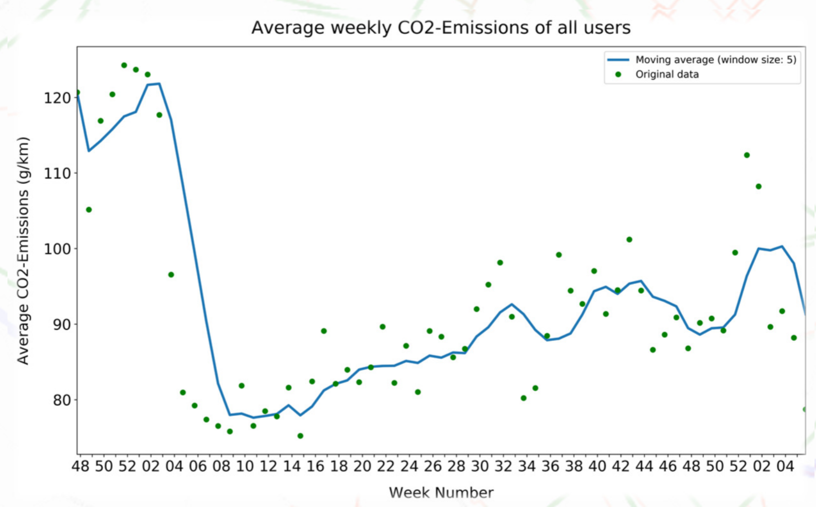
The employed analysis framework is centered around a PostGIS database, which is used to store the preprocessed tracking and car data, but also the intermediate datasets (such as map matched routes and quality indicators) and the final mobility metrics and user profiles. The visualization module extracts specific data points from the database and uses them for a variety of plots.

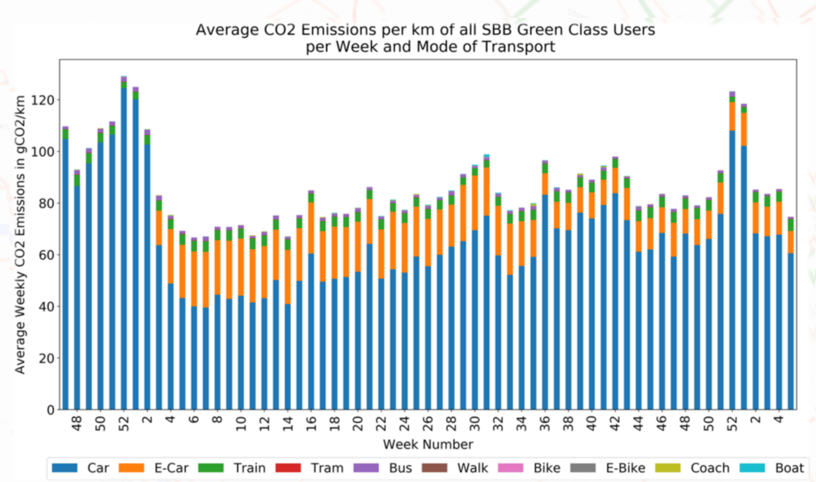
Modal Split



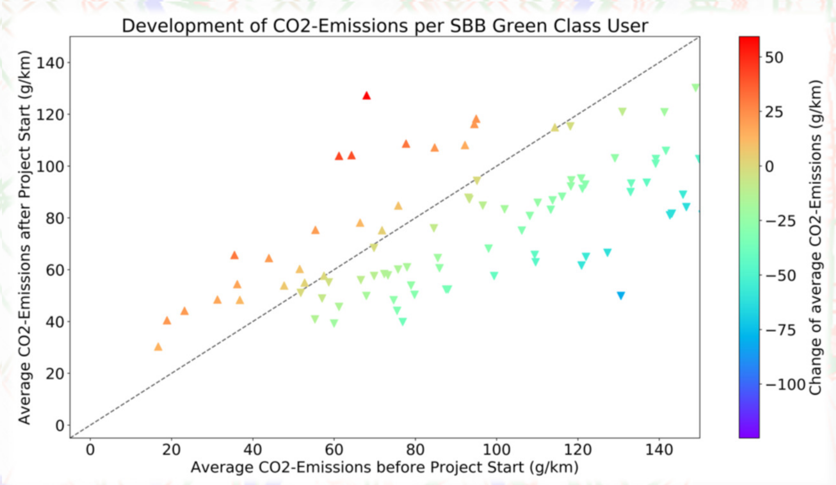
After the pilot study started in week 3 of 2017, the electric car quickly gains a large share of the modal split. The importance of the electric car slowly fades over the course of the project until it stabilizes at around 15 %. Furthermore, the graph shows weeks with abnormal mobility behavior such as the summer holidays (weeks 29 – 31) or Christmas (weeks 51 + 52)

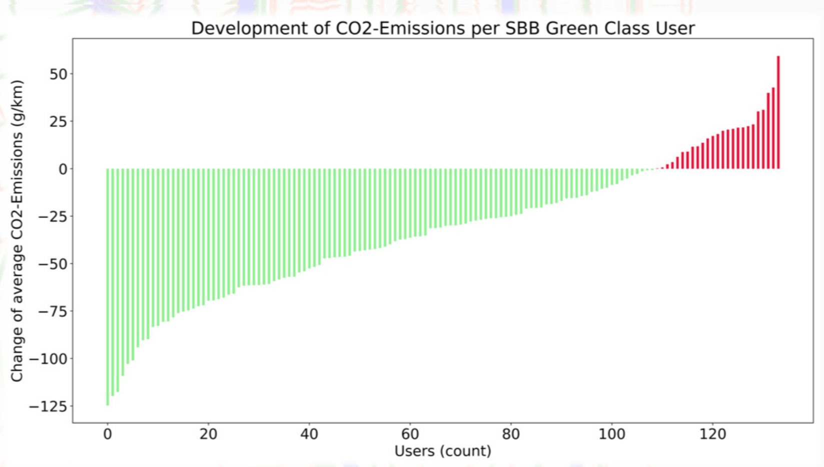
CO_2 Emissions





User Groups





Expected Impact

Depending on the personal context, a MaaS offer can lead to **substantially lower GHG emissions**. The majority of participants in the Green Class pilot study could reduced their GHG emissions. The participants that increased their GHG emissions after using the MaaS offer, were intensive users of public transportation before the project and partially replaced the train by the electric car. For the large majority, **lower GHG emissions were possible by replacing journeys with the internal combustion engine car with the electric car**. People who did not frequently use public transport before, showed an increase in its use, as the included general travelcard enabled them to use all public transport within Switzerland without marginal costs. In terms of the analysis framework, future work includes a statistics module that complements the visual analytics and facilitates statistical analyses, as well as the integration of (individual) spatio-temporal context (e.g. weather conditions or air quality) more thoroughly [4].

References

[1] Boulouchos, K., F. Cellina, F. Ciari, B. Cox, G. Georges, M. Hirschberg, D. Jonietz, R. Kannan, N. Kovacs, L. Küng, T. Michl, M. Raubal, R. Rudel & Schenler, W. (2017). *Towards an Energy Efficient and Climate Compatible Future Swiss Transportation System.* SCCER Mobility: ETHZ, PSI, SUPSI, ZHAW.

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[3] Jonietz, D. & Bucher, D. (2018). *Continuous trajectory pattern mining for mobility behaviour change detection.* In Proceedings of the 14th International Conference on Location Based Services (LBS 2018), Zurich, January 2018.

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