Generalized infinite factorization models

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Factorization models express a statistical object of interest in terms of a collection of simpler objects. For example, a matrix or tensor can be expressed as a sum of rank-one components.

However, in practice, it can be challenging to infer the relative impact of the different components as well as the number of components. A popular idea is to include infinitely many components having impact decreasing with the component index. This article is motivated by two limitations of existing methods: (1) lack of careful consideration of the within component sparsity structure; and (2) no accommodation for grouped variables and other non-exchangeable structures. We propose a general class of infinite factorization models that address these limitations. Theoretical support is provided, practical gains are shown in simulation studies, and an ecology application focusing on modelling bird species occurrence is discussed.