

## SCIENTIFIC REPORT

The final project meeting of the EST ACAT Network Project was held at IST Austria in Klosterneuburg, Austria, from July 6 to 10, 2015. Each of the five days featured the talk of a prominent invited speaker as well as contributed talks both in the morning and in the afternoon. The talks are arranged with ample time in between to encourage interactions and scientific discussions between the participants. To be more precise: the invited speaker scheduled on Tuesday had to cancel in the last minute so we substituted a contributed talk for the invited talk, on Wednesday afternoon, we organized an excursion at which the participants visited a local Abbey, and on Friday the program ended after the morning session.

The program represents a balance between work of researchers inside and outside the project, as well as between work in computational algebraic topology proper and work in related areas.

**Day One.** The theme of this day is combinatorial topology in geometry. Topics include Tarski's plank problem, Tverberg's theorem, and random knots. The focus here is on exploiting topological methods to prove statements in geometry.

**Day Two.** The theme of this day is the algebra of (multi-parameter) persistent homology and its relation to methods in machine learning. There are several proposals on how to connect these areas to produce effective shape learning algorithms.

**Day Three.** The invited talk on a multi-scale mapper was complemented by a fast algorithm for the offset topology of shapes and a combinatorial discussion of graph planarity and extension to multi-graph embedding and allowing for crossings between graphs.

**Day Four.** The main theme of this day is the application of topological data analysis methods to the sciences, including geology and neuroscience. This was complemented by two talk on the topology of distributed computing.

**Day Four.** The invited talk on this day returns to the Tverberg theorem also discussed on Day One. The focus is on the recent breakthrough leading to a counterexample of the topological version of this theorem. It came as a big surprise because the version has proofs in many but alas not all dimensions.

In summary, the program featured advances at a number of fronts, all within the scope of the project. Most rewarding is to see the formation of many collaborations among the researchers in the field and, of course, the elevation of the field through exchanges of insights in a broad and deep sense as facilitated by the project.