An Asymptotically Sharp Upper Bound for the Column Subset Selection Problem

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In this talk we study the spectral norm version of the column subset selection problem: given a matrix A and a positive integer k < rank(A), select exactly k columns of A which minimize the approximation error, i.e., the spectral norm of the residual matrix after projecting A onto the space spanned by the selected columns. First, we employ the method of interlacing polynomials, which was introduced by Marcus-Spielman-Srivastava, to derive an asymptotically sharp upper bound on the smallest approximation error. Second, we extend our first result to a column partition problem, which aims to partition the columns of A into r > 1 subsets, such that A can be well approximated by the columns from several different subsets. We show that the machinery of interlacing polynomials also works in this setting, and the relevant expected characteristic polynomials are related to the r-characteristic polynomials.