Log-linear modeling using conditional log-linear structures

P. Vellaisamy · V. Vijay

Abstract   Analysis of large dimensional contingency tables is rather difficult. Fienberg and Kim (1999, *Journal of American Statistical Association*, *94*, 229–239) studied the problem of combining conditional (on single variable) log-linear structures for graphical models to obtain partial information about the full graphical log-linear model. In this paper, we consider the general log-linear models and obtain explicit representation for the log-linear parameters of the full model based on that of conditional structures. As a consequence, we give conditions under which a particular log-linear parameter is present or not in the full model. Some of the main results of Fienberg and Kim follow from our results. The explicit relationships between full model and the conditional structures are also presented. The connections between conditional structures and the layer structures are pointed out. We investigate also the hierarchical nature of the full model, based on conditional structures. Kim (2006, *Computational Statistics and Data Analysis*, *50*, 2044–2064) analyzed graphical log-linear models based on conditional log-linear structures, when a set of variables is conditioned. For this case, we employ the Möbius inversion technique to obtain the interaction parameters of the full log-linear model, and discuss their properties. The hierarchical nature of the full model is also studied based on conditional structures. This result could be effectively used for the model selection also. As applications of our results, we have discussed several typical examples, including a real-life example.

Keywords   Categorical data · Conditional log-linear model · Graphical model · Hierarchical model · Interaction factor · Log-linear model · Möbius inversion · Model combining