

Industrial and Systems Engineering Seminar

A Model to Estimate Individual Preferences using Panel Data

Wednesday, March 11

3:15 PM – Refreshments before the Seminar

3:30 PM – Graduate Seminar

Mechanical Engineering Room 4125 A & B



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The building block for estimating customer choice is the specification of a choice model, either parametric or nonparametric. In this work, we take a non-parametric approach. We use a simple, though quite general, non-parametric choice model in which customer are represented by partial orders of preferences. In each store visit, each customer samples a full preference list of the products, consistent with her partial order, forms a consideration set, and then chooses to purchase the most preferred product among the considered ones.

We apply this model to making individual-level demand predictions when customers make repeated purchases from the firm. The canonical example is customers buying groceries on a weekly basis from a grocer retailer, but more broadly the setting includes any application in which customers exhibit loyalty through repeated purchases be it apparel, hotel, airline, etc. The goal of the retailer is to use the information from the repeated interactions to learn the preferences of the customer and customize the offering (both the assortment and the prices) in response to the learned preferences. We assume that the retailer has collected purchase transactions tagged by customer id. This type of data, popularly referred to as “panel data”, is very common in practical settings because of the proliferation of loyalty cards, personalized discount coupons, and other marketing programs.

Our approach involves: (a) defines behavioral models to build considerations sets, (b) a clustering algorithm for determining customer segments in the market, and (c) the derivation of marginal distributions for general partial preferences under the multinomial logit (MNL) and the Mallows models. Numerical experiments on real-world panel data (the IRI Academic dataset) show that our approach allows more accurate, fine-grained predictions for individual purchase behavior compared to state-of-the-art existing methods.