

Universal Decoding With an Erasure Option *

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Abstract

Motivated by applications of rateless coding, decision feedback, and ARQ, we study the problem of universal decoding for unknown channels, in the presence of an erasure option. Specifically, we harness the competitive minimax methodology developed in earlier studies, in order to derive a universal version of Forney's classical erasure/list decoder, which in the erasure case, optimally trades off between the probability of erasure and the probability of undetected error. The proposed universal erasure decoder guarantees universal achievability of a certain fraction ξ of the optimum error exponents of these probabilities (in a sense to be made precise in the sequel). A single-letter expression for ξ , which depends solely on the coding rate and the threshold, is provided. The example of the binary symmetric channel is studied in full detail, and some conclusions are drawn.

Index Terms: rateless codes, erasure, error exponent, universal decoding, generalized likelihood ratio test, channel uncertainty, competitive minimax.

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