Binary search on random graphs with distance measurements: The Dynamic Metric Dimension

Gergely Ódor
EPFL, Switzerland

In binary search on graphs with distance measurements, we ask a small subset of nodes to reveal their distance to the target node. We are interested in the minimal number of nodes that we must query to be able to find the target, no matter which node it is. If we must decide which nodes to ask before we observe any distance, this minimum number is the Metric Dimension (MD), which has been studied in Erdős-Rényi graphs by [1]. In this talk, we consider the setting where the queries are selected sequentially and can use the distance information revealed by the previous queries. We call the minimum number of nodes that must be queried in this setting the Dynamic Metric Dimension (DynMD). We find that in fully connected Erdős-Rényi graphs the MD and the DynMD are only a constant factor apart. For the lower bound, we present a clean analysis combining tools developed for the MD and a novel coupling argument. For the upper bound, we show that a strategy that greedily minimizes the number of candidate targets in each step uses asymptotically optimal queries in Erdős-Rényi graphs. Joint work with Patrick Thiran.

References

[1] B. Bollobás, D. Mitsche, and P. Prałat, "Metric dimension for random graphs," *The Electronic Journal of Combinatorics*, vol. 20, no. 4, p. P1, 2013.