

Tenseurs : information quantique, complexité et combinatoires quantiques

Tensors: Quantum Information, Complexity and Combinatorics

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Larger Corner-Free Sets from Combinatorial Degenerations

There is a large and important collection of Ramsey-type combinatorial problems, closely related to central problems in complexity theory, that can be formulated in terms of the asymptotic growth of the size of the maximum independent sets in powers of a fixed small (directed or undirected) hypergraph, also called the Shannon capacity. An important instance of this is the corner problem studied in the context of multiparty communication complexity in the Number On the Forehead (NOF) model. Versions of this problem and the NOF connection have seen much interest (and progress) in recent works of Linial, Pitassi and Shraibman (ITCS 2019) and Linial and Shraibman (CCC 2021).

We introduce and study a general algebraic method for lower bounding the Shannon capacity of directed hypergraphs via combinatorial degenerations, a combinatorial kind of "approximation" of subgraphs that originates from the study of matrix multiplication in algebraic complexity theory (and which play an important role there) but which we use in a novel way. Using the combinatorial degeneration method, we make progress on the corner problem by explicitly constructing larger corner-free subset in $F_2^n \times F_2^n$. Our new construction of corner-free sets implies an improved NOF protocol for the Eval problem.