Implementation of empirical Bayes methods

In the series of talks I will discuss statistical methodology in which the basis for the data analysis entails estimating a distribution that is a feature of the "science" of the problem.

The first topic is Bayesian FDR controlling methodology, for which the prior distribution is the proportion of true null hypotheses out of the total number tested null hypotheses. In Lecture 1, I will review control over the FDR from a frequentist and Bayesian perspective and explain how it is related to selective inference. In Lecture 2, I will discuss joint work with Ruth Heller: eBayes FDR controlling procedures for discovering replicability in genomics that are considerably more powerful than the Benjamini-Hochberg procedure.

In Lectures 3 and 4 I will discuss joint work with Asaf Weinstein, Malgorzata Bogdan and Jonas Wallin, on nonparametric shrinkage estimation for high-dimensional modelling. In this case the estimated distribution is the marginal distribution of the parameter vector. In Lecture 3 I turn to classic work in statistics (by Herbert Robbins and others) to provide motivation for this approach. In Lecture 4 I present hierarchical Bayes implementation of this approach for the Linear Regression model.

In Lecture 5 I will discuss joint work with Pallavi Basu and Barak Brill, in which we apply finite Polya Tree models to estimate the marginal parameter distribution for random-effects models. I will present methodology for constructing exact point-wise confidence intervals for the CDF of the random-effects mixing distribution from mixture distribution samples. I will present an implementation of this approach, taken from the PhD Thesis of Barak Brill, of a nonparametric random-intercept Poisson GLM for microbiome data.