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Advances in transportation research

These are very exciting times to be in transportation research. Transportation research has morphed into an inter-disciplinary field of interest, thereby attracting researchers from computer science, economics, urban planning, geography, materials-engineering and public health. There plethora of real-world problems surrounding the urban living in the era of emerging technologies gives us a unique opportunity to use various combinations of big data sources, technological tools and policy solutions to address traffic congestion and other externalities of transportation. On one hand, private mobility is challenged by shared mobility offered by ride-hailing services, and a variety of such services have emerged, thanks to sharing economy and the ubiquity of smart phones. On the other hand, cities around the globe are reviving their public transit systems to enhance the quality of service, reach, connectivity, and travel market share of their public transportation. Furthermore, there is an increase in the availability of large and diverse data streams for measurement, inference and control of transportation systems. Yet, traffic congestion, traffic related environmental impact and other public health-related problems attributable to transportation continue to be on the rise in most cities of the world.

A very notable technological milestone is the real-world testing of connected and automated vehicle (CAV) technologies, being experimented in a variety of different forms and settings. The research involving CAVs presents tremendous opportunities for humans. They may reduce accidents by 90 percent due to minimal or no human involvement, improved roadway capacity, enhanced mobility, increase fuel efficiency, reduce driver stress, etc. Results from studies (such as, Bansal and Kockelman, 2017; Haboucha et.al., 2017) suggests that the privately held fleet could have almost 25

In addition to revolutionizing the private mobility, the societal penetration of these emerging technologies such as peer-to-peer sharing applications and the internet-of-things are also expected to bring about a major change in collective mobility. Indeed, it is argued that this transition has already begun, and now there are critical questions to be posed in terms of how the transition is managed, and how both the benefits and any negative externalities of change will be governed. Research efforts (Docherty et.al., 2018) deploy the notion of ensuring and enhancing public value as a key governance aim for the transition. It is important to successfully negotiate the ways in which resources and power will be utilized, and shifts in how mobility is regulated, priced and taxed, if social value is to be captured from the transition.

However, another area of transportation research deals with methods designed to estimate and forecast the decision-making at the individual level. These decisions capture the daily-activity pattern, mode-choice, route-choice, in-home and out-of-home activity participation characteristics of individuals and households. These methods used to model car ownership, transit ridership, bicycle sharing usage and other aspects of travel behaviour are based on a widely used econometric method called discrete-choice modelling. These models, with foundations in microeconomics and mathematical psychology, specify travellers' choices as a function of their sociodemographic, transportation, built environment, technological and cultural attributes. Though there is a growing literature on the connection between the built environment and travel behaviour, limited efforts have been made to consider the intermediary nature of aspects of car ownership and travel distance simultaneously while modelling the relationship between the built environment and travel behaviour. This topic is particularly relevant in developing economies where increasing affluence has accelerated the growth in personal car travel and resulting traffic congestion. In this context, understanding and modelling car ownership (Ding et.al., 2017) is an important prerequisite due to its influence on individual-level travel behaviour and aggregate level travel demand. In similar research efforts, the relationships among travel mode choice, car ownership and travel distance are described using a framework of integrated structural equation model (SEM) and discrete choice model (DCM).

Other studies (Hensher, 2017) show that the digital age has created new opportunities to improve the customer experience in using public transport. By tailoring services that are individualised to the needs and preferences of public transport users, the service delivery option known as mobility as a service (MaaS) has gained popularity in the very recent times. In addition to point-to-point car-based services such as Uber, we observe recent interests in understanding and testing of bus-based options that include smart bookable 'point-via-point-to-point' services. This presents a number of positions that could potentially represent future contexts in which bus services might be offered, recognising that a hybrid multi-modal state of affairs may be the most appealing new contract setting, enabling the design of contracts to be driven by the mode-neutral customer experience, and the growing opportunity to focus on MaaS.

The field of transportation engineering thrives on its ability to incorporate advancements in other areas of research into solving the real-world problems in day-to-day transportation. One such field of study that has drastically grown in the past decade is that of Artificial Intelligence. Applications of machine learning algorithms have found their way into modelling of a central issue relevant to modelling and control of vehicular traffic—understanding, representing, and modelling spatial movement dynamics of vehicles. Deep neural networks (DNNs) have recently demonstrated (Wu et.al., 2018) the capability to predict traffic flow with big data. While existing DNN models can provide better performance than shallow models, it is still an open issue of making full use of spatial-temporal characteristics of the traffic flow to improve their performance.

Finally, the goal of transportation research, development and practice is sustainable mobility, which in-turn is key for sustainable cities. Ortúzar (2019) focuses on an important aspect of sustainable mobility–traffic congestion. The paper provides a traffic engineer's view of the traffic congestion problem and describes two well-known paradoxes from the network science literature to discuss why the apparently common-sense solutions such as adding more roads might not be adequate for addressing the problem. The paper emphasizes that political will and long-term strategies are necessary for the success of these approaches in addressing the problem of traffic congestion.

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