Approximating the Arboricity in Sublinear Time

Abstract:

We consider the problem of approximating the arboricity of a graph $G=(V,E)$, which we denote by $\text{arb}(G)$, in sublinear time, where the arboricity of a graph is the minimal number of forests required to cover its edges. An algorithm for this problem may perform degree and neighbor queries, and is allowed a small error probability. We design an algorithm that outputs an estimate $\hat{\alpha}$, such that with probability $1-1/poly(n)$, $\text{ar}(G)/c \leq \hat{\alpha} \leq \text{arb}(G)$, where $n=|V|$ and $c$ is a constant. The expected query complexity and running time of the algorithm are $O(n/\text{arb}(G)) \cdot \poly(\log n)$, and this upper bound also holds with high probability. This bound is optimal for such an approximation up to a $\poly(\log n)$ factor. This result has important implications as many sublinear-time algorithms are parameterized by the arboricity, and rely on getting its value as input.

Based on joint work with Saleet Mossel and Dana Ron.