Layered tree-independence number and clique-based separators

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Motivated by a question of Galby, Munaro, and Yang (SoCG 2023) asking whether every graph class of bounded layered tree-independence number admits clique-based separators of sublinear weight, we investigate relations between layered tree-independence number, weight of clique-based separators, clique cover degeneracy and independence degeneracy. In particular, we provide a number of results bounding these parameters on geometric intersection graphs. For example, we show that the layered tree-independence number is $\mathcal{O}(g)$ for g-map graphs, $\mathcal{O}(\frac{r}{\tanh r})$ for hyperbolic uniform disk graphs with radius r, and $\mathcal{O}(1)$ for spherical uniform disk graphs with radius r. Our structural results have algorithmic consequences. In particular, we obtain a number of subexponential or quasi-polynomial-time algorithms for weighted problems such as Max Weight Independent Set and Min Weight Feedback Vertex Set on several geometric intersection graphs. Finally, we conjecture that every fractionally tree-independence-number-fragile graph class has bounded independence degeneracy.