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siebertz@uni-bremen.de**Sekretariat****Tanja Rethemeyer**+49 421 218 – 63751
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14. Mai 2021**Report on the habilitation treatise*****Parameterized Approximation Algorithms in Network Design and Clustering* by
Dr. Andreas Emil Feldmann***Setting.*

There are countless examples of networks, such as communication networks, social networks, world-wide logistics networks and many more, that represent central infrastructure in our world. The tasks of planning and modifying such infrastructure is known as *network design*. *Clustering* on the other hand is a more analytic task in existing networks; the task is to group objects into clusters in such a way that objects of the same cluster are more similar to each other than to those in other clusters. On an abstract level, networks can be represented as directed or undirected graphs and many problems of network design and clustering can be formulated naturally as graph problems. Unfortunately, it turns out that many of these important problems (very likely) cannot be solved efficiently. Therefore, one has to settle either for approximate solutions or work with algorithms that do not work efficiently in general, e.g. with algorithms whose running time is exponential with respect to some parameter that is unbounded in general but hopefully small on real world instances.

Summary of contribution.

The habilitation thesis gives an overview over recent results of Dr. Feldmann and his co-authors in the area of parameterized approximation algorithms for network design and clustering problems in undirected and directed graphs. This overview is given on 25 pages and introduces and motivates the considered problems and presents the main results and ideas of the appended research works. The appendix consists of twelve publications that Dr. Feldmann co-authored and that have appeared in renowned journals and conferences.

He presents a series of coherent results including upper and lower bounds on the STEINER TREE problem and the directed generalizations DIRECTED STEINER TREE, STRONGLY CONNECTED STEINER SUBGRAPH and DIRECTED STEINER NETWORK on various (un-directed and directed) graph classes. Concerning clustering, he presents results on the k -MEDIAN, k -CENTER and FACILITY LOCATION problems under various parametrizations.

Significance of contribution.

The presented research makes substantial contributions to the advancement of the research field of parameterized approximation algorithms in network design and clustering. Dr. Feldmann provides new creative ideas, approaches and solutions to nontrivial problems. He shows comprehensive knowledge of the existing literature and uses technically sophisticated methods from the literature very elegantly. The research papers have been published in conferences and journals of highest international standard. Let me mention explicitly the publication [V. Cohen-Addad, A. E. Feldmann and D. Saulpic. *Near-Linear Time Approximations Schemes for Clustering in Doubling Metrics*] that has been published in the proceedings of the 60th IEEE Annual Symposium on Foundations of Computer Science (FOCS) 2019, and makes a significant improvement over the state-of-the-art algorithms. FOCS is considered to be one of the most prestigious conferences in theoretical computer science. These publications in the best conferences strongly underline the timeliness and relevance of the presented results.

Originality of contribution.

The main part of the habilitation treatise consists of published work that was co-authored by Dr. Feldmann. This leads to a high percentage of coincidence in the originality check by the Turnitin system, which is common in cumulative habilitation treatises. There is no doubt about the originality of the contribution by Dr. Feldmann and his co-authors.

Recommendation.

In summary, I recommend acceptance of the treatise without any reservations. It is an adequate, connected representation of highly relevant results in a current research area, via a series of coherent original research results.

With best regards


Prof.
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