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EDITORIAL

Guest Editors' Foreword

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The 33rd International Symposium on Computational Geometry (SoCG'17) took place at The University of Queensland, St Lucia, Brisbane, Australia, as part of the CG Week, on July 4–7, 2017. This special issue of *Discrete & Computational Geometry* contains a selection of papers from the symposium.

Of the 148 submissions to SoCG'17, 59 were accepted. Of these, a selection of nine especially strong papers are included in this issue. They were submitted, reviewed, and revised according to the usual high standards of *D&CG*. We thank the anonymous referees for the effort that they invested in the verification and improvement of these papers. We thank the authors for revising and polishing their work.

In this foreword, we briefly introduce the papers, loosely arranged by topic. In the issue itself, they appear in alphabetical order of the names of the first authors.

Algebraic Methods *Luis Barba*, *Jean Cardinal*, *John Iacono*, *Stefan Langerman*, *Aurélien Ooms* and *Noam Solomon* consider a generalization of the famous 3SUM problem: Detect a specific bounded-degree trivariate algebraic relation other than $a + b + c = 0$ in a set of n numbers. They construct a shallow, bounded-degree, algebraic decision tree for this purpose, and explore the connection to *general position testing*: given a set of points in the plane, are there any collinear triples?

Esther Ezra and *Micha Sharir* study the point-location problem in an arrangement of n hyperplanes, in any dimension d, in the linear decision tree model. Their main result is an algorithm that can determine whether a given point lies on any of the hyperplanes with $O(d^2 \log n)$ linear queries, improving previously known results. They also apply this result to the k-SUM problem and to the more general k-linear degeneracy testing problem, as well as to some other variants.

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Set systems of *bounded VC dimension* arise naturally as a result of interaction of points and semi-algebraic objects, and have thus been studied extensively. They have the property that, roughly, the restriction of the set system to a set of size n has size polynomial in n. Set systems with low *shallow-cell complexity* are further constrained in that the number of subsets of small cardinality in the above situation is even smaller. *Kunal Dutta*, *Arijit Ghosh*, *Bruno Jartoux* and *Nabil H. Mustafa* consider semi-algebraic set systems with this structure, and present an application of the shallow packing lemma to objects called ϵ-Mnets—small collections of fairly large subsets of the ground set with the property that any large subset of the ground set contains one of these special subsets.

Combinatorial Problems The famous Sylvester–Gallai theorem states that for a set of n non-collinear points in the real plane $\mathbb{R}^2$, there must be an ordinary line, i.e., a line containing precisely two points of the set. A lot of work has been done on proving that in fact many ordinary lines must exist for such a point set. Somewhat surprisingly, the analogous statement fails in the complex plane $\mathbb{C}^2$: there exist large point sets containing no ordinary complex line. However, Kelly's theorem states that such an ordinary line must exist in $\mathbb{C}^3$, provided the points span the space. *Abdul Basit*, *Zeev Dvir*, *Shubhangi Saraf* and *Charles Wolf* explore how many such ordinary complex lines must exist, depending on the degree of degeneracy of the point set.

The celebrated Erdős–Hajnal conjecture states that any class of graphs satisfying a fixed non-trivial hereditary property must contain either a large clique or a large independent set. It has been observed that many classes of graphs arising geometrically (such as semi-algebraic graphs) have unexpectedly good Ramsey-theory properties. *Jacob Fox*, *János Pach* and *Andrew Suk* consider a larger class of graphs, substantially more general than semi-algebraic graphs, namely that of graphs of bounded VC dimension: in such a graph the neighborhoods of vertices, considered as a set system, have VC dimension bounded by a constant. The authors prove a nearly tight version of the Erdős–Hajnal conjecture for this family of graphs.

A class of graphs is χ-bounded if there is a function that bounds the chromatic number of any graph in the family in terms of its clique number. *Alexandre Rok* and *Bartosz Walczak* study the intersection graphs of families of curves, such that each curve crosses a fixed curve between one and t times, for a fixed parameter $t > 0$. They show that such graphs are χ-bounded.

Topological Methods A *tower* is a sequence of simplicial complexes connected by simplicial maps. A persistent barcode of the tower is a way of representing the topological features that come and go as one moves along the tower, distinguishing long-living features from ephemeral ones. *Hannah Schreiber* and *Michael Kerber* describe how to compute the barcode by transforming the tower into a small filtration, a sequence of nested simplicial complexes. This is useful, since considerable previous work has been done on efficiently computing barcodes of filtrations. The process can also be performed space-efficiently using a streaming algorithm. Some experiments were carried out to confirm the theoretical results in situations of practical importance.

It is a classical result that any two triangulations of a discrete point set in the plane can be connected by a sequence of "edge flips," and it is well understood how many flips may be necessary in the worst case. *Anna Lubiw*, *Zuzana Masárová* and *Uli Wagner* consider a generalization of this problem to edge-labeled triangulations. They prove that indeed the connection is always achievable by a sequence of flips, provided a natural necessary condition holds. They also present a polynomial-time algorithm for constructing a sequence of such flips. Somewhat surprisingly, the proof involves the use of some higher-dimensional topological tools.

Data Structures Finally, *Timothy M. Chan* revisits the classical problem of preprocessing a set of n points in $\mathbb{R}^d$ for *orthogonal range searching* and *exact* ℓ_∞ *nearest neighbor searching* for a static set of points in moderate dimension, improving previous bounds and speeding up several previous algorithms as a consequence. Specifically, the paper describes the first data structure that supports truly sublinear queries in near-linear space when the dimension is a constant multiple of $\log n$.