Abstract. The constant emergence of novel technologies result in novel data generating devices and mechanisms that lead to a prevalence of highly complex data. To analyze such data, novel statistical methodologies need to be developed. This workshop addressed challenges that arise in the theoretical analyses of procedures in which geometry, shape and topology play central roles. The theoretical ideas involved here intersect deeply with a wide variety of fields, including mathematical statistics, probability theory, computational topology, and computational and differential geometry. The workshop brought together scholars with different perspectives, with the goal of facilitating cross-pollination to spur the development of new ideas, new analytical approaches, and new methods in geometric and shape statistics.


Introduction by the Organisers

The half-workshop Statistics for Shape and Geometric Features, organized by Dragi Anevski (Lund), Geurt Jongbloed (Delft), Christopher Genovese (Pittsburgh) and Wolfgang Polonik (Davis), was held July, 3rd – July 9th, 2016. This meeting was well attended by 26 participants with diverse geographic, demographic and disciplinary representation. For several of the participants it was the first time they attended an Oberwolfach Workshop, and they were deeply impressed by the workshop and the immensely stimulating atmosphere at the Forschungsinstitut.

The workshop consisted of presentations of the participants and discussions between them, either in groups or individually. The presentations earlier in the weeks
were intended to build a common platform for the participants, who came to the workshop with different backgrounds. These presentations were addressing principal component analysis for non-Euclidean data, inference for geometric objects, inference under shape constraints (log-concavity), and topological data analysis, respectively. Later in the week, the group discussed several emerging problems and ideas, including estimation in graphs under monotonicity constraints, algorithmic approaches for non-standard big data using the divide-and-conquer paradigm, and the estimation of flow lines. Some presentations also addressed applications of geometric/shape ideas to cutting-edge scientific problems, such as improving microscopy based image analysis, or the analysis of the filamentary structure of the world wide web. The PhD students attending the workshop also had an opportunity to present their dissertation research.

In summary, the workshop brought together scholars with related, but different statistical backgrounds that included shape constrained inference, topological data analysis, inference for geometric objects, and shape analysis. Corresponding major statistical problem areas include clustering and mode finding, identification and characterization of low-dimensional structures (e.g., embedded manifolds), as well as asymptotic distribution theory for estimators under various shape constraints. Another interesting aspect of the workshop was provided by a second half-workshop on Learning Theory and Approximation that was running in parallel. There was a lively interaction between the participants of the two workshops with complementary themes.

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