Structurally Tractable Graph Classes

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Abstract

Sparsity theory, initiated by Ossona de Mendez and Nešetřil, identifies those classes of sparse graphs that are tractable in various ways – algorithmically, combinatorially, and logically – as exactly the nowhere dense classes. An ongoing effort aims at generalizing sparsity theory to classes of graphs that are not necessarily sparse. Twin-width theory, developed by Bonnet, Thomassé and co-authors, is a step in that direction. A theory unifying the two is anticipated. It is conjectured that the relevant notion characterising dense graph classes that are tractable, generalising nowhere denseness and bounded twin-width, is the notion of a monadically dependent class, introduced by Shelah in model theory. I will survey the recent, rapid progress in the understanding of those classes, and of the related monadically stable classes. This development combines tools from structural graph theory, logic (finite and infinite model theory), and algorithms (parameterised algorithms and range search queries).

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