A Deep Dynamic Latent Block Model for Co-clustering of Zero-Inflated Data Matrices

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Abstract

The simultaneous clustering of observations and features of data sets (known as co-clustering) has recently emerged as a central machine learning application to summarize massive data sets. However, most existing models focus on continuous and dense data in stationary scenarios, where cluster assignments do not evolve over time. This work introduces a novel latent block model for the dynamic co-clustering of data matrices with high sparsity. To properly model this type of data, we assume that the observations follow a time and block dependent mixture of zero-inflated distributions, thus combining stochastic processes with the time-varying sparsity modeling. To detect abrupt changes in the dynamics of both cluster memberships and data sparsity, the mixing and sparsity proportions are modeled through systems of ordinary differential equations. The inference relies on an original variational procedure whose maximization step trains fully connected neural networks in order to solve the dynamical systems. Numerical experiments on simulated and real world data sets demonstrate the effectiveness of the proposed methodology in the context of count data.

Keywords: Co, clustering, Latent Block Model, zero, inflated distributions, dynamic systems, VEM algorithm

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