Modeling Potential Consequences of Connected and Automated Vehicle to Future Travel Behaviors and Patterns Changes: A Fuzzy Cognitive Map Approach

Haizhong Wang

Abstract The authors examined changes that are likely to affect transportation behaviors in the future, developed a "fuzzy cognitive map" (FCM) of the relationships, and used the FCM model to investigate the effects of those relationships. This new FCM method enables modeling the potential consequences of new technologies and services using a variant of the fuzzy cognitive map (FCM) approach, which enables problems involving imprecise and uncertain information to be modeled. Significant modifications to the standard FCM approach were made to address deficiencies found in applying the standard approach. The new approach retains some basic FCM characteristics, but it deviates substantially in a number of ways as well. It has been found that this produces well-behaved models that can be explained in common-sense terms, be easily configured, run many scenarios quickly, and used to analyze scenarios of disruptive change. The results of the study show that FCM models offer a promising method for transportation planners to enhance their ability to reason about system effects when quantitative information is limited and uncertain. More specifically, the results provide some initial guidance on the potential impacts of disruptive changes on future travel, which may help in targeting limited research funds on the most consequential potential changes.

Haizhong Wang

H. Wang (✉)
Oregon State University, Corvallis, OR 97330, USA
e-mail: Haizhong.Wang@oregonstate.edu

V.E. Balas et al. (eds.), *Information Technology and Intelligent Transportation Systems*, Advances in Intelligent Systems and Computing 454,
DOI 10.1007/978-3-319-38789-5_3

1 Short Biography

Dr. Haizhong Wang is an Assistant Professor of Transportation Engineering within the School of Civil and Construction Engineering at Oregon State University, Corvallis, OR. Dr. Wang received M.S. and Ph.D. degrees from University of Massachusetts, Amherst in Applied Mathematics and Civil Engineering (Transportation), and B.S. and M.S. degrees from Hebei University of Technology and Beijing University of Technology, China. Dr. Wang's research areas include (1) stochastic traffic flow models, traffic system planning and analysis in particular the impacts of emerging technologies such as connected and automated vehicles on traffic operations and future travel behavior; (2) an agent-based modeling and simulation (ABMS) to model behavioral heterogeneity (i.e., when, how, where to evacuate) for life safety and post-disaster mobility in multi-hazard emergency evacuation and disaster response; (3) a network of network (NON) approach to model interdependency for resilient lifeline infrastructure systems; (4) Complex adaptive system (CAS) for large-scale system modeling and simulation; (5) Mileage-based road user charge for alternative financing; and (6) Dada driven smart city and big data applications for urban mobility. Dr. Wang has published over 40 journal and major conference papers. He is a member for two TRB standing committee: ABJ70 Artificial Intelligence and Advanced Computing Applications and ABR 30: Emergency Evacuation and AHB45 (3) Subcommittee on Connected and Automated Vehicles through Traffic Flow Theory and Characteristics. He is the most recent receipt of the Outstanding Reviewer for ASCE Journal of Transportation Engineering for 2014.