Aalto University

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Could mobile systems help to improve safety and sustainability of urban transportation?

Title of the dissertation	Mobile systems for adaptive road safety and time-relevant modal shift Mobiilijärjestelmät mukautuvaan liikenneturvallisuuteen ja aikaperusteiseen liikennemuotosiirtymään
Contents of the dissertation	Blind-spot and bad weather conditions cause poor visibility for both drivers and autonomous cars, and increase the risk of serious accidents with pedestrians and cyclists. This thesis shows the possibility of improving road safety using smartphone data, particularly to prevent vehicle-to-pedestrian accidents in poor visibility conditions. It is shown that using mobile cloud computing can provide an affordable way to connect pedestrians and cyclists to vehicular wireless networks, and send warnings to the road-users at risk. The real-time location, speed and direction retrieved from phone sensors are used to predict the accidents. This thesis implements a model and a prototype of the collision warning system, and then evaluates the potentials and limitations regarding phone battery lifetime, cloud costs and mobile network speed and bandwidth. The evaluation reviews different city sizes, road-user populations and traffic conditions. We present and visualize experimental results for the city of Cologne, Germany. As road safety influences the choice of biking and walking, this thesis also implements a prototype that uses smartphone data to identify the daily door-to-door trips, and then estimate the potential of modal shifts where people replace car trips with public transport, bike and walk. For each observed car trip, the cloud computes alternative paths with bike, walk and public transport. As people have a limited daily travel-time budget, the increased travel time with low-carbon modes can be a challenge against replacing cars. On the other hand, the advantages of modal shifts include increased physical activity by walking and cycling, and reduced carbon emission. The proposed framework enables us to explore such pros and cons from various spatiotemporal viewpoints and from the traveler's point of view. We present experimental results for the Helsinki metropolitan region.
Field of the dissertation	Computer Science, Mobile Networks and Urban Mobility
Doctoral candidate	Mehrdad Bagheri, M.Sc. Born in Tehran
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Opponent	Professor Jyrki Nummenmaa, Tampere University, Finland
Custos	Professor Antti Ylä-Jääski, Aalto University School of Science, Department of Computer Science
Electronic dissertation	http://urn.fi/URN:ISBN:978-952-64-0206-2
Doctoral candidate's contact information	Mehrdad Bagheri, mehrdad.bm@gmail.com, mehrdad.bagheri@aalto.fi