A polynomial kernel for chordal edge deletion

Research Internship

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One of the earliest polynomial kernels for edge modification problems is the one designed in 1999 by Kaplan et al. [3] for chordal edge completion. In this problem, one aims at turning an arbitrary graph G into a *chordal graph*, *i.e.* a graph with no induced cycle on at least four vertices, by adding at most k edges to G. Since then, it has been shown that the problem admits a subexponential parameterized algorithm [2] and that the related problems of chordal edge editing and chordal edge deletion (where one respectively allows both addition and deletion of edges or deletion only) are also FPT [1], when parameterized by k. But the question of knowing whether chordal edge deletion (or editing) admits a polynomial kernel parameterized by k has since then remained open. One reason for this matter of fact is that breaking induced cycles by adding edges or by removing edges is very different. The goal of this internship is to design a polynomial kernel for chordal edge deletion, if possible, or to provide a proof of inexistence otherwise, based on classical complexity hypotheses (typically P≠NP or ETH). Another related question that may be investigated during the internship is the existence of a constant ratio approximation algorithm for the problem.

The requirements for this internship are:

1. a strong taste for graphs and algorithms,
2. basic notions of computational complexity and algorithm design.

The internship takes place in I3S laboratory at Sophia Antipolis, near Nice.

References

[1] Yixin Cao and Dániel Marx. Chordal editing is fixed-parameter tractable. *Algorithmica*, 75(1):118–137, May 2016.

[2] Fedor V. Fomin and Yngve Villanger. Subexponential parameterized algorithm for minimum fill-in. *SIAM J. Computing*, 42(6):2197–2216, 2013.

[3] Haim Kaplan, Ron Shamir, and Robert E. Tarjan. Tractability of parameterized completion problems on chordal, strongly chordal, and proper interval graphs. *SIAM J. Comput.*, 28(5):1906–1922, 1999.