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DISCUSSION

Comments on: Probability enhanced effective dimension reduction for classifying sparse functional data

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Congratulations to Yao, Wu, and Zou for extending the idea of effective dimension reduction to the framework of classifying sparse functional data. Traditionally, people consider conducting functional principal component analysis (FPCA) on the (sparse) functional data first, and then the first few leading functional principal component (FPC) scores are chosen to build a classifier. The FPCA approach can reduce the dimension of the predictor; however, it fails to account for the relationship between the FPC scores and the binary response. Usually, there is no clear evidence that those FPC scores, which have less variability, have more power in terms of prediction. In contrast, the PWEFCS method, proposed by the authors, is able to capture the relationship between the binary response Y and the functional predictor X, since the EDR space is constructed via cumulative slicing based on the conditional probabilities $p(\mathbf{X}) = p(Y = 1|\mathbf{X})$.

The method proposed here is based on the assumption (Assumption 2) that the EDR space exists. A simulation study may be necessary to evaluate the performance of this method when the assumption is violated. For instance, consider the following model:

$$f(\mathbf{X}) = \exp(< \beta_1, \mathbf{X} > \cdot < \beta_2, \mathbf{X} >) - 1 + \epsilon.$$

It will be interesting to make a comparison between the proposed approach and the FPCA-based approach in terms of the classification error.

This comment refers to the invited paper available at: doi:10.1007/s11749-015-0470-2.

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In Section 3, cross-validation is suggested to choose the tuning parameter λ in WSVM, the dimension of EDR space, i.e., K and the truncation level s_n. Since these three parameters need to be tuned simultaneously, computational efficiency becomes a big issue. Information criterion such as corrected AIC or BIC may provide a better selection rule, considering the intensive computation of cross-validation.

The approach is very powerful in classifying binary function data. It will be easier to be used if the authors can make the software implementing PWEFCS publicly available. The paper considers only the binary classification problem. We are wondering whether this method can be generalized to address the multi-class classification problem.