Tensor Optimization Framework for Sums-of-Squares Certification.

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Abstract

We propose a technique to prove identities involving rational functions using a combination of symbolic and numeric computation. We start with a symbolic formulation of the identity, formulate it as the computation of a lower bound of an optimization problem, translate it into tensor notations, and invoke a tensor solver based on interior point methodology. The output tensor is then converted back to symbolic representation to obtain a sum of square from which the identity can be proved or disproved. We apply our technique to find new proofs or shorter proofs to continuous problems (proving convexity of a new class of constant signature functions for interior point methods, and proving nonnegativity of counterexamples to Hilbert's 17th problem) and discrete problems (satisfiability and graph partitioning).