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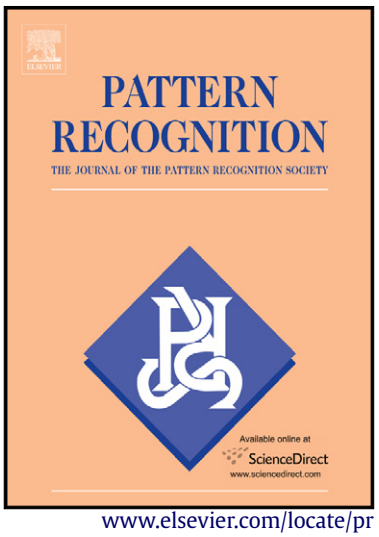

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PII: S0031-3203(14)00224-6
DOI: http://dx.doi.org/10.1016/j.patcog.2014.05.022
Reference: PR5130

To appear in: *Pattern Recognition*

Received date: 22 January 2014
Revised date: 18 May 2014
Accepted date: 31 May 2014

Cite this article as: Xue-Qiang Zeng, Guo-Zheng Li, Incremental partial least squares analysis of big streaming data, *Pattern Recognition,* http://dx.doi.org/10.1016/j.patcog.2014.05.022

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Incremental Partial Least Squares Analysis of Big Streaming Data

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Abstract

Incremental feature extraction is effective for facilitating the analysis of large-scale streaming data. However, most current incremental feature extraction methods are not suitable for processing streaming data with high feature dimensions because only a few methods have low time complexity, which is linear with both the number of samples and features. In addition, feature extraction methods need to improve the performance of further classification. Therefore, incremental feature extraction methods need to be more efficient and effective. Partial least squares (PLS) is known to be an effective dimension reduction technique for classification. However, the application of PLS to streaming data is still an open problem. In this study, we propose a highly efficient and powerful dimension reduction algorithm called incremental PLS (IPLS), which comprises a two-stage extraction process. In the first stage, the PLS target function is adapted so it is incremental by updating the historical mean to extract the leading projection direction. In the second stage, the other projection directions are calculated based on the equivalence between the PLS vectors and the Krylov sequence. We compared the performance of IPLS with other state-of-the-art incremental feature extraction methods such as incremental principal components analysis, incremental maximum margin criterion, and incremental inter-class scatter using real streaming datasets. Our empirical results showed that IPLS performed better than other methods in terms

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