Fixed-Parameter Computational Geometry

14 – 18 May 2018 @Oort

Aim of the workshop: bringing together FPT algorithms and computational geometry/topology.

A significant number of problems involving spatial data are intractable, so combining the fields of computational geometry and fixed-parameter algorithms is natural. Somewhat surprisingly, however, the work at the interface of these two fields is currently rather limited: there have been papers in this direction, but compared to domains like graph algorithms or logic, the number of papers is very small.

In 2016 we therefore organized a Lorentz workshop to bring together experts from the area of FPT algorithms computational geometry. The workshop was highly successful, and so the goal of second workshop, which was held April 4 - 18, 2018, was to build on the current momentum and further stimulate research at the interface between FPT algorithms and computational geometry. We also expanded the topic by including computational topology.

The main purpose of the new workshop was to identify important new key problems in this interface, and to work with the participants towards the solution of these problems.

Format and program.

Since our earlier workshop already lied the foundations for collaborations between the two fields, our new workshop had a focus on collaboration and problem solving (instead of having many talks and tutorials).

The key elements of the program were as follows.

- Open problem sessions: presentations and traditional open-problem session.
  We started the workshop with two open problem sessions. Traditional open-problem sessions are rather free-form, with participants giving very short and somewhat improvised presentations of their open problems. We decided to ask the participants for open problems already before the workshop, and offer them the possibility to give a 15 minutes presentation about their open problem. This format worked out very nicely, since in the presentations allowed to describe the background and related work in some more detail, to bring the audience up to speed very efficiently.

  We also had a traditional open problem session, for open problems that did not need a longer introduction and for more spontaneously arising open problems.

  We also set up a joint document on Overleaf, which was accessible to all participants, and which documented all open problems.

- Solving open problems in groups and progress-report sessions.
  Most of the week was spent on collaborating on the presented open problems. This was done in groups that formed naturally based on common interests of the participants. We also had plenary progress-report sessions. Here the subgroups would present the new insights or results they obtained so far. This also made it possible for people to join other groups, as everyone was kept informed about the status of each of the groups.

Problems that were studied by the groups include the unknot problem on knot diagrams with small treewidth, the maximum independent set problem on planar graphs with few faces, the barrier resilience problem, 2-dimensional label placement in maps with the 1-slider model, the relative prominence problem, independent set of axis parallel line segments, finding a sphere in a 2-dimensional simplicial complex embedded in 3-dimensional space, and fencing with multicolored objects.

Progress made by these groups was recorded in the Overleaf document mentioned earlier, and during the progress report sessions.

- Keynote lectures.
  To have a clearly marked start of the daily program, we started with keynote lectures on Tuesday - Friday. The keynote lectures will focus on exciting recent developments and results, and help to attract participants to the workshop. We also end the program by a keynote talk by a good speaker, to motivate participants to stay till the end.

  These lecture were given by Sergio Cabello (FPT in two and three dimensions), Sudeshna Kolay (Parameterized Algorithms for Terrain Guarding), Michal Pilipczuk (From Approximate to Parameterized and Back Again: Algorithms for Geometric Packing and Covering Problems using Voronoi Diagrams), Karl Bringmann (On Fine-Grained Complexity and Algorithm Engineering), and Eduard Bonnet (EPTAS for Max Clique in Disk and Unit Ball Graphs). Edouard's lecture replaced a lecture by Saketh Saurabh, who due to personal circumstances had to cancel his participation.

Outcome of the workshop.

We believe we had a very successful workshop. The atmosphere was excellent, and there were a lot of active collaborations and discussions.

We especially liked the new concept of open-problem presentations. Almost all participants stayed the entire five days of the workshop.

We expect that several papers will come out of the workshop. Some problems were already almost solved during the week itself, and for other problems the participants indicated that they would continue to collaborate after the workshop.

Finally, we would like to thank the Lorentz center for the excellent organization. As organizers, we could fully focus on scientific aspects during the week - essentially acting as participants ourselves -which was great.

Many participants also expressed their interest in another follow-up workshop on the topic, in a year or two. (We have already started thinking about this.) This was no doubt also due to the very nice environment that the Lorentz center offers.

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