A thresholding algorithm for order selection in finite mixture models.

Summary: Order selection is an important step in the application of finite mixture models. Classical methods such as AIC and BIC discourage complex models with a penalty directly proportional to the number of mixing components. In contrast, Chen and Khalili propose to link the penalty to two types of overfitting. In particular, they introduce a regularization penalty to merge similar subpopulations in a mixture model, where the shrinkage idea of regularized regression is seamlessly employed. However, the new method requires an effective and efficient algorithm. When the popular expectation-maximization (EM)-algorithm is used, we need to maximize a nonsmooth and nonconcave objective function in the M-step, which is computationally challenging. In this article, we show that such an objective function can be transformed into a sum of univariate auxiliary functions. We then design an iterative thresholding descent algorithm (ITD) to efficiently solve the associated optimization problem. Unlike many existing numerical approaches, the new algorithm leads to sparse solutions and thereby avoids undesirable ad hoc steps. We establish the convergence of the ITD and further assess its empirical performance using both simulations and real data examples.

Keywords: EM-algorithm; finite mixture model; nonconvex penalties; regularization; sparsity; thresholding
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