

Matrix Computations & Scientific Computing Seminar

Organizer: James Demmel & Ming Gu

Wednesday, 11:00am–12:00pm, 380 Soda

Nov. 24 **Lek-Heng Lim**, University of Chicago

Cholesky Decomposable Tensors

A real quadratic form $f(x) = x^t Ax$ may be expressed as a sum of squares of linear forms $f(x) = \sum_k (\beta_k^t x)^2$ iff the associated symmetric matrix A is positive semidefinite. We will examine a generalization of this notion: degree- p forms that are expressible as a sum of p -powers of linear forms: $f(x) = \sum_k (\beta_k^t x)^p$ (p even). In this case it is not sufficient that the symmetric tensor associated with f be positive semidefinite although that is a necessary condition. We call such tensors Cholesky decomposable tensors and show that they are surprisingly well-behaved. The sum-of-powers decomposition is then a higher-order analogue of the spectral decomposition of a positive semidefinite matrix. It arises naturally in diffusion MRI and gives the most accurate method for extracting nerve fibers crossing. This is joint work with T. Schultz.