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Counting small patterns via homomorphisms

Classical results by Lovász show that, for every fixed graph H , the number of H -subgraph copies in graphs G is a linear combination of homomorphism counts from fixed graphs F_1, \dots, F_t into G .

It turned out recently that the *algorithmic* problem of counting H -subgraphs and related patterns is precisely as hard as counting homomorphisms for the hardest graphs among F_1, \dots, F_t . This enabled clean upper and (conditional) lower bounds for these problems.

In this talk, we give an introduction to the algorithmic connection between counting subgraph-like patterns and homomorphisms and then survey recent results.