

HOW DO EXPONENTIAL SIZE SOLUTIONS ARISE IN SEMIDEFINITE PROGRAMMING?

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A striking pathology of semidefinite programs (SDPs) is illustrated by a classical example of Khachiyan: feasible solutions in SDPs may need exponential space even to write down. Such exponential size solutions are the main obstacle to solve a long standing, fundamental open problem: can we decide feasibility of SDPs in polynomial time?

The consensus seems that SDPs with large size solutions are rare. However, here we prove that they are actually quite common: a linear change of variables transforms every strictly feasible SDP into a Khachiyan type SDP, in which the leading variables are large. As to “how large”, that depends on the singularity degree of a dual problem. Further, we present some SDPs in which large solutions appear naturally, without any change of variables. We also partially answer the question: how do we represent such large solutions in polynomial space?

Joint work with Alex Touzov (UNC Chapel Hill).