

# **Oberwolfach Seminar: Statistical Inference for Complex Data *Random Matrices, Random Functions & Geometry and Topology***

## **Date:**

May 20 – May 26, 2018

## **Organizers:**

Alexander Aue, UC Davis  
Wolfgang Polonik, UC Davis

## **Program:**

An introduction to statistical inference for modern complex data structures with a special focus on:

- (1) Random matrix theory applications in statistics, in particular the asymptotic characterization of the eigenvalues of sample covariance matrices in the high-dimensional regime and their practical use.
- (2) Functional data analytic methods, in particular the use of Hilbert space and linear operator theory and their application to functional time series prediction and estimation.
- (3) Topological data analysis, in particular how feature extraction can be performed with the persistent homology and how topological features can be used to build methods for statistical inference.
- (4) Emphasizing the connection between topological data analysis and geometric approaches to statistical analysis, using Morse theory.

## **Introductory reading:**

Chazal, F., Fasy, B.T., Lecci, F., Rinaldo, A., Singh, A. & Wasserman, L. (2013). On the bootstrap for persistence diagrams and landscapes. *Modeling and Analysis of Information Systems* 20, 96-105.

Chazal, F. & Michel, B. (2017). An introduction to topological data analysis: fundamental and practical aspects for data scientists. arXiv:1719.04019.

Paul, D. & Aue, A. (2014). Random matrix theory in statistics: a review. *Journal of Statistical Planning and Inference* 150, 1-29.

Ramsay, J. & B. Silverman (2005). *Functional data analysis* (2nd edition). Springer, New York.

## **Deadline for applications:**

March 19, 2018 (to seminars@mfo.de)