



THE UNIVERSITY OF  
**CHICAGO**

DEPARTMENT OF STATISTICS

## Statistics Colloquium

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Bayesian Multiple Testing with Spike and Slab Priors

MONDAY, April 4, 2022, **at 12:30 PM via Zoom**

Zoom information will be sent via our weekly email distribution.

### ABSTRACT

Bayesian posterior distributions that allow for variable selection are often used in practice to address multiple testing questions. Besides their empirical success, they have been advocated among others by Bradley Efron for use in combination with empirical Bayes estimators of unknown prior parameters.

In this talk we consider three popular multiple testing procedures based on posterior distributions: the marginal posterior probabilities of the nulls (called ell-values, also called ‘local FDR’), cumulative ell-values (e.g. Sun and Cai 2007) and q-values (Storey 2003). While simple decision-theoretic arguments justify the use of these procedures from a purely Bayesian point of view, it is natural to wonder whether their use is well-founded from a frequentist point of view.

Next, in a sparse normal means setting, we investigate optimality of these procedures, if a spike-and-slab prior is taken with a weight calibrated using marginal maximum likelihood in an Empirical Bayes fashion. On the one hand, we prove that the frequentist FDR (False Discovery Rate) of these procedures is uniformly controlled: it goes to zero slowly for the ell-value procedure, and stays close to a user-specified nominal level for the q-value procedure. On the other hand, we study the power through the FNR (False Negative Rate). We investigate multiple testing minimax rates in this setting and prove that sharp adaptive minimaxity for the multiple testing risk is achieved by Empirical Bayes-calibrated ell-value procedures.

Based on joint works with Etienne Roquain (Sorbonne) and Kweku Abraham (Cambridge).