Schaeffer: Efficient Online Inference for Nonparam. Mixtures

- How does one perform efficient streaming inference in nonparametric mixture models?
- Goal: infer (filter) $p(z_t|o_{\leq t})$, subject to two constraints:
  1. Inference must be performed online, meaning the filter cannot make use of the (possibly) infinite past
  2. Inference must be efficient in the large t (sample) limit
- We propose R-CRP, a Bayesian Recursion based on the Chinese Restaurant Process that is exact for the CRP prior and requires only one approximation for inference:

$$\underbrace{p(z_t = k|o_{\leq t})}_{\text{Latent Posterior}} \approx \frac{p(o_t|z_t = k)}{p(o_t|o_{<t})}\left[\frac{1}{\alpha + t - 1}\sum_{t'<t}\underbrace{p(z_{t'} = k|o_{\leq t'})}_{\text{Previous Posteriors}} + \frac{\alpha}{\alpha + t - 1}p(K_{t-1} = k - 1|o_{<t})\right]$$

Experiments: CRP Prior, Mixture of Gaussians & more!