پژوهشگاه دانشهای بنیادی

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IPM

کارگاه آموزشی یک روزه

FAST ALGORITHMS FOR HARD GRAPH PROBLEMS BIDIMENSIONALITY, MINORS , AND (LOCAL) TREEWIDTH

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Abstract

Our newly developing theory of bidimensional graph problems provides general techniques for designing efficient fixed-parameter algorithms and approximation algorithms for NP-hard graph problems in broad classes of graphs. This theory applies to graph problems that are {*bidimensional*} in the sense that (1) the solution value for the k * k grid graph (and similar graphs) grows with k, typically as $\Omega(k^2)$, and (2) the solution value goes down when contracting edges and optionally when deleting edges. Examples of such problems include feedback vertex set, vertex cover, minimum maximal matching, face cover, a series of vertex-removal parameters, dominating set, edge dominating set, r-dominating set, connected dominating set, connected edge dominating set, connected r-dominating set, and unweighted TSP tour (a walk in the graph visiting all vertices). Bidimensional problems have many structural properties; for example, any graph embeddable in a surface of bounded genus has treewidth bounded above by the square root of the problem's solution value. These properties lead to efficient---often subexponential---fixed-parameter algorithms, as well as polynomial-time approximation schemes, for many minor-closed graph classes. One type of minor-closed graph class of particular relevance has bounded local treewidth, in the sense that the treewidth of a graph is bounded above in terms of the diameter; indeed, we show that such a bound is always at most linear. The bidimensionality theory unifies and improves several revious results. The theory is based on algorithmic and combinatorial extensions to parts of the Robertson-Seymour Graph Minor Theory, in particular initiating a parallel theory of graph contractions. The foundation of this work is the topological theory of drawings of graphs on surfaces. This is from several joint papers mainly with Erik D. Demaine It is worth mentioning that before this talk, there is a three-hours tutorial which introduces in more details the concepts used in this talk such as fixed parameter algorithms, treewidth and graph minors.

برنامه کارگاه

ساعت	عنوان سخنرانی
۹ - ۱۰:۱۵	Fixed parameter algorithms
۱۰:۴۵ -۱۲	Treewidth and graph minors
۱۴ - ۱۶	Fast algorithms for hard graph problems bidimensionality, minors and (local) treewidth

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