STATISTICS SEMINAR

Zachariah Button

Master's Defense

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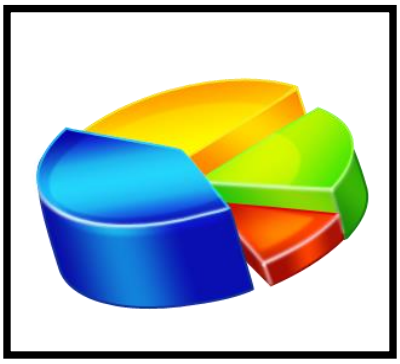

THE APPLICATION AND INTERPRETATION OF THE TWO-PARAMETER ITEM RESPONSE MODEL IN THE CONTEXT OF REPLICATED PREFERENCE TESTING

Preference testing is a popular method of determining consumer preferences for a variety of products in areas such as sensory analysis, animal welfare, and pharmacology. However, many prominent models for this type of data do not allow different probabilities of preferring one product over the other for each individual consumer, called overdispersion, which intuitively exists in real-world situations. We propose the Two-Parameter variation of the Item Response Model (IRM) in the context of replicated preference testing, which models the probability of preferring product A over product B as a function of the consumer's *latent preference* and the preference test replication's *discrimination* and *difficulty*. Because the IRM is most commonly applied to multiple-choice testing, our primary focus is the interpretation of the model parameters with respect to preference testing. We fit a Bayesian version of the Two-Parameter Probit IRM (2PP) to two real-world datasets, *Raisin Bran* and *Cola*, as well as five hypothetical datasets constructed with specific parameter properties in mind. The values of the parameters are sampled via the Gibbs Sampler, a popular Markov Chain Monte Carlo (MCMC) algorithm, and examined using various plots of the posterior distributions. Next, several different models and prior distribution specifications are compared over the *Raisin Bran* and *Cola* datasets using the Deviance Information Criterion (DIC), which is especially useful for MCMC results. Some potential difficulties in using the Gibbs Sampler with the Two-Parameter IRM are discussed in the Computation chapter, along with some solutions that we employ. The Two-Parameter IRM is a powerful tool in the context of replicated preference testing, due to its ability to accommodate overdispersion, its intuitive interpretation, and its flexibility in terms of parameterization, link function, and prior specification.