EFFICIENT LINEAR ALGEBRA ALGORITHMS IN SYMBOLIC COMPUTATION

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Abstract

Algorithms for linear algebra problems in the symbolic computation setting usually require that the scalar arithmetic is carried out exactly. The entries of the linear systems can be parameterized with variables. In the recent past there has been substantial activity to invent and implement efficient algorithms for exact linear algebra problems, especially when the coefficient matrices are sparse or structured. In my talk I will discuss several specific symbolic computation techniques, such as algebraic random preconditioning, that lead to theoretically efficient algorithms and practically high-performance implementations as in the LinBox library.

Exact randomized algorithms can be adapted through numerical optimization to hybrid symbolic-numeric methods which allow the input scalars to be inexact floating point numbers. The probabilistic analysis for the hybrid algorithms then hinges on the expected condition numbers of certain random matrices. On the example of sparse multivariate rational function interpolation I will discuss how some exact randomizations can result in large and others in small structured condition numbers (joint work with Zhengfeng Yand and Lihong Zhi).