# THE UNIVERSITY OF CONNECTICUT

## Civil & Environmental Engineering

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**PhD dissertation**

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#### CAST 306

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## EXPLORATION OF TEMPORAL DYNAMICS OF TRAVEL BEHAVIORS USING SEQUENTIAL DATA ANALYSIS TECHNIQUES

ABSTRACT

Over the last few years, as with many other fields, the transportation discipline has been swept by the big data revolution. The growth in data is from a variety of sources including traffic detectors, remote sensors, mobile devices, smart card data, global positioning system (GPS), and survey datasets among others. This revolution has not only brought about tremendous opportunities for conducting interesting data driven analysis for understanding activity-travel behavior, it has also highlighted challenges associated with using traditional analytical methods to analyze these large datasets.

To this end, this study first introduced a novel new Divide and Combine based approach to estimating Mixture Markov models for analyzing large scale sequential data. The validity of this approach is demonstrated using a simulation study. Further, the feasibility and applicability is highlighted by conducting a clustering analysis of large activity-travel sequences using multiyear travel survey datasets. The results suggest that travel patterns of individuals over the last three decades can be categorized into three types of travel patterns. Results also provide evidence in support of recent claims about different generational cohorts and their activity-travel behaviors. The second part of this study utilizes the method developed in the first study to analyze intra-day activity-travel behavior of the elderly (over 65 years old) using data from five waves of National Household Travel Survey (NHTS) and National Personal Transportation Survey (NPTS). By characterizing daily activity-travel behavior as categorical time series to incorporate timing and schedule of different activity-travel episodes jointly, three segments of elderly were identified based on their unique activity-travel patterns by applying the proposed Divide and Combine based approach. The heterogeneity in the segments is explored by analyzing the differences in socio-economic and demographic characteristics, generational cohort impacts as well as period effects using a multinomial logistic regression analysis. The study offered into the activity-travel characteristics of the elderly. The Markov model identified three segments of elderly. The multinomial logistic analysis offered interesting insights into the relationship between various elderly factors and the segment membership. For example, it was found that elderly who experienced 2008 recession are less likely to belong to the group that spends more time on discretionary activities and traveling. The third part of this study develops a time-varying mixture Markov model framework for analyzing dynamics in activity-travel behaviors along with a new estimation approach. The model and estimation approach are demonstrated by analyzing commute mode choice behavior of UK residents from 1991 to 2016. The results suggest that commute mode choice of UK residents can be categorized into two types of patterns. Results also indicate that probabilities of switching from one mode to other change over time.