Original Article

Distance‐based mixture modeling for classification via hypothetical local mapping

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Abstract

We propose a new approach for mixture modeling based only upon pairwise distances via the concept of hypothetical local mapping (HLM). This work is motivated by the increasingly commonplace applications involving complex objects that cannot be effectively represented by tractable mathematical entities. The new modeling approach consists of two steps. A distance‐based clustering algorithm is applied first. Then, HLM takes as input the distances between the training data and their corresponding cluster centroids to estimate the model parameters. In the special case where all the training data are taken as cluster centroids, we obtain a distance‐based counterpart of the kernel density. The classification performance of the mixture models is compared with other state‐of‐the‐art distance‐based classification methods. Results demonstrate that HLM‐based algorithms are highly competitive in terms of classification accuracy and are computationally efficient. Furthermore, the HLM‐based modeling approach adapts readily to incremental learning. We have developed and tested two schemes of incremental learning scalable for dynamic data arriving at a high speed.

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