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New and emerging methods for the improved modelling of travel behaviour

Transportation Research Part B: Special Issue of papers from the IATBR 2015 Conference

Guest Editors: Aruna Sivakumar & Stephane Hess

This special issue compiles five of the best methodological papers presented at the 14th conference of the International Association for Travel Behaviour Research (IATBR)¹, which was held in Windsor, UK in July 2015. Over 400 abstracts were received for the conference, with a 50% acceptance rate for presentation at the conference. Of these, only 70 papers were considered for publication in various special issues. All papers were subjected to a rigorous peer review process with 2-3 reviews per paper.

In keeping with the theme of the 14th conference 'Transitions in a Digital World', three of the five papers in this special issue present new methods with the aim of better exploiting the increasingly ubiquitous 'big data' sources such as GPS traces. These papers cover a wide array of topics, including new methods for data collection, for short term travel behaviour prediction, and the modelling of travel mode choice.

In a paper titled 'Interactive Online Machine Learning Approach for Activity-Travel Survey', Seo, Kusakabe, Gotoh and Asakura present a new method for enhancing mobile phone trace data while reducing the burden on respondents. Their paper proposes a framework for an interactive activity-travel survey method, implementable on mobile devices such as smartphones. The proposed method employs an online travel context estimation model and an online machine learning method as interactive processes. The estimation model is used for automatically estimating travel contexts during surveys, while the online machine learning method is used for dynamically updating the estimation model, based on answers from respondents. An empirical application of the method demonstrates that it is very successful for estimating commuting trips and the behaviours of respondents with recurrent activity-travel patterns. Although the method is not as effective at estimating some other types of trips, it eventually produces accurate results because of the interaction process. The authors show that the proposed method is effective at reducing respondent burden in long-term surveys, while maintaining high data quality and capturing traveller heterogeneity.

Krause and Zhang, in their paper titled 'Short term travel behaviour prediction through GPS and Land use/POI data' present a new short term prediction model structure that uses trip purpose when it is available yet falls back on traditional spatial temporal Markov models when it is not. Trip purpose is modelled in the prediction algorithm using open source Point of Interest (POI) and land use data, merged with GPS driving traces. This is one of the first papers to demonstrate short term prediction of destination location using an estimated trip purpose. This new methodology, though conceptually very simple, has the potential for significant advances by applying it to en-route destination prediction algorithms, thus improving traveller information systems and intelligent transport systems applications.

Calastri, Hess, Choudhury, Daly and Gabrielli, on the other hand present a new model structure that can exploit passive data sources to produce more effective travel mode choice models. In

¹ The International Association for Travel Behaviour Research (IATBR) is an international organization of scholars, researchers, practitioners, consultants, and public agency professionals dedicated to the advancement of travel behaviour research. The main activity of the association has been the organisation of triennial conferences on travel behaviour research.

their paper titled 'Mode choice with latent availability and consideration: theory and a case study', Calastri et al develop a joint model of mode availability, consideration and choice that can be used to better exploit passive data sets such as GPS traces. The proposed methodology in this paper overcomes one of the biggest hurdles in the effective use of passively collected 'big data' i.e. the lack of information on mode availability and consideration.

The fourth paper in this special issue addresses another topic that is specific to the new digital era, viz. Mobility as a Service (MaaS). Djavadian and Chow present 'An agent-based day-to-day adjustment process for modelling Mobility as a Service with a two-sided flexible transport market'. In this paper, the authors explore such flexible transport services in the framework of two-sided markets, such as Uber or AirBnB. A case study using real data from Oakville, Ontario, demonstrates the sensitivity of the day-to-day model to operating policies. Computational experiments are used to confirm the existence of locally stable states, and to show the existence of thresholds from which network externalities cause two-sided and one-sided market equilibria to diverge. The proposed methodology provides the opportunity to evaluate very complex policies and scenarios, such as system designs (e.g. fleet sizing) and operating policies (e.g. fare price), all on a common platform in terms of consumer surplus.

The fifth paper in this compilation is perhaps the most traditional of the papers, as it presents a new method for dealing with dominant alternatives in stated choice experiments. And yet, the value of this paper cannot be underestimated in an era where the future of the transport system looks very uncertain. With new technologies such as electric vehicles and autonomous vehicles around the corner, and new transport services, models of travel behaviour increasingly rely on stated choice experiments. In their paper titled 'Detecting dominance in stated choice data and accounting for dominance-based scale differences in logit models', Bliemer, Rose and Chorus discuss the issue of dominant alternatives in stated choice design. The authors demonstrate the problems associated with dominant alternatives, and propose a new measure based on the concept of minimum regret to calculate the dominance. This new measure is then used to define a new experimental design type that removes the dominance and ensures the making of trade-offs between attributes. They also go on to propose a new regret-scaled multinomial logit model that takes the level of dominance within a choice task into account.

We hope this special issue gives readers an insight into the very exciting methodological work presented at IATBR conferences. This special issue would not have been possible without the help of a great pool of enthusiastic reviewers and authors and we are indebted to them.

Aruna Sivakumar (corresponding author)
Centre for Transport Studies, Imperial College London, United Kingdom
Email: a.sivakumar@imperial.ac.uk

Stephane Hess
Institute for Transport Studies & Choice Modelling Centre, University of Leeds, United Kingdom
Email: s.hess@its.leeds.ac.uk