Polynomial Kernels for Hitting Forbidden Minors under Structural Parameterizations

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NETWORKS

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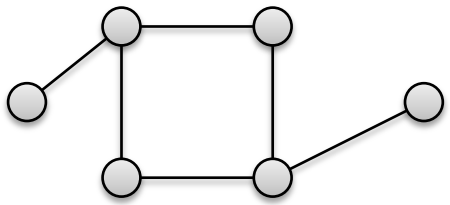
Problem

F is a finite set of connected graphs

F-minor free deletion

Given undirected graph G and budget b, can we remove b vertices from G such that it no longer has F-minors?

H is a minor of G



G

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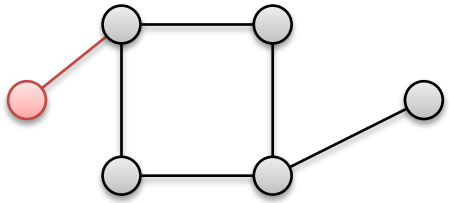

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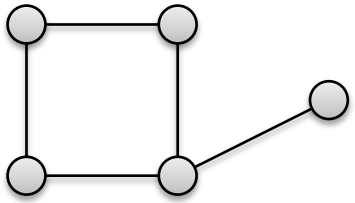

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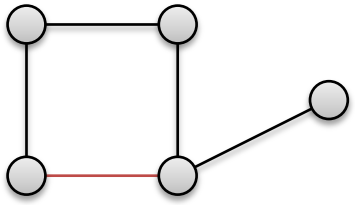

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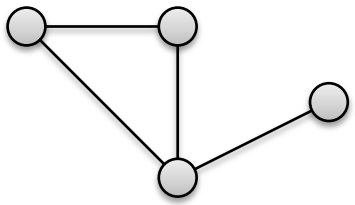


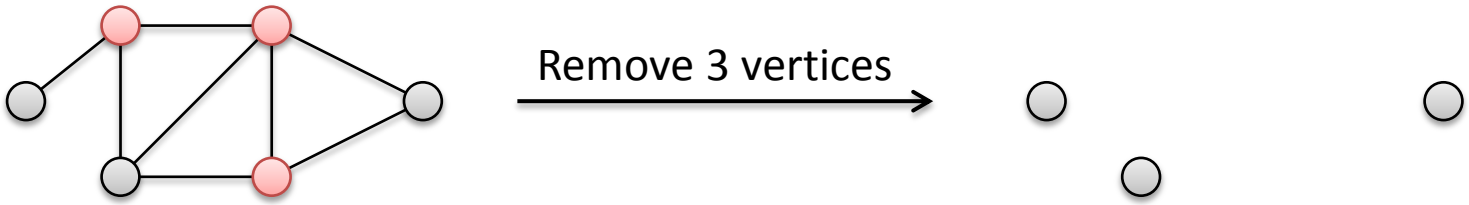
H

F-minor free deletion

Generalizes many known problems

Vertex Cover for $F = \{K_2\}$

Can we remove b vertices, such that G becomes edgeless?



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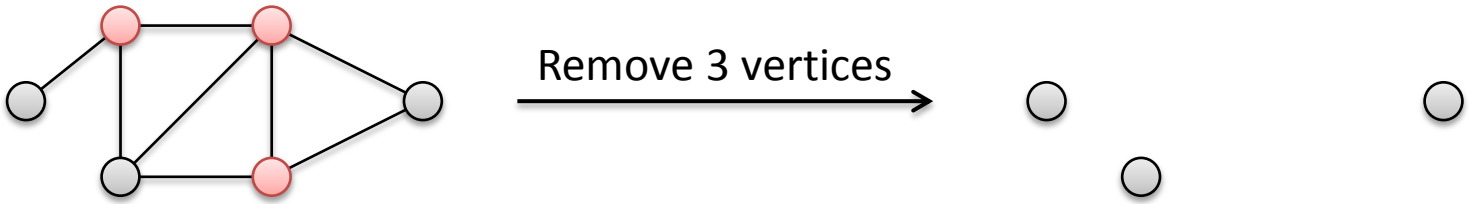
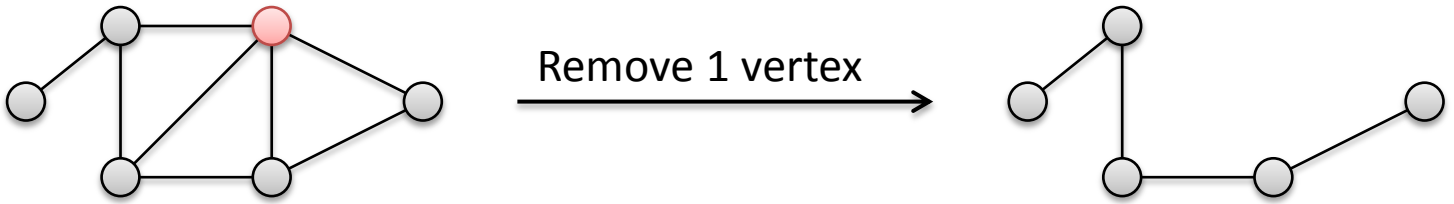


Feedback Vertex Set for $F = \{K_3\}$

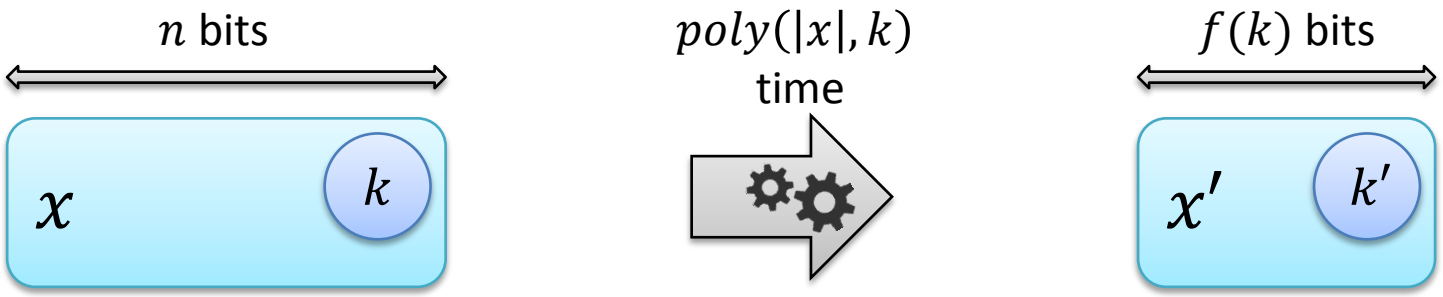
Can we remove b vertices, such that G becomes acyclic?



Kernelization

F-minor free deletion is NP-hard

- Do preprocessing
- Use an additional parameter k to measure complexity



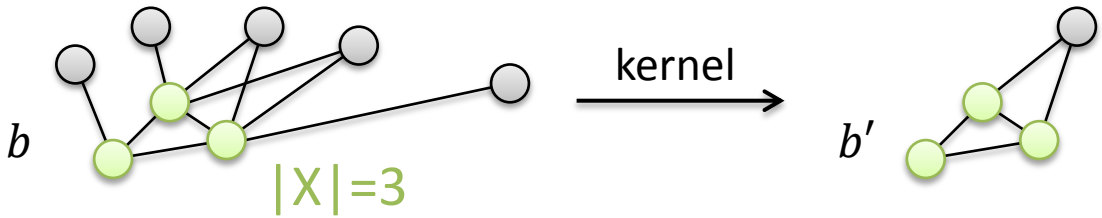
For which complexity measure, is good preprocessing possible?

- $f(k)$ polynomial in k

Previous work

General problem [Fomin, Jansen, Pilipczuk, J. Comput. Syst. Sci.'12]

Let X be a vertex cover of G, there is a kernel of size $poly(|X|)$ for F-minor free deletion



General parameter [Bougeret, Sau, IPEC'17]

modulator to treedepth 1 = vertex cover

Let X be a modulator to treedepth η, there is a kernel of size $poly(|X|)$ for vertex cover

vertex cover = $\{K_2\}$-minor free deletion

Main result

We generalize both existing results, resolving an open question by Bougeret and Sau on FVS

Theorem

F-minor free deletion parameterized by a modulator to treedepth η has a polynomial kernel

For more information & interesting proof techniques

Come see the poster!