Supervised classification of functional data in the presence of covariates

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A covariate-adjusted supervised classification method is proposed for functional response functions with taking into account the additional covariate effects. The response functions in each class are embedded in a cluster subspace spanned by a covariate-adjusted mean function and a set of eigenfunctions of the covariance kernel based on the covariate-adjusted Karhunen-Loève expansion. Under the assumption that all the cluster subspaces are different, a newly observed function is classified into the best predicted class by minimizing the distance between the observation and its projection onto the cluster subspaces among all classes. The theoretical derivations indicate that the covariate adjustment is advantageous to improving the discrimination capability, as compared with the classification without covariate adjustment, especially when the covariate effects dominate the cluster structures. The classification capability of the proposed method and the improvement obtained in correct classification rates by covariate adjustment are demonstrated through simulation studies and real data application.

Keywords: Discriminant analysis; Functional data analysis; Functional principal components analysis.