Department of Statistics

DISSERTATION PROPOSAL

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Learning High-Dimensional Concave Utility Functions for Discrete Choice Models

WEDNESDAY, November 11, 2015, at 8:30 AM
Ryerson 257D, 1100 E. 58th Street

ABSTRACT

The discrete choice model explains and predicts the behavior of a consumer who chooses one item to purchase from among a set of alternatives. The consumer is assumed to assign a utility to each item based on its features, and to choose an item with probability proportional to its utility. We consider the high-dimensional setting where the number of item features is large. It is important in this setting to identify and remove features that are irrelevant to the utility function. Not only is feature selection important to skirt the curse of *dimensionality* for statistical estimation, it is of interest to understand the factors on which people base their spending decisions. We show that, when the utility function has the diminishing returns property and is thus concave, an additive approximation is safe, in that in the population setting it does not erroneously remove relevant features. We propose a two stage feature screening method based on this result, evaluate our method on both simulation data and a novel job/housing survey *dataset*, and show that it is practical and effective. Moreover, we consider estimating a mixture of concave utility functions as it has applications in splitting consumers in the markets. Besides, we also plan to propose a high-dimensional test to detect whether the utility function is linear or nonlinear.

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