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Review on habilitation thesis of Mgr. David Kraus, Ph.D.

The habilitation thesis entitled *Topics in Functional Data Analysis* consist of five original papers of the author and a short introduction briefly describing the author's contribution to the functional data analysis. All presented papers appeared in excellent statistical journals.

Statistical methods developed in the presented papers are motivated by a real data mostly from biological and medical research. The common technique used in all papers is the analysis of the covariance operator of functional data and corresponding Karhunen-Loève expansion.

The first paper deals with two-sample comparison of the covariance operators of Gaussian processes. This research is motivated by the analysis of DNA minicircles. In the second paper the authors use dispersion operators to develop two-sample second-order tests for equality of dispersion operators. Analysis of incompletely observed functional data plays an important role in FDA. This problem is studied in all three remaining papers from different points of view. Namely, the main goal of the third paper the completion of the data and estimation of eigenvalues and eigenfunctions of the covariance operator. Classification for partially observed functional data is developed in

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the fourth paper, and the fifth paper presents the theoretical background and asymptotic results which allow to derive inferential procedures for partially observed data.

The contribution of the papers to the emerging field of functional data analysis is substantial. Despite the fact that all methods are data motivated, there is always deep mathematical analysis, and the papers always include detailed and thorough proofs of the validity of the statistical methodology. In particular, the developed methods show an innovative approach rather than being just a recyclement of known results. I personally appreciate the methods for partially observed functional data as this is a common situation in data collection that some parts of the data are missing.

It should be also emphasized that the papers and their overview are very well written. A reader gets very clearly stated motivation, explanation of the main idea, description of the solution and a guide to applications of the methods. That is not always the case in functional data literature that even deep results and technically difficult parts are presented in both clear and rigorous form.

All the papers show that David Kraus is an excellent expert in FDA. What need not to be clear from the thesis is the ability of David Kraus not only to conduct high-level theoretical statistical research but also his skill to work in team aplying advanced statistical methods in many disciplines. David Kraus is an excellent expert and it is beyond any doubts that the presented thesis meets all requirements for habilitation thesis in the field of Applied Mathematics and Statistics.

Conclusion

The habilitation thesis entitled “Topics in Functional Data Analysis” by David Kraus **fulfils** requirements expected of a habilitation thesis in the field of Mathematics – Applied Mathematics.

Sincerely

Daniel Hlubinka