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Kernels for edge dominating set: simpler or smaller.

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Summary: A kernelization for a parameterized computational problem is a polynomial-time procedure that transforms every instance of the problem into an equivalent instance (the so-called kernel) whose size is bounded by a function of the value of the chosen parameter. We present new kernelizations for the NP-complete Edge Dominating Set problem which asks, given an undirected graph $G = (V, E)$ and an integer k, whether there exists a subset $D \subseteq E$ with $|D| \leq k$ such that every edge in E shares at least one endpoint with some edge in D. The best previous kernelization for Edge Dominating Set, due to Xiao, Kloks and Poon, yields a kernel with at most $2k^2 + 2k$ vertices in linear time. We first describe a very simple linear-time kernelization whose output has at most $4k^2 + 4k$ vertices and is either a trivial "no" instance or a vertex-induced subgraph of the input graph in which every edge dominating set of size $\leq k$ is also an edge dominating set of the input graph. We then show that a refinement of the algorithm of Xiao, Kloks and Poon and a different analysis can lower the bound on the number of vertices in the kernel by a factor of about 4, namely to $\max\{\frac{1}{2}k^2 + \frac{7}{2}k, 6k\}$.

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