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Label Propagation Assisted Soft-constrained Deep Non-negative Matrix Factorization for Semi-supervised Multi-view Clustering

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To address the pressing challenge of capturing complex non-linear structures in semi-supervised multi-view clustering, we introduce a fundamentally novel framework:Label Propagation Assisted Soft-constrained Deep Non-negative Matrix Factorization for Semi-supervised Multi-view Clustering (LapSDNMF). Unlike prior approaches,LapSDNMF innovatively integrates deep hierarchical modelling with label propagation to jointly exploit the power of non-linear representation learning and the guidance from limited labelled data. By embedding a predictive membership matrix as a soft constraint within a deep architecture, LapSDNMF enables seamless propagation of label information, guided by graph-based regularization that reflects local data geometry. LapSDNMF unifies deep learning and graph-theoretic techniques in a principled optimisation framework. We also develop a novel, efficient algorithm based on multiplicative update rules to solve the resulting optimisation problem. Extensive experiments on diverse real-world datasets demonstrate that LapSDNMF consistently and significantly outperforms existing state-of-the-art multi-view clustering methods.

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