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A LEARNING ALGORITHM COMBINING FUNCTIONAL DISCRIMINANT COORDINATES AND FUNCTIONAL PRINCIPAL COMPONENTS

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Abstract

A new type of discriminant space for functional data is presented, combining the advantages of a functional discriminant coordinate space and a functional principal component space. In order to provide a comprehensive comparison, we conducted a set of experiments, testing effectiveness on 35 functional data sets (time series). Experiments show that constructed combined space provides a higher quality of classification of LDA method compared with component spaces.

Keywords: functional principal components, functional discriminant coordinates.

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REFERENCES

- [1] G. Bergmann and G. Hommel, *Improvements of general multiple test procedures for redundant systems of hypotheses*, in: Multiple Hypotheses Testing, P. Bauer, G. Hommel, E. Sonnemann (Ed.), Springer (1988) 110–115.
doi:10.1007/978-3-642-52307-6_8
- [2] D. Cozzolino, E. Restaino and A. Fassio, *Discrimination of yerba mate (ilex paraguayensis st. hil.) samples according to their geographical origin by means of near infrared spectroscopy and multivariate analysis*, Sensing and Instrumentation for Food Quality and Safety **4** (2002) 67–72. doi:10.1007/s11694-010-9096-y
- [3] R.A. Fisher, *The use of multiple measurements in taxonomic problem*, Annals of Eugenics **7** (1936) 179–188. doi:10.1111/j.1469-1809.1936.tb02137.x
- [4] S. Garcia and F. Herrera, *An extension on "statistical comparisons of classifiers over multiple data sets" for all pairwise comparisons*, Journal of Machine Learning Research **9** (2008) 2677–2694.
- [5] T. Górecki and M. Krzyśko, *Functional Principal Components Analysis*, in: Data analysis methods and its applications, J. Pociecha, R. Decker (Ed.), C.H. Beck (2012) 71–87.
- [6] T. Górecki, M. Krzyśko and Ł. Waszak, *Functional discriminant coordinates*, Communication in Statistics - Theory and Methods **43** (5) (2014) 1013–1025.
doi:10.1080/03610926.2013.828074
- [7] H. Hotelling, *Analysis of a complex of statistical variables into principal components*, Journal of Educational Psychology **24** (1933) 417–441, 498–520.
doi:10.1037/h0071325
- [8] R. Iman and J. Davenport, *Approximations of the critical region of the freidman statistic*, Communications in Statistics - Theory and Methods **9** (6) (1980) 571–595.
doi:10.1080/03610928008827904
- [9] E. Keogh, Q. Zhu, B. Hu, Y. Hao, X. Xi, L. Wei and C.A. Ratanamahatana, *The UCR Time Series Classification/Clustering*, Homepage, 2011.
http://www.cs.ucr.edu/~eamonn/time_series_data/.
- [10] N.K. Kwak, S.H. Kim, C.W. Lee and T.S. Choi, *An application of linear programming discriminant analysis to classifying and predicting the symptomatic status of hiv/aids patients*, Journal of Medical Systems **26** (5) (2002) 427–438.
- [11] T.S. Lim, W.Y. Loh and Y.S. Shih, *A comparison of prediction accuracy, complexity, and training time of thirty-three old and new classification algorithms*, Machine Learning **40** (3) (2000) 203–228. doi:10.1023/A:1007608224229
- [12] J.O. Ramsay and B.W. Silverman, *Functional Data Analysis*, Second Edition (Springer, 2005). doi:10.1007/b98888
- [13] G.A.F. Seber, *Multivariate Observations* (Wiley, 1984). doi:10.1002/9780470316641
- [14] G. Shmueli, *To explain or to predict?* Statistical Science **25** (3) (2010) 289–310.
doi:10.1214/10-STS330

- [15] F. Song, D. Zhang, Q. Chen and J. Wang, *Face recognition based on a novel linear discriminant criterion*, Pattern Analysis and Applications **10** (2007) 165–174.
doi:10.1007/s10044-006-0057-3

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