



# THE UNIVERSITY OF CHICAGO

Department of Statistics

## SCIENTIFIC AND STATISTICAL COMPUTING SEMINAR

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Departments of Mathematics and Statistics  
Stanford University

### Preserving Positivity Under Rank and Sparsity Constraints

THURSDAY, October 1, 2015 at 4:30 PM  
133 Eckhart Hall, 5734 S. University Avenue

#### ABSTRACT

Which functions preserve positive semidefiniteness (psd) when applied entrywise to the entries of psd matrices? This question has a long history beginning with Schur, Schoenberg, and Rudin, and has also recently received renewed attention due to its applications in high-dimensional statistics. However, effective characterizations of entrywise functions preserving positivity in a fixed dimension remain elusive to date.

We study the problem of preserving positivity in fixed dimension by imposing rank and sparsity constraints. These constraints arise naturally in theory as well as applications and provide a natural way to relax the elusive original problem. We provide the first classification of entrywise functions preserving positivity on matrices with zeros according to a graph, specifically, any tree. In a parallel direction, using an intuitive approach, we classify entrywise functions sending psd  $n \times n$  matrices of rank at most  $l$  to psd matrices of rank at most  $k$ , with  $1 \leq l, k \leq n$ . As a consequence, we recover the result by Schoenberg, Rudin et al., as a special case.

(Joint work with Dominique Guillot and Bala Rajaratnam.)

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