## Title: Understanding Early Adoption of Hybrid Cars via a New Multinomial Probit Model with Multiple Network Weights

Speaker: Prof. Bikram Karmakar, University of Florida

Area: DS

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## Abstract:

Modeling demand for durable products such as cars is challenging as we do not have repeated purchases for most customers. One way to try and overcome this data scarcity is to pool information across similar customers. We implement such a pooling strategy by proposing a new multinomial probit model that simultaneously accommodates different network structures among customers by connecting them through multiple weighted networks. Unlike the traditional multinomial spatial probit, our model links consumer connectedness to their preference and marketing mix coefficients so that each subset of the parameter vector is correlated in a unique way. We propose and implement a novel Monte-Carlo Expectation-Maximization (MCEM) based approach to parameter estimation that significantly increases the number of consumers and choice alternatives that the model can handle. Our method modifies the computationally expensive E-step in the classical EM algorithm by a fast Gibbs sampling based evaluation. Further, it implements the M-step using a fast backfitting method that iteratively fits weighted regressions based on associated similarity matrices for each subset of the coefficients. We establish the convergence properties of the proposed MCEM algorithm, present computational perspectives on the scalability of the proposed method, and provide a distributed computing-based implementation.

We show that a multinomial probit model based on two different similarity structures can significantly improve the prediction of customer choices. Specifically, the best fitting model includes spatially contiguous weight structures on the intercepts based on the similarity between the consumers' previously owned vehicles, while crosscustomer correlated coefficients are based on the geographical distance between consumers. We demonstrate how an automobile manufacturer can leverage the estimated heterogeneous spatial contiguity effects to develop more effective targeted promotions to accelerate the consumer adoption of a hybrid car.

## Speaker Profile:



Bikram Karmakar is an Assistant Professor in the Statistics Department at the University of Florida, USA. Bikram received his Ph.D. in Statistics from the Wharton School, University of Pennsylvania in 2019, with Dylan S. Small as thesis advisor. Before that, he completed his bachelor's and masters' education from Indian Statistical Institute. Bikram's research focuses on causal inference, design and analysis of observational

studies, and applying statistics in social sciences, public policy, health and marketing. His research is supported by research grants from the National Science Foundation and the National Institute of Health, USA.

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