NYU Stern School of Business
Department of Information, Operations & Management Sciences
STATISTICS RESEARCH SEMINAR

TOPIC: Bayesian inference in the logistic regression model: the Polya-Gamma method
SPEAKER: James Scott (The University of Texas at Austin)
DATE: Friday, December 6th
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PLACE: KMC 5-75

ABSTRACT

Bayesian inference for the logistic regression model has long been recognized as a hard problem, due to the analytically inconvenient form of the model's likelihood function. By comparison, Bayesian inference for the probit model is much easier, owing to the simple latent-variable method of Albert and Chib (1993) for posterior sampling.

In the two decades since the work of Albert and Chib on the probit model, there have been many attempts to apply a similar computational strategy to the logit model. These efforts have had mixed results: all such methods are either approximate, or are significantly more complicated than the Albert/Chib method. Perhaps as a result, the Bayesian treatment of the logit model has not seen widespread adoption by non-statisticians in the way that, for example, the Bayesian probit model is used extensively in political science, market research, and psychometrics. The lack of a standard computational approach also makes it more difficult to use the logit link in the kind of rich hierarchical models that have become routine in Bayesian statistics.

In this talk, I propose a new data-augmentation algorithm for Bayesian logistic regression. It appeals to a new class of distributions, called the Polya-Gamma family. Although our method involves a different missing-data mechanism from that of Albert and Chib, it is nonetheless a direct analogue of their construction, in that it is both exact and simple. Moreover, because our method works for any binomial likelihood parametrized by log odds, it leads to an equally painless Bayesian treatment of the negative-binomial model for overdispersed count data. I will describe the Polya-Gamma method in detail; demonstrate its superior efficiency; and highlight a variety of examples, focusing on generalized linear mixed models.