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**On using prototype reduction schemes to optimize locally linear reconstruction methods.**

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Summary: This paper concerns the use of prototype reduction schemes (PRS) to optimize the computations involved in typical  $k$ -nearest neighbor ( $k$ -NN) rules. These rules have been successfully used for decades in statistical pattern recognition (PR) [1] and [15] applications and are particularly effective for density estimation, classification, and regression because of the known error bounds that they possess. For a given data point of unknown identity, the  $k$ -NN possesses the phenomenon that it combines the information about the samples from a priori target classes (values) of selected neighbors to predict the target class of the tested sample, or to estimate the density function value of the given queried sample. Recently, an implementation of the  $k$ -NN, named as the locally linear reconstruction (LLR) [2], has been proposed. The salient and brilliant feature of the latter is that by invoking a quadratic optimization process, it is capable of systematically setting model parameters, such as the number of neighbors (specified by the parameter,  $k$ ) and the weights. However, the LLR takes more time than other conventional methods when it has to be applied to classification tasks. To overcome this problem, we propose a strategy of using a PRS to efficiently compute the optimization problem. In this paper, we demonstrate, first of all, that by completely discarding the points not included by the PRS, we can obtain a reduced set of sample points, using which, in turn, the quadratic optimization problem can be computed far more expediently. The values of the corresponding indices are comparable to those obtained with the original training set (i.e., the one which considers all the data points) even though the computations required to obtain the prototypes and the corresponding classification accuracies are noticeably less. The proposed method has been tested on artificial and real-life data sets, and the results obtained are very promising, and could have potential in PR applications.

*Keywords:* prototype reduction schemes (PRS);  $k$ -nearest neighbor ( $k$ -NN) learning; locally linear reconstruction (LLR)

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