



THE UNIVERSITY OF CHICAGO

Department of Statistics

SCIENTIFIC AND STATISTICAL COMPUTING SEMINAR

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New Certificates for Nonnegativity via Circuit Polynomials and Geometric Programming

THURSDAY, February 11, 2016 at 4:30 PM
133 Eckhart Hall, 5734 S. University Avenue

ABSTRACT

Deciding nonnegativity of real polynomials is a key question in real algebraic geometry with crucial importance in polynomial optimization. Since this problem is NP-hard, one is interested in finding sufficient conditions (certificates) for nonnegativity, which are easier to check. Since the 19th century the standard certificates are sums of squares (SOS); see particularly Hilbert's 17th problem.

In this talk we introduce **polynomials supported on circuits**. For this class, nonnegativity is characterized by an invariant, which can be derived from the initial polynomial immediately. In consequence, we obtain an **entirely new class** of nonnegativity certificates, which are **independent** of SOS certificates.

Our certificates crucially extend geometric programming approaches for the computation of lower bounds in polynomial optimization. Particularly, for polynomials with simplex Newton polytope our approach is significantly faster and often yields better than bounds than semidefinite programming, which is the standard method for polynomial optimization.

These results generalize earlier works by Fidalgo, Ghasemi, Kovacec, Marshall, and Reznick. The talk is based on joint work with Sadik Iliman.

Organizers:

Lek-Heng Lim, Department of Statistics, lekheng@galton.uchicago.edu, Ridgway Scott, Departments of Computer Science and Mathematics, ridg@cs.uchicago.edu, Jonathan Weare, Department of Statistics and The James Franck Institute, weare@uchicago.edu. SSC Seminar URL: http://www.stat.uchicago.edu/seminars/SSC_seminars.shtml.

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