Just-in-time adaptive similarity component analysis in nonstationary environments

Abstract

This article introduces a just-in-time adaptive nonparametric multiclass component analysis technique for application in nonstationary environments. This generative model enables adaptive similarity-based classifiers to classify time-labeled inquiry patterns with superior accuracy in low-dimensional feature space. While there are adaptive forms of feature extraction methods, which transform training patterns to low-dimensional space and/or improve classifier accuracy, they are vulnerable to nonparametric changes in data and must continuously update their parameters. In the proposed method, an optimal transformation matrix transforms time-labeled instances from the original space to a new feature space to maximize the probability of selecting the correct class label for incoming instances using similarity-based classifiers. To this end, for a given time-labeled instance, nonparametric intra-class and extra-class distributions are proposed. The proposed method is also furnished to a temporal detector to provide the most convenient time for the adaptation phase. Experimental results on real and synthesized datasets that include real and artificial changes demonstrate the performance of the proposed method in terms of accuracy and dimension reduction in dynamic environments.

Keyword: Just-in-time adaptive component analysis; Adaptive classification; Nonparametric data stream processing; Similarity-based feature extraction