

Adaptive Error Correcting Codes Based on Cooperative Play of the Game of "Twenty Questions with a Liar"

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Abstract

The existence of a noiseless, delayless feedback channel permits the transmitter to detect transmission errors at the time they occur. Such a feedback channel does not increase channel capacity, but it does permit the use of adaptive codes with significantly enhanced error correction capabilities. It is well known that codes of this type can be based on cooperative play of the game of "Twenty Questions with a Liar". However, it is perhaps not so well appreciated that it is practicable to implement codes of this type on general purpose computers. We describe a simple and fast implementation in which the transmitter makes reference to a fully worked out game tree. In the worst case, storage requirements grow exponentially with block length. For many cases of interest, storage requirements are not excessive. For example, a 4-error correcting code with 8 information bits and 13 check bits requires only 103.2 kilobytes of storage. By contrast, an 8-error correcting code with 6 information bits and 25 check bits requires 21.2 megabytes of storage. However, no nonadaptive code is capable of correcting as many as 8 errors when 6 information bits are encoded in a block of length 31.

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