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Limiting Entropy and Independence Entropy of d-dimensional shift spaces I

Topological entropy is a fundamental invariant for $\mathbb{Z}^d$-shift spaces. When $d = 1$ and the shift space is a shift of finite type (SFT), it is easy to compute the topological entropy. In higher dimensions, it is much more difficult to compute, and exact values are known in only a handful of cases. However, a limiting entropy, as the dimension $d \to \infty$, defined as follows, can be computed in many more cases.

A 1-dimensional shift space $X$ determines $\mathbb{Z}^d$-shift spaces $X \otimes d$ for each $d$; namely, $X \otimes d$ is the $\mathbb{Z}^d$-shift space where every “row” in every coordinate direction satisfies the constraints of $X$. Let $h_d(X)$ denote the topological entropy of $X \otimes d$. Then $h_d(X)$ is non-increasing in $d$ and its limit is denoted $h_\infty(X)$.

We introduce a notion of “independence entropy” denoted $h_{\text{ind}}(X)$, which is explicitly computable if $X$ is a 1-dimensional SFT. We show that $h_\infty(X) \geq h_{\text{ind}}(X) = h_{\text{ind}}(X \otimes d)$ for all $d$. We can prove that equality holds in many cases, and it may well hold in general.

(joint work with Erez Louidor and Ronnie Pavlov)