

Non-commutative Sums of Squares in Quantum Information

Sabine Burgdorf, University of Konstanz

Due to the phenomenon of entanglement quantum correlations are more powerful than classical correlations. One way to investigate those correlations is to compute the best winning probabilities of nonlocal games with either a classical or a quantum strategy. These numbers are in general hard to compute but they might be approximated using non-commutative versions of Sum of Squares relaxations (thus semidefinite programs).

There are two models for quantum correlations: the spatial model and the commuting model. Furthermore, there are two ways to define positivity of a symmetric operator, either by its smallest eigenvalue or by its trace, yielding two types of non-commutative polynomial optimization problems. It will turn out that each optimization problem suits well for one of the quantum correlation models resulting in the above mentioned SoS relaxations.

After a short introduction we will describe the connection between those two worlds, present a few examples and discuss some problems showing up.