University of California, Irvine
Statistics Seminar

On a Quasi-Bayes Procedure
for Recursive Learning in Mixture Models

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4 p.m., 6011 Bren Hall
(Bldg. #314 on campus map)

Bayesian methods are often optimal, yet nowadays pressure for fast computations, especially with streaming data and online learning, brings renewed interest in faster, although possibly sub-optimal, solutions. To what extent these algorithms approximate a Bayesian solution is a problem of interest, not always solved.
On this background, we revisit a recursive procedure proposed by Smith and Makov (1978) for unsupervised learning in finite mixtures, and extended by Newton and collaborators (Newton and Zhang, 1999) to nonparametric mixtures. Newton's algorithm is simple and fast, and theoretically intriguing. Although originally proposed as an approximation of the Bayesian solution, its quasi-Bayes properties remain unclear. We propose a novel methodological approach. We regard the algorithm as a probabilistic learning rule, that implicitly defines an underlying probabilistic model; and we find such model. We can prove that it is, asymptotically, a Bayesian, exchangeable mixture model, and we show that, under some conditions, it implies a novel nonparametric prior on densities. Moreover, while the algorithm only offers a point estimate, we can obtain the asymptotic posterior distribution and asymptotic credible intervals for the mixing distribution. We also provide hints for tuning the algorithm to obtain desirable properties. Beyond mixture models, our approach may be of interest for recursive quasi-Bayes methods in other settings. This is a joint work with Sandra Fortini.

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