Convergence of latent mixing measures in finite and infinite mixture models

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We consider Wasserstein distances for assessing the convergence of latent discrete measures, which serve as mixing distributions in hierarchical and nonparametric mixture models. We clarify the relationships between Wasserstein distances of mixing distributions and f-divergence functionals such as Hellinger and Kullback-Leibler distances on the space of mixture distributions using various identifiability conditions. The convergence in Wasserstein metrics for discrete measures has a natural interpretation of the convergence of individual atoms that provide support for the discrete measure. It is also typically stronger than the weak convergence induced by standard f-divergence metrics. We establish rates of convergence of posterior distributions for latent discrete measures in several mixture models, including finite mixtures of multivariate distributions and infinite mixtures based on the Dirichlet process.