Efficient computation of maximum likelihood estimators of hierarchical subspace models

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Abstract

In this talk we discuss the algorithm for computing the maximum likelihood estimator (MLE) for general log linear models for contingency tables. In general an iterative algorithm, such as the iterative proportional fitting (IPF), is required for computing the MLE of a log linear model. For a hierarchical model, it is well known that the updating rule for IPF is localized according to the separation or decomposition of the graph describing conditional independence structure among variables of the model and then the computational cost is reduced (e.g. Badsberg and Malvestute(2001)). Here we extend the localized algorithm for a hierarchical model to the hierarchical subspace model (HSM) introduced by Hara et al.(2012). HSM is considered as a hierarchical model with structures in interaction terms. More generally, HSM is defined by a hierarchical model with linear constraints among natural parameters. Therefore the HSM has the same conditional independence structure as the hierarchical model. The likelihood of a hierarchical model is decomposed according to the decomposability of the conditional independence graph. In the case of HSM, however, the decomposability of likelihood depends on the linear constrains and does not coincide with the decomposability of the graph. We define separation or decomposition for HSM corresponding to the decomposability of the likelihood and propose an localized algorithm of updating rule of IPF for HSM by using the notion.

Keywords : chordal extension, graphical model, hierarchical model, information propagation, iterative proportional fitting