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Label and Orthogonality Regularized Non-Negative Matrix Factorization for Image Classification

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Abstract

As one of the most popular data-representation methods, non- negative matrix factorization (NMF) has been widely used in image processing and pattern recognition. Compared with other dimension reduction methods, we can interpret the data with psychological intuition using NMF since NMF can decompose the whole into visual parts by learning the non-negative basis. However, the original NMF lacks of extracting the discriminant information of the data for the image classification task. For enhancing the discriminant and parts-based interpretability, this work proposes a label and orthogonality regularized NMF (LONMF) algorithm based on the squared Euclidean distance. LONMF takes into account the label consistence with the low -dimensional projected data and orthogonal property of the non-negative basis. By integrating the non-negative constraint, label consistence, and orthogonal property into the objective function, the efficient updating procedure can obtain a discriminant basis matrix. Meanwhile, we design a linear classifier using the projected data to guide the label for efficient image classification task. Experiment results of the competitive NMF variants on the challenging digit and face databases demonstrate the effectiveness of the proposed LONMF algorithm.

Keywords: Non-negative matrix factorization (NMF), orthogonal property, label consistence, image classification

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