

Discrete Choice Models for Transportation Mode Choice: A Systematic Literature Review

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Abstract

The objective of this paper is to determine the current methods and data sources used to model mode choice for transportation of the population in universities and urban areas. We performed a systematic literature review to compare the different methods, techniques, data sources, and metrics used to model mode choice behavior and evaluate its performance. A mode choice model is a discrete choice model, which predicts a choice in a set of discrete alternatives; it describes the selection of a transportation mode from an individual, in disaggregated models, or a percentage of a population, in aggregated models. We collected a total of 60 primary studies after searching on different databases from 1982 to 2021, most of them being published in journals. The studied areas range from small regions, such as universities, to wider regions, like metropolitan areas. As most of the models in the studied research papers used data collected from surveys the authors created for that specific research, we advise to ensure that the data sources for the model training contain the required sample characteristics and variables. If such database is not available, performing a survey as an initial data gathering phase is recommended. Another finding is that mode choice models can be categorized as econometric, in which parameter estimation is interpretable, and black box models, in which parameters are not explicit, therefore practical interpretations about the relation of each variable with the mode choice probability cannot be made. We conclude that applying econometric models is still recommended for initial experiences developing discrete choice models, as they continue to be widely used. Given that they are composed of a utility function, followed by the application of a model, such as the Logit and its variants, a recently used option consists of incorporating black box algorithms for the utility calculation, enhancing the quality of predictions, and then applying econometric models to keep parameter interpretability. The study and application of mode choice models have increased, having a growing number of publications in recent years. Additionally, applied algorithms have evolved and range from specialized artificial neural networks such as the deep neural networks, to classification algorithms, such as the random forest classifier. Therefore, we expect the relevance of this research area to continue growing as technology and new methods develop.

Keywords

Discrete choice model 1, Mode choice 2, Modelling transport 3, Literature Review 4.

Biographies

Juan Estrada-García is a Business Management Engineering undergraduate student at University of Monterrey. He has worked as a research assistant at University of Monterrey in traffic modelling and microsimulation. In Tecnológico de Monterrey he has worked as a Research Specialist to develop traffic simulation models. He participated in the 2020 Summer Undergraduate Research in Engineering at the University of Michigan developing analytical models for the mobility changes due to the COVID-19 pandemic. He has the Internal Auditor ISO 9001:2015 quality certification. His research interests are mathematical optimization and machine learning applications on transportation systems, mobility, and business intelligence.

Juliana Figueroa is a Business Management Engineering undergraduate student at University of Monterrey, where she was the treasurer of the APICS student group. She is currently an online exchange student in Australian Catholic University, Australia. She worked in a professional practices project for H-E-B, San Pedro, Mexico, where her team developed forecasting models for the demand of basic goods. She has also been in entrepreneurship programs where

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Ezequiel González is an Industrial Engineering undergraduate student at the University of Monterrey. He has worked as an intern on Energetic Planning, Industrial Engineering and Process Engineering, developing projects to estimate electricity consumption of steel production lines, optimizing the Head Count on water treatment plants, and helping on IATF certification of a pickling line, respectively.

Jenny Díaz-Ramírez is currently a professor of the Department of Engineering at the University of Monterrey. She has worked previously as professor at Tecnológico de Monterrey, Mexico and Pontificia Universidad Javeriana Cali, Colombia. She is an industrial engineer from Universidad del Valle, Colombia. She holds an MSc in industrial engineering from Universidad de Los Andes, Bogota, Colombia, an MSc in operations research from Georgia Tech, US, and a PhD in Industrial Engineering from Tecnológico de Monterrey. She is a member of the National System of Researchers of CONACYT, SNI Level I, since 2015 and recognized as an associated researcher by Colciencias, 2016. She is the author and co-author of scientific articles on topics such as applied optimization and statistics in health systems, air quality, energy efficiency, transport, and logistics.