Towards Optimal Deterministic Coding for Interactive Communication.

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We show an *efficient, deterministic* interactive coding scheme that simulates any interactive protocol under random errors with nearly optimal parameters.

Specifically, our coding scheme achieves a communication rate of 1 – õ(\sqrt{epsilon}) and a failure probability of exp(-n/ \log n), where n is the protocol length and each bit is flipped independently with constant probability epsilon. Prior to our work, all nontrivial deterministic schemes (either efficient or not) had a rate bounded away from 1. Furthermore, the best failure probability achievable by an efficient deterministic scheme with constant rate was only quasi-polynomial, i.e., of the form exp(-polylog(n)) (Braverman, ITCS 2012). The rate of our scheme is essentially optimal (up to poly-logarithmic factors) by a result of Kol and Raz (STOC 2013).

A central contribution in deriving our coding scheme is a novel code-concatenation scheme, a notion standard in coding theory that we adapt for the interactive setting. Essential to our concatenation approach is an explicit, efficiently encodable and decodable *linear tree code* of sufficiently good parameters. The fact that our tree code is linear, and in particular can be made *systematic*, turns out to play an important role in our concatenation scheme. We use this tree code as the ``outer code'' in the concatenation scheme. The necessary deterministic ``inner code'' is achieved by a nontrivial derandomization of a randomized interactive coding scheme of (Haeupler, STOC 2014).

This is a joint work with Ran Gelles, Bernhard Haeupler, Gillat Kol and Avi Wigderson.