Local Classification Methods for Heterogeneous Classes

Julia Schiffner and Claus Weihs

Technische Universität Dortmund, Germany

Abstract. Many classification methods, for example LDA, QDA or *Fisher discriminant analysis* (FDA), assume the classes to form homogeneous groups. But in practical applications heterogeneous classes that consist of multiple subclasses can often be observed. In such cases *local* classification methods that take the local class structure, i. e. the subclasses, into account can be beneficial. In package `klaR` (Weihs et al., 2005) the function `loclda` that performs *localized linear discriminant analysis* (Czogiel et al., 2007) is already available. Now, three more local classification methods are added.

The first two methods, the *common components classifier* and the *hierarchical mixture classifier* (Titsias and Likas, 2002), rely on modeling the class conditional densities by means of gaussian mixtures. The third method, *local Fisher discriminant analysis* (LFDA), was proposed by Sugiyama (2007). FDA seeks for a projection of the data into a subspace such that the between-class scatter is maximized and the within-class scatter is minimized. In LFDA the projection additionally has to fulfill the condition that nearby data points in the same class are kept close to each other and thus the local class structure is preserved.

The three local methods and their implementations in `R` are presented and their usefulness is demonstrated in several examples.

References

I. Czogiel, K. Luebke, M. Zentgraf, and C. Weihs. Localized linear discriminant analysis. In R. Decker and H.-J. Lenz, editors, *Advances in Data Analysis*, pages 133–140, Heidelberg, 2007. Springer.

M. Sugiyama. Dimensionality reduction of multimodal labeled data by local Fisher discriminant analysis. *Journal of Machine Learning Research*, (8):1027–1061, May 2007.

M. K. Titsias and A. C. Likas. Mixture of experts classification using a hierarchical mixture model. *Neural Computation*, 14:2221–2244, 2002.

C. Weihs, U. Ligges, K. Luebke, and N. Raabe. klaR analyzing german business cycles. In D. Baier, R. Becker, and L. Schmidt-Thieme, editors, *Data Analysis and Decision Support*, pages 335–343. Springer, Berlin, 2005.