Scientific report: Fixed Parameter Computational Geometry

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Description and aims

Algorithms and data structures form a key component of any software system. Many algorithmic problems arising in practice are intractable, which means there are no fast algorithm solving these problems optimally on all problem instances. The area of fixed-parameter tractability tries to gain more insight into such problems, by analyzing them in terms of some well-defined parameter(s) that capture the difficulty of the problem. In many applications, algorithms are needed for problems involving spatial data. Computational geometry is the area within algorithm research dealing with spatial data. This workshop brought together researchers from the areas of computational geometry and fixed-parameter tractability, to advance the study of intractable problems on spatial data.

Outcome

We believe that the workshop was very successful in what it aimed to establish. The workshop excelled in a lively atmosphere with participants that learned a lot from the other field (and a little bit as well from their own), scientific research in intensive discussions in groups, new collaborations being formed that did not exist yet.

During the workshop, the participants worked in small teams on a number of open problems. We made a small survey by email among the participants, and many reported that they are currently working on joint papers with other participants, based upon work that was initiated / done during the week of the workshop in the Lorentz center.

Scientific Developments and Aha-insights

There were no `great scientific breakthroughs' in the workshop, but instead, a large collection of interesting new developments, smaller insights, and new work in progress. A partial list of such results is: red-blue separation; graph drawing; disk graphs; unit disk graphs; dominated "hypervolume" and convex-hull volume selection; maximum number of points in general position.

There were several aha-moments by participants, in particular when unexpected connections between the fields were shown in lectures or during work on problems, e.g., the tutorial by Benjamin Burton showed the (for many unknown) connection between topology (including the theory of knots) and graph algorithms (in particular, the notion of treewidth).

Format

We had a number of tutorials, a number of talks by participants explaining recent work, and open problem sessions and progress reports, with an outlook lecture at the end of the workshop. After the first open problem session, participants formed groups to work on the stated open problems.

We plan to organize a follow-up workshop, with a similar format: possibly somewhat less tutorials as the participants are now more up to knowledge of the different fields and possibly with additional emphasis on topology.

Other comments

We thank the Lorentz staff for the excellent help in all aspects concerning the workshop. Probably due to the timing in the year, several senior staff cancelled, often due to obligations at their own universities; but we also had a relatively large number of requests for participation by younger scientists, attracted by the topic of the workshop. This proved to be beneficial for the workshop, as

these younger participants were very active in cooperation and discussion. We had a short email survey with the participants of the workshop; information in this report is partly based on the comments of participants