



Editorial on the special issue on Functional Data Analysis and Related Topics

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1 Introduction

On the occasion of the 4th International Workshop on Functional and Operatorial Statistics (IWFOS 2017), dedicated to the memory of Peter Hall, the journal *Computational Statistics* decided to publish a special issue devoted to Functional Data Analysis and Related Topics. The 10 papers included in this special issue are authored not only by researchers who presented their work in IWFOS 2017, but also by other active researchers in the field. These contributions are exploring many different faces of this area, with special attention to its computational statistical aspects. We would like to thank the authors of papers in this special issue. The number of submissions and their high scientific level implied a selective reviewing process. We would like to extend these thanks to authors whose contributions could not be included in this issue.

In summary, we believe that most of the scientists in Functional Data Analysis (FDA) will be interested in reading this issue. We sincerely hope that this will be the case and that our enterprise will serve as promotion for further research on FDA and on its connections with Big Data analysis. Undoubtedly, it still remains many challenges to be taken up in FDA for which we would be very pleased if this special issue could be of some help.

We still remember the important role played by the IWFOS meetings. To the readers interested in the evolution of FDA in the last ten years, we recommend the books of proceedings (short papers) edited by Dabo-Niang and Ferraty (2008), Ferraty (2011),

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Bongiorno et al. (2014) and Aneiros et al. (2017) corresponding to the four editions of IWFOs (2008 in Toulouse, France; 2011 in Santander, Spain; 2014 in Stresa, Italy; and 2017 in A Coruña, Spain, respectively), as well as the special issues edited by Ferraty (2010) and Goia and Vieu (2016) (linked to IWFOs 2008 and 2014, respectively) and Aneiros et al. (2019) (a companion special issue to this one, linked to IWFOs 2017).

2 Contents of this special issue

The articles included in this special issue are briefly reviewed now. A goodness-of-fit procedure for functional data is presented in Bongiorno et al. (2019). The method uses some estimate of the volumetric part in the small-ball probability factorization which plays the role of a real complexity index. The test procedure is applied to a financial time series.

The paper by Febrero-Bande et al. (2019) considers the problem of variable selection for additive regression models when some of the explanatory variables are functional and some other are scalar, multivariate, directional, etc.

A functional dynamic factor model is proposed in Burdejová and Härdle (2019) to study the dynamics of expectile curves. The model is applied to climatology for temperature, rainfalls and wind speed daily functional data.

The paper by Yua et al. (2019) presents a robust estimation procedure for partial functional linear regression models, using exponential squared loss. The slope function and functional predictor variable are approximated by functional principal component basis functions.

A new approach for functional data clustering based on a combination of a hypothesis test of parallelism and the test for equality of means is proposed in Zamboni et al. (2019). The method is incorporated into a modified k-means algorithm to partition subjects into clusters and find the cluster centers. The method is applied to simulated data as well as for four data sets concerning Canadian weather, growth, the Yeast gene, and Fat spectrum.

Clustering of effects curves techniques are applied in Sottile and Adelfio (2019) to obtain quantile regression coefficients, in order to find similarity of effects based on quantile regression models. The method is applied to three datasets related to earthquakes, lung function and pollution.

A new R package, fdANOVA, is presented in Górecki and Smaga (2019). It provides a broad range of global analysis of variance methods for univariate and multivariate functional data. The computation time is reduced by using parallel implementation.

The multivariate two-sample problem for high-dimensional data has been studied in Tsukada (2019). New criteria are proposed for two previously reported tests and theoretical properties are proven for the new test when the dimension tends to infinity and the sample size is fixed, and when the dimension is fixed and the sample size tends to infinity.

Functional principal component analysis is used in Koláček et al. (2019) to differentiate between the control and the treatment groups in an experiment concerning sensory perception in neural processing using evoked potentials.

Finally, in Traore et al. (2019), spline smoothing methods with nonparametric functional and dimension reduction methods are applied for nuclear safety experiments in order to perform functional data clustering for acoustic emission curves.

3 Some acknowledgments

We would like to remark the important contribution of a large panel of scientific experts whose help has been essential along the reviewing process. All of them are gratefully thanked for having kindly agreed to act as referees. Their comments contributed to the quality of this special issue.

Even if it covers a much wider scope, this issue would probably not be what it is without the last edition of this event, IWFOs 2017, held in A Coruña (Spain) in June 2017. We would like to thank all the people who have contributed to the success of this conference, with special attention to J. Aston, A. Aue, A. Cuevas, A. Delaigle, J. Goldsmith, S. Huckemann, A. Nieto-Reyes, V. Panaretos, P. Raña and L. Sangalli for their keynote presentations, to A. Aguilera, G. Boente, P. Delicado, A. Goia, W. González-Manteiga, S. Greven, S. Hörmann, M. Hušková, S. Marron, J. Park, D. Politis, J. Romo, P. Secchi, H. Shang and S. van de Geer for taking part in the Scientific Committee and E. Bongiorno, R. Fernández-Casal, M. Francisco-Fernández, S. Naya, P. Raña, E. Salinelli, J. Tarrío-Saavedra, S. Viguier-Pla, J.A. Vilar and J.M. Vilar whose actions as organizers have been greatly appreciated.

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