CCIT Report No. 341

Tradeoffs Between the Excess-Code-Length Exponent and the Excess-Distortion Exponent in Lossy Source Coding

Tsachy Weissman and Neri Merhav

Lossy compression of a discrete memoryless source (DMS) with respect to a single-letter distortion measure, is considered. We study the exponent associated with the probability of the event that the distortion exceeds a level d, if for large block length the best code from the set of codes confined to have an excess-code-length exponent above a given level is used. This exponent is obtained for various cases. The first scenario examined is that where the source is corrupted by a discrete memoryless channel prior to reaching the coder. This is later generalized to the case where side information is available at both encoder and decoder. Finally, we examine the universal setting, where the (noise-free) source is an unknown member, P_θ, of a given family, $\{P_\theta, \theta \in \Theta\}$. Here, inspired by an approach which was proven fruitful in the context of composite hypothesis testing, we allow the constraint on the excess-code-length exponent to be θ-dependent. Corollaries are derived for some special cases of interest, including Marton's classical source coding exponent and its generalization to the case where the constraint on the rate of the code is relaxed from an almost sure constraint to a constraint on the excess-code-length exponent.