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Tight Bounds for Chordal/Interval Vertex Deletion Parameterized by Treewidth

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Abstract: In Chordal/Interval Vertex Deletion we ask how many vertices one needs to remove from a graph to make it chordal (respectively: interval). We study these problems under the parameterization by treewidth (tw) of the input graph G. On the one hand, we present an algorithm for Chordal Vertex Deletion with running time $2^{O(tw)}|V(G)|$, improving upon the running time $2^{O(tw^2)}|V(G)|^{O(1)}$ by Jansen, de Kroon, and Wlodarczyk (STOC'21). When a tree decomposition of width tw is given, then the base of the exponent equals $2^{(omega-1)3+1}$. Our algorithm is based on a novel link between chordal graphs and graphic matroids, which allows us to employ the framework of representative families. On the other hand, we prove that the known $2^{O(tw \log tw)}|V(G)|$-time algorithm for Interval Vertex Deletion cannot be improved assuming Exponential Time Hypothesis.

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