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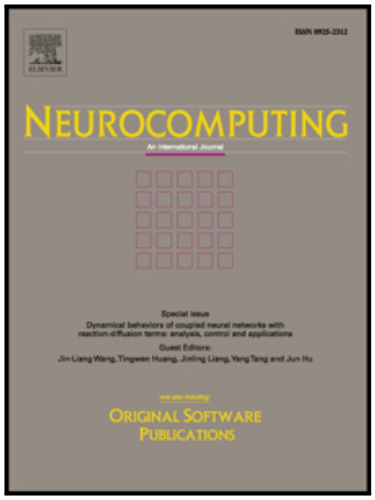

Block Principal Component Analysis for Tensor Objects with Frequency or Time Information

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Block Principal Component Analysis for Tensor Objects with Frequency or Time Information

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Abstract

Feature extraction is a prerequisite in many machine learning and data mining applications. As the advancement of data acquisition techniques, nowadays tensor objects are accumulated with respect to frequency or time information in a great number of fields. For instance color or hyperspectral faces in multichannel information, and human gait motion in time information are obtained. In this paper, we propose and develop a block principal component analysis (BPCA) to extract features for this kind of tensor objects. Our idea is to unfold tensor objects according to their spatial information and frequency/time information, and represent them in block matrix form. The corresponding covariance matrix for frequency/time information can be captured and used. The block eigen-decomposition of such covariance matrix is employed to seek for projection solution as features. Both reconstruction and classification problems can be solved via these projected features. Extensive experiments have been conducted on various face or gait databases to demonstrate the superiority of BPCA compared with existing methods such as PCA, $(2D)^2$PCA, MPCA, and UMPCA in terms of effectiveness. Moreover, the proposed BPCA is competitively efficient compared to these existing methods.

Keywords: tensors, feature extraction, hyperspectral face recognition, gait recognition, block matrix, covariance matrix